Stock Costs Reduction – Case Study at a Spirit Company

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Abstract

Presented case was performed at a large Israeli Spirit company, which is facing a rapid growth, resulting high and growing inventory costs. This research aimed to reduce the company's logistics costs.

Methodology included data collection (both qualitative and quantitative), forecasting methods, Lean management principals, linear programing and financial evaluations.

Initial Benchmark indicated the company absorbed additional charges of 9% which were not coherent to the growth in quantities. Analyzing company's financial reports expenses showed that outer warehouse expenses summed up to 2.8M NIS, clearly demonstrates rapid growth vs. previous years. By DEMA forecasting (chosen for minimum historical error by MAD and MSE measures) expected demand calculated for products categorized as Class A. It is used as a tool for the warehouse manager in planning long term warehouse layout and occupancy. As forecasts indicated that current warehouse shelves do not comply with storage requirements, a new warehouse model was developed in Linear planning. As a result, inner warehouse layout was re-designed, considering current warehouse dimensions and needs. Final recommendation supported by WFM model comparing the three scenarios: current process unchanged, building tent in company's facilities or purchasing additional shelves. Result indicated additional shelves as the best alternative- supported by NPV calculations.

Keywords
Stock Costs, Warehouse Organization, Logistics Management, Forecasting, Case Study

1. Introduction

The Spirit company described is one of the largest alcoholic importers and distributers located in Israel, established 18 years ago. The company is the official distributor of several international brands. As it stands todays, the company is facing a rapid growth, both in terms of import capacity and in the range of SKU's (Stock Keeping Units), resulting high and growing inventory costs. Presented research aimed to reduce working stock costs at the company.

Company warehouse layout contains of six storage areas, each of 3 floor pallet racking apart from area B used for ground storage and allows no more then 3-layer storage possibilities. Evaluating current ongoing process and inner warehouse occupancy, it appears, that 67% of the total imported pallets are maneuvered to outer warehouse storage despite the fact the 34% of the warehouse shelves are unoccupied. Figure 1 presents the current situation.

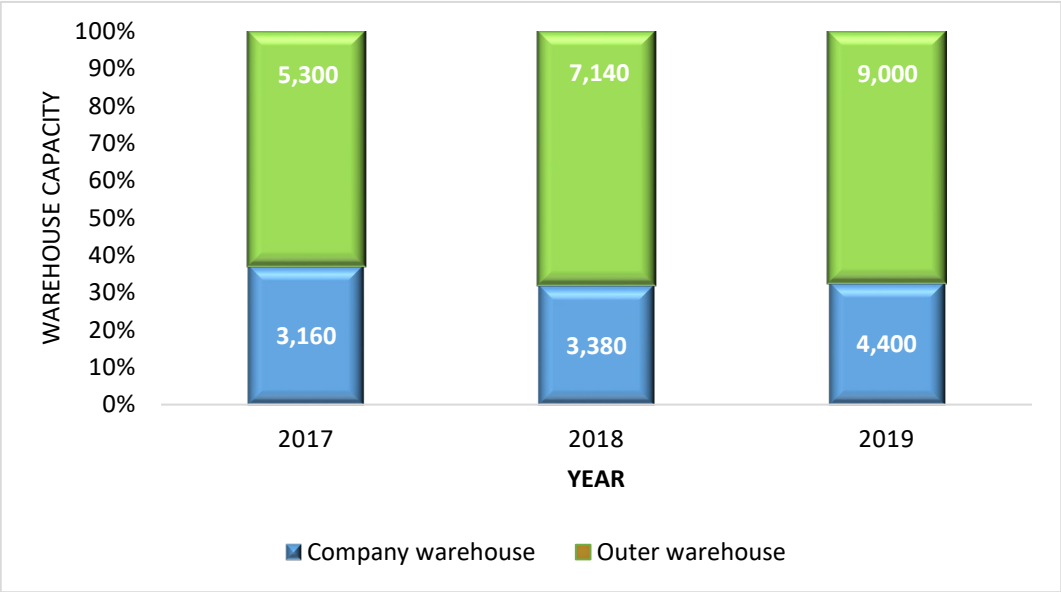

Figure 1. Warehouse capacity divided to inner vs. outer storage

Applying Benchmarking method, indicated that between the years 2017-2019 the company absorbed additional charges of 9% which is not coherent to the growth in quantities. Furthermore, each pallet which is maneuvered to outer warehouse rather than company warehouse absorbs additional charge of 200 NIS, cumulative amount of 1.8M NIS a year. Figure 2 is showing analysis of company's financial reports for year 2019 expenses for outer warehouse summed up to 2.8M NIS, clearly demonstrates rapid growth vs. previous years.

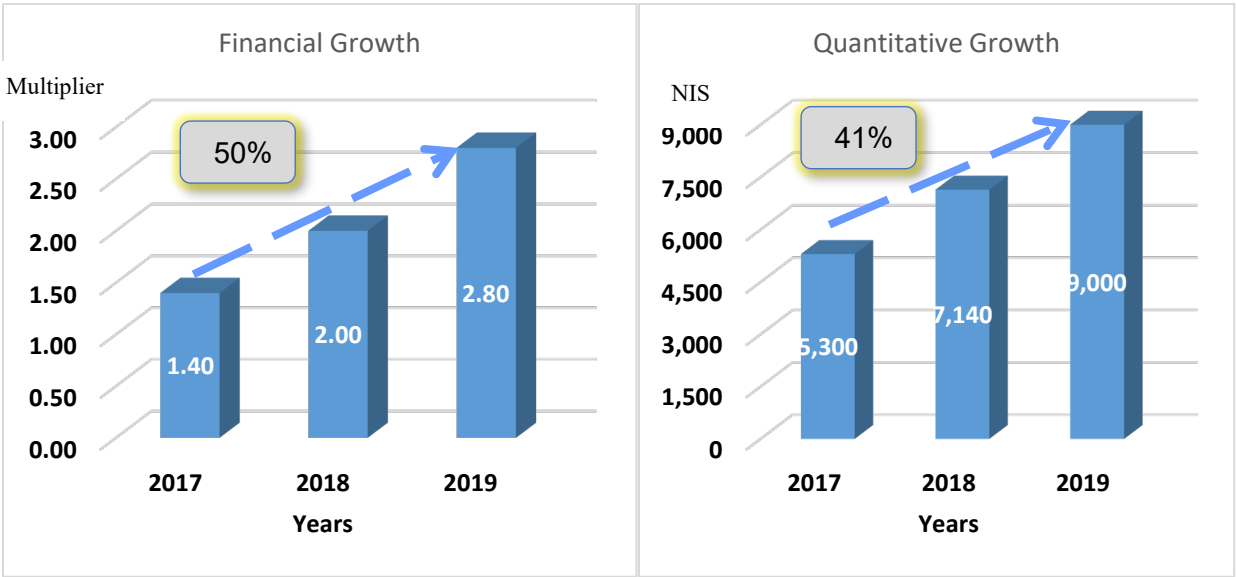

Figure 2. Company growth trend – years 2017-2019

The next sections are as following. Section 2 highlights the literature, section 3 outlines the methodology, section 4 is describing the results by sub-sections. Section 5 states the conclusions and discussion and finally section 6 presents limitations and future suggestions.

2. Literature Review

The basic aim of enterprise activity is to optimize profitability by increasing revenue and decreasing cost. The result reflects the value for shareholders, customer satisfaction, and employee satisfaction (Tadokoro, 2014). The

role of worldwide logistics continues to grow as manufacturers and markets become more distributed (Gue, Ivanović, & Meller, 2012). An important node is the warehouse, where incoming goods are held until the final destination of the goods is known. Many researchers deal with aspects of planning warehouse and layout (Gu, Goetschalckx, & McGinnis, 2010). However, until recently, a fundamental question about the implementation of such theories remained unanswered.

Companies know that inventory equals to money lying on products that are, literally, sitting on a shelf waiting to experience "random demand". Worse, after items are requested, the distributor must pay workers to extract items, prepare them, and send them on to customers (Tsai, 2011). Despite the exhausted image they conjure up in the minds of many professionals, warehouses continue to serve a vital role in the modern economy (Golfarelli, Rizzi, & Cella, 2004; Lee, Lv, Ng, Ho, & Choy, 2018). The presented company is a major importer, so its manufacturing overseas, it is left with the task of importing goods to the country and distributing them through warehouses, distribution centres and order fulfilment centres, which serve as necessary and efficient points of consolidation, storage, and distribution. Israeli case is interesting because the country has almost no land-borders.

Presented case will demonstrate how an importer can review and decrease its inventory costs without decreasing the items on stock. The idea was presented by (Huq, Bhutta, & Cutright, 2015) that published a case study that also considers relocating items from secondary storage locations.

3. Methodology

The methodology employed included data collection – interviews, observations, documents collection and data collected from company's information systems. Analysis was done with forecast methods, Lean management model, linear programming financial tools. Then a detailed recommendation was given to Spirit, which embraced the results and started the implementation in order to reduce inventory costs.

4. Results

4.1. General

Evaluating current ongoing process and inner warehouse occupancy, it appears, that 67% of the total imported pallets are maneuvered to outer warehouse storage despite the fact the 34% of the warehouse shelves are unoccupied. Applying Benchmarking method, indicated that between the years 2017-2019 the company absorbed additional charges of 9% which is not coherent to the growth in quantities. Analyzing company's financial reports for year 2019 expenses for outer warehouse summed up to 2.8M NIS, clearly demonstrates rapid growth vs. previous years.

Spirit portfolio includes 234 different SKUs in which all SKUs are managed in the same manner without focusing on brands which consist of diverse monthly depletion. Pareto allows dividing portfolio and setting focus on products that are categorized as Class A. Figure 3 shows that out of the 13 products which were evaluated, 3 products are categorized as class A, consisting of 60% of the demand.

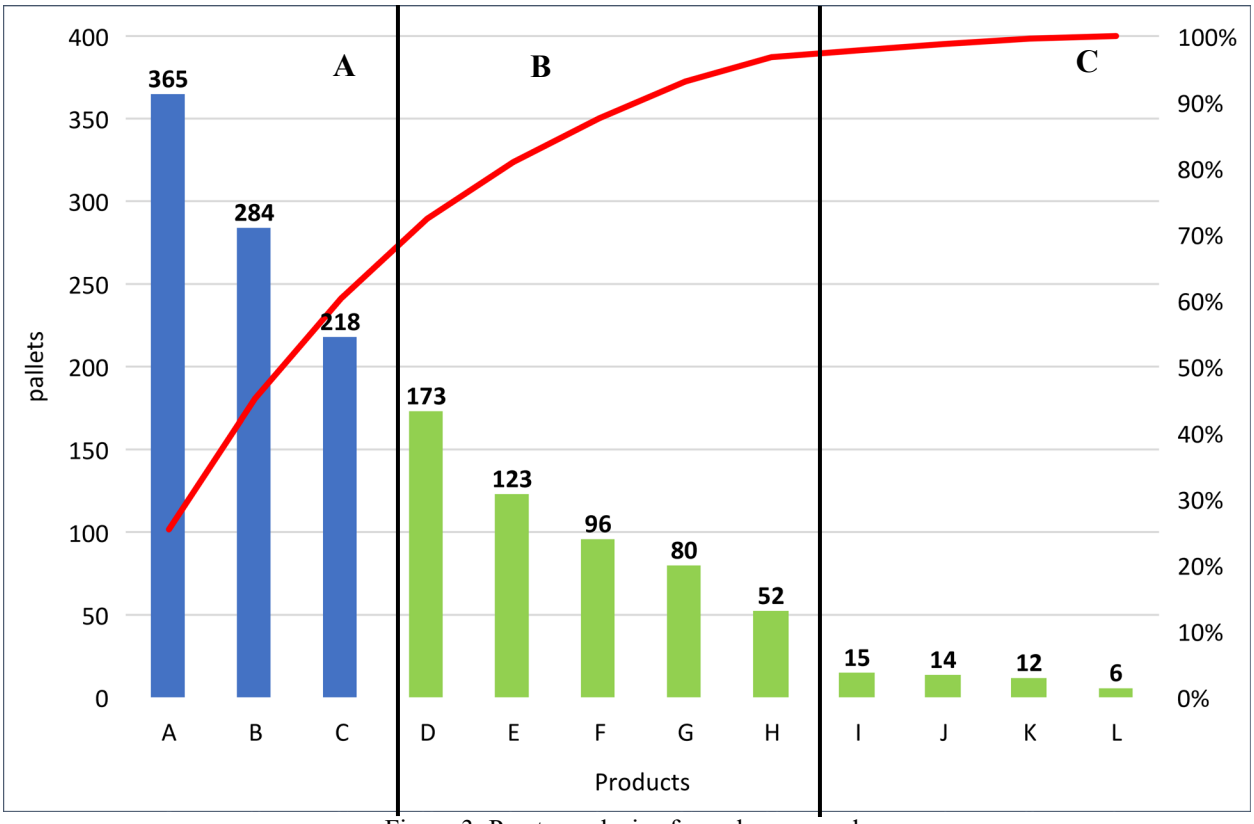

Figure 3: Pareto analysis of warehouse goods

4.2. Forecasting

Evaluation was done for Class A products with different forecasting methods which will allow minimum historical error. Seasonal forecasting was done based on actual depletion between the years of 2015-2019: Double Exponential Moving Average (K=2), Regression, Holt & Winters. Results are presented in Table 1. It is clearly demonstrating that minimum historical error by means of MAD and MSE were achieved by DEMA method.

Table 1: Comparison between error measures of forecast methods

Method	Exponential Double Moving Average (K=2)	Regression	Holt	Winter
MAD	**34**	130	43	91
MSE	**1,863**	20,344	2,339	17,255

Accurate demand forecast for the 3 products in Class A category will not only allow planning department to prepare orders more accurately but also allow the warehouse manager to plan long term storage demand to enable reduction in usage of outer warehouse.

Figure 4 presents quarterly demand for the 3 products (out of the 324 products in the portfolio). Results indicates that current shelves available in inner warehouse are not enough to fill the demand and additional shelf are required in order to maximize current warehouse layout to enable further storage options.

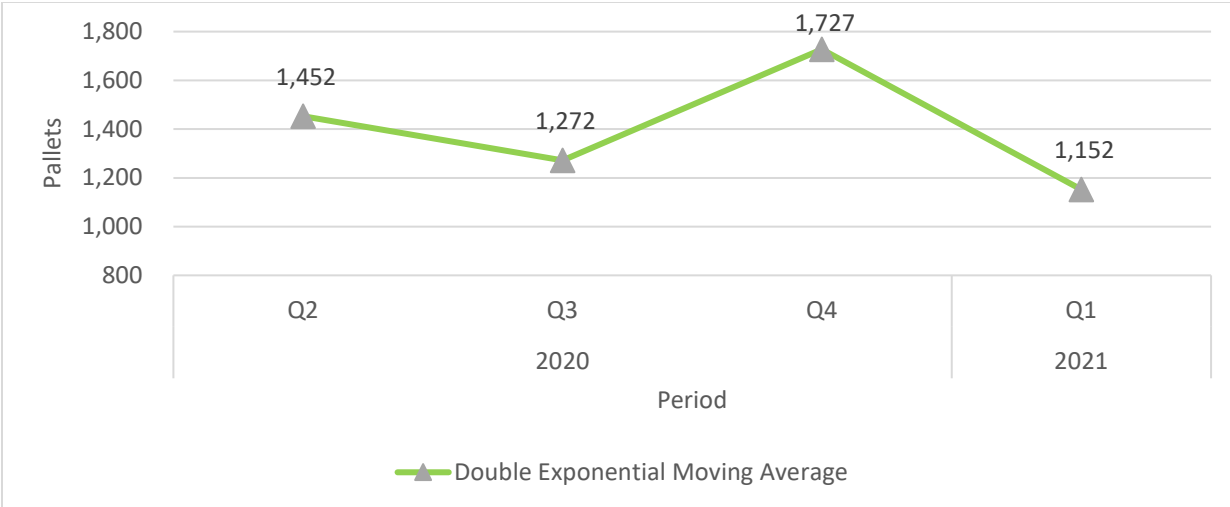

Figure 4: Forecasted quarterly demand for 3 items in Category A

4.3. Lean Management Model

5S model enabled analyzing warehouse premises set to improve the safety of the employees and transforming the layout which will simultaneously reduce the handling time of imported pallets.

Together with WH manager, we evaluated current working environment for the sole purpose of making the warehouse safer and more efficient. Table 2 presents the summary of the results – prior to team recommendations and after. Part of the transformation included establishing designated area for unloading imported pallets close to truck dock. This designated area includes all the dry material required for handling of the goods such as the wrapping machine, wrapping material, identification labeling etc. This enabled reduction in handing time from 160 minutes to 140 minutes for each imported container, consisting of 22 pallets.

Table 2: 5S grading summary company warehouse

Category	Improvements	Current situation	After Implementation
Sort	Establishing designated area for unloading imported pallets close by to dock.	**2.75**	**4.5**
Set in Order	Marking warehouse areas- location for parking forklifts, unloading area for pallets, marking shelves.	**1.5**	**4**
Shine	Supervision by the warehouse manager for sufficient order and cleanliness of the work surfaces at the beginning & end of each day.	**3**	**4.5**
Standardize	Implementation of work procedure & instructions according to standards held by the warehouse manager	**3**	**3**
Sustain	Mapping of the findings in the field out of a continuous effort for conservation and continuous improvement	**2.33**	**4**
	Overall Result	**2.5**	**4**

4.4. Linear Programming for Optimal Planning

Using linear planning model, we examined the number of pallets that can be stored in all 6 areas of the company warehouse. Starting with goal function formulation, then definition of decision variables and constraints according to the existing warehouse volumes. The objective function measures the maximum number of pallets that can be stored in each area, according to the existing storage volumes. For each area, we defined constraints according to the dimensions of the warehouse considering volume of each shelf should be 5CBM. The model was developed, and research team used Lindo software to gain optimal results. The results, presented in Figure 5, obtained indicated that

the company currently stores approx. 1,323 pallets while 2,070 pallets fit for maximum storage possibilities, without increasing the volume of the warehouse.

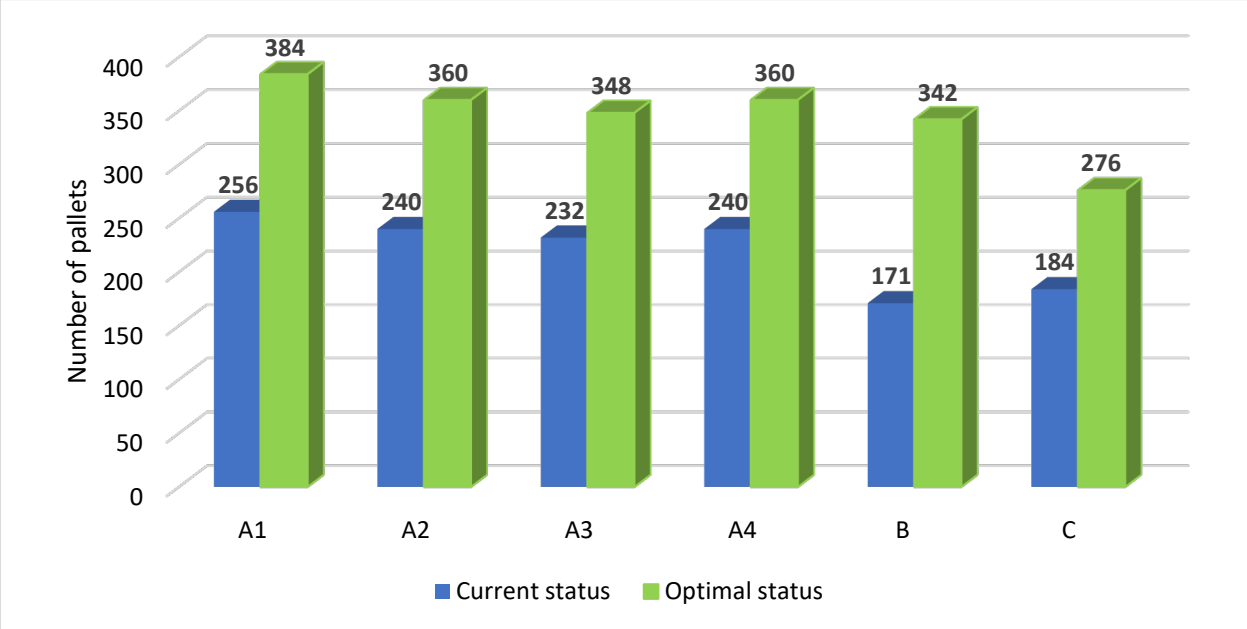

Figure 5: Linear programing results comparison between optimal status to current status

4.5. Financial Analysis

As this is clear now that existing warehouse cannot provide required warehouse capacity storage team examined two additional alternatives. The first was purchase of a tent and forklift and the second was the alternative of adding shelves in the company warehouse. Analysis of expected costs and revenue set project duration as summarized in table 3. It shows the criteria as well for decision.

Table 3: Additional warehouse capacity alternatives comparison

	Investment (NIS)	**Interest**	**Project Duration**
1st alternative- purchase of tent & forklift	-237,000	4.50%	2 Years
2nd alternative- Addition shelves & purchase of forklift	-394,000	4.50%	2 Years

	return Investment	**NPV**	**Project Duration**
1st alternative- purchase of tent & forklift	1.03 years	NIS 214,902	2 Years
2nd alternative- Addition shelves & purchase of forklift	0.53 years	NIS 1,037,635	2 Years

Figure 6 presents point of return for each of the alternatives, results demonstrates that investment return will be complete within 0.53 years.

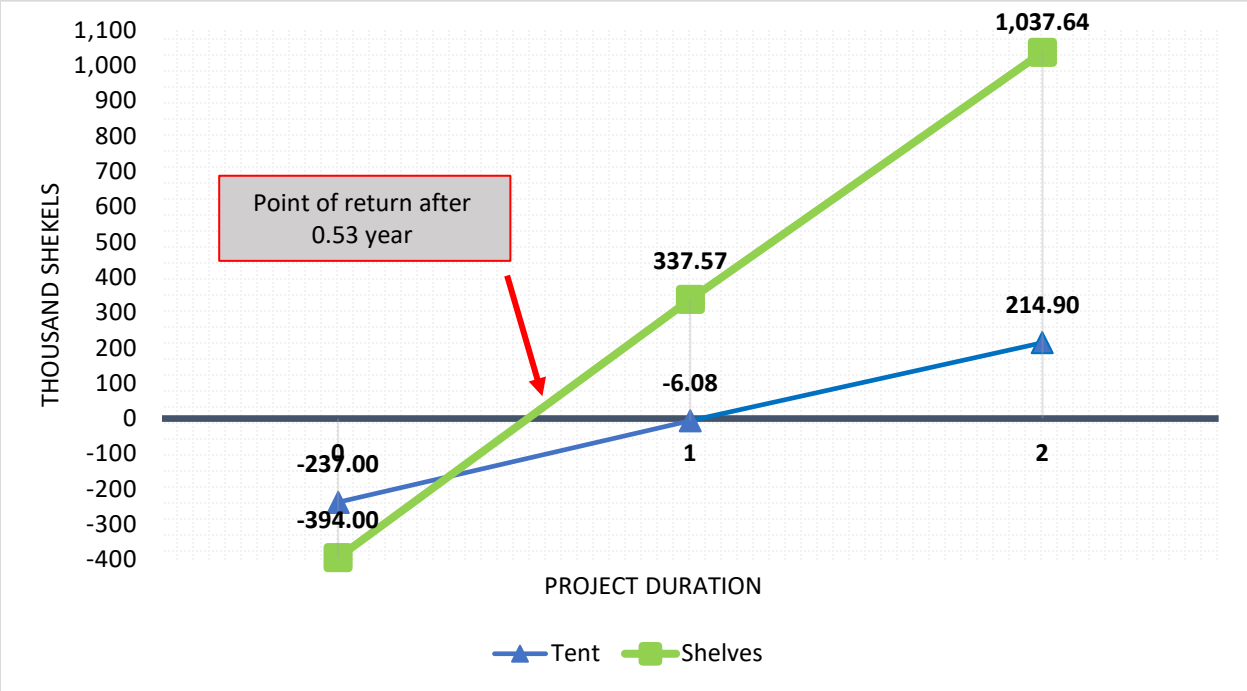

Figure 6: ROI of additional warehouse capacity alternatives

5. Conclusions and Discussion

Utilizing a fishbone diagram and a survey sample, simulation model findings indicated that main blockers for a more efficient process were technology and work procedure utilization (75%). These findings assist in separating the wheat from the chaff and allow focusing on the barriers towards efficient working procedures. Using 5S model, enabled a safer and more effective working environment in the warehouse by implementing several actions such as marking designated areas for unloading imported goods. Executing Pareto model, enabled focusing on products which consume 60% of the storage requirements, for which forecast methods were employed. Results indicate that Double Exponential Moving Average (DEMA) forecasting method as the chosen method (minimum historical error by MAD and MSE measures), future demand expectancy calculated, for products categorized as Class A. It will be used as a tool for Spirit warehouse manager in planning long term warehouse layout and occupancy. Forecasting results indicated that current warehouse shelves do not comply with storage requirements.

A simulation model in Linear planning (Lindo) characterized by the inner warehouse dimensions, while taking into consideration constraints such as shelf dimensions and height limitation, indicated that additional shelves can be added to current warehouse layout. Drilling down furthermore, by using decision making model WFM enabled comparison between three possible scenarios: current process unchanged, building tent in company's facilities or purchasing additional shelves. Result indicated additional shelves as the best alternative- by characteristics, by benefit and by NPV model.

This work has shown that process and technology solutions, along with additional efficiencies, can substantially improve logistics process and reduce costs. Results show that by applying research alternative will allow reduction of the number of pallets stored in outer Warehouse from 9,000 pallets a month to 4,160 pallets, 36% improvement. By means of costs, such alternative will allow reduction in the yearly expenses from 2.8M NIS to 1.3M NIS, way above our initial target of 2.1M NIS, total of 54% reduction.

In this research we presented that adding additional shelves in company warehouse as the best alternative. Implementation research suggestion at one time cost of 394K NIS will reduce the number of pallets stored in outer warehouse and reduce total costs by 1.5M NIS. Presented alternative will allow future improvements resulting for forecasting depletion demands.

6. Research Limitations and Future Suggestions

This work has shown that process and technology solutions, along with additional efficiencies, can substantially improve logistics process and reduce costs. Results are reduction by 54% the yearly expenses on stock resulting from outer warehouse charges by dropping down yearly usage by 36%. Spirit management is currently evaluating implementation of the recommendations presented in this study.

Case study research from its nature has advantages and limitations. Case study strengths are that it can help us understand complex inter-relationships, is grounded in live-events, and can demonstrate easily implementation of models. Though, presented limitations are that the complexity examined is difficult to represent simply, it is hard to generalize from one case and the "objectivity" can be problematic (Aberdeen, 2013; Yazan, 2015; Yin, 2003). However, this case can be used to demonstrate how an importer, that cannot substantially reduce stock levels, can reduce the inventory costs dramatically.

Future efficiencies should include viewing stock management process to enable diverse focus on products based on Class ABC (Pareto) to reduce stock hold of products that are categorized as Class A which cover 60% of the demand, and possibly increase stock hold for the rest of the products.

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Biography

Pnina Tiybi: A student for bachelor's degree in the Logistics Department at Sapir Academic College, employed at the Spirit company as planning & importing manager with 18 years of experience in supply chain.

Inna Shepelev: A student for bachelor's degree in the Logistics Department at Sapir Academic College, employed at Crown Plaza Tel Aviv as PR manager with 5 years of experience in the Hotel Industry

Sagit Kedem-Yemini is an Industrial Engineer, proficient in information systems and currently holding two lecturing positions: a tenured lecturer position at Sapir Academic College (Logistics Department) and an adjunct lecturer at Ben Gurion University (both in IE&M and Faculty of Business and Management). Her teaching portfolio is broad, focusing on Enterprise Systems implementation (SAP and Oracle Applications) and derivatives of ERP data collection – from Business Analytics to Process Mining. Additionally, she has extensive experience in academic curriculum development, is head of her department's teaching committee and serves as liaison to the graduation projects unit. Her research interests include Process Mining and its practical applications, ERP relates issues and DSS development. Since 2015 serves as member of JITCAR Editorial Review Board.
Prior her to academic career, Dr. Kedem-Yemini worked at a global Clean-Room Fab Build-Up Construction Management Company with major clients (such as Intel, Tower Semiconductors, and Teva Pharmaceuticals), where she held various positions, including Logistics Manager, Scheduling Manager and CIO (Chief Information Officer).

Yana Karpek: is an Industrial and Engineer with a master's degree in Business Administration in Finance and a teaching certificate. For the past few years, served as a manager of a high-tech manufacturing facility that was located in high- school, where employees are both first-class professionals and students, a winning combination of knowledge and experience and a desire to success. Realizing the vision of the largest industrialists in the country for professional development and building curricula is already in the stages of schooling in the southern region and growing a new generation of industrialists. She also currently serves as a supervisor for final projects at Sapir Academic College of Production Management and Logistics.