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Shelf Life - Managing Building Material in a Warehouse

Francisco Evangelista Pimentel Neto[1], Alexandra Priscilla Tregue Costa[2], David Barbosa de Alencar[3]

[1]Academic department, University Center FAMETRO, Manaus-AM, Brazil
[2,3]Engineering Coordination, University Center FAMETRO, Manaus-AM, Brazil

Abstract**—** *Currently the theme Shelf Life appears as a large tool to increase the quality and control of life time. The present article presents a management model focused on the validity of the material, based on real inventory data, using a computational tool in which it is possible to explore the functionality of the system and improve its performance. The main principal of this Shelf Life system is an auxiliary tool for verifying data search processes and a search for better results, including a computational tool with extensive performance analysis. The method used consisted, first of all, of the process of obtaining real data on the receipt and indebtedness of companies, thus creating a virtual planning and planning environment. The results obtained consisted of a more efficient evaluation of materials management, besides the visualization of cost reductions, with more punctual and weighted results in the supply chain.*

Keywords**— Raw Material Management, Process Automation, Raw Material Storage Methodology.**

I. INTRODUCTION

The need to improve the aging process of a material is not very important for the companies, since there is a constant need, the search for new alternatives that facilitate the management of activities and, consequently, the detection of problems that affect the flow of processes. in many cases, disruption to the internal and external consumer of the organization.

Brazilian legislation consists of all industrialized products, such as food, cosmetics, medicines, household cleaning materials, toiletries, etc., which can be clearly useful in their shelf life. The expiration date is defined as the time period, from the date of shipment, however, which is a quality indicator of an acceptable payment system [1].

Component routing processes are controlled according to the va- lue data being executed for the subordinate components in order to ensure the quality of the product, according to the production, quality, materials and planning sectors.

The maturity of a product starts from its production data and the contribution of some factors such as its production process, hygiene situation and storage, but the largest quantities are the type of packaging used. Choosing the right packaging for each type of product is essential to increase its shelf life, maintaining quality, facilitating identification and facilitating distribution in more distant locations. One of the most sought after solutions today is a vacuum packaging. A vacuum sealer removes all oxygen from the packaging, which is primarily responsible for food spoilage, increasing shelf life [2].

Shelf life means shelf life, time that we must store our materials always within the deadline established by the manufacturer, where it will be automatically monitored in Excel spreadsheet with the manufacturer's information, expiration date, manufacturing date and manufacturing year and week.

Aging can be characterized as a gradual change in the operational characteristics of an electronic component. Generally, this behavior is expected to be more frequent after the lifetime or qualified period reported by the manufacturer. However, some factors can accelerate the aging process even within the qualifying period. There are two types of process that can accelerate the aging of electronic components: external and internal factors (IAEA, 2004), (ERTL et al., 2006). External processes include: ambient temperature; local humidity; sources of ionizing radiation (alpha, beta, gamma and X-rays) and non-ionizing radiation (Radiofrequency, Ultra red); atmospheric chemical condition (presence of gases and solid particles in suspension). The internal factors that can accelerate aging are: heating due to electric or mechanical loads; mechanical stress; oscillations of energy; vibrations [3].

However, after the single supply of a large volume of parts for long periods of time, it is also necessary to ensure the integrity and compliance of these materials. In this sense, the shelf life process is related to the control and monitoring of raw materials with limited life cycles, that is, components whose qualitative and functional

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characteristics are conditioned by the respective shelf life [4].

The Materials area where the Shelf Life process is executed was implemented in 2013 by Management seeking to reduce cost by showing how well-executed Shelf Life reduces obsolete costs and increases the turnover of common materials within a warehouse.

The Shelf Life control starts from the input of the material in the receipt, where all the materials are collected through bar code consisting of material code, manufacturing date and quantity, this data is loaded in an excel spreadsheet with macros that are formulas programmed into a single button, the validity of the material is automatically informed by checking for quantity and code divergences.

Temperature is one of the factors that most contribute to the instability of a substance. As a result, the same product can have different shelf life depending on the environmental conditions of the place where it is stored [5].

The material that arrives as SPARE PARTS that are stored, these are changed according to the arrival of the kits, they are controlled in an excel spreadsheet with macros signaling respectively the dates of maturity of the materials, these spreadsheets are accurate every day due to the rotating inventory and internal audits done by quality.

Material planning analyzes according to the maturity date of the raw material using the Shelf Life report sent by the Materials sector, where the quality makes internal audits verifying the validity of the same. Shelf Life is relevant in decreasing obsolete material, unnecessary disposal of material in use.

The logistics chain management is reviewed in [6] and [7].

The present article refers to the Inventory Management having the choice of Shelf Life theme, we will address how to control the life time of the raw material in order to optimize the aging process of the products from the entry of the raw material and manufacturing process.

I.II Contextualization of Materials Management

Current research on Shelf Life shows strong application in a number of areas. [8] reviews the temperature profile in four main home delivery services, addresses the impact of temperature abuse on the remaining life of the materials. Simulates and proposes temperature management options. The material flow management in Thailand is analyzed on the basis of electronic research, which states that 58% of the respondents are managing material flow information (self-classification), yet companies with material flow management manage waste (hazardous) and raw materials well, addresses the cost relationship and profitability that affect whether companies decide to manage the flow of material.

[10] Existing material flow cost accounting and management perspectives, Material Flow Cost Accounting (MFCA) has been developed around the world as an important tool in environmental management accounting. [11] It deals with an information system for sustainable materials management with material flow accounting and waste input-output analysis. In their work, hierarchical and interactive dashboards allow a convenient overview of material accounts across economy, waste streams, and circulation of secondary resources. In addition, the system can track material flows through associated supply chain activities and production consumption. Integrated with economic models; this system can predict possible overload in the current capacities of the waste management facility and provide decision support for designing strategies to address resource sustainability.

In the work Improving the waste management of electrical and electronic equipment in real scale, using material flow analysis and life cycle evaluation [12]. WEEE management was analyzed in a large scale Italian plant, two recycling scenarios (S0, partial and S1 - improved) were investigated, recycling rates were 40-86% for S0 and 80-99% for S1 for different types of WEEE, major environmental benefits derived from the recycling of metals and other fractions, the main environmental impacts were due to transportation and incineration of polyurethane.

The application of material management has application in distinct areas, using techniques specific to each scenario.

II. MATERIAL AND METHOD

The Shelf Life project originated in the year 2013, where it was executed in an automated way, using the computational tool (Excel), using macros with programmed formulas in a single button and indicators indicating the validity of each material in months.

2.1 Receipt of material

The material is received and scanned 100% in a spreadsheet, reading two labels one containing code, date of manufacture and another containing the quantity.

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Model	LE43S5970	Qty Items PKL	KIT CONFERENCE	Date / Hour
Invoice	85023732		Responsable	07/07/2017
Qty	10000	333	RODRIGO/JOAO/PAULO/RAMILTON/FABIO	08:38:00

Status Invoice	NºPt	NºBox	SFIS (ShopFloor)	Qty	Part Number	Year/Wk	Manufacture date	Expire date	Shelf Life
	PLT-01	85023732AA0019	356G0563263424 16101329401MJG181	800	356G0563263424	1610	06.03.2016	06.03.2019	8.07
	PLT14	85023732AA0009	065G080533232K Y16313680503726107	1,000	065G080533232K Y	1631	31.07.2016	31.07.2019	12.97
	PLT14	85023732AA0003	071G 59A121 TA 15323824701730033	4,000	071G 59A121 TA	1532	02.08.2015	01.08.2018	0.83
	PLT01 IM	85023732AA0129	367G215X470PHZ002S17021396401111120	1,920	367G215X470PHZ002S	1702	08.01.2017	07.07.2018	-0.01

Fig.1: Shows the receipt process informing Shelf Life inside the warehouse.

2.2 Addressing material

The material after it is received is addressed via the system and updated in a spreadsheet by entering the data of the material and arranging in its proper addresses according to the family of material, capacitor, resistor, transistor, IC etc.

SHELF LIFE

>9 months - Out of Risk | 0~6 months - Critical | 6~9 months - Warning | <0 months - Expired

Address	Part Number	Shelf Life (Shop Floor)	Qty. Scan	Date Code	Manufacture date	Expire Date	Shelf Life	Balance
2R3E010401	367G215X470PHZ002S	367G215X470PHZ002S174713964011A2253	384	1747	19.11.2017	18.05.2019	3.10	365
2R3E040302	715G6316K020000041	715G6316K020000041I7283979601170715	840	1728	09.07.2017	05.04.2018	-10.50	840
2R3E070402	361G0058159LGN005A	361G0058159LGN005A1718366700109F259	1,000	1718	30.04.2017	29.04.2020	14.67	1,000
2R3E110202	421120315200T14001	421120315200T14001-1738-HH00-A00001	200	1738	17.09.2017	17.09.2019	7.17	200

Fig.2: Shows the addressing process showing Shelf Life inside the warehouse.

According to the two activities mentioned above, the "Shelf Life" maturity indicators are indicated in black, red, yellow and green, where, respectively, if less than 0 month is due, between 0 and 6 months is risk of maturity, the 9 month forecast for risk of maturity and greater than 9 months is out of maturity risk, this months forecast was analyzed with the data reported by the vendor table, see below the table reporting the restriction in months by color.

Subtitle	
Indicator	Remark
>9 months	Out of Risk
6~9 months	Warning
0~6 months	Critical
<0 months	Expired

Fig.3: Shows the Shelf Life table by color and months of material criticality.

The material conference requires a computer, optical collector and two collaborators, where all the bar codes of the materials containing material code, date of manufacture and quantity will be read, see the figure below, exemplifying the activity.

Fig.4: Shows the conference process.

Fig.5: Shows the addressing process.

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The Shelf Life control is checked weekly by a responsible person where it analyzes the materials that needed to be exchanged to keep the stock always out of risk, see the figures below showing the control worksheets:

Subtitle	
Indicator	Remark
>9 months	Out of Risk
6~9 months	Warning
0~6 months	Critical
<0 months	Expired

Out of Risk
Warning
Critical
Expired

Address	Part Number	Scan Shelf Life	Year/Wk	Manufacture date	Expire Date	Shelf Life	Stock	Life Time	Family	Class Material
2R3E040302	715G6316K02000004I	715G6316K02000004I1728397901170715	1728	09.07.2017	05.04.2018	0.17	840	9 months	Key Board Imported	A
2R3E070401	715G8009R01000004Y	715G8009R01000004Y17273465501016144	1727	02.07.2017	29.03.2018	-0.11	120	9 months	Ir Board Imported	A
2R3E110101	47236308T4A2233GB3	47236308T4A2233GB3180566041002797O5	1805	28.01.2018	28.01.2019	7.05	1,400	1 Year	Board Ktc	A
2R3E110102	47236308T4A2233GB3	47236308T4A2233GB3180566041002797O5	1805	28.01.2018	28.01.2019	10.05	3,600	1 Year	Board Ktc	A

Fig.6: Shows the data collection indicating the criticality of each material.

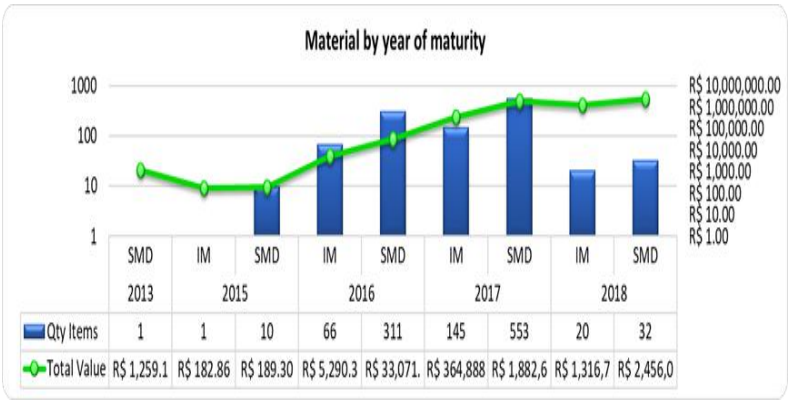

Fig.7: Shows quantity and monetary value of the material by year of maturity.

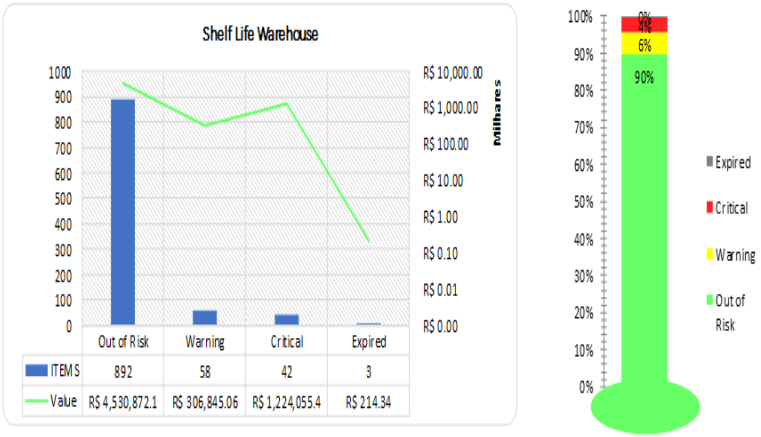

Fig.8: Shows the inventory situation, showing quantity and monetary value of each material and stock criticality in percentage.

The control sheet and indicators cited above demonstrate how much the Shelf Life system is organized, data collection, quantity of material per year of maturity, and the inventory situation showing the amount of material and monetary value and the thermometer next to it shows the percentage of how the stock is evolving.

III. RESULTS

2.3 Survey of data

The data are collected weekly and fed into the spreadsheet where the most critical items to be exchanged will be analyzed

We obtained great results implemented the process of Shelf Life, where it aims to keep material stock out of risk of maturity and avoid cost with discard of material due inside the inventory, see below two indicators indicating the quantities and monetary value of materials exchanged weekly and monthly.

• Weekly report informing the amount and monetary value exchanged.

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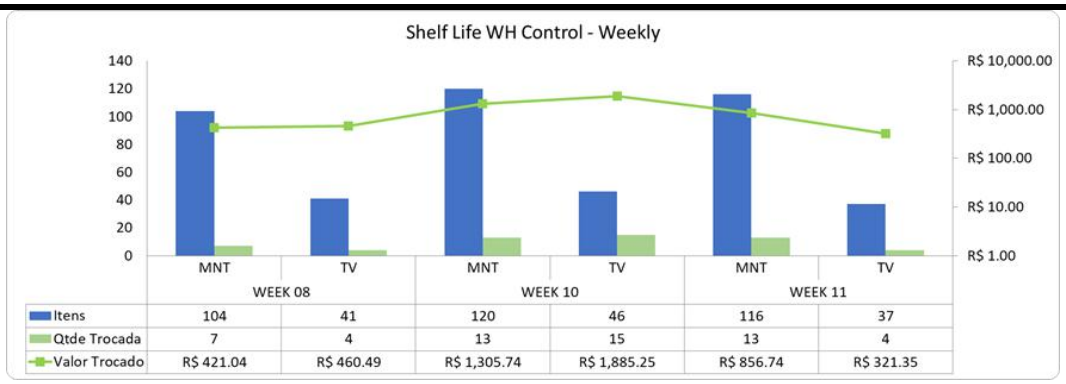
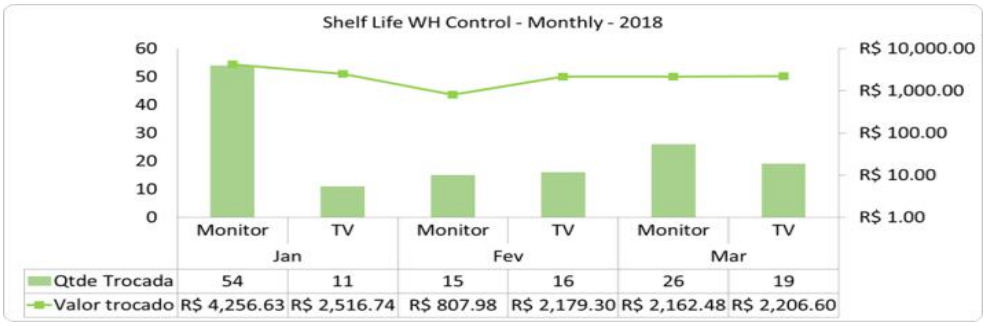


Week	Items	Change Qty	Exchange Value
WEEK 08	**145**	**11**	**R$ 881.54**
MNT	104	7	R$ 421.04
TV	41	4	R$ 460.49
WEEK 10	**166**	**28**	**R$ 3,190.99**
MNT	120	13	R$ 1,305.74
TV	46	15	R$ 1,885.25
WEEK 11	**153**	**17**	**R$ 1,178.09**
MNT	116	13	R$ 856.74
TV	37	4	R$ 321.35
Total Geral	**464**	**56**	**R$ 5,250.62**

- Monthly report informing the amount and monetary value exchanged.



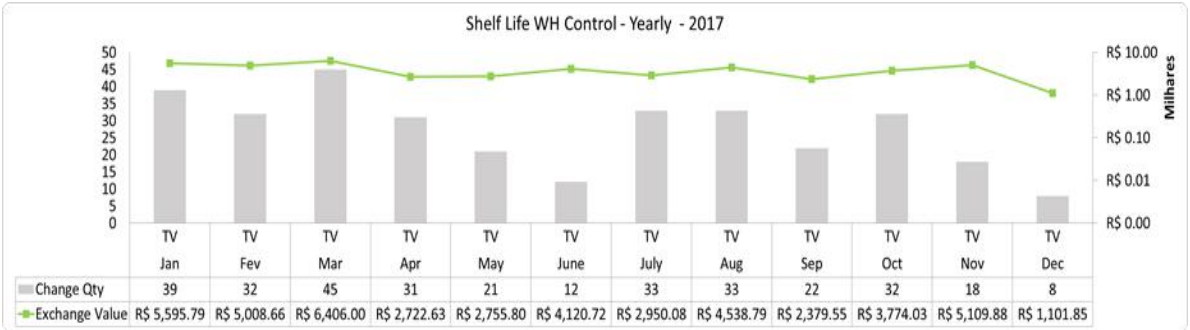
The exchange of older materials for newer materials made the stock always remain with materials within the expiration date, depending on the material input volume, the changeover number, the turnover is very large so we can avoid waste with repair of finished products and reducing the number of defects caused by material overdue, this project Shel Life made us succeed quantitatively and qualitatively, always seeking to reduce unnecessary cost and maintaining the quality of the material.

IV. DISCUSSION OF RESULTS

During the year 2017, 963 materials were exchanged, resulting in a savings of R $ 116,418.27, showing that this Shelf Life project is effective for cost reduction, the inventory was with material that was not risk of maturity and organized, see below this great result:

• Annual results of items that were switched from TV and Monitor.

- TV (Television)



- MNT (Monitor)

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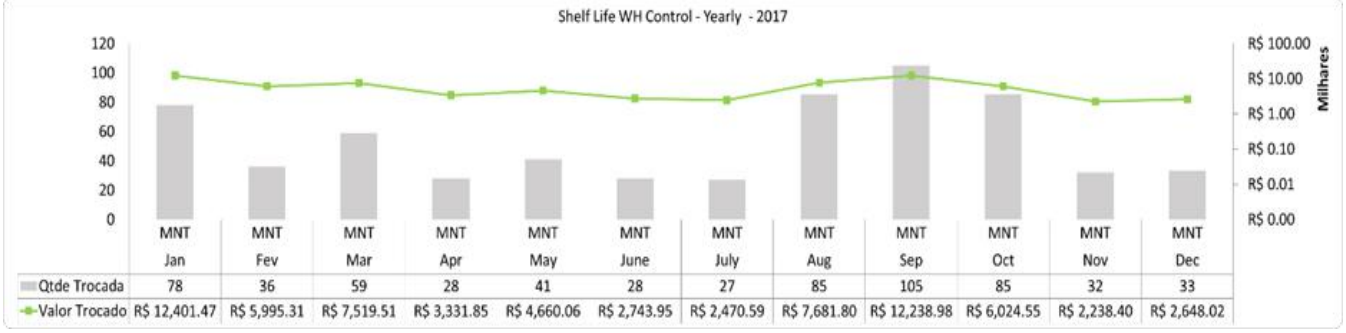

This great result gave us great expectations for the year 2018 and we were able to continue with this project as mentioned above in III. Results The first quarter of 2018, which exchanged 141 materials resulting in a saving of R $ 14,129.73 true data, we saw that this Shelf Life project brought us a work dynamic that generated great results such as economy, qualification and relocation of people.

V. CONCLUSION

The Shelf life process has been innovative within the warehouse, providing a fast and effective routine in conjunction with Excel so that we have insight into all the materials by date of manufacture that are winning. The turnover of material exchanges results in us always keeping new material in the stock.

With the control worksheets we were able to maintain the accuracy of each material in the inventory referring to its manufacturing date and expiration date, trying to identify several maturity situations facilitating the flow of materials.

The difficulties encountered are due to the internal system (ERP - SAP) that does not allow this dynamic of maturity by the movement inside the stock. This is so that we have manual control in Excel worksheet using advanced formulas and macros, even if well functional, are susceptible to errors.

The implementation of this project resulted in R $ 116,418.27 in the year 2017 of savings in material disposal, we also added process optimization and better distribution of labor, seeking to add value in the activities in the warehouse, we reduced the emission of Paper, time of conference of the materials and fatigue of the collaborators, because today excel makes the whole conference process.

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