

**Market research on Warehouse
Management System solutions for
medium wholesale companies with 3
Party Logistics opportunities.**

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Description

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<p>Description</p> <p>Due to the absence of the already-existing works on the field of the market research concerning the warehousing management systems the need of such work has been clear. The main specific need for the systems was possibility to keep several warehouses at the same time with different manager personnel. This is the reason why third-party logistics has been chosen as one of the main criteria for the search and filtering.</p> <p>The task has been set as search the list of ten most suitable solutions with the description of their advantages, disadvantages and area of application. Due to the "100:10:3:1 rule" the number of the systems has been limited to the amount of 10.</p> <p>The systems have been gathered through the internet databases using available filters and then analyzed manually. Main filters chosen were: web-based solutions, access to the information from outside (SQL bridge, API or other solution), barcodes handling, multilinguistic opportunities, trial version availability, and the pricing.</p> <p>Result have been presented as the list of 12 solutions that can be applied to the situation that host company might has in the future, with the description of advantages, disadvantages and limitations of their usage.</p> <p>The research can be counted as a success. Suitable systems have been found and described. The weighted ranking has been applied in order to highlight the most perspective solutions.</p>		
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List of abbreviation

WMS	Warehouse Management System is the system that helps to manage activities of warehouses by people. In most cases it is involved in every step of warehouse: dispatching, receiving, storing, packing etc. It collects information and sums it up for the dashboards.
ERP	Enterprise Resource Planning software is the software that helps to the company to optimize its business activities in Functional areas that company has (e.g. Marketing/Sales, Customer Relationship Management, Supply Chain Management, Accounting & Finance and Human Resources)
3PL	Third-Party Logistics is the arrangement of the company's logistics so that some activities for supply chain or even whole logistics chain is outsourced by another company or companies that have better expertise in that area.
SCM	Supply Chain Management is the management of material and information flow in order to get the biggest customer satisfaction at the lowest costs. The "material" includes raw material, work-in-process and finished goods.
R&D	Research and Development is the term for the activities that are connected to the creation of innovations. This is the first step for the innovation life cycle which can end up with the commercialization of the found solution, item or other innovation created.
OS	Operating System is the large program that manages and controls hardware of the device and software installed on it.
DB	Data Base is the place where data is stored so that it can be easily accessed, managed and updated.

- HR Human Resources is the area of business that includes activities connected to the employees, their salaries, hiring, work efficiency and other things connected to the employees and their work.
- BT BlueTooth is the wireless technology standard for the data exchange between devices on the short distances. The range of work depends on the power of both sending and receiving devices.
- JIT Just In Time is the philosophy for increasing process efficiency by eliminating waste. Such a philosophy helps to analyze and optimize work, but cannot be fully realized in the real world due to different factors.

1 Introduction

In today's business, all companies deal with Enterprise Resource Planning systems. Such systems connect business activities together. Companies get benefits if the system installed correctly and has been planned well. Certainly, installation takes time and money. Quite often small companies cannot afford ERP systems and live with keeping many things in the brain, on papers, and in some Excel files and it costs a little to the company. Such an approach looks like a saving to the owners of the business, but there many situations when a company cannot compete anymore with other players of the market while keeping such structure of information within a company.

For example, if company wants to cooperate with other business partners in most cases information sharing is one part of cooperation. Partners have difficulties with data sharing if company stores everything in old style methods. Unnecessary queries should be made that lead to big lead times. Certainly, ERP system can help in this matter, but usually installation happens with the purpose to optimize the business activities and if we are talking about situations of small companies when the main target is to optimize the data flow it is possible to find less expensive and more professional solutions on the market that concentrates more on the data sharing.

One of the situations when data sharing important is warehousing. Warehousing Management Systems that handle warehousing data storing, sharing and gathering is covered in this Thesis. The biggest accent is made on the situation when Enterprise that collects goods from small companies and wants to optimize the data flow in order to have real-time information on quantities available in order to minimize delays in work and own safety stocks.

There are several ways to handle activities inside of warehouses connected to the information and goods flow. In some cases, companies do have an ERP and install an additional module to handle them. Some companies do prefer to use standalone Warehousing Management Systems for such purposes.

Warehousing management module of an ERP system is a good solution especially for the case when ERP is already installed, but if there is no ERP the standalone WMS is a good solution. Difficulties appear in the situation when several companies do have different kinds of ERP systems and want to cooperate. The WMS is chosen as a system that is needed as it handles the warehousing while ERP does help with the functions of the company in total.

1.1 Objectives

In order to make objectives of the Thesis as clear as possible, here is an introduction of main stakeholders of the generalized situation that is supposed to be optimized in a sense of data flow and its' availability:

Manufacturer – medium-sized companies which has plenty of suppliers and makes products out of material supplied.

Supplier – small-sized company that is mainly working for supplying material to the single manufacturer. Raw material is stored in a big boxes or containers so that cannot be moved on anything except forklifts.

Intermediary – the host company of this Thesis. It supplies equipment for quality control on the supplier's side. Quality control happens through collecting information concerning storing condition and providing it to the manufacturer. The intermediary has installed portable computers with Linux-family OS onto each forklift that supplier has and many wireless sensors to the containers (types of containers depending on the suppliers) and warehouses themselves. The information from the sensors moves through the portable computer to the internet and stored at the cloud-based DB and then shares between stakeholders (e.g. manufacturer).

The structure of the situation is generalized. We are not talking about amounts of sensors, types of containers, numbering systems of warehouse or other things that are

very case-specific. The solution that we are looking is planned to use in many cases that is why it should be as universal as possible. Main constraints are described for the choosing the solution, what narrows the scope of solutions. The only suggestion concerning the suitability of the systems and way of its usage is made. The choice and further implementation are done by the host company of this Thesis. The decision on choosing the system is supported by the weighted grading system implemented. The weight helps to make accents on the features that are more valuable for the generalized situation, than others. Such a grading supports the decision on which order the systems should be checked.

1.2 Data flow structure improvement plan

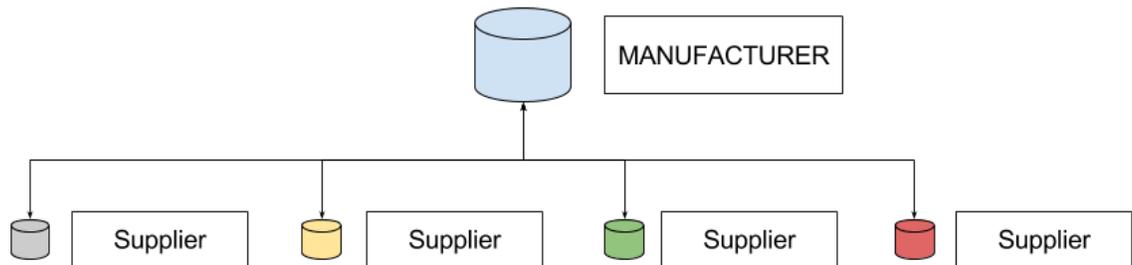


Figure 1. Initial structure and connections of databases.

Small suppliers have different WMS such as Excel files and other unstandardized solutions. On the figure 1 different, unstandardized WMS shown as blocks with different colors. In most cases, they cannot be reached from outside. The manufacturer must make a query to the supplier to get the information about amounts of available goods and other information needed. It makes the supply chain difficult and inefficient. In case if suppliers are working not only for one manufacturer and have seasonal production it

becomes a lot bigger problem that definitely needs attention from the stakeholders of the supply chain. Here are some possible problems:

1. Too much of waiting time leads to big safety stock.
2. Needs big warehouse at manufacturer side.
3. Big problems with implementation of JIT philosophy.
4. Too much of personnel needed for purchasing needs.
5. Inability to create precise forecast for the nearest future.

Intermediary wants to help with solving that problem by standardizing WMS of suppliers and make the structure so that safety stocks of the manufacturer and working hours for the stocks availability checks decrease through installing new WMS system on the supplier's side. Such an approach will definitely affect the way of work, but the ability to show real-time information on stocks of the supplier is important for the manufacturer so that they are ready to invest in such systems. It needs to say that the manufacturer is interested in such opportunities more than anyone else in this supply chain and it acts as the main customer for the intermediary. The overall goal that manufacturer is pointing to reach is to optimize the supply chain as much as possible in order to increase the competitiveness of the company on the market.

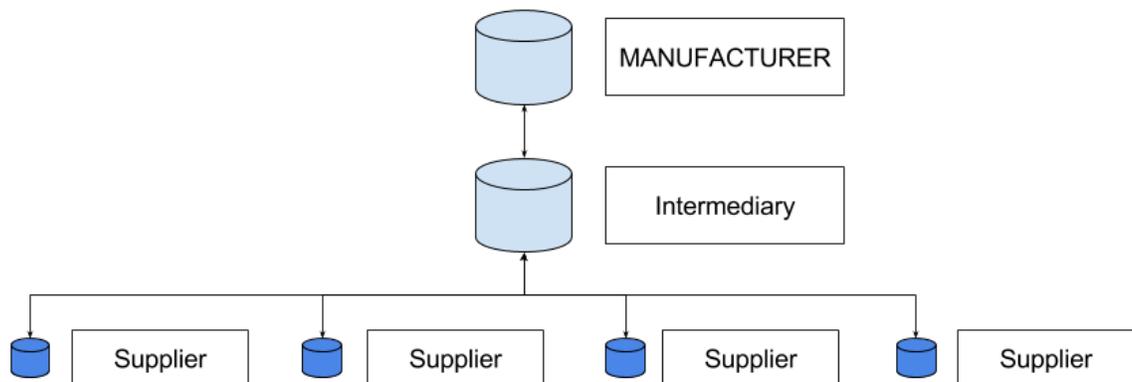


Figure 2. The structure of databases and their connections that are planned to implement.

It is already planned to use the same way for the warehousing data flow as it has been done with the sensors before: we grant an access to the manufacturer in a simple and easy-to-use format JSON. The cloud server of the intermediary is used as a bridge between supplier's portable computers installed on the forklifts and stakeholders to provide information about production forecasts, quantities available and other information that is needed for the supply chain optimization. Possible destinations for the information that is gathered are existing ERP system of the manufacturer and personnel of the manufacturer or supplier that needs the information.

There is a big chance that smart implementation of the new WMS to suppliers will lead to improvement of the work on the supplier side too. Usually, such a small companies just cannot afford the new WMS for the usage due to the big costs and hard implementation, but it comes to the smaller problem with the help from intermediary and manufacturer side. Even if the installation of the WMS will not lead to improvements in warehouse operations (it might happen) supplier has definitely the competitiveness increase due to easier and more open way of cooperation with other suppliers.

1.3 The result outlook

The result of the Thesis looks as top 10 most suitable Warehouse Management Systems that can be applied to this generalized situation with the descriptions of constraints of the usage and specific features that are important for the stakeholders in order to make the most rational, efficient and universal solution that can bring new orders and help to grow the companies. Rational pricing and possibility to apply the solution to different situations are very important as there are many customers for the host company who have different current technical context with the equipment and not too much of investments available.

Constraints for the stated generalized problem are:

1. Easy access to the information in order to export to the cloud server. The preferable format of an access is SQL connection or API of the system's development team, otherwise, R&D team might make own parser if other features are a lot better, that in other warehousing management systems found.
2. Barcoding feature should be included to the WMS as almost all warehouses use them.
3. Multilingual solution. The range of possible customers is very wide. Definitely, companies who are working do have personnel who speaks English, but if we are talking about warehousing processes, most of the manual work, as forklift driver is not a very popular position for people with a university degree and English language knowledge. Language matrix is what can help to the R&D department to localize the WMS.
4. The system should be web-based. Providing solutions working through the internet is the trend of the market as well as the main market that host company of the Thesis is working on.

1.4 Methods

The research has a mix of qualitative and the quantitative methods. The qualitative is used for the systems choosing. There are many contenders and exploring the software suppliers' websites narrows the scope of the systems to the most suitable ones. Another method, called quantitative, helped to grade suitable systems and determines the order of the systems from the most suitable to the least desirable in order to help the R&D department to have a starting point of their own study.

2 Theoretical basis

Theoretical basis chapter is the ground or basement for the research that is done. Every word in that part is supported by the sources to make the work as reliable as possible.

2.1 Warehouse and its' role

According to Chand(n.d.) a warehouse is one of the main stages of the supply chain where goods are accumulated. Usually, it is connected to the real goods, like something that we can touch, but when Information Age came we can understand that we can store information as well. Such kind of warehouses also called as Data Bases.

Warehouses do play an important role and the rationally allocated goods benefit to the company:

1. Regular production

Buffers between the production stages help to keep production as smooth as possible. Usually, it needs to be done at least because of the different tact times of the machines, breakdowns, human factor and such kind of reasons. Time is money. The more break in production happened due to different reasons the more money are lost. These storages between the phases of production are already something that goes against the Just In Time philosophy which is straightly against any buffers as it is counted as waste.

We might think that delay in a few minutes might be neglected, but if we are talking about whole supply chain, there is a big chance to find out the Bullwhip effect that will lead to big troubles. Further we go the more noticeable the problem will be.

2. Time utility

Warehouse gives the time gap between the production and consumption of goods whenever goods are required. In most cases, the demand is something that is hard to predict and companies are storing goods in order to keep customer service high and ship items straight after the purchasing query. People who are connected to the real business jokes about it as "Demand forecast is always wrong." This is one of the reasons why such kind of stock reaches quite big amounts.

Another story is about seasonal production when such kinds of production as rice, potatoes, wheat, bananas etc. are produced mainly in the summer. There is no surprise that people demand these goods all the time and they don't care about current season much in a sense of their food consumption.

3. Store of surplus goods

If the production is not required immediately after the production in many cases it doesn't make sense to through everything out immediately. It can be stored in the proper packaging for a sometime in the warehouse until the demand appears.

4. Price stabilization

Usual story is when demand is fluctuating all the time. The production rate cannot be changed at the same time as it costs money. There is a big issue due to work load of employees, governmental laws etc. Quite often companies decide to overproduce at least for a little to meet up the future demand and keep production smooth. Less money company spend on the production change the smaller price of the items it can afford.

5. Minimization of risks

One aspect is connected to the perishable goods storage. Lifetime of such goods can be increased with the control of temperature, humidity and other characteristics of an artificially made environment inside of a warehouse.

Another aspect is connected to the warehouses that are made to save the things that customers want. In other words, we are talking about banks and other such kinds of services.

6. Packing and grading

Normally, warehouses are made so that human being can be inside without any big risks being hurt by poisonous air or some other dangerous things. Such an arrangement gives a good opportunity to use the space of warehouse for the packaging, good inspections, blending etc.

7. Financing

The goods stored at the warehouse have their value even though they are not sold. In some countries, warehouse authorities advance money against the goods deposited in the warehouse.

2.2 ERP system as the main competitive advantage

According to Woo (2012) Enterprise Resource Planning systems are made to take over all business activities of the company. At some point, company comes to the point when Excel spreadsheets cannot support everything that the business requires. The main question that arises on that point is about the cost of the new solution and can company afford it. One of the ERP software Blog Writers of the website erpsoftwareblog.com tells that while implementation we talk a lot about third-party logistics, number of employees, accounting management, volume, scope, complexity and internal resources as well as the need for customization and training. All these things determine the investment needed for the implementation. Investments in the software only might reach hundreds of thousands Euros. This is only software, while new hardware will take a lot of investments too.

ERP system is software that helps to link business functions of the organization. In the case of rational approach and efficient usage of already existing solutions, it may lead to the increase of the efficiency. The list of the functional areas that ERP can link altogether can be found below:

Table 1. Functional areas of ERP systems and their activities (ERP functional areas).

Functional area	Possible area content
Marketing/Sales	Shipping, analysis of competitors, forecasting, invoicing.
Customer Relationship	Sales management, lead prioritization, sales

Management	marketing, call center support.
Supply chain Management	Purchasing, product configuration, supplier scheduling, goods inspections, claims processing, warehousing, order processing, distribution tasks.
Manufacturing	Engineering, scheduling, quality control, workflow, product lifetime, phase's management.
Accounting & Finance	Budgeting, cost&cash management, activity-based costing, money flow.
Human Resources	Training, recruiting, payroll, benefits, retirement and diversity management personal key performance indicators.

The list of possible area contents is not full and shows that ERP systems are huge and the implementation takes very much time. Definitely, companies should think twice whether it is rational to install such big software and rebuild the structure of working places or not. Usually, software suppliers do separate ERP into modules that cover one or more functional areas with the ability to extend in the future. Such an approach is used to save workforces and implement only what customer needs without any additional and useless costs.

2.3 ERP versus WMS and problems of implementation

According to the Woo (2012) the ERP system is the core software of the companies and takes over accounting, billing, human resources and other. Certainly, it might include warehousing too as a module, but in the case of the Thesis we want to find a solution for warehousing and its' data flow only. If we chose to implement ERP for suppliers should change a lot in their work. Not all suppliers will take a risk and want to implement such system as the existing way works fine. People have never been very opened to changes. WMS is the system that has an accent on optimization of warehouses and does it well. It should solve all stated problems easily, especially if third-party logistics is included in it.

3PL will give an opportunity to access information easily by third parties (e.g. intermediary) in order to gather real-time information on supplier's activities.

In some cases, warehousing management system does have additional modules, like accounting, human resources, and others. Finally, it will have the same functionality as ERP systems do, but the approach won't be as rational and efficient as ERP does. If warehousing and goods distribution is the core activity that company wants to optimize than WMS is the good fit.

It is important to understand that modules are usually provided by big software suppliers, that exist for a long time already. If we are talking about modern web-based solutions they could make an accent on the warehousing only as they didn't have much time to think about modules. Even though they are new players on the market, the cloud-based data warehouses and web solutions is the future.

Certainly, implementation of a WMS is a hard process and usually, mistakes show up after it. Software suppliers claim that new solution will reduce inventory, labor cost and increase storage capacity, customer service as well as inventory accuracy, but the reality might be different.

According to Piasecki (n.d.) we can increase in accuracy, reduction in labor costs and a greater ability to service the customer by reducing cycle times by implementing the WMS, but this is only one side of the coin. There is a low chance of inventory reduction and storage capacity increase. There are other factors that change with the WMS, but in most cases, the significance very likely will be negligible. It depends on how sloppy your pre-WMS processes were.

Even though work efficiency might not be increased much there are other reasons to implement new WMS such as first-in-first-out, yard management, cross-docking, automated pick replenishment, lot tracking, automated material handling equipment, wave picking, automated data collection, etc.

Another view comes from personnel. A company should train employees. Success very much depends on already existing people and their will to learn something new. Not every person understands how to use modern technologies straight away after installing. The more user-friendly the solution the less cost for trainings will be. This is a good reason to pay attention to the outlook of the software supplier websites. The better looking the more chance that user interface is well brainstormed.

2.4 Steps to successful WMS implementation

When it has been understood that such system, as WMS, should be implemented due to reaching goals of controlling the supply chain and increasing of its efficiency the question about successful implementation arises. According to the Pierce (2014), there are 11 basic steps for the WMS implementation.

1. Expectations and motivations.

Implementation involves many expectations from different stakeholders. Such system doesn't help in business cooperation but eliminates inefficiency in daily work, helps to fulfill the expectations of directors, operators, logistics managers and other stakeholders in order to create user-friendly systems and make work easier, than it was.

2. Risk reduction.

This is the matter of how experienced the software supplier is. The more he is involved and more case scenarios he has been involved the fewer amounts of unexpected risks can arise during the implementation process.

3. Business review.

This is the phase of discussion for the both parties about the project, it's needs, functions, and requirements in order to eliminate misunderstandings and cooperate as efficient as possible. Eliminate useless features as well as add needed ones. The implementation plan should be built around the business review.

4. Implementation schedule.

It is a big issue to meet the schedule and follow the plan. Unexpected obstacles are very usual things in such project. Due to that fact, the plan should be flexible and realistic as much as possible. We end up with the idea that successful planning is a result of experienced warehouse management system provider's installation team work.

5. Team building

Teams are very important for the WMS's implementation. There are two of them: implementation team and the warehouse executives. The right people in right teams leads to faster and better installation.

6. Design and customization

Flexibility of the future WMS is the big factor for the choice and implementation itself. Even if the system looks good after the installation it often requires some future changes.

7. Training

The successful result greatly depends on the personnel that is going to use the system. The company where the system has been implemented should not neglect the training phase even though it is time-consuming.

8. Data

One part of an installing is connected to the transfer of the information stored in the old system to the new Data Base according to the new names, fields and other specific things. If some needed information is missing it should be added. There are two main ways to transfer the data. One is the big BOOM when all information is transferred at once and the second one is the smooth transferring. The old DB is used until old information is stored there, but all new data comes to the new data warehouse.

9. Testing

This is the phase that cannot be neglected anyhow. The new system is tested on the real warehousing data with different scenarios in order to find and fix bugs in design and functionality.

10. Deployment

When all tests have been passed we need to start running the new system and stop using the old one. In a small scale it might happen at one day, but when we are talking about enterprises it does make sense to start that at few warehouses out of many.

11. Support

It often happens that some misunderstanding left between personnel and the system or some problems arise during operations and it is extremely important that there is a dialog between the user and software supplier.

2.5 Information security

One of very important part of the WMS implementation is the security of the information stored. Definitely, companies do have the information that they don't want to be shared due to privacy and ability to compete. When company is big, competitors will search for a way to get company's information that can benefit to them. According to the Pennic (2013) there are many causes for the breaches that might lead to very bad results in a sense of data leakages.

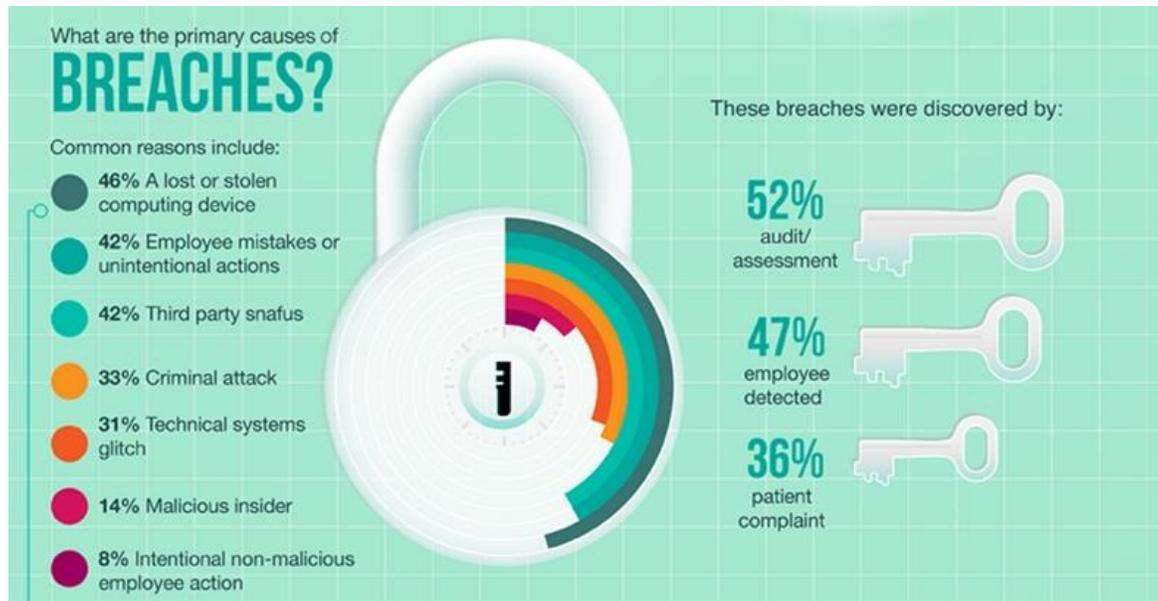


Figure 3. Causes of information leaks in enterprise (Pennic)

It impossible to prevent all reasons for information leaks, but we can try to minimize risks. Leaver (2013) gives five hints how to do that:

1. Prepare ahead of time

It is essentially important to know which system and which information is vital for the company. The background of employees should be checked before giving the high-level access to such kind of sensitive information.

2. Monitor access and activity

Close eye on the business should be on the information that is shared due to the business cooperation with other companies, like partners, suppliers, and customers. It is extremely important to monitor the activity of the data bases that contain sensitive information that will be damaging for the company in case of leakage. Administrators should be notified when employees are downloading, copying, deleting or modifying any of sensitive data.

3. Encryption

Due to possible sniffing of the traffic that employees have the informational transmission methods should be encrypted using SSH/SCP or other methods

4. Lock down the network

The Web and an email are the most common information leakage ways, therefore, having network security that covers these channels are absolutely vital.

5. Endpoint security

The usual situation, when employees are using a cellular phone or another portable device for the work. Monitoring of the activity of such devices should exist, otherwise, the breaches of the data might be unrecognized for a long time, or even never if logs do not exist.

While choosing the WMS it is important to take into account all these tips to measure how secure is the solution. Risks that appear with the new system and how it might affect the future of the companies involved in the work should be understood in advance to prevent failures of the security implementation.

2.6 Weighted scoring model

According to O'Loughlin (N.d.) the weighted scoring model helps to compare software solutions using weights of criteria. It is important to understand what the requirements are and how some features more or less important, than others. There are plenty of requirements for the software e.g. security, workflow, cost, integration, adaptability etc. There are three main steps for the scoring model creation:

1. Identifying the requirements.
2. Ranking the software solutions by the requirements using the same scale.
3. Assign the scores for each criterion.

There is no more, than that. That is very simple way to rank the solutions and have a clear picture about solutions gathered.

3 Market research

3.1 Necessary features for WMS that can be applied for the situation described at the chapter “Introduction”.

All warehousing management systems are made to support basic activities of the warehouses. There are many business types that need a different kind of solutions. Our case is very specific due to needs of the company that should be fulfilled e.g. real-time information in JSON format.

3.1.1 SQL bridge or other access to the available information

One of the main criteria to the WMS that should be chosen is real-time access to the information for the intermediary so that they can provide that info in a simple manner to the manufacturer.

When the system is installed locally that criteria is a big problem to the software developers. Usually, some new module needs to be planned, developed, tested. It takes very much time and money. A lot better to find an already existing solution that provides such opportunities. Such an approach will eliminate many pitfalls.

In the case of cloud-based solutions, we might not need any support from the software suppliers as everything presented on the web page. It is possible to use such kind of webserver language (e.g. PHP) that intermediary specialized on and parse needed information straight from their system. Certainly, it is easier if an access is granted in more flexible JSON or another format, but if the price is very high for such module we need to think about parsing using our own abilities.

3.1.2 Third party logistics

The third-party Logistics is the arrangement in which a firm outsources its logistical operations to one or more firms (third party) that are specialized for such kind of operations (Third party logistics (3PL)). Experienced partner for cooperation saves time and money via well planned and efficient work. That helps to stay competitive on the market.

In the case that is overviewed in this Thesis, the third party is the Intermediary. It wants to implement the system and take care of the information that is saved on the software's web server. (We are dealing with the data flow and this sphere might be also called as informational logistics. We outsource the informational logistics.) The simplest way to find such software suppliers that provide SQL bridge or other things, like developer's API is to filter by 3PL opportunities.

Definitely, it is possible to parse information from the web pages, but it will take very much time for the R&D team of Intermediary to develop that system.

There are many suppliers that will be using the same system. It means that there are several warehouses in the system. Third-party logistics opportunities give a possibility to hold them all at the same time. This is economies of scales.

3.1.3 Optimal WMS access

As we know from the introduction manufacturer wants to improve the efficiency of working with suppliers. The perspective way to grow is to implement new WMS. We need to determine what are the devices are going to be used for the access the system (e.g. phones, tablets, computers, specially developed gadgets etc.)

One way is to use already-existing portable computers on the supplier's side. According to the information gathered from Intermediary, the computer has Linux-family OS and USB ports what is enough to support the web browser. Internet connection is stable

pretty much everywhere, but if there are problems for a couple of seconds it might be solved by using asynchronous queries.

Another rapidly growing and popular way is mobile versions of applications. Such applications are usually done for Android and Apple phones or other devices. Android devices have more rational prices. If we are talking about amount of devices that should be bought Android is the absolute leader. Certainly, there are other mobile OS producers, but they are very unpopular as platforms. Conclusion concerning the difference in prices of iOS and Android OS devices is done according to the research that has been made by Siegal (2014): The price gap is even growing. There are no reasons to use or search software for iOS.

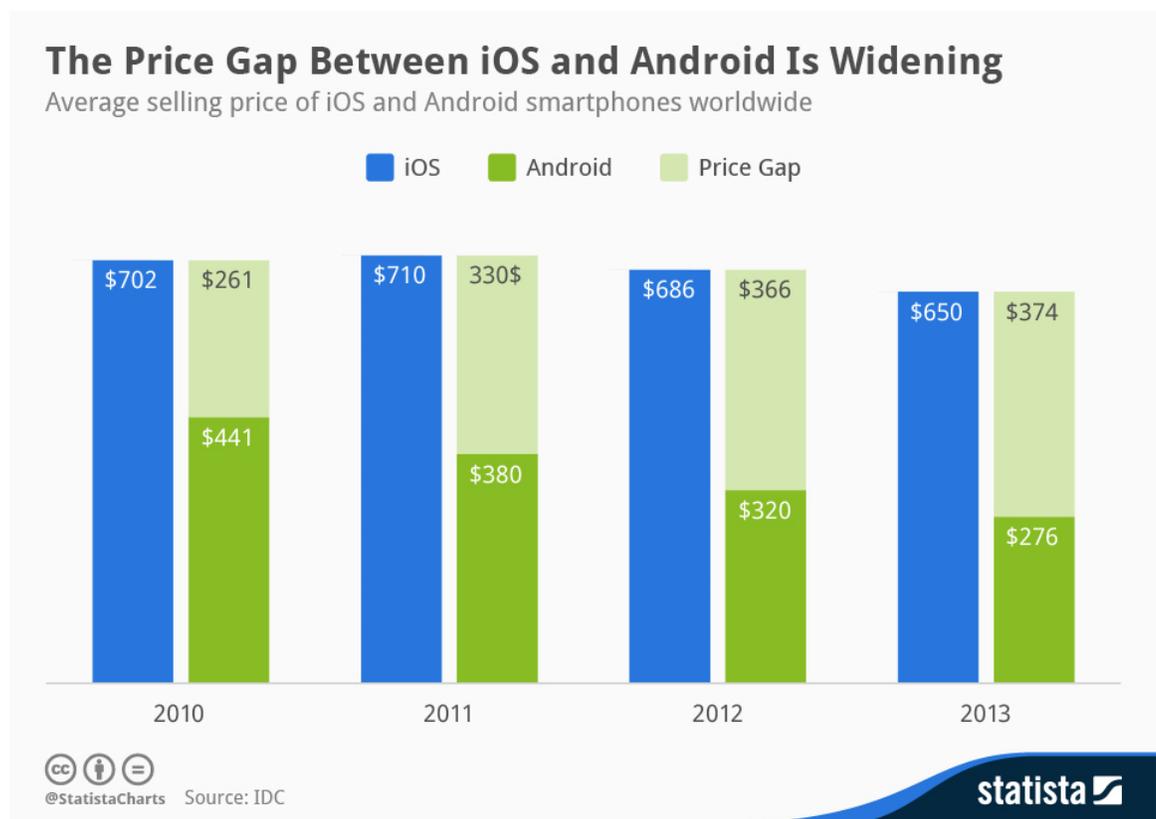


Figure 4. The price gap between iOS and Android (Siegal).

We know that suppliers do have phones and want to check details of goods stored at the warehouse by scanning the barcode. So if we chose the web-based solution we might kill two birds with one stone. We will have an opportunity to run WMS on any already existing phone as well as any Operating System what makes the system very flexible in use at the warehouse and working places.

3.2 Problems of the internet lists with software suppliers.

Warehousing Management Systems are the software solutions. The market changes so rapidly that we need to use the most recent information on this topic. The Internet does provide most up-to-date information comparing to books, especially if we are talking about web-based solutions that we are looking for. Currently, there are many bases of WMS available on the Internet that can be used for collecting and comparing. In most cases, they are presented as simple lists with different filters. Usually, the list of filters of one system does not match to the list of another list. Often they do not have the filters that we need for the research that is why manual checks of the software supplier's websites are applied in many cases. For example, the design of the software supplier's website tells us a lot about how serious they are, but it cannot be anyhow checked through the filtering.

3.3 WMS collecting risks

While collecting the systems the use of sources should be very. It is important to find rational pricing, good language support, user-friendly design and other things. Definitely not every list can provide them reliable and there are a few reasons for it:

- 1) Solutions collected by one person might be orientated on the one country where he has born and many systems listed might have problems with languages available and the design. As an example, US people would collect systems that are in use only at the US. In most cases, only English language will be available

and difficulties with support can be met as software supplier's offices are far away.

Another example is about cultural features. People from China would prefer totally different designs compared to Finnish preferences.

- 2) Bases made of advertised solution might consist of not fairly ranked systems, therefore, mislead about the picture of the real market. Unfair lists create bigger costs in implementations phase as well.
- 3) Old lists lead to wrong conclusions concerning current market solutions, old-stylish methods of implementation make the life of an R&D department harder and increase overall costs.

These risks must be avoided by using several sources and taking very close look at the list positioning, their authors and reviews of other people on the website if they do exist.

3.4 Research constraints

There are hundreds of solutions that could be found in different lists on the internet is hard handle, therefore, they are filtered by the filters available. Not every filter is needed for the stated situation in this Thesis. Let us take a closer look on them.

3.5 Research methods

There are three main types of researches that can be applied: qualitative, quantitative and mixed. According to the task that has been set the need is to find suitable solution to the problem stated. Two methods are used in this Thesis:

- Qualitative research as the word description of the systems in order to provide picture of application areas of found solutions.
- In order to give ability to the R&D department of the host company to have a clear picture where to start the weighted grading can be made. Weighted grading brings wider and clearer picture with the quantitative analysis of the systems found, their benefits and leaders. The more important the feature the

bigger weight should be. If the feature is just an additional thing that good to have the weight is 1 and the most important ones do have weight 2.

3.5.1 Mandatory features of new WMS that are needed

Deployment: According to the chapter “Optimal WMS access” we need to filter systems by Web-based solutions and Android apps. It is already known that some employees are using barcode reader from phone to check information about goods and portable computer installed on the forklifts that have an access to the internet and can be used as a base for the web apps. Definitely, we might count well-made web-based solutions that are localized for the mobile phones as a mobile app.

Access from outside: very rare criteria that is impossible to check the lists and should be explored by hands reading the software supplier’s website, but even, in that case, there is no 100% warranty of gathering information. Usually, request is needed. The access itself should give an opportunity to extract real-time information from the system, in other words, the criteria is API available or SQL bridge. Even though filter “access from outside” does not exist as it is, but from time to time we can find filter as API and it might help, as well as third-party logistics. There is a big chance that company does provide the access for the solutions with open API and 3PL opportunities.

Barcoding: It is a good plus for the suppliers to have an opportunity to use barcodes as they do already. QR code is the choice of the company due to the reliability of it. Even if the big part of the barcode is destroyed there is a big chance that reader will recognize the data encrypted. The new WMS must has the reading and printing of the labels

Rational price: Solution must be with rational price as suppliers are small and manufacturer will not invest a lot in such solution as they do work already and do not have much of investments at the moment. Certainly, the manufacturer as the main stakeholder might help with some part of the investments, but it won’t be full price.

3.5.2 Additional WMS's features that might benefit

Well looking website: the clearer information and more effort on the website say that company is up-to-date and can provide more modern technology. This criterion is also saying about the user interfaces. Well-made interface leads to the smaller costs of personnel trainings.

Opened pricing: usually, when prices are shown that means software company deals with the web a lot and opened to the trends. The trend of the last years is to be opened as much as possible. Especially, it is seen in the web technologies. If people are opened with the prices they are sure that their solution worth the money asked and that they can compete with other players of the market.

Trial version is a good feature in order to check the opportunities of the WMS by R&D team of Intermediary in pre-hand. That criterion will save time for the system suitability check.

3.6 Warehousing Management System choosing principles and sources

The internet is used to search for the solution as the most up-to-date source. There are several web-lists with the WMS collections that have been gathered from the Internet in order to search the most suitable solution:

1. Collections from the internet
 - a. SoftInsider: <http://warehouse-management.softwareinsider.com/>
 - b. Capterra: <http://www.capterra.com/warehouse-management-software>
 - c. Softwareadvice: <http://www.softwareadvice.com/scm/warehouse-management-system-comparison/>
 - d. SelectHub: <https://selecthub.com/categories/warehouse-management>
 - e. G2Crowd: <https://www.g2crowd.com/categories/warehouse-management>

- f. GetApp: <https://www.getapp.com/operations-management-software/warehouse-management/>

2. Theses

- a. <https://www.theseus.fi/handle/10024/45767> (Lemonsoft, Visma Software, Microsoft Dynamics)

It was enough to search through SoftwareInsider, Capterra and GetApp websites to gather needed 10 solutions. There were no good matches in Capterra website, but SoftwareInsider and GetApp brought 10 solutions that can be used for the case as they do fulfill the needs. Two more solutions have been chosen in addition to the list of 10 systems. They are taken from the Thesis of Matias Perttu due to the availability of Finnish language. The Finnish language is so specific that there only a few systems that might offer it's integration. All systems were collected with a filter that narrowed the list to the web-based solutions. Other columns in the table are added according to the generalized needs. Information on them has been partly checked manually and partly via the filters of bases. Not every base provides opportunities to filter for the features that we are looking for.

List of all solutions can be found into Appendixes 1 and 2.

The decision about the optimal number of solutions should be presented is made according to the "100:10:3:1 rule" that is known from the studies of Robert Kiyosaki. The article can be found on the pages of the northcoastfinancialinc.com website and it tells that:

- An investor must look at **100** properties to find **10** potential deals that can be profitable
- From these 10 potential deals, an investor will submit offers on **3**
- Of the 3 offers submitted, **1** will be accepted

The rule itself has been made for the decisions on real-estate, but it can be also nicely applied in the situation described in this Thesis too. The job of this Thesis is to provide

these 10 solutions as the suggestion in order to give an opportunity to the host company rank them and choose the most suitable solutions.

3.7 Results of the warehousing management system search

All systems are chosen so that they are available through the internet. In other words, they are web-based. All other features and options that valuable for the case a listed below for each case separately. If some results were outstanding or just important they were remarked.

Shopping Cart Elite:

1. Full API access to the system
2. Barcodes handling (Printing&reading)
3. Prices is on average level (119\$/month/User, 0.0175\$/month/SKU).
4. Mobile version available
5. Trial version available (everything might be checked before the purchasing)
6. There is no information on the website about third-party logistics.
7. English is only available language

Paragon ERP:

1. Information can be exported as PDF, raw data, XML or Excel
2. Barcodes handling (Printing&reading)
3. Low price (68-125 euro/user/month)
4. Mobile version available as mobile design for the website.
5. There is no trial version.
6. 3PL is available.
7. Dutch, English, French

PALMS WMS:

1. Electronics Data Interchange is available for the data export.
2. Barcodes handling (Printing&reading)
3. Price is 200\$/month/User

4. Mobile version available as mobile design for the website.
5. No trial version.
6. Outstanding support of 3PL.
7. English is only the one language.

Micrologistics WMS:

1. Very good data export methods: EDI, MS SQL, Oracle etc.
2. Barcodes handling (Printing&reading)
3. Prices are not available on the website.
4. Mobile version is available.
5. No trial version.
6. 3PL support
7. Chinese, Chinese (Simplified), English, French, German, Italian, Japanese, Korean, Portuguese, Russian, Spanish, Swedish, Turkish, Vietnamese

Unleashed Software:

1. API of the system's development team is opened for users
2. There is no barcode handling support
3. Prices are extremely low (30-85 euro/user/month)
4. Mobile version available as mobile design for the website.
5. There is a trial version
6. 3PL is not mentioned, but it looks like it might be implemented if needed.
7. Multi-Language, Multi-Currency, Multiple Company & Locations

3ex.net:

1. SQL reporting connection available
2. Barcode handling is available.
3. Prices are not available.
4. Mobile version does exist.
5. Trial version is not mentioned
6. 3PL is not mentioned on the website.
7. English is the only one language.

NetSuite:

1. Exporting tools are not mentioned, but such a big company should have it.
2. Barcode handling is available.
3. Prices are not available, but some reviews on the softwareinsider mentioned range of 1 000-50 000 \$
4. Mobile version exists.
5. There is no trial version.
6. 3PL is not mentioned, but most probably exist.
7. Many languages available, including Finnish.

Magaya WMS:

1. Exporting tools are not mentioned on the software developer's website, but the base of WMS says that API is available.
2. Barcode handling is available.
3. Prices are not available.
4. There is mobile version.
5. There is trial version.
6. 3PL is available.
7. English and Spanish languages are available.

Clarus WMS:

1. Nothing concerning API is mentioned on the website.
2. Barcode handling is available.
3. Price is 250€/month
4. Mobile version is available
5. Trial version is available
6. 3PL is available
7. Dutch, English, German, Polish, Spanish

Cin7 Inventory Software :

1. Export into excel or usage of existing Dashboard. Parsing of information might help with that issue.

2. Barcode handling is available
3. Rational price (800euro/month = 5 users, 45 euro/add. user/month, 100euro/3pl con/month)
4. Mobile version exists.
5. Trial version is available.
6. 3PL is supported.
7. English is the only language available.

Lemonsoft and Visma Software are originally from Nordic countries and the Finnish language is available. Language is very specific, not too many companies provide such language. There is not much information available on the website. In terms of features they are not the very best solution, but if supplier works in Finland it is possible that employees don't know English very well or don't want to work in some other languages, than Finnish.

3.8 The weighted scaling rules

Usually, during the research there are many filters and representing findings in a table or in words is useful, but cannot really highlight the main points and determine the leaders. Each criterion that has been used for a choosing the solutions should be counted with the weighted grade. Weighting is counted by the real need of some of the features (requirements). The way how weighted grade can be calculated is well described by Stapel (N.d.) Grading should be invented in order to be able to compare the solutions. The grading system can be done as follows:

Table 2. Grading system for the systems' features

Grade	Meaning
1	The feature is missing.
2	Information is not available.

3	Some solution exists, but might need study from R&D department.
4	Does fulfill the needs.
5	Outstanding result.

When the grading system has been determined the next step is to understand how features important to the situation that are covered. Like always, not everything is equally matters to the choosing of the system that are needed for the host companys' future use.

Table 3. Weights for the requirements

Criterion	Weight	Comment / reasoning
Web-based	1	It does help with the availability of information and very modern way.
API / SQL bridge	2	The most important feature that we are looking for. If it is missing the system shouldn't be considered at all.
Barcoding	2	Modern and efficient way that is used worldwide. The host company works in different countries. It is extremely important to have such thing, as barcodes handling.
3PL	2	Very important criterion in terms of data access for different users.
Price	1.5	Good to keep price rational.
Mobile version	1	In most cases the systems that are web-based do have the possibility to run the system on the phone due to the mobile design.
Trial version	1	This is a good plus in order to have a chance to check the features. If there is not such thing the query should be made if some information is mission of the software suppliers' website.
Languages	2	

The result of the weighted scoring is represented in the chapter "Conclusion".

4 Conclusion

The main target of that Thesis was the market study on Warehouse Management Systems. The host company wanted to penetrate into the new market of WMS in order to play the role of warehousing management systems' supplier that help with localization of the WMS system for mid-size manufacturers and their specific needs.

Host company of the Thesis has pretty wide range of customers that have almost the same needs in the optimization of the supply chain. Certainly, some of them already found the solution concerning warehousing informational flow, but many don't. This is basically the reason why solution needed to be searched. The target of the research was to support the choice of the WMS that will give an opportunity to solve problems of host company's customers. The main target is to provide real-time information on stock quantitative and other supportive information on supplier's warehouses to the manufacturer.

The choice is supported by investigating the market and providing top 10 most suitable WMS for the host company with the description of the systems and reasoning for the choosing.

Due to the 100:10:3:1 rule it has been decided that the Thesis should consist of 10 most suitable solutions. The result of the research is the list of the systems with the explanation of the choice. There are pretty many constraints for the generalized situation where it should be used. Only very necessary are taken, than must be in the solution due to the specific needs. 160 solutions have been observed and only 10 were somehow suitable for our needs. Sometimes something was missing but can be finished up by R&D team. Overall the full match hasn't been found. Apparently, API, DB access, 3PL opportunity and multilingual solution is a very specific scope of constraints that very rarely can be met in warehousing management systems. The barcode reading, barcode printing and mobile versions of the systems are very popular for the web solutions and have been met almost in every case. Barcoding is a very typical thing for the warehouse as well as mobile versions for websites.

There are many customers that will be using the solution that we were searching for in this Thesis. Due to the different situation, the universal solution should be chosen. The scope of the situations is known only to the host of the Thesis and hasn't been shared due to privacy reasons. That is the reason why we will take a closer look on which situation what systems we might take. If the scope is too diverse I would strongly suggest to divide them into the groups and find a solution for each group separately ignoring the smallest ones. According to the Pareto rule 20% of the forces will bring 80% of profit.

1. Shopping Cart Elite

This is the solution that fulfills almost anything concerning the stated generalized situation. We do have a very good opportunity to use full API access to the system that solves the main problem with the providing the real-time information on stocks of the suppliers' warehouses. It does have all basic warehouses' features. The cost is pretty much rational, especially if we remember that number of SKU in or case is small. We are talking about big containers. Mobile and trial versions are provided what makes it easier to use.

One of two problems that they have is that there is not information concerning 3PL. It might affect on the granting an access for the employees to the right warehouse. In my opinion, the system's opportunity of handling the 3PL can be checked via trial version usage. Another problem is concerning languages. According to the available information, they do have only English language. It should be checked as well.

Overall the solution is a very good match for the English-speaking countries. If the system will give some opportunities for the language change it would be the best choice that you might do in such situation that we are taking over in this Thesis.

2. Paragon ERP

The system does have everything to support the typical warehouse's needs: barcodes (printing and reading), 3PL opportunity, mobile version. There is even outstanding result concerning the price. It is one of the cheapest solutions that match our needs. We do need to make sure that formulating as "PDF, raw data, XML or Excel" does give an opportunity to export information automatically and the possibility of the different language's usage. It is mentioned that they do have only Dutch, English and French.

Overall it is a good match. Few things need to be discovered in advance. It might be a good match for the customers located in Denmark, France, and English-speaking countries.

3. PALMS WMS

The situation with this solution is very close to the Shopping Cart Elite. The difference is only about the price which is higher, no Trial version and we can say for sure that there is a 3PL opportunity. English is still the language that is only available and ability to make it multilingual should be checked via query to the company.

4. Microlitics WMS

This is one of very big software suppliers that have an old hand at warehousing management systems. It does provide everything that we need for the situation we have. There is any kind of bridges for the information access. Many languages are available. Third-party logistics strongly supported as well as barcoding. The problem is only that the price is unknown and it might be anything.

5. Unleashed Software

Perfect language support, outstanding open API access, very cheap price and available trial version is what describes the Unleashed software. It does sound like the perfect match at first, but there is no barcode handling. The closer look should be made on the trial version in order to

understand how suitable the system is for the needs that we are looking for.

6. 3ex.net

The system is specially designed for the retailers. It does not sound very good at first, but it can be very useful for the case when we talk about the situation about the big shops and their suppliers. There is an SQL reporting connection available that makes very easy access to the stocks available for the big shop and the barcodes that are fully supported by this system. Problems are about 3PL, unavailable price and inability to handle multiple languages. It is not useless it is for the specific situation that might appear now or in the future.

7. NetSuite

Professional software supplier that would provide the solution that you might fully trust. All technical features are implemented or could be added, the problem that their customers notice are about the poor interface and high price. We are coming to the step when we choose what matter more to us: money or reliability.

8. Magaya WMS

The pretty professional team doing a good job with the WMS. The system does include the barcode handling, third-party logistics, mobile version, trial version. The problems that they have are the support of many languages (there are only Spanish and English) and the unavailable price. Never know what it will cost. The API or something for the access to the information is not mentioned.

9. Clarus WMS

Fulfills all needs that we are looking for. Barcoding, 3PL, open pricing, mobile version, trial version and several languages (Dutch, English, German, Polish, Spanish) Nothing is perfect. They do not provide the API (There are only Excel and PDF reports). The website is formed so that they are very open. It can be very good idea to ask for the SQL access. I think

they might implement such thing for a big customer. Certainly it will take time, but still it worth it. Especially, if the available languages match the need of the situation where the system it is planned to apply.

10. Cin7 Inventory Software

Well looking system with an ability to export information to the Excel or own dashboard with the only English available. The real-time information might be parsed, but due to the language, such a solution can be used only for the English-speaking countries. 3PL, Barcode handling, trial version and mobile versions do exist.

11. Lemonsoft and Visma Software

Solutions that are having an accent on operation in Nordic countries. Do have offices located in Finland or very close. It is easy to meet up and discuss the needs and most probably, they would fulfill whatever is needed. Such kind of companies does not share the prices and there is a big risk to invest much of an effort on them and find out that solution cost a lost and reject it. Otherwise, it might be a good choice if you don't find a good match in other situation listed above.

These solutions have been found. They are all different and can be applied to the stated situation or some other that might appear in the future of the host company. The current situation with the raw material suppliers to the manufacturer in Finland can be solved with the Unleashed Software and NetSuite. Definitely, it might a problem with the barcodes in Unleashed Software solution, but the additional small program might be installed and used as barcode scanning/printing help. 12 solutions have been compressed to these two just because of Finnish language need. In the case of some other countries, we might want to use other solutions as well.

4.1 Scailing of the systems found

Systems are listed, but decision about where to start might be hard for the company. Certainly, it is better to check every solution separately, but in order to give the starting

point the table of comparison of the systems is made. The table itself can be found in the appendix 3. The summary of the grading is presented below:

Table 4. Found solutions comparison.

	Sum of grading	Weighted grading result
Paragon ERP	30	49.5
Microlistics WMS	29	48
Clarus WMS	31	48
Shopping Cart Elite	30	46
PALMS WMS	28	46
Cin7 Inventory Software	30	46
Unleashed Software	29	44.5
Magaya WMS	28	43
3ex.net	26	41
NetSuite	24	38

According to the grading above we can certainly say that it is a good idea to start exploring the systems starting from the biggest grades. Paragon ERP is the leader that should go first and the NetSuite is the solution that is least desirable for the choice and goes under review last.

The weight of the grades of the features had an effect on the importance and that is why the Clarus WMS is not on the first place even though the sum of grading is high.

4.2 Next steps

The whole picture about the customers and their current situations with the labour forces hasn't been shared due to privacy reasons. That is why it is hard to propose any of the solutions out from these 12 that have been found during the market research.

Almost probable case scenarios that host company might meet up in the future are taken into account. The solution for most of them can be found in these 12 WMS that are described in the results of the Thesis.

The next step for the company will be a deep analysis of its own current situation as well as customer's requirements and business activities. We should not forget the 11 steps of WMS implementation described in the chapter "Steps to successful WMS implementation". It is good to follow them to make the whole story less risky. Keep remembering that choosing the WMS system is just a start of a long story for the logistics optimization.

Definitely, there is more, than just a list of warehousing management solution for the host company of the Thesis. This market research is a valuable thing for any company that wants to implement new WMS to their warehouse even if they are not looking for the 3PL. The main accent is made on web solution as the most perspective way to grow. The appendixes can be used freely to gather names of the WMS with the short analysis of their features. This can a good start for small and medium sized companies, but might be not the best solutions for huge enterprises as the structure of them is complicated. It leads that such huge software suppliers as SAP should be used what will lead to the more efficient system implemented with more rational solutions, but it will definitely cost more, than what we found out and installing of SAP solutions take a lot more time. It is clear, that the found solutions cannot support that amount of activities that huge enterprises have. Servers do have limitations. In most cases, the whole structure of the servers is supposed to be changed for the ability to support enterprises.

5 Discussion

This Thesis covered the topic of Warehousing Management Systems and the ways how they might be applied in different situations of companies that do cooperate with other businesses closely. Such kind of cooperation helps to keep supply chain clean and efficient. One of the most important things is to be fair and transparent with your partners. Sharing information on stocks available does benefit to everyone in the supply chain. Bullwhip effect won't be seen in this case. It will decrease the safety stocks and workforces for the checks of goods availability as we would not have to make any additional queries, but just take a look at the system. That is the system that customers need. During the market research it has been found that amounts of WMS is huge, but only a few percent of them is suitable to meet today's business requirements of cooperation between the companies.

The search into the already existing works on the topic of warehouse managements systems has been made and has not brought any good results. Certainly, there are plenty of Thesis which are fully theory-based concerning the advantages and disadvantages of WMS, but nothing about real world applications with their problems and pitfalls.

The work that is done has made an accent on the aspect of real software, their features, and unexpected constraints that software suppliers have done by their own choices. The biggest constraints in our case were the SQL bridge or other access to the real-time information and the languages. The best solution with the languages would be the matrix made solutions where you might add any languages that you need, but just a very few do have that. It is even hard to say why did it happen so, but that is the reality.

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Appendix 1(3). GetApp WMS comparison

GETAPP			- Good		Y = Yes			
Filter:	Web-based		- Very good		N = NO			
			- Something wrong		empty = hasn't been checked / Not found			
			- Bad for the solution					
Result:								
N	Name	API	WEB	Barcode scanning	3PL	Trial version	Open-source	One-time payment
1	Asset Panda	Y	Y	Y	N	Y		
2	EZOfficeInventory	Y	Y	Y	N	Y		
3	Cin7 Inventory Software	Y	Y	Y	Y	Y		
4	Unleashed Software	Y	Y	N	Y	Y		
5	Megaventory	Y	Y	Y	N	Y		
6	Paragon ERP	Y	Y	Y	Y	Y		
7	Shipwire	Y	Y	N	N	Y		
8	PowerHouseWMS	Y	Y	N	N			
9	AscentERP	Y	N	N	N			
10	TradeGecko	N	Y	Y	Y	Y		
11	Finale Inventory	N	Y	Y	N	Y		
12	Fishbowl	N	Y	N	N	Y		Y
13	Acctivate	N	Y	Y	Y	Y		
14	3PL Central Warehouse Mgr	N	Y	Y	N	Y		
15	Sellsy Stocks	N	Y	N	N	Y	Y	
16	SKULabs	N	Y	Y	N	Y		
17	SkuVault	N	Y	Y	Y	Y		
18	LA WMS	N	Y	Y	Y			
19	Propago	N	Y	N	N			
20	Odoo Inventory	N	Y	Y	N	Y	Y	
21	Acumatica Cloud ERP	N	Y	N	N			Y
22	Dynamic Inventory	N	Y	Y	N	Y		Y
23	DistributionPlus	N	Y	N	Y			Y
24	BusinessMan CRM	N	Y	N	N			Y
25	LogFire	N	Y	Y	N			
26	WAERlinx	N	Y	Y	N		Y	
27	TECSYS Distribution	N	Y	N	N			

	Management							
28	PackManager	N	Y	Y	N			
29	BirdDog Software	N	Y	N	N			
30	OneStop Internet	N	Y	N	N			
31	Logivations	N	Y	N	N	Y		
32	RSA eBusiness	N	Y	N	N	Y		Y
33	ASCTrac WMS	N	Y	Y	N			
34	EnterpriseIQ	N	Y	N	N			Y
35	GESIO	N	Y	N	N	Y	Y	
36	TECSYS Warehouse Management	N	Y	Y	N			Y
37	Blast Ramp	N	Y	N	N	Y		
38	CoreWarehouse	N	Y	N	N			

Appendix 2(3). Software Insider WMS comparison

SoftwareInsider			- Good					Y = Yes
Filter:	Web-based		- Very good					N = NO
			- Something wrong					empty = hasn't been checked / Not found
Result:								
N	Name	WEB	Barcode scanning	Barcode printing	FI lang	API	3PL	Notes
1	Shopping Cart Elite	Y	Y	N	N	Y		
2	NetSuite	Y	Y	Y	Y			
3	Magaya WMS	Y	Y	Y	N	Y		
4	3ex.net	Y	Y	Y	N	Y		
5	PALMS WMS	Y	Y	Y	N	Y		
6	Micrologistics WMS	Y	Y	Y	N	Y	Y	
7	ClarusWMS	Y	Y	Y	N	?	Y	Web, very well made solution. No information concerning API. Good idea is to ask.
8	3PL Warehouse Manager	Y	Y	Y	N	NF		
9	ACCTivate!	Y	Y	Y	N	NF		
10	Focus i	Y	Y	Y	N			
11	ASCTrac WMS	Y	Y	Y	N	NF		
12	Easy WMS	Y	Y	Y	N	NF		
13	SphereWMS	Y	Y	Y	N	XML uploads		
14	Slingshot IWM	Y	Y	Y	N	NF		
15	CoreIMS	Y	Y	Y	N	NF		
16	WISE	Y	Y	Y	N	NF		
17	SIMMS Inventory Control	Y	Y	Y	N	NF		
18	Passport WMS	Y	Y	Y	N	?		good
19	Brilliant WMS	Y	Y	Y	N	Import and export		

						function ality.		
20	Appticity Warehouse	Y	Y	Y	N	NF		
21	Shippedge	Y	Y	Y	N	Accounting reporting		
22	Geneva Business Management Systems (GBMS)	Y	Y	Y	N	NF	Y	
23	E-Business Suite(oracle)	Y	Y	Y	N	NF		
24	EnterpriseIQ	Y	Y	Y	N	N		
25	ViewPoint Logistics	Y	Y	Y	N			
26	Finale Inventory WMS	Y	Y	Y	N	N		
27	Fishbowl Manufacturing	Y	Y	Y	N	N		
28	IntelliTrack WMS	Y	Y	Y	N	NF	Y	
29	Inventory Traker	Y	Y	Y	N	NF		
30	DPS Zap WMS	Y	Y	Y	N	NF		
31	Orderwave	Y	Y	Y	N	Y		Strange representation of infomation.
32	DistributionPlus	Y	Y	Y	N	NF		
33	JAIX Warehouse	Y	Y	Y	N	NF		
34	MyWarehouseMa nager	Y	Y	Y	N	NF		
35	Monsoon WMS	Y	Y	Y	N	NF		Specially done for retailers that sale good in such systems, as ebay.
36	LISA WMS	Y	Y	Y	N	NF		
37	LA WMS	Y	Y	Y	N	NF		
38	Pangaea IMSpro	Y	Y	Y	N	NF		
39	Event Tracker (eVT)	Y	Y	Y	N	NF		
40	iBEM WMS	Y	Y	Y	N	NF		
41	Basis WMS	Y	Y	Y	N	NF		
42	BONDmanage	Y	Y	Y	N	NF		

	Express WMS							
43	VeraCore	Y	Y	Y	N	NF		
44	CALIDUS WMS	Y	Y	Y	N	NF		
45	DCMS	Y	Y	Y	N			
46	PackManager	Y	Y	Y	N	NF		
47	DEPOT WMS	Y	Y	Y	N			
48	DX Op-Center	Y	Y	Y	N	NF		
49	Foxfire WMS	Y	Y	Y	N	NF		
50	iRadar Cloud Suite	Y	Y	Y	N	NF		
51	Inventory Pro	Y	Y	Y	N	NF		
52	KBQuest WMS	Y	Y	Y	N			Windows OS available only.
53	TECSYS WMS	Y	Y	Y	N	NF		
54	PeopleVox WMS	Y	Y	Y	N	External carrier interface		
55	Synapse	Y	Y	Y	N			Do help with installation and can even outsource everything that is needed. Very flexible.
56	WithoutWire Warehouse	Y	Y	Y	N			
57	Proteus WMS	Y	Y	N	N			
58	DM Warehouse	Y	Y	N	N			
59	3PLink WMS	Y	Y	N	N			
60	Enterprise WMS	Y	Y	N	N			
61	CoreWarehouse	Y	Y	N	N			
62	irms WM	Y	Y	N	N			
63	Snapfulfil WMS	Y	Y	N	N			
64	Foysonis WMS	Y	Y	N	N			
65	ASSIST4 Warehouse Management	Y	Y	N	N			
66	Axacon WMS	Y	Y	N	N			
67	Dakota Series	Y	Y	N	N			
68	CIO Direct	Y	Y	N	N			

69	Tablet Director	Y	Y	N	N			
70	Kewill MOVE	Y	Y	N	N			
71	LOG-NET System	Y	Y	N	N			
72	BoxcarCentral	Y	Y	N	N			
73	Autostore WMS	Y	Y	N	N			
74	CartonLogic	Y	Y	N	N			
75	e-comDrive WMS	Y	Y	N	N			
76	Apriso Warehouse	Y	Y	N	N			
77	FortnaWCS	Y	Y	N	N			
78	FOXWARE WMS	Y	Y	N	N			
79	Fusion Stock Control	Y	Y	N	N			
80	Integrated Warehouse Solution (IWS)	Y	Y	N	N			
81	Barcoding WMS	Y	Y	N	N			
82	Optimiser Core WMS	Y	Y	N	N			
83	The SWIFT WMS	Y	Y	N	N			
84	Symphony WMS-Online	Y	Y	N	N			
85	WAERlinx	Y	Y	N	N			
86	WMS for 3PLs	Y	N	Y	N			
87	Click Reply WMS	Y	N	Y	N			
88	LocateIT WMS	Y	N	Y	N			
89	DataCollection GP	Y	N	Y	N			
90	JDA Warehouse Management	Y	N	N	N			
91	S2K Warehouse	Y	N	N	N			
92	Anywhere Warehouse Management	Y	N	N	N			
93	Exacta WCS	Y	N	N	N			
94	Infor Supply Chain Execution	Y	N	N	N			
95	Montisvir WMS	Y	N	N	N			
96	GoECard IMS	Y	N	N	N			
97	Contalog	Y	N	N	N			
98	IBS Dynamam	Y	N	N	N			

99	NCR Warehouse Management	Y	N	N	N			
100	SmartTurn WMS	Y	N	N	N			
101	Jesta Vision Suite	Y	N	N	N			
102	a-SIS Warehouse Management	Y	N	N	N			
103	Vision WMS	Y	N	N	N			
104	Commerce Management System	Y	N	N	N			
105	AWLview WMS	Y	N	N	N			
106	ProfitPoint	Y	N	N	N			
107	Nexpart Distribution Management	Y	N	N	N			
108	Codeworks WDLS	Y	N	N	N			
109	CRiSTAL WMS	Y	N	N	N			
110	DataFreight	Y	N	N	N			
111	Dematic iQ	Y	N	N	N			
112	Traverse	Y	N	N	N			
113	iLEX	Y	N	N	N			
114	MACSwms	Y	N	N	N			
115	Manhattan WMS	Y	N	N	N			
116	Minster WMS	Y	N	N	N			
117	Bright Warehouse	Y	N	N	N			
118	SWS Aurora	Y	N	N	N			
119	WarehouseNet	Y	N	N	N			
120	WarehouseQ	Y	N	N	N			
121	WM 6 Warehouse Management	Y	N	N	N			
122	Gateway V2	Y	N	N	N			

Appendix 3(3). Weighted WMS grading

			W		- Weighted result													
			N		- Non-weighted grading													
WMS	Web		API / SQL connect		Barcoding		3PL		Price		Mobile		Trial		Languages		SUM	
	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W
Paragon ERP	4	4	5	10	5	10	4	8	5	7.5	3	3	1	1	3	6	30	49.5
Micrologistics WMS	4	4	5	10	5	10	4	8	2	3	4	4	1	1	4	8	29	48
Clarus WMS	4	4	2	4	5	10	4	8	4	6	4	4	4	4	4	8	31	48
Shopping Cart Elite	4	4	5	10	5	10	2	4	4	6	4	4	4	4	2	4	30	46
PALMS WMS	4	4	4	8	5	10	5	10	4	6	3	3	1	1	2	4	28	46
Cin7 Inventory Software	4	4	3	6	5	10	4	8	4	6	4	4	4	4	2	4	30	46
Unleashed Software	4	4	5	10	1	2	2	4	5	7.5	3	3	4	4	5	10	29	44.5
Magaya WMS	4	4	2	4	5	10	4	8	2	3	4	4	4	4	3	6	28	43
3ex.net	4	4	5	10	5	10	2	4	2	3	4	4	2	2	2	4	26	41
NetSuite	4	4	2	4	4	8	2	4	2	3	4	4	1	1	5	10	24	38