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The Physical Arrangement Based on the SLP Method, an Analysis on the LCM Fabrication Process

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Abstract *— Physical arrangement or layout is a term widely used in corporate language, it is the configuration of productive elements and transformers. In the industrial hub of Manaus in many cases it is either new installations or rearrangements of deactivated line spaces. This paper aims to show the importance of Layout study as well as its tools for process improvements and productivity increase. The methodology adopted is based on bibliographic and documentary research (internal corporate documentation) using the method SLP (systematic planning of Layout) that seeks the best configuration between: man, machine and equipment. The aim of this work is to compare other academic works, books by great authors and to report a little of the experience lived in the industry of the industrial pole of Manaus in lines of manufacture of Monitors and televisions, in particular introduction of lines of LCD panels and LED, thus collaborating with the academic community.*

Keywords *— **SLP, Physical Arrangement, Television screens.***

I. INTRODUCTION

The competitive market has led us to the configurations of companies and products of the most varied possible with previous margins of 12 months between a new product and another, currently many products are world launches with differences of days between one country and another.

In times of globalization, companies do not want to stay behind any other, so processes, products, physical arrangements must be dynamic and functional and in many cases, new products, follow new assembly lines, as if a new product or process the physical arrangement installed.

This article has analyzed papers, scientific articles, scientific report, Samsung technical documentation, and specialized books.

This work raises the following problem: How the systematic use of the physical arrangement can optimize processes and increase productivity, focusing on the SLP methodology.

On the basis of this question, this work seeks the support within the vast literature to show the efficiency of the systematic use of the physical arrangement through the SLP tool with the objective to demonstrate during the work how this tool was internalized in the academic doctrine and the innovative methods of arranging arrangements physicists in particular, in the lines of panels of TV of the Industrial Polo of Manaus.

Therefore the present work compares and demonstrates the importance of Layout as process optimizer and productivity increase through physical rearrangements of entire production lines or workstations.

This research is justified by the importance of studying the SLP methodology even with a whole current computational environment, the SLP methodology has not become obsolete, but few academics know and use it.

II. THEORETICAL REFERENCE

Layouts or physical arrangements are provisions of transforming and transformed resources, people, and equipment. At Manaus industrial hub, many factories adopt reuse structures, jigs and deactivated line equipment, others use new equipment and structures, new equipment, a high cost, shipping logistics (maritime), but everything developed for that new application , new process or new product, avoiding rework and line stops for suitability, having only ramp-up (curve of growth of production) as a hindrance.

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2.1 LAYOUTS

According to [1] the physical arrangement, or even layout, of a company or just a department, is nothing more than the physical distribution of machines and equipment within the organization where, through calculations and definitions established according to the the product to be manufactured, is organized so that the work can be developed in the best possible way and with the least waste of time [2].

According to [3] the Layout study was driven shortly after World War II and conceptualized layout taking into consideration 05 factors of industrial management: Man, material, money, machines and market. Neumann classifies the 05 types of layouts: Positional, by Product (in line), by Processes, cell layout and mixed layout. Of all the works this opens a special chapter for the cellular physical arrangement for line projects. [3] and [4] lists 2 variables that are variety and volume, indicating the application of each physical arrangement.

For [5] the physical arrangement of a productive operation refers to the physical positioning of its transforming resources. [4] is much more traditional in its concept and encompasses in transforming resources everything that modifies or transforms the raw material of production. [6] conceptualizes in a much more complete way the 05 types of physical arrangements that are used by several companies, they are: Positional (fixed) physical arrangement, functional physical arrangement (by processes), cellular physical arrangement, physical arrangement by product and arrangement mixed physical

According to [6] it tells us that the study of physical arrangement is concerned with the physical location of the transformation resources. [7] also lists and conceptualizes the 05 types of arrangements. He tells us that decisions about physical arrangement can appear in the 03 structural levels of a corporation (strategic, tactical, and operational level).

2.1.1. Layout Types

Layout by fixed position, for [8] in this Layout the element to be transformed remains still, in fixed position, here the dimensions of this material to be transformed are verified as it is a large element and the operations, operators and tools are moved around the element to be transformed, here low production or single production is verified.

By process or functional layout, for [7] physical arrangement widely used in tooling in the companies of the industrial pole of Manaus, here is the transforming resources grouped in places and both the operator and the resource to be transformed move to the tool transformation.

Layout by products or online layout, for [9] the most usual of the layouts used in the industrial complexes installed in the industrial pole of Manaus is observed, since it is a layout compatible with high production and little variation.

Layout in Cells, is the physical arrangement that has been gaining the preference of Asian companies in the production lines of Cell Phones and Tablets Samsung all models are assembled in cells because it is easy to programming and calculating efficiency in cell layout.

According to [1] before distributing the machines by the company, it is necessary to know the product that will be developed, what materials will be used to manufacture the same, which production processes and etc. We first define the Layout by Product that is the one that represents all the operations from the entrance of the material at the end of the process to the finished product at the other end. Then, we define the Process Layout that represents the process flow and the most varied sections that the raw material will pass inside the productive process [1]. According to [10], in order to prepare a layout it is necessary to first know the quantity of pieces / product that will be produced, according to the pre-established capacity, taking into account the number of employees, the shifts that the company will work, technology available to develop the product according to the manufacturing time of the product. From these definitions it is possible to stipulate, based on concrete data and production calculations, the number of machines / tools that will be necessary to develop the product in question and then distribute them by the company [10].

2.2 SLP (SYSTEMATIC LAYOUT PLANNING)

The industrial pole of Manaus (PIM) is dominated by Asian companies, most Japanese companies (Honda, Semp, Sony, Panasonic), soon followed the Korean companies (LG, Samsung) and finally the Chinese (a giant in china, TPV, also installed in Manaus). In changes and installations of new lines, Japanese companies are very conservative in the Asian process, I believe they are unaware of SLP, but they are used in fragments of the SLP method.

Looking for a structured approach, Systematic Layout Planning (SLP) represents a methodology that has a great applicability in design and layout redesign, especially in functional layouts. Although it has been proposed long ago by [11], the SLP system still has a great applicability in modern production systems and serves as a reference for projects of productive facilities and also for research in the area. According to [11], the SLP is composed of a structure of phases, a model of procedures and a series of

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conventions for identification, evaluation and visualization of the elements and the areas involved in the planning.

Korean companies throw away the old line and install new ones with high cost, recovering everything in high production. Chinese companies use a mix of any method that brings them low cost and high functionality, here yes, you see the SLP method being used with the combination of other methods.

In the work of [12], he directs the methodology to 03 professionals: Layout Planner, the unprofessional enthusiast and the self-directed planning team. The systematic SLP can be followed step by step and is aimed at some types of enterprises, they are: office areas of up to 300 square meters; areas of shops or laboratories of up to 500 square meters and storage areas from 750 to 1000 square meters, but nothing prevents from being adapted to other situations. The SLP is a set of six processes to be followed to be able to make the layout of an area and the 06 steps involve 03 basic elements, they are 1) Relations between the various functions or activities; 2) space in a given quantity and type for each activity; 3) The adjustment of these, within layout planning.

In his work [13] he makes use of SLP in a layout project in a confectionery industry, he shows from a case study the use of SLP methodology and its tools as a way to achieve optimization and increase the capacity of a textile industry

In the article [14] the SLP methodology was applied in the improvement of the layout of a shower production line, it re-arranges an existing layout [14] obtained a new layout but this time in arrangement in cells a to increase productivity, improve quality, reduce inventories, reduce operator downtime in order to avoid fatigue, reduce physical space and reduce movement, thus raising the satisfaction of operators, thereby obtaining multifunctional employees who used to stay limited to 2 or 3 operations and currently assemble and know the entire product to be assembled with due time study applied.

III. TOOLS AND METHODS

The methodology of this work was based on a bibliographical research of a basic nature that aims to generate knowledge with a new vision bringing a little of the reality of the industrial pole of Manaus, from the point of view of the research objectives can be characterized as exploratory research because in some points were obtained in an unsystematic, spontaneous, informal, simple, free way, and in other cases, data were systematically based on articles and scientific works that sought the same objective of the bibliographic research of this work.

3.1 MANUFACTURING PROCESS OF LCM PANELS (TV AND MONITOR)

Panels or digital displays (displays) have undergone an abrupt technological evolution from being simple 8-segment displays for touch-sensitive graphic panels Cellular screen Figure 1.

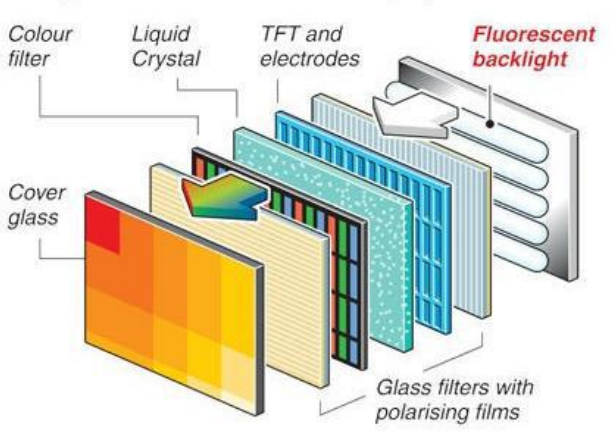

Fig. 1: Manufacturing Process of LCM Panels

There are 03 basic processes that make up an LCM panel for TV or Monitor, they are: Data Matrix Board (Tcon); Polarized glass (Open Cell); Backlight component.

3.2 TCON CARD

The first component that mounts an LCM panel is the T-con or (Matrix Board or Screen Control) board in many designs can be incorporated into the main board of the Tv or Monitor or it can be a separate board or even have the circuits incorporated into the board "Source board" which is a board attached to Open Cell through the flats Figure 2.

Fig. 2: Tcon Plate Model

A Tv or Monitor screen is with a large dot matrix, the T-con's function is to take the information from the main board and address that information in columns and lines and provide the Open Cell Source card (the information is addressed to each pixel color: red, green and blue)

3.3 OPEN CELL (POLARIZED GLASS)

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The 2nd Component that mounts an LCM panel is the Open Cell (polarized glass) has the benefit of versatility of use in various environments, its use is recommended as monitors, televisions, instrument panels and other devices, ranging from aircraft cockpit, displays on car computers, daily use devices such as video players, game devices, clocks, calculators and telephones. Among its main features are weight, portability and its ability to be produced in much larger quantities than cathode ray tubes (CRT). Its low power consumption allows it to be used in portable equipment, powered by electronic battery Figure 3.

Fig. 3: Polarized Glass Model

Open Cell has two glass plates filled with a kind of gel with particles of organic crystals. Each particle individually receives an electric discharge to block the light (which it receives constantly from the backlight), and from these electrical impulses the crystal has the information of where it should block the light of one or more colors that are not useful in the formation of image . Each particle is a pixel, and each pixel has 3 subpixels that represent the primary colors (RGB - red, green, and blue), which together form the image.

LED televisions work like LCD technology in imaging. The difference is in the backlight that is formed by micro LEDs, located in the ends of the screen (Edge LED). The LEDs send brightness through the slots of the Light Guide Plate, illuminating the pixels for image formation.

The system of opening and closing of the micro-doors for the passage of light is equal to LCD. The difference is that the LED distributes better the light emitted compared to the LCD panels, this due to not having the lamp accesses the whole time behind the screen. Another advantage of this TV is related to energy saving. It is also greener because it uses fewer environmentally harmful products, such as mercury from the CCFL lamp (present on LCD panels).

3.4 BACKLIGHT COMPONENT

The third and final component of the LCM TV panel is not just a single component, but several components that assembled together form the backlight because as shown above the lamp or LED bar is on all the time and the liquid crystal deposited on the glass layers of the Open Cell (sandwich) when being polarized let light pass or block the light working as light-pass doors to the screen.

IV. ANALYSIS OF INPUT DATA

As a rescue of the documentary research, we had as an introduction the line of panels LCM (Light component module) the panels of 32 ", 40" and 48 ". As an example of documentary research we will use the data from panel 32 ".

Panel 32 "(LTJ320AP03-K): Panel 32" Full HD (resolution 1920 x 1080 Pixels), prediction of the beginning of production 3000 pieces, pilot lot of 100 pieces, Target 3500 pieces upon reaching the growth curve, Production cycle 8 seconds, daily production.

Parts List Panel 32 "Table 1:

Tab. 1: Part List Painel 32"

AMOUNT	DESCRIPTION	NAME
01	CHASSIS TOP	METAL FRONT PANEL 32 "
01	OPEN CELL	POLARIZED GLASS 32 "
01	MlDDLE MOLD	INTERNAL PLASTIC FRAME
01	H-SHEET	HORIZONTAL DIFFUSER SHEET
01	V-SHEET	VERTICAL DIFFUSING SHEET
01	DIFUSER SHEET	DIFFUSING SHEE
01	LIGHT GUIDE PLATE (LGP)	ACRYLIC LIGHT GUIDE
01	REFLECTOR SHEET	REFLECTIVE SHEET
02	LED BAR	LED BARS
01	CHASSIS BOTTOM	METALLIC BASE OR SHIELDING
01	POWER BOARD	POWER PLATE
01	TCON BOARD	TCON PLATE

By the year 2011, Samsung had a one-room, Figure 4 production of monitors only, the Layout was functional (both the operator and the feature being processed move to the transformation tool) and the ability to production was limited and low (500 units / day). In this configuration it had no production of the TV panels, forcing the PCPM and purchases to import panels.

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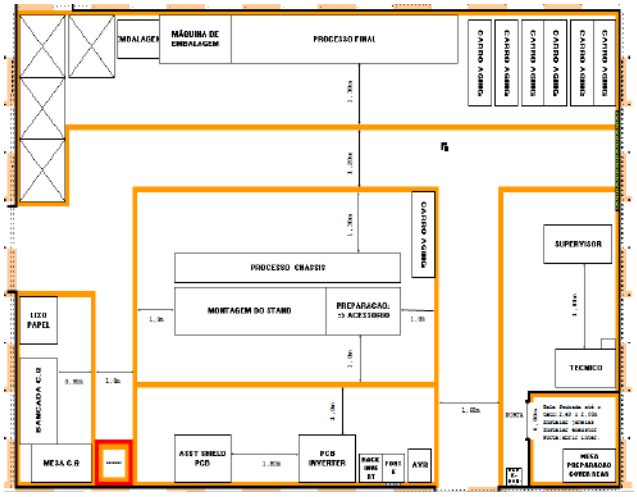

Fig. 4: Hall of Panels

As of 2011, the Samsung factory changed its address and started to operate at Av. Dos Oitis, Armando Mendes, Distrito Industrial 1, it ceased to be just a simple factory and became an industrial complex forcing Management to elaborate form to aggregate all parts that came from the supplier within the manufacturing complex, Figure 5 shows the LCM Area.

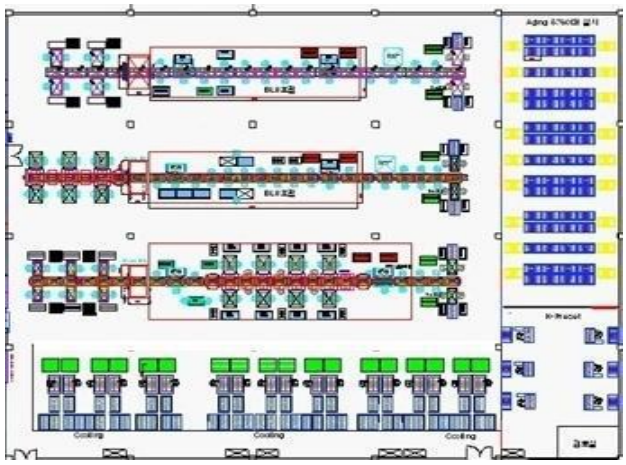

Fig. 5: LCM Area

Therefore, LCM Panels, Plastic Covers, Frontal Plastic Panels, EPS Pads, Metallic Lids, TV Cards and Monitor should be produced within the new industrial complex leaving out only Carton box and printed graphics.

So in 2012 we already had 03 panel production lines and Layout that was functional and low capacity started to target 3000 pieces per day for panels of 32 "Layout in line below, Figures 6.

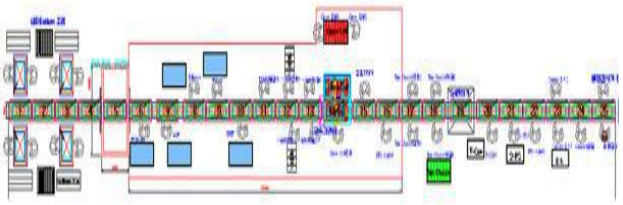

Fig. 6: Televisions production line

The production process shown in Figure 7, the sequence as below, reflector, LGP, Diffuser, BDEF-D, Blue Inspection, Middle-Mold, Final Test.

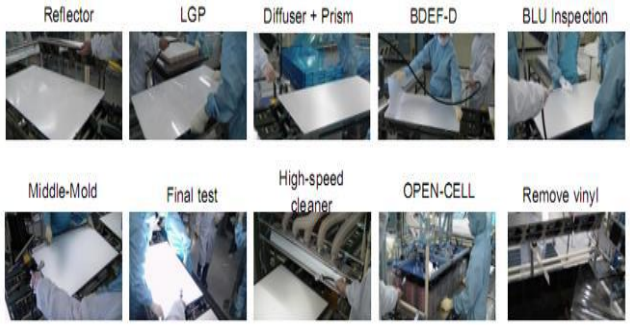

Fig. 7: Steps of the assembly process with SLP

It was demonstrated in this stage the operation of the assembly line of the television, using SLP, other methodologies are used in several other companies of the industrial pole of Manaus.

V. FINAL CONSIDERATIONS

The SLP method is used by many corporations in the introduction of rows or arrangement changes. In practice, much of the mixed physical arrangements happen, so was the line of Samsung LCM panels in 2013, she started the line in 2012 with Physical Layout by product, but due to the introduction of the line of phones and tablets in the industrial complex and the model applied here (cell phones and tablets) were assembly cells, then we tried to migrate the panel line to assembly cells, did not work, then returned to the layout by products but some cells remained on the line and the end result was a layout mixed, product and cell layout.

In addition to the previous works that had an emphasis on the assembly process of TV panels and monitor, this work sought to show the systematic SLP for the choice of physical arrangements, even with all evolution of CAD technology for modeling Layouts, systematic SLP is still widely used.

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