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The international scientific association of economists "Consilium"
Web-page: www.isaec.info
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ECONOMICS SECTIONS:

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THE ECONOMIC RESULT AT A LEAN WAREHOUSE

Dmitry A. Kuzin
Higher School of Economics - National Research University (Russia)
dkuzin@hse.ru

An abstract. *The article investigates how the Lean tools can be used in Warehousing businesses with positive economic effect. This study showcases the implementation of two Lean tools, such as, Pull system and eliminating waste (Muda) on motion and waiting in the warehouse.*
Key-words: *Lean Warehousing, Stock location, JIT purchasing.*

The empirical part of this article is conducted as a cases study in a Russian manufacturing and retail companies. The primary source of information was the review of the firm's databases.

We advanced the hypotheses that implementation of Lean system will allow the company to reduce costs, optimize warehouse operations, and as a result, improve the common economic indicators.

Background of the study. Lean is a concept that got its name from a research program that started in the 1980s by scientist from the Massachusetts Institute of Technology. But its idea's and principles comes from the Toyota Production System that originated in the early 1940s.

Lean in production is now a well known subject with years of practical experience. In the 21st century, the warehouse is becoming a strategic tool to be used for a competitive advantage. Optimizing the warehouse operations allows being more flexible and efficient, especially in the rapidly growing world of e-commerce (Friedman, 2008).

Currently, there are a number of tools that can be used by companies to be Leaner, but not all the organizations know what tools to use, when to use them, or how to use them. It suggests that the topic remains poorly understood. Therefore this project is needed to investigate how to be lean in warehousing and how this can be supported by using JIT – Pull purchasing, and waste - elimination system.

The problem statement. To be lean in warehousing is to improve the processes that are value added for customer and to eliminate processes that can be avoided without reducing the warehouse ability to perform its function.

This thesis will identify stock keeping, stock location and purchasing processes in warehousing and how the Lean Thinking concept applies to these processes.

Stock management is the problem of optimization of the physical layout of goods in the warehouse to minimize materials handling expenses, to achieve maximum utilization of the warehouse space. The red line of optimization methods is to reduce storing and handling costs by eliminating waste (Muda) on motion and waiting.

The goal of optimization is to minimize stock volume and the total travel distance throughout the warehouse.

Professional significance. This study is aimed at investigating the effective approach to implement the Lean tools that will improve the warehouse operations. In addition, this project is an attempt to consider the ways to improve stock management using Lean Production system. According to the project it is expected to solve a number of tasks.

One of the tasks of this research is to study and improve the logistic process in the warehouse. Secondly, it is exceedingly important to evaluate the economical impact of implementing Lean technologies on the warehouse operations and to develop guidelines for an effective implementation of Lean strategies.

Literature review. The principles of lean are now being applied universally, including inside the warehouse. According to Fridman (2008), the effective introduction of lean in the warehouse can help to improve the warehouse operations and, as a result, increase the competitive advantage of the company. In Rauch's (2013) opinion, implementing lean concepts is costly and time-consuming. However the evidence suggests that Lean Manufacturing can benefit by improving competitiveness through faster innovation and production (Rauch, 2013).

The fact is that most Lean concepts can work well in the warehouse, especially 5S, value stream mapping and kanban/pull system (Shook, 2009). Numerous researches generally concluded that a good way to attain better flow is to start with Value Stream Management (Shook, 2009).

Evidence suggests that lean warehousing produces tangible and measurable results (Mulcahy, 2007). These include labor productivity, space utilization and inventory reduction. The company can have accurate baselines from which to measure improvement. Therefore, waste reduction and cost reduction will be visible and tangible.

The scholar (Mulcahy, 2007: 47) also states that «creating a lean warehouse is not something you accomplish overnight». The results achieved through the lean efforts can be seen after a certain period of time. Improved customer fill rates, decreased inventory levels, decreased inventory carrying costs, improved inventory accuracy, increased asset and team member utilization are all benefits of lean warehousing.

Intuitive methods of optimization SKU location are often used becouse they provide some useful

guidelines for layout without the need for higher-level mathematics. Layout is often intuitively based on next criteria: compatibility, popularity and size. Intuitive layout methods are simple to use but do not guarantee that the lowest cost materials handling layout pattern will be found (Ballou, 2003).

Methodology. The research methodology used in this study closest resembles to the definition of a case study. The major advantage of a case study methodology is that it is capable of combining the quantitative and qualitative research streams to conduct a holistic and in-depth investigation (Jones, 2006). Case study is an especially useful methodology for organizing a wide range of information. It also allows using multiple sources of data which increases the reliability and brings out the smallest details of the case problem. Therefore this research method is the most suitable.

The object of research will be the warehouse of domestic electronic reseller company "M" with 400 square meters of storing area. Length of the warehouse is 91 meter and width is 4,4 meters.

All goods are stored in a chaotic order (case "AS – IS"), names and product lines are mixed. Movement of inventory items happens in one direction: from the goods acceptance area (inbound dock) to an area of goods shipment to the final customer (outbound dock). All small equipment which has the sizes less than 0,5 cubic meters is stored on racks. Other large equipment is stored by a pallet stack. All small appliances are stored on half-internal racks about 2 meters high.

The main problem of "M" is chaotic stock location of goods in the warehouse. The goods which are in great demand are far from sales area. It considerably slows down the process of transfer of goods to the buyer, and the big quantity of the personnel in a warehouse is required.

For more effective storing the "ABC-XYZ" analysis method will be used.

In our case, class "A" stands for 80% of the picking frequency of SKU, "B" stands for 15 % and "C" for 5% to minimize motion waste. The boundaries for determine XYZ classes are based on the variation of demand SKU, respectively.

Layout by popularity (Figure 1) recognizes that products have different turnover rates in a warehouse, and materials handling cost is related to the distance traveled in the warehouse to locate and pick the stock.

Stock location by popularity neglects the size of the item being stored and the possibility that a larger number of smaller items can be located near the outbound dock.

By locating the smaller items near the outbound point in the warehouse, materials handling may be less than in the arrangement by popularity, as a greater density of items can be located close to the shipping dock.

Stock location by popularity or by size is not completely satisfactory because one neglects an important factor of the other. Heskett (1963, 1964) combined both features into a "cube-per-order index".

Figure 1: Stock location by ABC – XYZ analysis

Outbound dock	
Product Line	Class
TV	AX
Vacuum Cleaners	AX
Microwave Owens	AX
Irons	AY
Kettles	AY
Hair dryers	AY
Blenders	AZ
DVD-players	AZ
MFU	AZ
Monitors	BX
Double boilers	BY
Computers	BY
Computers Accessory	BY
Bread Machines	CY
Radio tape recorders	CY
Home theatres	CY
Acoustics	CY
Food processors	CY
Blu-ray players	CY
Printers	CY
Mixers	CY
Musical Centers	CY
Conditioners	CZ
Inbound dock	

This index is the ratio of the average required cubic footage of the product for storage to the average number of daily orders on which the item is requested. Products having low index values are located as near as possible to the outbound point (Figure 2).

On next step of research was calculate total non-value added movement travel distance (Figure 3) throughout the warehouse per one quarter of the year by measuring distance from outbound dock to each product line and movement speed. Elimination wasting time on motion and waiting will decrease handling workers wage and will give positive economic effect as a result.

Stock location by the "ABC – XYZ" method doesn't save time. We can suggest that the initial placement of goods "AS-IS" is similar to placement by "ABC – XYZ" method. Due to the experience of the employees from this warehouse, some product lines were placed on «non wasting time" optimal locations in "AS-IS" case.

Results. As the result of analysis, method "cube-per-order index" is the best one. In this case we will ***decrease variable costs by 200,000 rubles (~$6,000) per year and increase ROA by 0.04%*** in this lean warehouse.

The results of implementation of JIT Purchasing Policy (Pull system) in the middle-size manufacturing

Figure 2: Stock location by Cube-per-Order Index

Outbound dock			
Product Line	Number of orders/day	Storage Space, cubic dm	Cube per Order Index
Hair dryers	9,27	4975	536,61
Irons	10,77	6798	631,05
Kettles	9,48	6654	701,94
MFU	4,22	3195	757,26
Blenders	7,04	5580	793,11
Mixers	1,04	954	916,34
Radio tape recorders	2,44	2535	1037,30
Computers	3,50	3720	1064,11
DVD-players	5,44	6735	1239,05
Monitors	3,73	4620	1239,93
Blu-ray players	1,25	1560	1248,68
Computers Accessory	3,21	4410	1373,42
Printers	1,13	1680	1488,35
Bread Machines	2,71	5024	1856,03
Microwave Owens	12,11	24850	2052,09
Vacuum Cleaners	14,35	53845	3753,52
Double boilers	3,54	14912	4212,76
TV	30,10	188375	6257,45
Musical Centers	0,76	6825	9025,82
Food processors	1,27	12900	10147,63
Conditioners	0,11	1750	15968,75
Home theatres	1,83	31312,5	17109,38
Acoustics	1,72	64312,5	37379,08
Inbound dock			

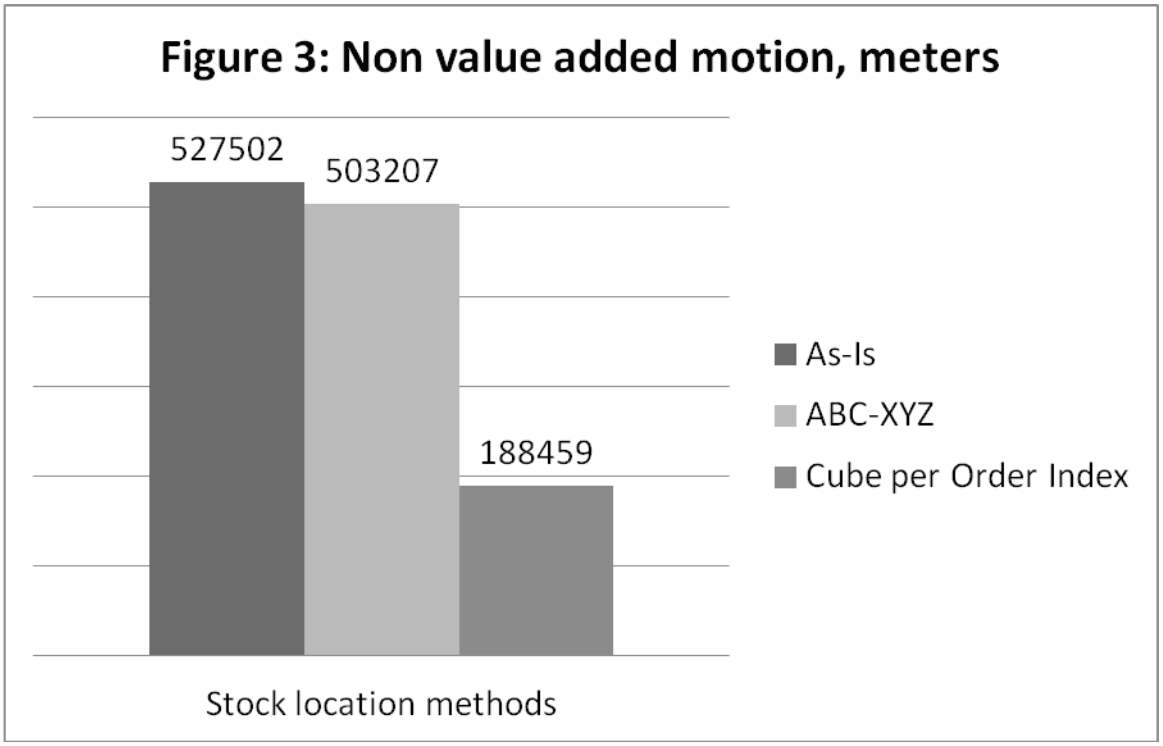

Figure 4: Annual Relevant Costs of Current Purchasing Policy and JIT Purchasing Policy

	Current Purchasing Policy	JIT Purchasing Policy
Order quantity, units	280	80
Carrying costs, RR	382 200	109 200
Warehousing costs, RR	50 214	36 564
Alternative costs (loss of profit), RR	121 824	0
Transportation costs, RR	100 800	201 600
Ordering costs, RR	18 000	20 000
Total incremental costs and difference in favor of JIT purchasing, RR	**673 038**	**367 364**
	305 674	

company evidence that Pull systems can also be helpful in the warehouse environment and ***decrease incremental costs by 50%*** (Figure 4).

Finally, results the Lean tools implementations will use to develop guidelines to improving the inventory management techniques.

Conclusion. The results reported that the first steps of implementation of Lean system will allow the company to reduce costs, standardize and optimize warehouse operations, minimize warehousing area, and as a result, improve the competitiveness in the market.

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