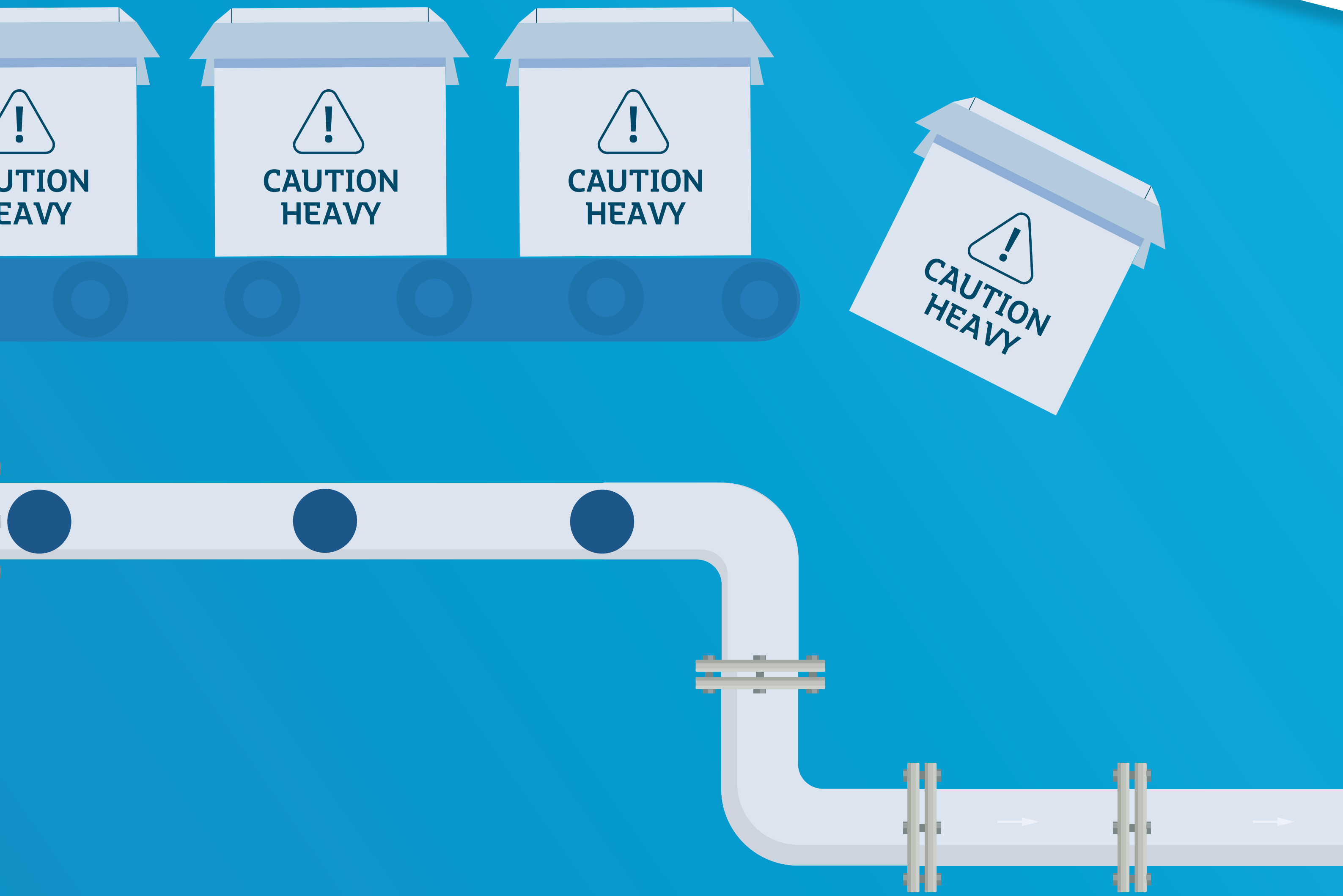
Invest Northern Ireland



Plant Layout – in Pursuit of Operational Excellence Tutorial

1. Welcome

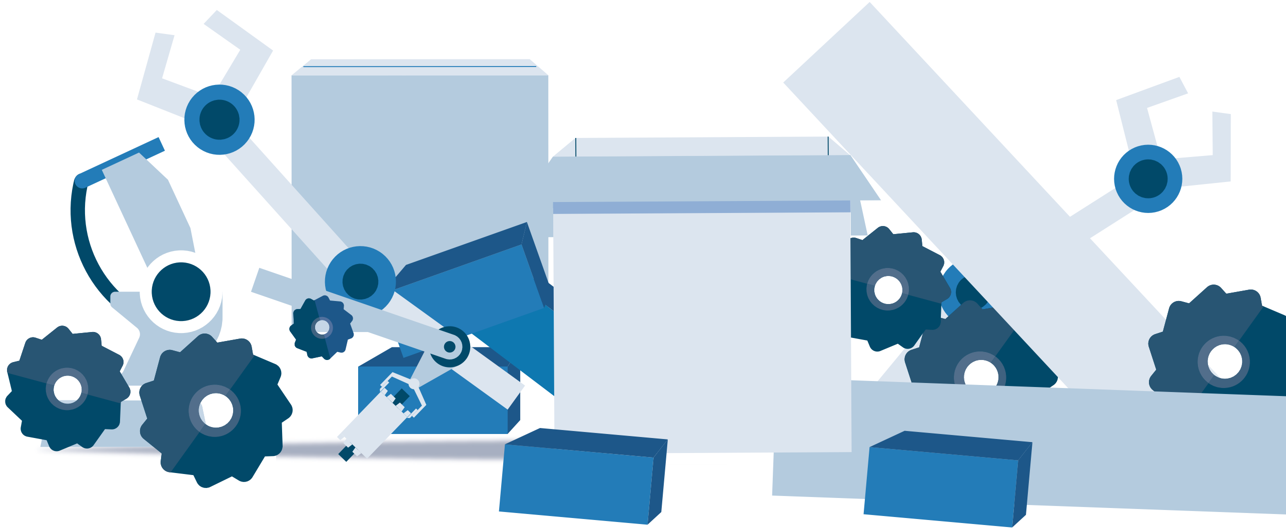
Introduction

Hello and welcome to 'Plant Layout - In Pursuit of Operational Excellence', an Invest NI video tutorial.

From Adam Smith's pin manufacturers, through Henry Ford's assembly lines, to Amazon's automated warehouses, finding new and better ways to organise work has driven the modern economy's advances.

Organising processes in your business is critical to satisfying demand and turning profits. At the heart of that organisation is plant layout – understanding and optimising how space is used in your business. It provides the boundaries within which your work processes take place, and getting it right can improve the way those processes are performed. The result is efficient, low-waste production.

This tutorial explains the broad principles that underpin good plant layout. These principles were developed in manufacturing, but they have been applied to businesses in all sectors.



2. What's so important about layout?

Why should you think about it?

Well, sometimes our workplace can grow up around us without much thought as to how it is organised. As we add processes and make others redundant, make space for storing raw materials, or create buffers against unexpected demand, we place things where it is convenient to do so.

These places may be convenient, but they aren't necessarily efficient. Workers must perform more movement, travel further, and suffer discomfort when their workplace is poorly designed, cluttered or otherwise inconvenient. This wastes time and effort, which reduces quality and productivity. It also raises the risk of accidents and injuries.

These problems can often go unnoticed. You probably spend a lot of time working to improve individual processes, but you may not have applied the same rigour to improving the overall physical space of your workplace. Plant layout helps you to think about the big picture issues of how you use space.

How do you know that you have plant layout issues in your facility?

Ask yourself some questions:

- Are you experiencing bottlenecks, poor customer service or late deliveries?
- Is your inventory in good shape, while customer service –

Think outside the box. Forget the walls, pipes, drains and everything else. If you had a blank canvas, what would you do differently?

Take a look around your facility. Follow the process flow and look out for the following:

- Are some machines heavily loaded, while others remain idle for extended periods?
- is there excessive handling by skilled workers?
- Do you have a lot of goods in temporary storage?
- Are there long material flow lines and re-handling?
- Are some products spoiling during handling?
- Are you experiencing supervision and control difficulties?

Even if your facility's plant layout is generally good, you may be forced to reorganise. You might be:

- introducing new products
- experiencing changes in demand
- introducing changes to your product designs
- storing large amounts of work in progress
- or moving premises.

What does good layout look like?

A good layout:

- minimises handling time and effort
- utilises floor space well
- shortens the distance that materials travel
- utilises labour more efficiently
- adapts to changing conditions
- and increases production and reduces costs.

Perhaps most importantly, but less tangibly, good layout can bring a sense of unity and purpose to your staff. Their movements and activities will seem choreographed in pursuit of the same goal, fostering team spirit and boosting productivity.

As we move through this tutorial series, there are nine factors you should keep in mind. These are things that will shape your choice of layout. You can download this list from the link below the video.

Equipment

How you arrange your equipment will depend on the type of materials in your product. You must consider the size, shape, volume, weight and chemical composition of your materials. Each characteristic will influence your manufacturing methods, storage and handling processes.

It's important to understand the machinery and tools in your plant. How big is each machine? What is its purpose? How many people operate it? How much space do they need?

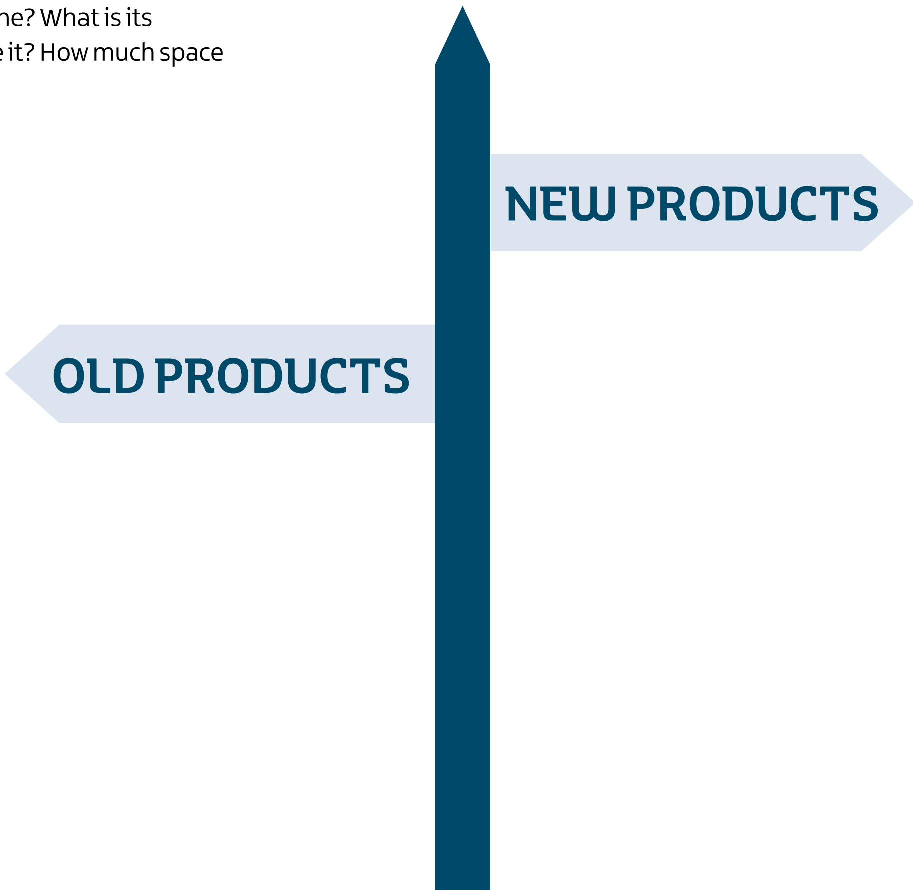
Two or more workflows might share a piece of equipment. Make sure the layout allows easy access to it. Shared equipment poses challenges beyond layout – you must consider scheduling and handling issues as well.

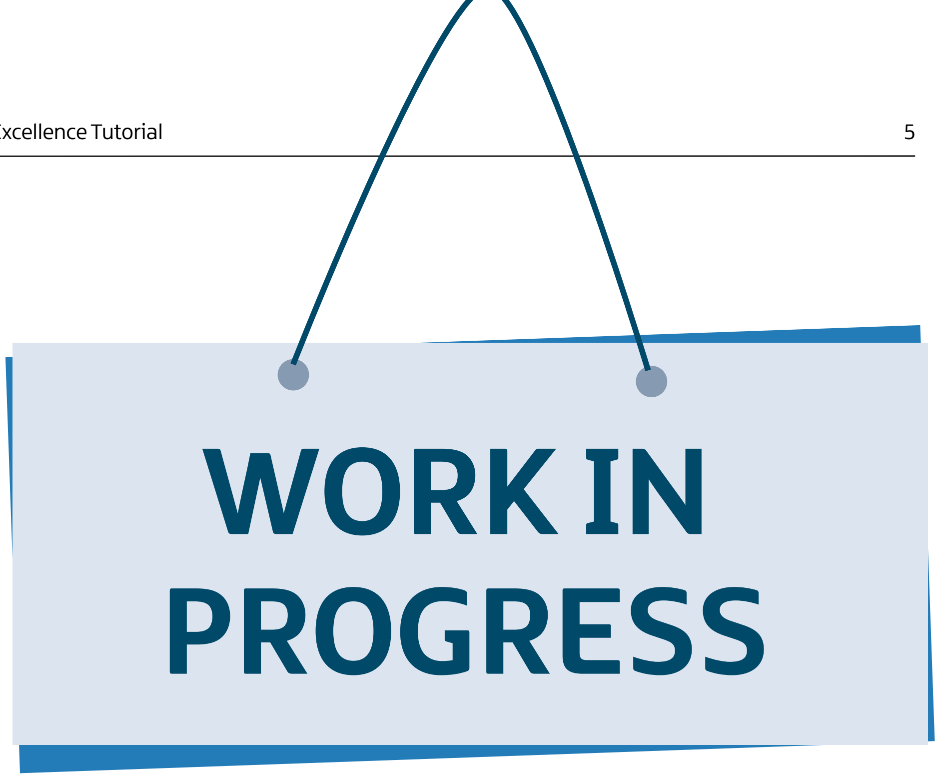
A process monument is a unit, or piece of equipment, that cannot be moved. The location of your process monuments, just like receiving and dispatch areas, will have a strong influence on the rest of your layout.

Worker's needs

Consider your workers' needs. Labour, supervisors and auxiliary services will all need to work in safety. They should have enough light, receive plenty of ventilation, and work in reasonable ambient temperatures with no undue noise. You must organise their activities too – are the people with the right qualifications in the right places, in the right numbers, at the right time?

They will need to get in touch with each other regularly – especially supervisors coordinating work between different parts of the workflow. Communication equipment should be placed at regular intervals throughout the layout.





Material handling

Material handling does not add value to your product – it is a form of waste. Your objective is to minimise material handling by combining it with other operations, and eliminating unnecessary and costly movements.

The routes that materials take through the layout should be clearly marked.

The flow of materials should be channelled by the layout to reduce the distance that products must travel.

Consider the bulk of the materials that you are handling on the line. Make sure that lines dealing with the heaviest materials are close to entry and exit points.

The location of your receiving and dispatch areas will exert a strong influence on your layout designs. If you are designing a space from scratch, give plenty of thought to these areas to minimise material handling.

Accessability

Restrict access to dangerous processes to authorised operators. Clearly mark fire access points. Pathways should be clearly defined and free from obstructions.

All machines and equipment should be easily accessible for cleaning and maintenance.

You should aim to achieve continuous material flow through your facility to avoid the cost of waiting time and the problems that occur when the flow stops.

Typically, auxiliary services such as stores, rest rooms and break areas represent around 30% of the space at a facility. **Auxiliary services include spaces for:**

- the workforce, such as accessibility paths, fire protection installations, supervision areas, and safety equipment
- materials such as stores and quality control areas
- machinery such as maintenance areas, tools and jigs, electrical and water lines.

Building height is a major constraining factor. Make sure that you can fit machinery beneath the roof and that any heavy equipment is placed on floors that are rated for the load.

Flexibility

Good plant layout is flexible. You need to be able to react to market fluctuations with minimum disruption to production. You can achieve flexibility by keeping the original layout as free as possible, with a minimum of fixed centres.

Some in-process tasks such as plating, anodising or heat treatment might be contracted to outside suppliers. This can add to your layout's complexity, so you may have to treat the outsourced part of your operations as a separate workflow.

3. Types of plant layout

There are four basic layout types:

- Product – or straight line – layout
- Process – or functional – layout
- Cellular – or group – layout
- Static layout
- Or you can have a combination of all of them.

What are they?

We will focus our attention on the first three types – product, process and cellular. In each one, the product is assembled as it moves through the space inside a factory.

The fourth kind – **static layout** – is different. In this layout, materials and equipment are moved to a large, stationary product – common in shipbuilding and aircraft manufacture.

A product layout locates the machines, tools and equipment along a line inside the factory. The products flow along this line, usually on a conveyor system. It is clear, predictable and relatively easy to control. Product layouts might be a single line, or several, parallel lines, combining at one node.

Process layout locates similar types of work in the same place. All the drills may be in one area, all the lathes in another. Different products require different processes, so the movement of materials through a process layout can be complex.

Cellular layout is an attempt to bring more order to a process layout by introducing elements of a product layout.

Pros & cons

Each layout has its own advantages and disadvantages.

Product layout has low unit costs for high volume production. It can incorporate specialised equipment, which improves efficiency, and it can be calibrated for optimal materials movement, ensuring a minimum of wasted time.

Its drawbacks include inflexibility and susceptibility to disruption. If something goes wrong at any point on the line, all production must halt.

Process layout allows many different products to be made simultaneously and is robust against disruption. It's also easier to supervise and coordinate.

It can, however, lead to underutilisation of some machines, high levels of work-in-progress, and requires a complex material flow.

Cellular layout is a good compromise between cost and flexibility for complex product mixes. It also allows fast throughput, as we will see later.

However, a cellular layout requires more investment in machinery, some of which may not always be in use.

4. Product layout

Product layouts follow a line through the factory. The products flow along this line, usually on some type of conveyance, from one processing stage to the next. A good example is paper making. All paper is made in a similar way.

Paper making example

1. Wood chips are combined with chemicals and water. The resulting mixture is cooked to form pulp.
2. The pulp undergoes a cleaning process to refine the fibres and lock them together.
3. It is then mixed with more chemicals and spread across a wire mesh and pressed to remove most of the moisture.
4. The resulting paper sheet then passes through a series of heated, cast-iron cylinders to dry.
5. The sheet is then collected on a reel for further processing.
6. It makes sense to locate these processes in the order they're performed, and to let the materials flow through them in a predictable manner.

Each of these steps is known as a **processing stage.** When you're planning a product layout for your operations, you'll need to know how many processing stages are required. Let's look at how to work that out. To do so, we'll need to explore a few terms that designers use when discussing layout. We'll use the example of a door factory to illustrate each.

The first is 'total work content'. This is the amount of time it would take for a single worker to complete one unit of your product if they were to work on it from beginning to end, using one processing stage after another. If they were making paper, it would be the time it took them to single-handedly pulp, clean, press, dry and reel a roll of paper. If they were making doors, it would be the time it took them to cut, plane, sand and install handles on a door own their own. You can calculate total work content in a factory by adding together the time a product must spend at each processing stage.

Door factory example

Let's say our door factory has a total work content of 60 minutes.

The next term we need to understand is **'cycle time'.** This is the amount of time between beginning the production on one unit and beginning production on the next one. It is not a measure of how long it takes to make a product. It's more like the heartbeat of the factory, the pace at which it is producing. It reflects customer demand for the product – if customers are crying out for more products, the cycle time must be shorter to meet demand.

The cycle time is relatively easy to calculate – it is the available time divided by the number of products required in that time. Say a door company's customers purchase 160 doors per week, and the available time to make the doors is 40 hours per week. The cycle time is 40 hours divided by 160 doors. The result? 15 minutes. The factory must be capable of starting production on a new door every 15 minutes.

The last term we'll need is **'task time'.** This is the length of time that a product spends at each processing stage in the line. This may vary from stage to stage, but for optimal performance, it is best if the task time across all stages is the same.

We will return to task time in a moment.

In the meantime, let's calculate how many process stages our door factory would have.

We've established that the total work content to manufacture a single door is 60 minutes and that the cycle time required to meet demand is 15 minutes. To maintain this cycle time, we need to ensure that the first processing stage takes no longer than 15 minutes before passing it on to other stages. How many stages are needed to maintain this cycle time?

We can find out by dividing the total work content by the required cycle time. In this case, that's 60 minutes divided by 15 minutes. The door factory requires four processing stages.

5. Task time variation

In the previous chapter, we were looking at how to organise the process stages in a factory manufacturing wooden doors. In this one, we'll examine how to make sure they are coordinated to achieve your production targets.

Door factory example

We can imagine a line of four stages, each contributing a quarter of the total work content in processing a door. In reality, things are never so neat. Each stage may take fifteen minutes on average, but this time will vary for because no two doors and no two workers are the same. The quality of the wood may vary, requiring more time, or less time to plane and sand. There are usually slight variations in the efforts of each person, or the performance of each machine in the line. This is known as task time variation.

This variation can make the flow of work along the line irregular, leading to queues of work-in-progress and lost processing time. The result is less efficiency and may require additional resources – such as more staff time or storage space – at additional cost.

How can we make allowances for task time variation? This is the most problematic product layout design decision. The answer is **line balancing.**

In the door processing line, we have assumed that 15 minutes of work content can be allocated equally to each of the four processing stages.

But this is nearly impossible to achieve in practice, increasing the effective cycle time of the line. In reality, the final stage takes 20 minutes, which means that each of the preceding stages must wait an extra five minutes before passing their work on. This pushes the total work content up from 60 minutes to 80 minutes.

This lost time is known as balancing loss. Balancing loss is expressed as a percentage of the total time it takes to process a product. In this case the time lost is 20 minutes and the total time is 80 minutes, so the balancing loss stands at 25%.

Precedence diagrams

What to do? There are several techniques to help correct line balancing issues. A common one is a precedence diagram.

In a precedence diagram, each task is represented by a circle, and each circle notes the name of the task and the length of time it takes.

The circles are connected by arrows that show the ordering of each element. Two rules apply when organising the diagram:

- Draw each circle as far to the left as possible.
- None of the arrows should be vertical.

Start with the required cycle time and the required number of stages.

Allocate the tasks to each stage, starting from the left. Make sure that the work allocated to each stage is as close to, but less than the cycle time. When a stage is as full as possible, move on to the next stage. Continue this process until all the tasks have been allocated.

Sometimes, you may have to choose between two elements where each could fit into a stage, but not both. Here's two rules of thumb to make the choice easier:

- choose the largest task that will fit into the time remaining in the stage
- choose the task with the most followers – the one with the highest number of subsequent tasks that can only be allocated after that task.

Cake factory example

Let's work up a precedence diagram to allocate tasks to processing stages in a cake factory. The cake factory has been contracted to supply a supermarket chain with a specialty cake. The factory will require a new production line to finish, decorate and pack the cakes.

Here are the tasks and the time that it takes to complete each:

We can begin by arranging these tasks, starting at the left-hand side and adding them in the order they occur, joined by arrows.

The supermarket has placed an order for 5,000 cakes a week. The cake factory operates for 40 hours per week – that's 2,400 minutes. We can use these figures to calculate the required cycle time.

A new cake must start production every 28.8 seconds if the factory is to achieve its target. How many stages does that require?

The total work content – the sum times for each task – is 100.86 seconds. We can use this to calculate the number of stages the factory will need.

The factory requires 3.5 stages to meet its target cycle time. Of course, the factory can't have half a stage – so we can round up to four. If we rounded down to three, it would have too few.

Let's allocate these tasks to the four stages. Remember, each stage must come to no more than 28.8 seconds.

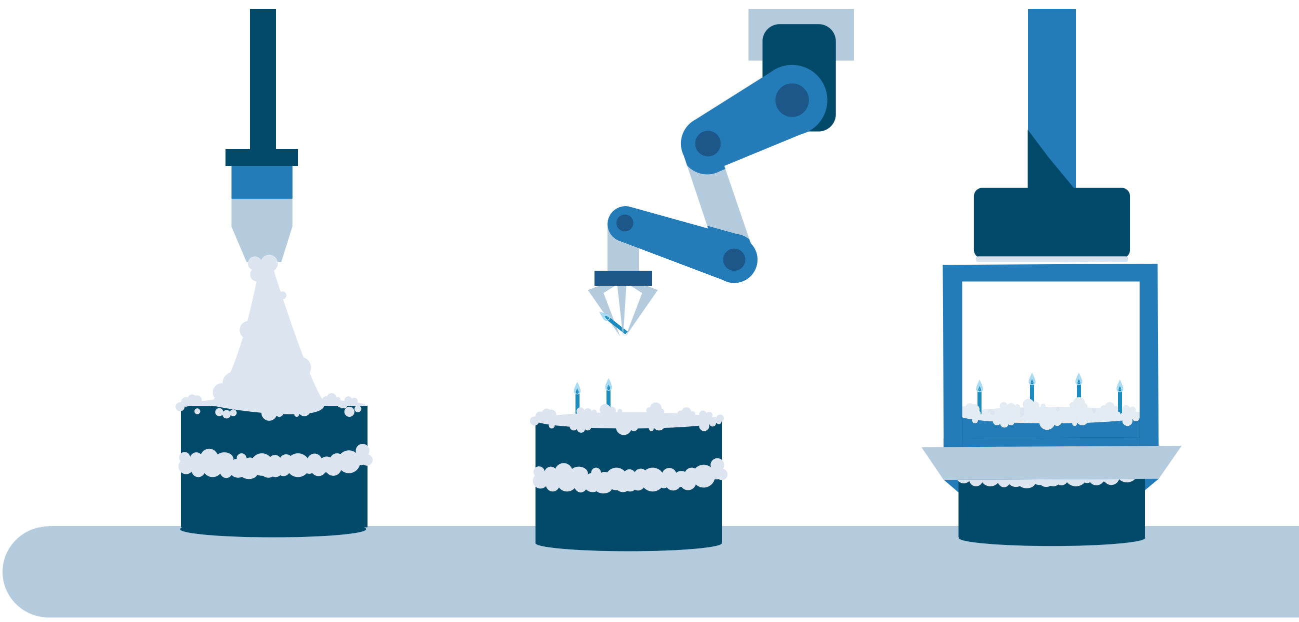
We can allocate elements A and B to stage 1. They total 25.2 seconds, within the 28.8 second limit.

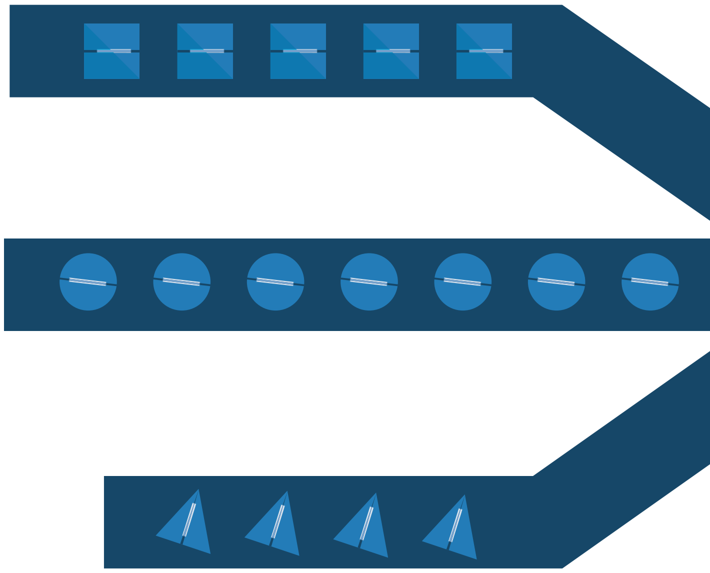
Including element C to stage 1 would take it over 28.8 seconds. It receives its own stage – stage 2.

Element D is allocated to stage 3. Both element E and element F are short enough to include in stage 3, but following the 'largest element rule', we should include element E. The remaining elements are allocated to stage 4.

The cake product line task time allocation isn't perfect, but it is reasonable:

Not all stages in a product line need to be sequential. Workers decorate some cakes with red icing in Task E, while another team decorate others with green in Task F. While some cakes receive blue icing in G, others have transfers affixed in Task H. These parallel processes allow the factory to deepen its product mix while conserving production time.





6. Product line configurations

There are two broad types of product lines, long-thin lines and short-fat ones. A long-thin line is a single line of many sequential processes – such as the ones we've encountered in the wooden door and cake factories so far. A short-fat line is two or more parallel lines with the processes spread out across them.

Advantages

Long-thin lines offer:

- a controlled flow of materials
- simple materials handling, especially if the products are large or heavy
- lower capital requirements, because fewer machines are needed
- more efficient operation, since each worker and machine will be used more often.

Meanwhile, **short-fat lines offer:**

- a higher mix flexibility – since each stage or line could specialise in different types of product
- greater volume flexibility – as stages can be closed or opened as required. Long-thin lines require rebalancing every time the cycle time changes.
- higher robustness. If one stage breaks down, parallel stages are unaffected. Long-thin lines stop operating altogether.
- less monotonous work – since tasks are repeated less often.

Lines don't have to be straight, either. Curved lines are common – U-shaped for shorter lines, or S-shaped for longer ones.

The advantages of curved lines include:

- staffing flexibility and balance – The U-shape allows one person to tend to several workstations – adjacent or across the U – without much walking. This opens options for balancing work among operators – when demand grows, more labour can be added until each station has an operator.
- rework – when the line bends around itself, it is easy to return bad work to an earlier station for rework.
- handling – it is easier to disperse materials to several workstations from the centre of a U, or bend in a longer, serpentine line.
- passage – long, straight lines makes crossing from one side to the other difficult. Curved lines are shorter overall, reducing travel times around the factory
- teamwork – a semi-circular arrangement brings teams into closer contact with each other.

7. Process & cellular layout

So far we've been discussing product layout, it's benefits and challenges. Let's look at the other typical layouts – process and cellular. These are not as common as product layouts, but they do have distinct advantages for certain types of manufacturing.

In process layout, similar manufacturing processes are located together because they have similar needs.

Some processes, such as painting, need specialist support – like fume extraction. Others, such as milling centres, need technical support from machine setters and operators. The factory can be arranged with fume extraction in one place, heat treatment in another, and machining centres in a third.

Different products require different processes, so the movement of materials through a process layout can be complex.

Advantages and disadvantages

Preparing detailed designs of a process layout is challenging because of these complex workflows. Most are designed through intuition, common sense and systematic trial and error.

Even so, here are a few questions to guide your experimentation:

- How much space does each work centre need?
- What are the constraints on the shape of the area allocated for each work centre?
- What is the direction and the strength of the flow between each work centre? You can work this out by asking:
- How many journeys are workers making between each point?
- How many loads are they carrying?
- How much is it costing per journey?
- How desirable is it for certain work centres to be close together? Does it make sense to place a heat treatment facility next to a refrigeration unit?

In fact, you should give good deal of thought to where you locate your work centres in a process flow. **Here are a few guidelines for where you should put them:**

1. Collect information about the work centres and the flow of work between them.
2. Using this information, draw up a schematic layout, putting the work centres managing the greatest flows close to each other.
3. Adjust the schematic to take account of the constraints of the space into which it must fit.
4. Draw the layout showing the distances that materials must travel. Calculate how effective the layout is by measuring the total distance a product must travel and the cost of that travel.
5. heck to see if moving the work centres around reduces the total distance travelled and the cost of that travel.

The third layout alternative is **cellular layout,** which attempts to bring order to the complex workflows of a process layout by combining them with product layout order. In cellular layouts, materials and information entering the factory enter a kind of triage, like patients in an emergency room. They are moved to departments, or cells, in which all the machines required to process them are located. The resulting part-finished product is moved to another cell for further processing.

Cellular layout is popular with manufacturers of complex goods, such as computers, where each component requires specialist attention.

Cellular layout is neither as flexible as product layout, nor utilises equipment as efficiently as process layout. Instead, it does a reasonable job of both while keeping work flow complexity under control. The key to a successful cellular layout is allocating machinery well.

One way is to group processes that complement each other. Imagine a furniture factory, producing pieces in wood. If all the parts that need holes in them also need those holes to be countersunk, it makes sense to locate the drilling the countersinking machines in the same cell.

Another is to organise cells around groups of products known as product families. Each product family shares similar qualities of size, shape and material – in the furniture factory, drawers and shelves share more in common than either does with kitchen benchtops. The factory's cells can be designed to co-locate the necessary processes for each family.

A useful way to allocate machines to cells is production flow analysis.

The first step is to create a matrix of your product families and the machines that are needed to produce them.

Populate the matrix by identifying which machines process each product family.

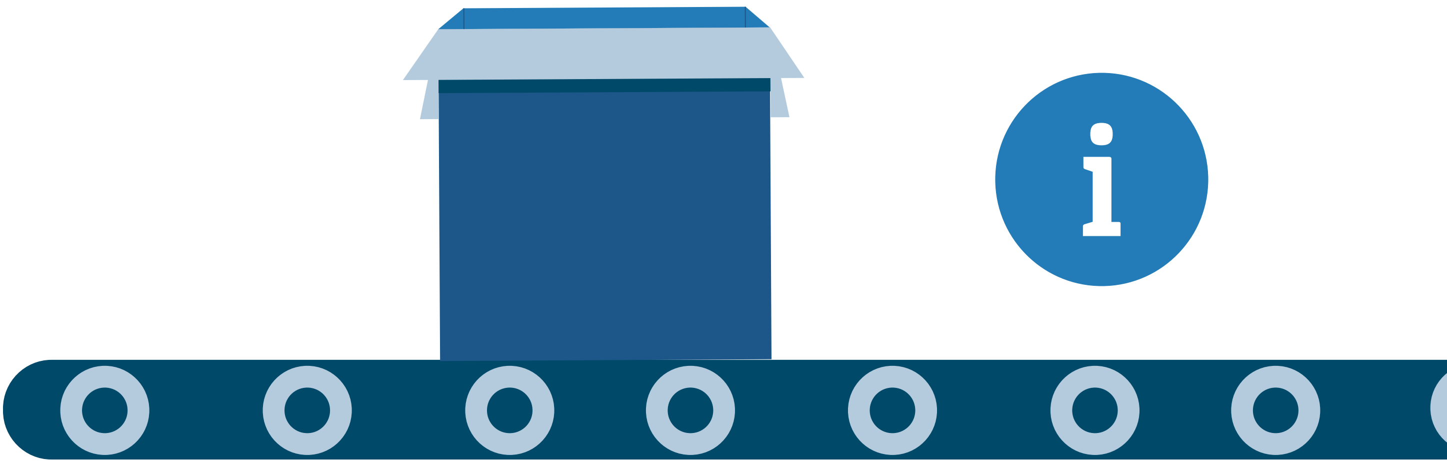
You'll notice that there are no obvious groups in this arrangement. If we reorganise the product families and machines, we can bring them closer together.

Each of these groups can be allocated to a cell.

Production flow analysis can't eliminate all allocation problems because it rarely results in mutually exclusive cells. You can see that Product Family H – which has been allocated to Cell A – needs to be processed by Machine 3 – which has been allocated to Cell B. **There are three ways of dealing with this:**

- Purchase a new Machine 3 and put it in Cell A. This solves the problem requires investment in a machine that may be underutilised.
- Send products from Family H to Cell B after they have been processed in Cell A. This avoids the need to purchase a new machine, but results in a more complex materials flow.
- If there are several product families that must be processed in two cells, it may pay to create a new cell just for them. It can include all the machinery that their processing requires. This will cost more in capital expenditure, but results in a more predictable and ordered flow overall.

Choosing the right layout for your operations is critical to making efficiency gains.



8. Route planning & string diagrams

There are many variables when you are designing a plant layout, and it's difficult to keep track of them all. We're going to talk about three ways that you can marshal all that information and put it to good use – **route planning and string diagrams.**

Route planning charts

We've talked a lot about minimising the distances that your materials must travel as they move through your plant layout. A route planning chart – also known as a 'from-to chart', or a 'travel chart' – is a good way to envision just how much traveling and material handling is involved in your processes. You can use them to measure the distance that materials travel, the weight of goods that move between stages, or the number of items that are transferred around the factory.

This example shows the distance that goods travel between process stages. You'll notice that there are figures in the top right half, but not in the bottom left. This route planning chart reflects a one-way layout, where goods do not travel backwards on the line.

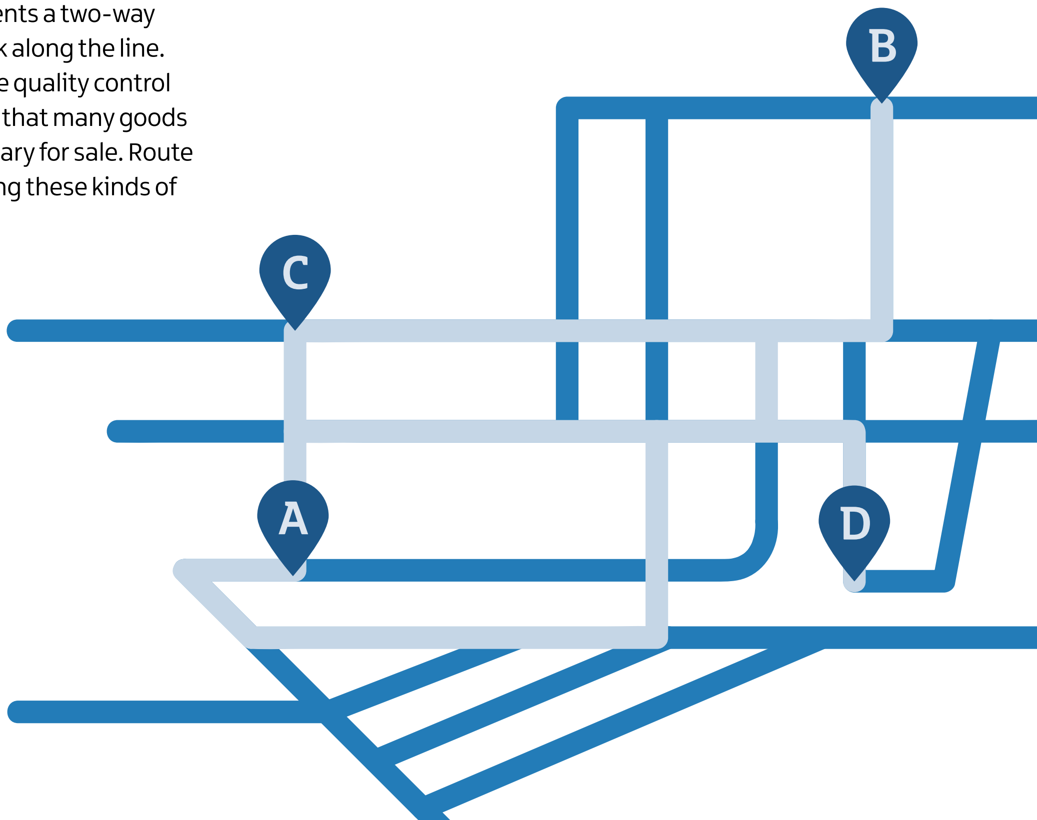
This route planning chart shows the weight of goods moved between manufacturing stages, quality control and the warehouse. This chart represents a two-way system, where some goods travel back along the line. One tonne of goods is moving from the quality control facilities back to stage one, indicating that many goods are not meeting the standards necessary for sale. Route planning charts are useful in identifying these kinds of inefficiencies.

We often place machinery and furniture in work areas somewhat randomly, rather than thinking through which arrangement will make the work easier. We end up moving around more than is necessary. A part of the problem is that we struggle to anticipate exactly how an arrangement will force us to work.

String diagrams

A string diagram (or spaghetti diagram) is a simple tool for analysing and designing work spaces to reduce the amount of movement required to negotiate them.

Creating one will require you to work closely with your workers, perhaps following each of them through their work days. Observe how they negotiate their workspace. Take a scale drawing of your work space on grid paper, a set of pins and a ball of string and measure out the ways that your workers move through their workspace. You'll be surprised by just how much time is used moving around obstacles caused by poor design.



9. Process mapping

There are many mapping tools that can help you visualise how materials pass through your factory.

SIPOC

SIPOC (sigh-pock) stands for suppliers, inputs, process, outputs and customers. It is a visual tool for documenting how materials move through your business from beginning to end. You might hear them referred to as high-level process amps and, as the name implies, they tend to be light on detail. There's six steps to drawing one.

Draw up a table with a column for each part of the business.

Start in the process column and write down all the processes that the business performs. Keep it reasonably general – decorating a cake, rather than applying blue icing, for instance.

Determine all the outputs of the process being evaluated.

List all the customers who receive the outputs. These can be internal or external customers. If they are downstream processes, the outputs of this system are the inputs of the following system.

Go back and think of the inputs needed for the established process.

List all the suppliers of the inputs. Again, these can be internal or external suppliers.

Flow charts

A flow chart is a visual representation of the steps and choices in a process. They are a popular tool in business communication because they are visual, simple and easy to understand.

Each step in the process is visualised in a shape, the shapes are linked by directional arrows showing the flow of the process. Breaking down processes into smaller steps in this way helps to reveal areas of operating inefficiency and opportunities for improvement.

Swim lane diagrams

A swim lane diagram is a type of flowchart that distinguishes job sharing and responsibilities in a process. Each lane is dedicated to an employee, work group or department.

They show connections, lines of communication and handoffs between these lanes at each step in the process. These kinds of diagrams help to highlight waste and redundancy and makes clear who is responsible for each step of the process.

Value stream maps

Value stream maps visualise a process' steps from collecting inputs to delivering the product to the customer.

They share many features with flowcharts, but include details of material and information flows. They include all value-adding and non-value-adding steps in the process.

This type of chart is used for organising maintenance. They help to reduce the time that equipment is out of commission.

Separate bars or columns are allotted to each subject – a worker or a machine. These subjects are placed against a common time scale. The activities of each subject are recorded by shading the respective bars or columns against the time that they are in operation. This multiple activity chart shows the process of reading a deck of cards in a card reader.

Yamazumi charts

Yamazumi is a Japanese word that means 'to stack up'. Toyota uses yamazumi charts to visually represent the work content in a series of tasks. These charts facilitate work balancing and help to isolate and eliminate non-value-adding work.

Each task of a process is individually represented in a stacked bar chart. These can be categorised as value-added, non-value added or waste. The mean duration time of each task is recorded on the bar chart. Each task of the process is stacked to represent the entire stage. The vertical axis measures time. A target cycle time is plotted to help line balancing.

All these tools have their place in designing your plant layout. They can help you collect data and put it to the best use in designing for efficiency.

10. Thinking about layout in other sectors

So far, we've looked at plant layout in the context of manufacturing. In this chapter, we'll look at a few ways you can apply these principles to operations in other sectors.

Service providers

Service businesses, such as restaurants or hospitals, are much more customer-facing than factories. Here, the customer is part of the workflow, so the layout is focused on their satisfaction with efficiency implications for the operation itself. The workspace needs to look attractive and provide some comforts in addition to operating well.

Forecasting the workload can be difficult, because demand is often seasonal, resulting in widely varying cycle times from one period to the next.

Service providers, unlike factories, deliver intangible goods, which means that adjusting production to demand cannot be achieved through inventory management alone.

Offices

You can use layout principles to organize workflows in an office, although here the emphasis is on information rather than materials.

The process stages in an office are places where information is exchanged such as:

- individual conversations
- telephone calls and chat services
- mail and other physical documents
- email
- meetings and discussion groups

Retail environments

In a retail environment, sales are directly related to exposing the customer to as many products as possible while ensuring that their experience is comfortable. Supermarkets will tend to display goods for everyday consumption at the margins of the store, while putting impulse purchases and high profit margin products in prominent places.

Some shops shepherd their customers through as much merchandise as possible by making it difficult to move from one part of the shop to another without seeing all the products in between. Think of IKEA's circuitous shop floor.

A successful retail layout takes a global approach to organising the available space. Attractive products are interspersed between ones that sell less well. The ends of rows provide extra space to display goods. The first section that customers encounter is carefully curated to present the best image of the business.

Material handling plays a particularly important role in warehousing, so logistics operations benefit greatly from good layout. It can help to increase the use of each cubic metre of space.

Whatever line of business you're in, you can benefit from the principles of good layout.

Conclusion

That concludes **'Plant Layout - In Pursuit of Operational Excellence'**, we hope you've found it useful. Remember that if you are planning to design a new layout for your operations, Invest NI can help you with tailored, practical advice.

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