



# TWEAKING INDUSTRIAL LAYOUT IN A FACILITY DURING COVID ERA FOR PRODUCTIVITY AND SAFETY

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**Abstract** - The COVID 19 has brought new challenges for the manufacturing industry. The type of layout change will largely focus on the nature of the manufacturing tasks, volume and variety of the products including the norms of social distancing. Therefore it is important for any sector to develop their way of working around the recent problems yet maintaining World Class Standards. This paper provides a review of the comparison between old and new industry layout. It provides the beneficial information of the latest layout with new methods and installing the new technology in the industry layout for optimum productivity, maximum safety and minimum health risks. In this paper, the current layout of an industry is examined and a new layout is proposed based on the traditional plan of layout to reduce the risky interaction. It has opted processes layout. The number of available inventories have been analyzed. The study review operation-process data, activity-relationship data and the intermigration between equipment and area has been seen. The proposed industrial layout depicts the reduced distance of material flow which improves on the touch time of handler. The implementation of the proposed layout may help in the productivity of industry without hampering the health.

**Key words:** Industry, Industrial layout, COVID, health risk, productivity, process layout, Optimization, Industrial Layout Optimization, Layout Planning

## 1. INTRODUCTION

"Envision a major TREE. When you begin culling out leaves, bloom, natural product, branches, stem, root hair, root individually, you are really not eliminating a Tree straightforwardly however once you forget about it's substance the whole unit is influenced." Industrial design is actually the equivalent. Modern design is characterized as the precise plan of everything required including machines, faculty, crude materials, and completed products. All parts make up one interconnected entire unit of Industrial format plan. Presently, enterprises have consistently centered around security of its faculty, another ordinary has been raised. The pandemic, the heartless COVID or any natural wellbeing influencing thing, which spreads by human contact. It can without much of a stretch impact a significant piece of work proficiency. Industry design reconsider is an of means getting the things in its right position so the dangers are insignificant and there is a simplicity of future developments, there is adequacy in material dealing with regarding cost and time, appropriate hardware use, legitimate space usage, wellbeing and housekeeping, legitimate working conditions, appropriate appearance, more significant salary out, return and benefit.

By and large, most formats are put useful for the underlying non extending states of the business and not set for unanticipated circumstances. Be that as it may, these formats give numerous requirements during development, thus as long as industry design configuration ends up being effective, it needs to adjust the inner and outer changes for which a re-design is important. Because of ill-advised industry design there is no extension for additional development in little scope fabricating industry, there is a great deal of material taking care of by talented specialists which includes the expense of creation, a ton of room is squandered in the plant in keeping scraps at any situations, because of scraps found anyplace in the business it gives awful appearance to the business, likewise the working states of the laborers isn't reasonable as they are playing out their obligations without legitimate preparing and limit building. These reasons legitimize the possibility of movement of specific offices to have an improvement in the entirety of the territories expressed previously.

In order to achieve maximum returns from the capacity of facilities, it is very essential to optimize industry layout for proposed units or re-layout of existing manufacturing units as per the changing market scenario. One of the main goals of a manufacturing system is the maximization of its productivity. This depends upon several factors, such as the kind and the complexity of the product made, the quality of the raw materials, the complexity of the manufacturing process and the arrangement of the workstations constituting the production process. A layout has rarely appeared by chance, but is the final product of a thorough planning where the governing factors are e.g. what products to make, how to make them, which components to make and which to buy from another manufacturer.

## 2. OBJECTIVES

For the most part the normal business format ought to have the accompanying goals:

- Economic needs, for example, interests in hardware and material taking care of cost are to be limited.
- Requirement of item plan and volume is to be fulfilled.
- Requirement of cycle hardware and limit, for example, limiting generally creation time.
- Maintain adaptability of game plan and tasks are to be defended.
- Different kinds of material dealing with hardware are to be encouraged in the assembling cycle.
- The nature of work life accommodated representative accommodation, wellbeing and solace.
- Facilitating the hierarchical structure must be the essential need.
- Requirement of building and site imperatives, for example, using existing space most adequately.

On the off chance that we notice, worker accommodation is one of the prime destinations, which really hampers efficiency. The principle and prime target of exploration work is to plan a changed industry design, which won't just expand the benefit by organizing all the offices to the best preferred position of all out assembling of the item, it will likewise be a more secure workplace. A decent arrangement is the best connection between inputs, yields, space, producing cost and wellbeing. The primary destinations of change in industry format is to plan an advance industry design dependent on deliberate methodology, increment in efficiency, decreasing material dealing with, arrangement of action relationship diagram and viable use of men, machine and material and so on and has worries over wellbeing dangers associated with the cutting edge COVID period.

## 3. SCOPE OF THIS WORK

The extent of this examination work is to contemplate the current modern design and to recommend a few enhancements at shop floor level alongside usage of some current and demonstrated efficiency models like 5S idea, JIT, KAIZEN. This work has incorporated the rules from Indian Government. It will cover so numerous serious boundaries just as wellbeing boundaries. It might upgrade stock turnover proportion which would improve working conditions and abilities of labor. In this exploration work, the arranging of format depends on a mechanical framework at times alluded as Systematic Layout Planning Method. It is proposing for tackling the current format issue, which we have envisioned having inward structure dividers and sections. The current design is having a two story producing game plan with a crisscross cycle. With the assistance of methodical format arranging technique, a correlation with a current design and proposed format will be assessed.

The comparison results show that the proposed layout is superior to the existing one. The approach is the best for the small scale manufacturing industry layout. The movement was to be reduced, new machines were to be installed, which may have bargained for some capital, but future productivity was very high compared now. Since, this research was a two level approach, the focus was also two faced. With one attempt, the movement was optimized and it is also recommended to implement other tools like Lean Manufacturing Concept, 5S, KAIZEN, JIT etc. those will improve the efficiency in men, machine and material. With the other attempt, the behavior change was also recommended in view of the pandemic.

## 4. LITERATURE REVIEW

Before proceeding with the idea, we have gone through several references and papers which belong to optimization of plant layout in the manufacturing industry. We have studied few researches and reviews during our own research work and considered for the review and proposal. Some of these are worth mentioning, which directly inspired us. Carlo, Antonietta, Borgia, & Tucci, 2013[1] One of the main goals of a manufacturing system is the maximization of its productivity. The industry we imagined was not a very big setup, so we considered Layout Design For A Low Capacity Manufacturing Line: A Case Study by Filippo De Carlo, Maria Antonietta Arleo, Orlando Borgia and Mario Tucci[1]. The aftereffect of the contextual investigation demonstrated a slight preferred position with the lean methodology in thinking about such proficiency pointers. This relies on a few components, for example, the sort and the multifaceted nature of the item made, the nature of the crude materials, the unpredictability of the assembling cycle and the course of action of the workstations establishing the creation cycle. A portion of these boundaries are controlled by the item and, consequently, are unchangeable; others, be that as it may, are variable and subsequently improvable. The test of deciding the best course of action of the workstations is one of the components that greatly affect framework execution. It is known as the —facility design issue. The writing gives a ton of meanings of different design issues. We by one way or another figured out how to not utilize the immediate information from this paper, however it manufactured our idea to continue.

A Case Study Of Plant Layout: To Compare Production Efficiency Of Manual Plant Layout And Computerized Plant Layout Using Arena Software by Priyanka Yadav, Suman Sharma[2], these Studies gave a fabulous change underway rate, profitability and plant proficiency with productive usage. Since, we were getting ready for new portions, we were resolute of exceptional yield thus, so as to acquire the most extreme pace of return it is prudent to change the plant format configuration to accomplish the better proficiency, we have gone through Comprehensive Survey On Optimum Plant Layout Design by Dr. P.Sivasankaran[3]. We heavily relied on systematic

layout planning, so this particular paper was very crucial. Improvement Plant Layout Based On Systematic Layout Planning by W. Wiyaratn, A. Watanapa, And P. Kajondecha[4]. The purpose of this research was to modify the present plant layout of a plant of canned fish.

The production process needs to be equipped with the ability to have lower cost with higher effectiveness. Therefore, the way to solve the problem of production is very important. There are numerous ways that are quality control, complete quality administration, standard time, plant format to tackle the issues concerning profitability. Out of these, the whole plant format being the least expensive strategy to build efficiency. As indicated by the investigation of the assembling cycle, it was discovered that the significant distance could be decreased for moving crude materials and the issue about futile regions could be fathomed. The best approach to improve the plant was to apply the SLP strategy to make the work process consistently by orchestrating the significant arrangement of the assembling. Precise format arranging strategy appears to be intriguing to plan the business design, it is essential thing and very basic technique, including it tends to be utilized into training.

Now, our focus was shifted to the human resource. Dr. Devendra S. Verma, Rajdeep Chaurasia[5] focused on a study to identify the factors affecting employee turnover in small scale industries. Point and destinations of the investigation is to look at the worker turnover of a little scope industry with the utilization of Quality of work life in both deliberate and automatic perspective, discover different needy and free factors that influences the representative turnover legitimately or by implication in little scope industry and to get how Managers can take fitting activities to improve representatives' nature of work and hence lessen workers' turnover. In view of relapses examination done in the investigation paper, the biggest beta coefficient has a place from open door for advancement. This implies this is the most critical factor affecting the activity fulfillment. Besides that, top management's appreciation recorded second largest. Meanwhile; the third significant factor influencing turnover intention is fair compensation. Then, it is followed by job security, team work, training program, fringe and welfare benefits and work stress. We had a general idea of the impact of fear on people. We attached our perception to the found result.

Dr. Devendra Singh Verma, Shashank Singh Pawar[6] Paper Name: Design Cost Engineering through Quality Function Deployment. Due to increase in awareness of customer about environment issues, eco-friendly products have gained more and more importance. Such interests in clients about condition issues have constrained the maker to consider nature effect of the item during the plan stage. At the point when condition necessities are considered during the item configuration stage the expense turns out to be moderately low. In this examination paper Green boundaries are utilized to upgrade the quality of the item utilizing quality function deployment (QFD). After that the upgraded assessed cost of the item based on its element attributes is assessed with the assistance of multi attribute utility theory (MAUT) model. Finally conclusion of product is that when the changes in the designing level occur, the cost of the product get change. We took all these factors and concluded that all the stakeholders when watch the effort. They readily agree to pay a significant moreover the period.

## 5. METHODOLOGY

Present condition of this plant may lead to less productivity with less efficiency utilization of industry. It may also lead to non-effective utilization of men, machines and material. What we assumed was that only tweaking the system for pandemic alert may lead to more cash wastage. We suggested not only the tweak, but also an optimized layout. We already reviewed the Systematic Industry Layout method. Systematic Industry Layout against all the methods stated as above is an organized method for industry layout optimization. For optimization of industry layout, following analysis were taken into account:

**1. Activity Analysis :** In order to plan a layout all the activities of this plant have been studied in depth. All the analysis to identify the base level situation has been done.

**2. Situational Analysis:** Activities movement is the key component to design a new industry layout for optimization activity. For calculation of activity movement, meter movement tool is used for analysis. With the help of this, the differences between changes in meter movement for different processes are found out. This was a very crucial step. This step was going to give us a very clear idea about the meter movement, which ultimately was going to result in lesser or optimized movement and lesser movement with crossing paths. Diagram of Current Industry Layout Based on the data collected and activity analysis, a block cum movement diagram of current layout is designed. This is showing the movement between various processes. The below figure shows the continuous flow line between processes. It is also clear from the research work that men, machine and material movement is in the zigzag way, resulting in loss of productivity.

It took a few formulas like a work flow chart and actual movement chart. Calculation based on these formulas were showing a loss in productivity.

Industry Layout after implementing the new proposed layout based on the systematic layout planning technique will reduce the distance between workflow and smooth flow of material throughout the cycle. Therefore, rearranging the layout improves material flow, reduced travelled distance and cost resulting in an increase in production. In the proposed layout the position of various departments are altered with various others based on activity relationship charts. The smaller machines like type 4 machines were also shifted in such a way that will render the less space. Earlier two floors were used for the crucial process

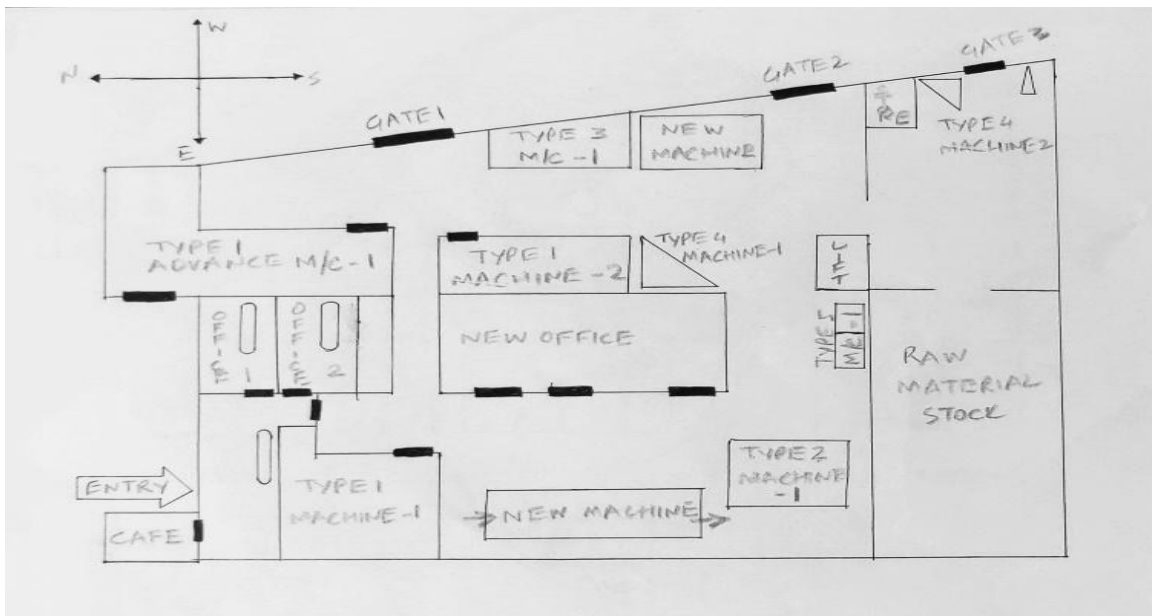


figure 1: layout before tweaking

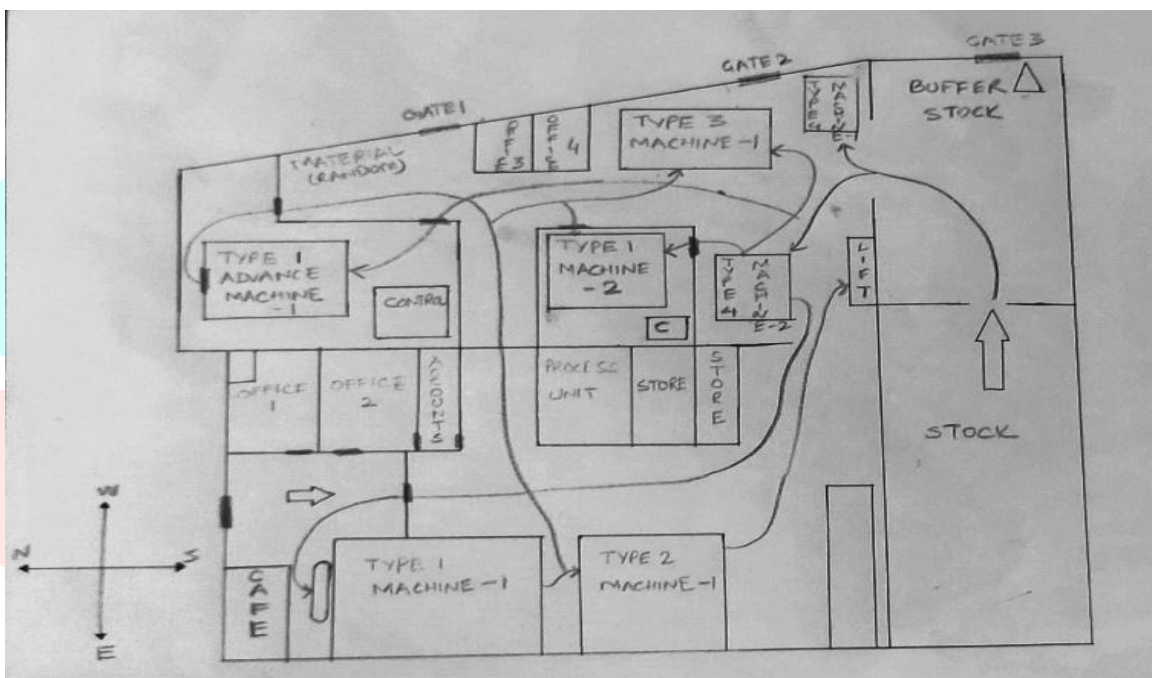


figure 2: layout after tweaking

but as per the new proposed industry layout, the support machine was shifted to the ground floor. Therefore extra movement had reduced.

Now, after the basic setup was optimized, a cultural change was observed. The meeting technique was tweaked. Every entry and exit had sanitizers with automatic dispensers. Walls were pasted with posters for making necessary amends in the thought process. Work timing, idle timing, wait timing were changed. Attendance making was changed. Any tool with multiple users was pre-sanitized before every use. Not so costly tools were bought.

## 6. COMPARISONS BETWEEN OLD AND NEW INDUSTRY LAYOUT

The figure 1 consists of old industry layout, it consists of all the essential machines. The quality obtained from this process is moderate. Movement was high with overly path crossings. Sometimes, the wait time was too high due to material and equipment movement. We were very sure that we will be focusing on health scare only. The Installation of health equipment actually prompted us to work on productivity. So, from that point we were working on two levels, One was optimization of layout and new installation for pandemic measures. Cleanliness and safety is not maintained in the previous layout. Human effort was more consumed, like more time in movement and not used for mass production.

Figure 2 is showing the tweaked industry layout consisting of new technology and modern machines. Only two new machines were recommended and it was placed accordingly. The cost thus obtained was analyzed, it actually gave a breather as in the not very long term the cost was not only recovered, the quality product was also obtained. The clean environment and safety is obtained. The process consists of automation and reducing human effort and movement. Reduced movement of material and equipment was also registered. It actually decreased the 'man to man' touch and also 'man to equipment to man' touch. Let us look at the encouraging result.

## 7. RESULT

It is very clear that after the industry is laid down using the systematic layout planning by an area saving of 120 Sq. Mt. is achieved. It made the layout very spacious open for less infection and more expansion in the future. This area can be effectively be used for future expansion, stocking of raw material and finished products in times of demand fluctuations or raw material cost decrease. Not to forget the extra space we achieved.

Choosing the optimum layout was the most important part of the work. We were very sure of the reducing movement and less cross-paths. There are several methods that can be used to find the best layout among alternatives. As the industry we envisioned is a small scale industry. Therefore, a direct suggestion based on an activity relationship chart was a good solution as it was able to reduce the lengthy calculations and raise the accuracy. Finally, the loss in movement resulted in minimum interaction also, which actually reduced the hazard. We were never expecting the overall behavioral changes from the staff, but our approach was to move 2 steps and expect staff to move few steps. It worked well and we achieved encouraging result in term of some pre determined parameters like Reduction in Material Movement, Financial Saving, Inventory Turnover Ratio, Labor Productivity, Searching Time, Man movement, Man to Man interaction, Equipment interaction, Virus spread, Behavioral change.

**table – 1:** result based on pre determined particulars

S.N	Particulars	Target	Achieved
1	Reduction in Material Movement	20% (Before 141 Meter)	14 % (After 120 Meter)
2	Financial Saving	10 Lac/Year	4 Lac/year
3	Inventory Turnover Ratio	12.93	30.29
4	Labor Productivity	287.75 (45%)	398.70 (38%)
5	Searching Time	2.5 Hrs/Shift	2.0 Hrs/Shift
6	Man movement	2.3 km (avg.)	2.1 km
7	Man to Man interaction	124 minute	130 minute
8	Equipment interaction	430 minute	456 minute
9	Virus spread	less than 1	less than 1
10	Behavioral change	Everybody	almost everybody

## 8. CONCLUSION

The objective of the exploration work is to build up an insightful change just as creation format taking into account the need to expand the creation limit utilizing office arranging and plan strategies just as to decrease the dread of pandemic with genuine impact of pandemic. The point of the exploration work is to create designs with improving proficiency of item yield without hampering the soundness of faculties. Efficient format arranging strategy, which is broadly utilized in past investigations during the previous many years, is the best advancement movement which investigates the connection between different exercises. We comprehended that it tends to be founded on numerical models additionally and experiential models moreover. The proposed model dependent on SLP is discovered to be powerful in taking care of the different issues of the little business we envisioned. The stock turnover proportion has expanded by 30.29 what we considered at first, the work efficiency of the organization has expanded to 398.7 (38%) and absolute meter development by material descended by 14%. In the examination work separation is considered to improve existing design yet there are numerous different boundaries to break down the format that might be number of laborers, necessity of territory and transformation of cutting edge innovation and progressed outlook. The issue of the current format is the huge relative separation between a few offices that is compelled to travel a significant distance and hinders the smooth material stream and prompts higher association. In the proposed design the situation of different offices is modified with different others dependent on action relationship diagrams. It is normal this proposed model will generally be ideal while setting up another plant usage and will help in the general improvement of creation execution, not changing the wellbeing status of the work power. The clear change in various execution markers, for example, decrease in cost and throughput time just as upgrades away space and controls, quality and a sheltered workplace were seen. There was a checked reduction in the separations went by segments and number of developments because of an expansion in loads for every development.

The achievement of present day producing offices is attached to the ability to effectively configuration, run, and keep up industry designs that can undoubtedly adjust to the various mechanical changes, client requests and just as demonstration of god. Because of consistently changing business sector prerequisites, hardened rivalry, more assortment of items, diminished life pattern of items, and significant expense of assembling, organizations that have only one item may think that it's hard to endure. This discloses the need to have a very much planned useful industry format that will have the option to change starting with one line of item then onto the next without significant adjustments. it must not just support, it must flourish. It will likewise accomplish quick progression of crude materials and work in progress at the most minimal expense, and with the least measure of taking care of as qualities are being added to the item from the receipt of crude materials to the shipment of the yield. The paper inspected in detail the different kinds of industry

format, their favorable circumstances and impediments, the plan of a useful industry format, just as the various advantages of an all around planned design.

This exploration paper has given a decent presentation to office arranging and format plans for the improvement of the proficiency. The decision of which sort of office format to embrace can significantly affect the drawn out accomplishment of a firm. This choice, hence, ought not be considered gently, yet simply after an intensive examination of the operational necessities has been finished. A significant issue to be tended to in office format choices in assembling is: How adaptable should the design be so as to acclimate to future changes in item request and item blend. The investigation of design has gotten critical. The most well-known target of format plan, that is to limit separation voyaged, isn't generally appropriate for all the assembling ventures. Blockage in a particular region may must be endured while keeping up least partition between offices. Rather than measure of limiting all out separation voyaged, one may wish to limit the absolute separation of the material voyaged.

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