A study on cellular manufacturing business essay

A cellular manufacturing layout is in direct contradiction to the traditional production line. In the production line, numerous workers are needed to service a single production line running from receiving of raw material to shipping of finished product. A breakdown in staffing or machinery in any part of the line nearly always resulted in the entire process being idled until the specific difficulty in the line was repaired, or re-crewed. With cellular manufacturing, production is divided among groups, or cells, of workers and production machinery. Thus, the breakdown of one cell, due to equipment malfunction or staffing problems, does not radically affect the rest of the production process.

Technology and cellular manufacturing have combined to streamline the production processes of numerous established and start-up manufacturing facilities worldwide. Lean systems, such as Kaizen, and Six Sigma, to name just two, though very often high in startup cost, provide both a short- and long-term benefit in reducing the waste common to the traditional production line. The bottom line in any manufacturing enterprise is profit. Cellular manufacturing has been proven to dramatically increase profits.

Cellular Manufacturing is a model for workplace design, and is an integral part of lean manufacturing systems. The goal of lean manufacturing is the aggressive minimisation of waste, called muda, to achieve maximum efficiency of resources. Cellular manufacturing, sometimes called cellular or cell production, arranges factory floor labor into semi-autonomous and multi-skilled teams, or work cells, who manufacture complete products or complex components. Properly trained and implemented cells are more flexible and responsive than the traditional mass-production line, and can manage

processes, defects, scheduling, equipment maintenance, and other manufacturing issues more efficiently.

A cell is a group of workstations, machines or equipment arranged such that a product can be processed progressively from one workstation to another without having to wait for a batch to be completed or requiring additional handling between operations. Cells may be dedicated to a process, a sub-component, or an entire product. Cells are conducive to single-piece and one-touch manufacturing methods and are often found as part of lean manufacturing applications. Cells may be designed for the office as well as the factory.

Though very technical and detailed, the concept of cellular production is basically simple; get a finished product from raw materials to shipment as efficiently, and as profitably as possible. Cellular manufacturing systems and layouts essentially separate the production line into segments, or cells, sometimes called modules. Each cell, consisting of both workers and production machinery, is dedicated to a particular component of the manufactured product. Ideally, workers and equipment comprising a particular cell are trained and configured to be able to take over the processes of another cell when necessary, thus minimizing downtime and wastage of raw material

Group technology or families-of-parts concepts are often used in cellular design. Group technology is the process of studying a large population of different workpieces and then dividing them into groups of items having similar characteristics. The process may be executed with the aid of a

computer, and has been used to divide parts into groups for use with CAD/CAM processing. Family of parts is the process of grouping workpieces into logical families so that they can be produced by the same group of machines, tooling, and people with only minor changes on procedure or setup.

In production, setups and changeovers are faster because the same tools and fixtures can be used for similar parts. With group technology the workpieces and machining operations have to be classified. Once coded into classifications, processing information can be retrieved quickly.

There are many forms of cellular technology

Straight line,

U-shape, but equipment contained with the cell, or workstations, are normally configured in closely proximity to compress time and space.

It is very important to ensure quick changeover from one product to the next for inducing cell velocity.

For handling materials, robots, conveyors etc are used and sometimes it is also manual. If totally automated, then a supervisory computer is required to control movement between the individual pieces of equipment and the automated conveyance.

The goal of cellular manufacturing is having the flexibility to produce a high variety of low demand products, while maintaining the high productivity of

large scale production. Cell designers achieve this through modularity in both process design and product design.

Process Design

Work is divided into discrete segments and each segment is assigned a work cell. This introduced the modularity of processes. In this way, if any segment of the process needs to be changed, only the particular cell would be affected, not the entire production line.

For example, if a particular component was prone to defects, and this could be solved by upgrading the equipment, a new work cell could be designed and prepared while the obsolete cell continued production. Also, this will help in reducing stalling time and will increase the capacity.

Once the new cell is tested and ready for production, the incoming parts to and outgoing parts from the old cell will simply be rerouted to the new cell without having to disrupt the entire production line.

In this way, work cells increase the flexibility to upgrade processes and allow changes in products to better suit customer demands while reducing or eliminating the costs of breakdown. Even though the machinery may be functionally dissimilar, the family of parts produced contains similar processing requirements or has structural similarities. Thus, all parts basically follow the same routing with some minor variations (e. g., skipping an operation). The cells may have no conveyorized movement of parts between machines, or they may have a flow line connected by a conveyor that can provide automatic transfer.

Product Design

It must match the modularity of processes. Even though the entire production system becomes more flexible, each individual cell is still optimised for a relatively narrow range of tasks, in order to take advantage of the mass-production efficiencies of specialisation and scale. This means that a large variety of products can be designed to be assembled from a small number of modular parts, through which a high product variety as well as high productivity can be achieved. For example, a varied range of automobiles may be designed to use the same chassis, a small number of engine configurations, and a moderate variety of car bodies, each available in a range of colours. In this way, a large variety of automobiles, with different performances and appearances and functions, can be produced by combining the outputs from a more limited number of work cells.

Cells are usually larger than traditional workstations, but smaller than a complete department. Additionally, a cellular manufacturing layout requires less floor space as a result of the optimized production processes. Each cell is responsible for its own internal control of quality, scheduling, ordering, and record keeping. This way, responsibilities of tasks are assigned to those who are most familiar with the situation and most able to quickly fix any problems. The middle management no longer has to monitor the outputs and interrelationships of every single worker.

Implementation

The biggest challenge when implementing cellular manufacturing in a company is dividing the entire manufacturing system into cells. There are two types of issues

The “ hard” issues of equipment, such as material flow and layout, and

The “ soft” issues of management, such as up skilling and corporate culture.

The hard issues are a matter of design and investment. The entire factory floor is rearranged, and equipment is modified or replaced to enable cell manufacturing. The costs of work stoppages during implementation can be considerable, and generally this rearrangement is preferred to be phased to minimize the impacts of such disruptions as much as possible.

The soft issues are more difficult to calculate and control. The implementation of cell manufacturing often involves employee training and the redefinition and reassignment of jobs. Each of the workers in each cell should ideally be able to complete the entire range of tasks required from that cell, and often this means being more multi-skilled than they were previously. For this reason, transition from a progressive assembly line type of manufacturing to cellular is often best managed in stages with both types co-existing for a period of time.

In addition, to make cells self-managing (to some extent), workers are expected to learn the tools and strategies for effective teamwork and management, tasks that workers in conventional factory environments are entirely unused to.

On the same lines, the management will also find their jobs redefined, as they must take a more “ hands-off” approach to allow work cells to effectively self-manage. So they are supposed to learn to perform a more oversight and support role, and maintain a system where work cells self-

optimize through supplier-input-process-output-customer (SIPOC) relationships.

Product start-ups can be more difficult to manage if assembly training was traditionally accomplished station-by-station on a fixed assembly line. As each operator in a cell is responsible for a larger number of assembled parts and operations, the time needed to master the sequence and techniques is considerably longer. If multiple parallel cells are used, each cell must be launched separately (meaning slower production ramp) or with equal training resources (meaning more in total). The consideration of the cell’s internal group dynamics, personalities and other traits is often more of a concern in cellular manufacturing due to the closer proximity and co-dependency of the team members; however properly implemented this is a major benefit of cellular manufacturing.

Benefits and Costs

Among the biggest benefits are these

Processes become more balanced and productivity increases because the manufacturing floor has been reorganized and tidied up.

Part movement, set-up time, and wait time between operations are reduced, resulting in a reduction of work in progress inventory freeing idle capital that can be better utilized elsewhere.

Helps eliminate overproduction by only producing items when they are needed.

There is ample amount of cost savings and the better control of operations.

Costs involved: Along with the set up costs, there are also other costs associated with particular cells in cellular manufacturing. Sometimes different work cells can require the same machines and tools, possibly resulting in duplication causing a higher investment of equipment and lowered machine utilization. However, this is a matter of optimization and can be addressed through process design.

The cellular manufacturing system, often called lean manufacturing, is a fairly recent development in global manufacturing processes. One of the first, and today, the most common cellular, or lean manufacturing systems is the Kaizen system. Originally conceived by the Toyota Corporation in Japan, Kaizen utilizes technology and cellular manufacturing to reduce the waste of time, effort, money, and resources in the production process.

Cellular Manufacturing using Toyota Production System

Toyota Motor Corporation’s vehicle production system is a way of “ making things” that is sometimes referred to as a “ lean manufacturing system” or a “ Just-in-Time (JIT) system,” and has come to be well known and studied worldwide.

Its motto is to increase efficiency and optimise flow of operations by reducing wastage thus delivering a high customer value.

This production control system has been established based on many years of continuous improvements, with the objective of “ making the vehicles ordered by customers in the quickest and most efficient way, in order to deliver the vehicles as quickly as possible.”

The Toyota Production System (TPS) was established based on two concepts: The first is called “ jidoka” (which can be loosely translated as “ automation with a human touch”) which means that when a problem occurs, the equipment stops immediately, preventing defective products from being produced; The second is the concept of “ Just-in-Time,” in which each process produces only what is needed by the next process in a continuous flow.

Based on the basic philosophies of jidoka and Just-in-Time, the TPS can efficiently and quickly produce vehicles of sound quality, one at a time, that fully satisfy customer requirements.

5 main principles at Toyota

Always be faithful to your duties, thereby contributing to the company and to the overall good.

Always be studious and creative, striving to stay ahead of the times.

Always be practical and avoid frivolousness.

Always strive to build a homelike atmosphere at work that is warm and friendly.

Always have respect for spiritual matters, and remember to be grateful at all times.

Guiding Principles at Toyota

Honor the language and spirit of the law of every nation and undertake open and fair business activities to be a good corporate citizen of the world.

Respect the culture and customs of every nation and contribute to economic and social development through corporate activities in their respective communities.

Dedicate our business to providing clean and safe products and to enhancing the quality of life everywhere through all of our activities.

Create and develop advanced technologies and provide outstanding products and services that fulfill the needs of customers worldwide.

Foster a corporate culture that enhances both individual creativity and the value of teamwork, while honoring mutual trust and respect between labor and management.

Pursue growth through harmony with the global community via innovative management.

Work with business partners in research and manufacture to achieve stable, long-term growth and mutual benefits, while keeping ourselves open to new partnerships.

The foundation of the everyday operation in Toyota Production System is Standardized Work, standardized procedures that regulate every single work step in the entire process of producing an automobile. Concentrating on human movements, Standardized Work sets up the best work sequence for each manufacturing and assembling process. Once the most efficient sequence has been determined, it is always repeated in exactly the same way, thereby avoiding unnecessary motion and wasted effort, maintaining quality, assuring safety, and preventing damage.

Standardized work establishes guidelines for three central elements of a manned work process:

Talkt Time : the amount of time within which a given job is to be completed

Working Sequence: the step-by-step order in which each processing or assembly operation is to be performed

Standard In-Process Stock: specifies the number of parts that should be in-process at any given time

Below are few pictures illustrating the efficient layout at Toyota car manufacturing plant.

In Toyota’s manufacturing facility, processes like Kaizen, Jidoka and Just in Time are implemented to increase efficiency, make the process very optimised and reduce wastage.

As a result there is cost saving and the process is streamlined to deliver high satisfaction. In Toyota, employees have their own suggestion system in each cell through which they increase the productivity of the work assigned to them. On a more overall approach, when the productivity of each cell improves then the overall productivity also improves a lot.

Below we explain them :

Kaizen is a daily process, the purpose of which goes beyond simple productivity improvement. It helps in including all workers make suggestions on overall improvement in the workplace and these suggestions lead to

overall efficiency. Thorugh Kaizen Approach workers can increase productivity and efficiency which will give better quality of work.

People at all levels of an organization participate in kaizen, from the CEO down to janitorial staff, as well as external stakeholders when applicable. The format for kaizen can be individual, suggestion system, small group, or large group.

The Toyota Production System is known for kaizen, where all line personnel are expected to stop their moving production line in case of any abnormality and, along with their supervisor, suggest an improvement to resolve the abnormality which may initiate a kaizen. The cycle of kaizen activity can be defined as:

Standardize an operation

Measure the standardized operation (find cycle time and amount of in-process inventory)

Gauge measurements against requirements

Innovate to meet requirements and increase productivity

Standardize the new, improved operations

Continue cycle ad infinitum

The 5 mail elements of Kaizen are:

Teamwork

Personal discipline

Improved morale

Quality circles

Suggestions for improvement

Waste management: Toyota defines three broad types of waste – muda, muri and mura

Toyota assumes a smoothness based approach which will lead to waste minimization. So quality problems due to buffer stocks, unnecessary manual work (last bolt tightens the nut, rest are only for driving) etc are showcase through this approach. Similarly, Muri is all the unreasonable work that management imposes on workers and machines because of poor organization, such as carrying heavy weights, moving things around, dangerous tasks, even working significantly faster than usual. It is pushing a person or a machine beyond its natural limits.

Firstly, muri focuses on the preparation and planning of the process, or what work can be avoided proactively by design. Next, mura then focuses on how the work design is implemented and the elimination of fluctuation at the scheduling or operations level, such as quality and volume. Muda is then discovered after the process is in place and is dealt with reactively. It is seen through variation in output. It is the role of management to examine the muda, in the processes and eliminate the deeper causes by considering the connections to the muri and mura of the system. The muda and mura

inconsistencies must be feb back to the muri, or planning, stage for the next project.

Jidoka

If any machine malfunctions then the errors are countered and handled at a cellular level. The machines are so calibrated that when a problem occurs it is able to stop on its own without further spreading the problem to other parts of the manufacturing process. Through cellular manufacturing, this is one big advantage that has happened in the Toyota manufacturing plant. If equipment malfunction or a defective part is discovered, the affected machine automatically stops, and operators cease production and correct the problem.

For the Just-in-Time system to function, all of the parts that are made and supplied must meet predetermined quality standards. This is achieved through jidoka.

Jidoka means that a machine safely stops when the normal processing is completed. It also means that, should a quality / equipment problem arise, the machine detects the problem on its own and stops, preventing defective products from being produced. As a result, only products satisfying quality standards will be passed on to the following processes on the production line.

Since a machine automatically stops when processing is completed or when a problem arises and is communicated via the “ andon” (problem display board), operators can confidently continue performing work at another machine, as well as easily identify the problem’s cause to prevent its

recurrence. This means that each operator can be in charge of many machines, resulting in higher productivity, while continuous improvements lead to greater processing capacity

Productivity Improvement

Quality products are produced through increasing the efficiency through the complete elimination of waste, inconsistencies, and unreasonable requirements on the production line. In order to deliver a vehicle ordered by a customer as quickly as possible, the vehicle is efficiently built within the shortest possible period of time by adhering to the following:

When a vehicle order is received, a production instruction must be issued to the beginning of the vehicle production line as soon as possible.

The assembly line must be stocked with required number of all needed parts so that any type of ordered vehicle can be assembled.

The assembly line must replace the parts used by retrieving the same number of parts from the parts-producing process (the preceding process).

The preceding process must be stocked with small numbers of all types of parts and produce only the numbers of parts that were retrieved by an operator from the next process.

Flowchart of Toyota car manufacture process

Facility Layouts:

The layout in this clinic can be compared to the manufacturing layouts like cellular manufacturing layout and fixed position layouts.

Cellular manufacturing layout

In a cellular manufacturing layout, machines are grouped into cells and the cells functions somewhat like a product island within a larger job shop or process layout. Similarly in this clinic machines that are associated with a single test are kept in a room for eg: ENT or Dentistry here consists of many machines which are grouped into cells and act as a product island within this process layout.

Fixed position layout

Some of the manufacturing and construction firms use a layout for arranging work that locates the product in a fixed position and transports workers, materials, machines and sub contractors to and from the product. Similarly in the clinic when the patient cannot move, the machines or the instruments are moved to the patients and the tests are conducted.

Hybrid layout

Hybrid is a combination of the above layouts specified. Here the patients move towards the individual units to do their tests and operations and in some cases the machines are moved towards the patients to conduct the tests.

BACKGROUND OF THE COMPANY:

At the genesis of the Apollo story there was a dream. A dream so powerful, that it helped transform the medical landscape in India. The dream nurtured and grew within Dr. Prathap C Reddy, the founder Chairman of Apollo Hospitals, until the point of inflection happened in 1983. A young man succumbing to an ailing heart was what it took to ignite Dr. Reddy’s vision

into a reality – a vision where quality healthcare was given. Apollo Hospitals started as a 150 bed hospital in Chennai in 1983. The Apollo Hospitals group today includes over 7500 beds across 43 hospitals in India and overseas, neighborhood diagnostic clinics, an extensive chain of Apollo Pharmacies, medical BPO and health insurance services and clinical research divisions that are working on the cutting edge of medical science. Apollo Hospitals Group had become an integrated healthcare organization with owned and managed hospitals, diagnostic clinics, dispensing pharmacies and consultancy services. Apollo Hospitals, Chennai & Hyderabad won the healthcare awards 2008, instituted by the Express Healthcare Publications (The Indian Express Group). The awards received include:

– Apollo Hospitals Chennai- Overall Best Hospital of the year

– Apollo Hospital Chennai- Operational Excellence

– Apollo Specialty Hospital, Chennai- Leveraging Global Opportunity

– Apollo Health City Hyderabad- Sustained Growth

– Apollo Health City Hyderabad- Patient Care

-Apollo Hospitals, Chennai has been rated ‘ Best Private Sector Hospital’ in India by the Week magazine for 2003, 2004, 2007 and 2008

METHODOLOGY:

We selected a franchisee of Apollo Hospitals called as Apollo Clinic as a part of our study of the facility layout. The reason for starting of the franchisee was to ensure the presence of Apollo Hospitals all over the world. There is a

unit called as AHLL (Apollo Health & Lifestyle Limited) which is the body which maintains and take care of all the franchisees and their requirements. The name of Clinic which we visited is Apollo Craddle which is located in the sector 14 of Gurgaon. The Clinic is the only clinic in the entire chain of the Apollo Clinics across the world to have Operation Theatre. The main segment which the Clinic is targeting is the upper class people only who can afford to pay more for the services.

The main facility located at the Electronic City which we selected for the layout analysis. It is a franchisee of Apollo Hospitals and the franchisee name is Spring Leaf Healthcare Services.

Facility Location:

Apollo Clinic is situated in sector 14. The main reasons for the location of the clinic in that place are

The target segment of Apollo clinic is the software companies and BPO employees. This takes care of the customer and the constituent trends.

The cost of construction and land in this place while establishing this clinic was cheap.

Since they are in a prime area like electronics city (Situated in the old National highway), the transportation systems availability is good. .

Since it is located in a densely concentrated area, the overall response time is low thereby reducing property loss and loss of life.

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SAMPLE COLLECTION ECG/PFT

EMERGENCY

OR OBSERVATION ROOM

PAEDIATION

(FOR CHILDRENS)

CONSULTANTS ROOM

GYNAECOLOGIST

WASHROOM

RECEPTION AREA

CUSTOMER WAITING LOUNGELAYOUT OF GROUND FLOOR

PHARMACY

Pharmacy is open for both in house as well as for outhouse patients. In house patients are given the medicines as per the prescriptions and then are charged on their final bill

Also the customer waiting lounge is well furnished and proper care is taken that the persons in the waiting lounge do not get bored and for this reason only they have kept a LCD television in the waiting area. Also there are lots

of banners that are put in the waiting lounge which tells about the various services that Apollo provides. This forms a part of the indirect Marketing of the product and services they provide.

Explanation of the Layout

Ground Floor:

The ground floor has the waiting lobby, reception, Sample collection areas, emergency/observation rooms, consultation rooms, pharmacy, gynaec centers as well as pediatrician centers.

Pharmacy is situated near the entrance so that the out patients, who come to the hospital, buy medicines as soon as the consultation is done and move out of the hospital thereby reducing the congestion in the hospital if they had kept the pharmacy inside. Moreover this pharmacy can be accessed by the people who want medicines also.

Left side near the entrance is the emergency/observation rooms, which takes care of the patients who are critical and need emergency help.

Opposite to emergency room to the right side of the entrance is the lobby for the people to wait. This lobby is opposite the reception counter, which takes care of registration, enquiry etc.

Behind the reception is the sample collection area where blood tests are taken, the reason for keeping this sample collection room in ground floor is because this is a general test taken for all ailments as well as critical incidents (like accidents etc) and it has to be kept in a place it can be accessed quickly and the response time is less.

The other frequent cases that come other than emergencies are for general check up (which is just after the emergency room), pregnant ladies (gynecologists') and children (pediatrician) etc. Since most of the cases that the clinic receives belong to either of these, all these are situated in the ground floor, once again emphasizing the less response time to treat the above patients.

Gynaec centre is the last after the general check up room; pediatrician room is the last room in the ground floor..

LAYOUT OF FIRST FLOOR

WAY FROM GROUND FLOOR

ELEVATOR

L

O

B

B

Y

DENTAL CARE

CUSTOMER WAITING LOUNGE

DESK OF NURSE OR COMPOUNDER

X-RAY

ECHO, SCANNING

& DOPPLER

WASH

ROOM

LAB FOR ALL TESTS

TMT TEST

PANTRY

SPOOTUM TEST

(PROTECTED AREA)

First Floor:

First floor of the hospital is the heart wherein all the main tests are conducted.

As soon as we enter the first floor there is a pantry in the left side, which allows the patient to have something as soon as he/she has finished his test. And since most of the tests are conducted in the first floor pantry is also situated in the entrance of the first floor.

The first floor houses Dental care, X-Ray test, Echocardiogram, Doppler, scanning, tread mill test, a very big lab conducts tests like hematology, biochemistry, serology, micro biology, cytology etc.

The lab is further sub divided into a very small test lab, which is secluded and kept.

The reason is since the results of all tests are found in this lab and it is protected from germs, moisture etc so that they do not alter the accuracy of the result of the report.

Dental care is kept first as they observe that most of the patients who come are generally for their dental check up.

There is a lobby in between Dental care and the X- ray room, as they once again observe that X ray is a common test that almost 96% of patients has to perform.

There is a tread mill room test near by the ECG room because, patients who come for ECG test are mostly told to perform the tread mill test after ECG.

ECHO, Scanning and Doppler are not the most preferred test because patients who come to the clinic generally come for general tests rather than specialized tests like these.

As told the small test lab is kept in the last because they should be perfectly sealed from the daily chores.

All test rooms have a toilet attached to it and there is a common toilet in the floor.

WAY FROM 1ST FLOOR

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B

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SEMI PRIVATE ROOM

DESK OF COMPOUNDER OR NURSE

OPERATION THEATRE

PRE-TREATMENT

SEMI-PRIVATE ROOM

WASH ROOM

DELUXE ROOMS

ENT/

OPTHOMOLOGY

DOCTOR'S CHANGING ROOM LAYOUT OF 2ND FLOOR

MAJOR OT

MINOR OT

Second Floor:

This floor houses two semi deluxe rooms, one deluxe room, an

ENT/Ophthalmologist care centre and an operation theatre.

The reason for keeping the ENT/ophthalmologist centre in the second floor is because the number of patients coming for the above tests are ve