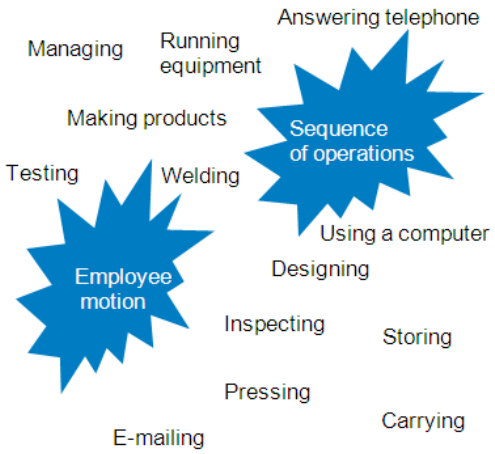
7 Wastes

1. What Makes Up Work?

Before we try and identify waste it is important to understand what elements work is made up of.

Consider all aspects of a day at work. What tasks might be performed?



Examples of tasks carried out at work

All the tasks performed by employees and equipment are referred to as work. Examples are shown in Figure 1.

These work tasks can be categorised in one of three ways.

We can now split the list of tasks into three categories.

- Value Added - Any work that changes the nature, shape or characteristics of the product, in line with customer requirements e.g. welding, assembly, printing, programming.

- Non Value Added - Any work carried out, which is necessary under current conditions but does not increase product value e.g. inspection, product movement, tool changing, maintenance, filing, certification, computer start up.

- Waste - All unnecessary work.

It is wise to avoid using the definition of value adding that uses the phrase “any tasks that the customer pays for”. This is because some organisations negotiate that the customer pays separately for tasks like set up times and tool changing. The team often find it difficult to then categorise tasks and opportunities to reduce waste and therefore cost are lost.

It also avoids difficulties when making improvements in processes that are not truly value adding for the organisation. For example, in a manufacturing organisation the value adding tasks are those that

change the nature, shape or characteristics of the raw materials closer to the finished product as required by the customer. The collation of an internal financial report could be considered as a waste activity (or at best non value adding). However if we want to eliminate waste within the process of collating the financial report, consider the report itself as the product of a process. The tasks that are carried out to collate that report can then be considered as value adding, non value adding and waste and the activity can proceed as normal.

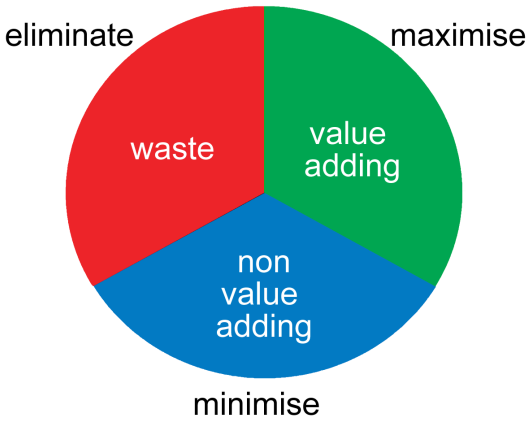
The Objective Of Waste Elimination

In the ideal world all tasks carried out would be value adding and there would be no non value adding or waste activity. This would assist in maximising profit and reducing costs.

The objective of a 7 Waste activity is to work towards this ideal state.

In reality it is unlikely that this ideal state will be reached in the short term and so the objective is to continually raise the ratio of value added tasks to non-value added and waste.

This means maximising the time spent on value adding tasks, minimising the time spent on non value added and eliminating waste, Figure 2.

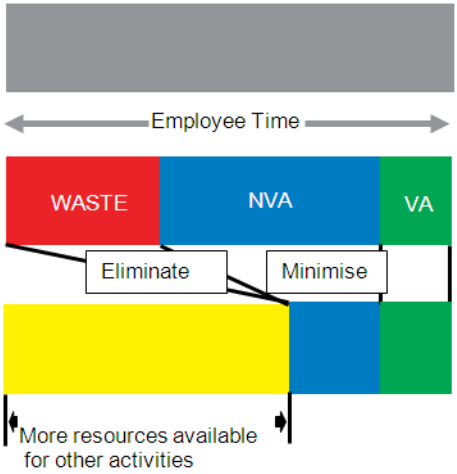


Raising the ratio of value added tasks to non-value added and waste

The traditional method of maximising value adding tasks is to carry out time and motion studies and implement incentive schemes. These studies are often time consuming, controversial and provide only short term improvements. The easiest way to maximise value adding tasks is to concentrate instead on reducing the time spent on non value added tasks and eliminate the wasteful activities.

“Work smarter not harder.”

The aim of the 7 Waste activity is to identify, categorise and eliminate all forms of waste. Figure 3 illustrates how eliminating waste and reducing non-value adding activities releases time and resource that can be used for other activities.



Releasing time and resource

If there is demand for the product, then more repeat value adding activity can be done. There is no benefit in doing this if there is no demand. In this case the released resource must be used to either carry out other cost reduction activities, or disposed of to ensure that cost benefits are gained from the exercise.

The 7 Categories Of Waste

1.1 Overproduction

Producing more than the customer requires at that point in time.

Characteristics

Overproduction generally occurs for following reasons.

- Producing in batch sizes larger than the customer order. This is often planned for to compensate for problems or wastes within the process such as; known quality concerns which reduce the batch size, matching batch size to the incoming material size e.g. using a whole coil of steel or batching documents together to process them all together.
- Producing ahead of schedule i.e. before the order needs to be made for despatch. This is often done to accommodate excessive lead times or to accommodate excessive set up times.
- Producing to keep an expensive process running to counteract depreciation or to keep efficiency figures high.
- Each of these scenarios consumes resource that may be required for other orders that are subsequently delayed.

1.2 Inventory

Excess raw material, work in progress and finished goods (more than is required to maintain the process flow). Excess equipment.

Characteristics

Inventory ties up money and needs to be stored somewhere. The cost of inventory is often carried by the supplier who has paid for the materials and the work to be carried out, but who has not yet been paid by the customer. In cases where the customer has paid in advance then they are carrying the cost of the inventory as they have not yet been paid by the end user. In essence excess inventory is a cost to somebody.

Inventory that is not being worked upon needs to be stored e.g. raw material and finished goods stores, space for work in progress, off site warehousing, computer memory storage, archives, in trays. In addition to paying for the upkeep of this space, rent, power bills etc. there are the associated costs of moving the inventory to storage, stock taking and retrieving it e.g. people and equipment such as fork lift trucks, trolleys, conveyors, also the cost of damage during handling and transport. In some cases it costs to protect the inventory from deteriorating in storage e.g. special lighting, temperature control or coating and preservatives. There is also a cost associated with stock rotation, maintaining first in first out systems and keeping the workplace clear. Money and storage space tied up on slow moving or obsolete stock can prevent the purchase of stock that may be required immediately and so affect delivery performance to the customer.

Holding high levels of inventory can also mask other problems which are wastes in their own right. High levels of raw materials can hide poor supplier performance. High levels of work in progress can hide unplanned downtime, idle time and excessive operator motion. High levels of finished goods can hide quality problems until discovered by the customer. A high level of inventory is at risk of becoming obsolete due to cancelled orders or specification change from the customer. Response time to get specification changes to the customer is slower the higher the stock levels.

1.3 Transportation

Excessive or unnecessary moving or handling of products, information or equipment.

Characteristics

Excessive transportation is moving any distance greater than is required to do the value adding work, although a very small proportion of distance travelled may be classed as non value added.

Unnecessary transportation includes double handling and transport mechanisms moving empty e.g. a fork lift truck with nothing on the forks, a wagon travelling without a paying load, a delivery person making separate trips for delivery and then pick ups instead of a round robin, a feed system running empty.

Transportation waste can occur as a result of overproduction, excessive inventory, poor workplace layout, inappropriate or disorganised location of materials and information i.e. poor 5C condition.

Drawing a Standardised Work Combination Table or a string diagram, as in Figure 11, is a good way to spot transportation waste

1.4 Process

Unnecessary or complicated processes. Too many steps in the process. Unplanned downtime.

Characteristics

Processes which are not required to add value to the product.

Processes which are unnecessarily complicated for the function they perform.

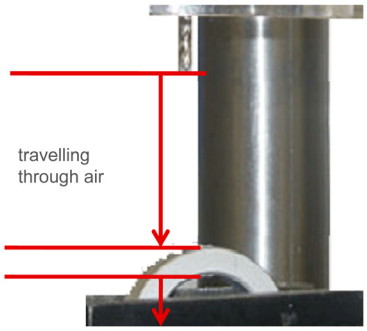
Processes which consume excessive amounts of time due to setup or unplanned downtime problems.

Examples

- Non value adding operations such as; making roughing and finishing cuts when just one cut will do or removing burrs rather than finding a way to not create the burr in the first place.
- Non value adding operations which do not add to the customer requirements or expectations such as; machining all surfaces rather than just the functional areas or creating high surface finishes or polishing for appearance only.
- Applying and later removing protective materials to prevent the product deteriorating in storage.
- Manually collecting swarf.
- Providing verbal explanations as well as hard copy and electronic copies of work.
- Using unsuitable equipment for the task that makes the task take longer or creates additional non value adding tasks.
- Repetition of tasks e.g. two reviews, duplicating test sequences, document signature loops.
- Searching through non standard data bases and filing systems.
- Searching through multiple or duplicate sources to collate information.
- Using unlinked documents so multiple sheets have to be opened and multiple entry of information required.
- Inputting numerous user ID passwords.
- Using non standard individual design or programming methods, leading to loss of time when a project is handed to another employee.
- Using different date systems, different application versions, different numbering or coding systems.
- Unclear lines of responsibility or complicated process flow e.g. shown on a string diagram or as in Figure 12 on a value stream map.

A value stream map highlights process waste

- Variation in cycle times caused by lack of standardisation of best techniques.
- Running high speed, high performance equipment that outpaces the employee, leading to unplanned stoppages or reject products. Better results are gained using older, slower equipment.
- Conducting 100% internal quality checks to contain a quality problem.
- Being interrupted, equipment or system breakdown (unplanned downtime).
- Waiting for shared hardware (unplanned downtime).
- Slow feed speeds and excessive distance moved by a tool before making contact with the material to do value adding work. In Figure 13 the drill bit travels an excessive distance before it cuts the material. This is process waste, as is any distance on the other side of the material that the drill travels. The value adding is the distance travelled where the drill bit is cutting the material. A small amount of non value adding occurs between the process waste and value adding on both sides where the drill bit is not cutting but a small amount of clearance is needed for material loading.



Excessive distance travelling through the air is a process waste

- Excessive equipment movements.

- Slow running computer systems e.g. laptop with too many pictures stored, shared server doing back up, too many people logging on at once.
- Wasted energy and consumables or fluids not being recycled e.g. coolants.
- Printing on one side of the paper, or not using draft print settings.
- Having a kanban system as well as a schedule.

Benefits Of Elimination

The benefits of reducing process waste are:

- Less resource deployed in waste and non value adding tasks.
- Improved flow through processes and reduced lead times.
- Reduced cycle times.
- Increased availability of equipment, leading to smaller batch sizes or greater capacity if there is demand for it.
- Improvements will be made in the 7 QCD measures depending on the nature of the process waste eliminated.

1.5 Idle Time

Employee or equipment inactivity during process cycle time.

Characteristics

Idle time occurs when either the employee is waiting for a piece of equipment or another employee to finish or when the equipment is waiting for the employee to continue its running cycle. These instances occur where there is poor line balance or no standardised work, leading to variability in process cycle times.

Do not be tempted to fill idle time with additional processes if the output of the process is not required. This would be overproduction.

Note: Unplanned downtime is not included as part of the process cycle time and so is classified as a process waste.

Examples

- The total cycle time of a process is 50 seconds. During the equipment auto cycle, the employee prepares a material for the next cycle, but this takes longer than the auto cycle and the equipment is waiting. This is shown in Figure 14, an extract of a Standardised Work Combination table.

NO.	WORK ELEMENT	TIME				OPERATION TIME
		MANUAL	AUTO	WAIT	WALK	
1	Load equipment & start	10	20			
2	Prepare for next cycle	30				
3	Unload machine	10				
TOTALS		50	20			

Equipment waiting for employee is idle time

The equipment could be a photocopier, printer, press, test equipment, automated manufacturing equipment or a CNC machine.

- The total cycle time of a process is 55 seconds, 25 seconds of which is manual loading/ unloading time, 30 seconds is automatic cycle. After loading the equipment the employee is waiting for 30 seconds. This is shown in Figure 15, an extract of the Standardised Work Combination table.

NO.	WORK ELEMENT	TIME				OPERATION TIME
		MANUAL	AUTO	WAIT	WALK	
1	Load equipment	10	30			
2	Wait			30		
3	Unload machine	15				
TOTALS		25	30	30		

Employee waiting to unload machine is idle time

- Employee idle time as the result of over manning of automated processes, possibly caused by an unstable process which requires constant monitoring.
- Waiting to input data into a slow running system.
- Waiting for signatures or people to answer your phone call.
- Waiting for manual tests or long test sequences to finish.
- Tasks on hold because of time zones between organisations in different parts of the world.

Benefits Of Elimination

The benefits of reducing idle time are:

- Better utilisation of employee time through reduced cycle time. This will improve the People Productivity measure and possibly Value Added Per Person.
- Better utilisation of equipment through reduced cycle times. This will improve the OEE measure.
- Less employee boredom.

- No time available to carry out waste and non-value-adding activities (e.g. rework), therefore discouraging the acceptance of such activities.
- Improved Delivery Schedule Achievement.

1.6 Operator Motion

Any unnecessary or excessive walking, bending, turning and reaching. A physically difficult or awkward part of the process.

Characteristics

Operator motion waste is frequently caused by a badly organised work environment, use of unsuitable equipment and poor ergonomics. Absence from 'over three day injuries' is a symptom of a working in such an environment.

It is sometimes useful to refer to operator motion as employee effort. This is particularly the case in an office environment or where clearly visible movements can not be seen, but where there are many difficulties for the employee

Examples

- Transferring any items from one hand to the other or changing hands.
- Repeatedly moving on and off a stool or chair.
- Large workstations causing excessive movement such as over reaching.
- Storage of items on the floor causing frequent bending by the employee.
- Storage of heavy items above shoulder height.
- Carrying objects or awkward loads over long distances.
- Poorly designed storage causing excessive reaching and bending to retrieve items, as in Figure 16.

Excessive reaching to retrieve item

- Repetitive difficult or awkward finger, hand or arm movements.
- Poorly designed workplace layout involving excessive walking to colleagues or equipment. Frequently used items not close to hand, as in Figure 17.

Frequently used items are a stretch

- Repeated twisting or rotating from working position.
- Typing in long data fields instead of using an easy to use pull down menu.
- Printing and proof reading hard copies of electronic documents.
- Scrolling through long lists of electronic documents instead of having a structured directory.

Benefits Of Elimination

The benefits of reducing operator motion waste are:

- Reduced fatigue, injuries and absence rates.

- Reduced cycle times and lead times showing as improvements in People Productivity, Delivery Schedule Achievement.
- Improvements in Value Added Per Person and Floor Space Utilisation depending on the nature of the operator motion waste eliminated.
- Improved morale as employees see a greater proportion of their effort as value adding activity.

1.7 Bad Quality

Scrap or reworking products.

Characteristics

High Not Right First Time performance or low Supplier Quality Rating figures.

High levels of bad quality in tangible products can be indicated by collection containers or whole areas dedicated to storing and processing scrap and rework. e.g. skips, as in Figure 18, litter bins, quarantine zones.

Dedicated skips indicate bad quality waste

Indicators of bad quality for all types of products include high levels of overtime to meet customer demand, confidence in schedules being low and launching batch sizes larger than orders (overproduction). Other indicators are large inspection departments or teams and 100% inspection of all products prior to despatch.

The true cost of a scrap product needs to include the time and materials used to produce it and also the cost of the inspection and associated paperwork or other tasks associated with disposal of the product.

The true cost of rework needs to include the time and materials to produce it and inspect it in the first place and then all the costs associated with reworking it e.g. employee time, equipment costs, replacement materials and consumables, paperwork and other tasks associated with reworking the product.

If the product is rejected by the customer there is also the cost of returning the products and replacing them as well as loss of customer confidence.

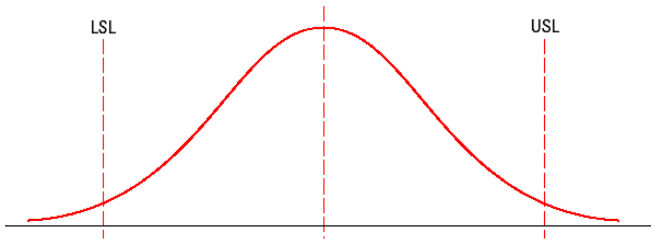
The mushroom model: If ten bad quality products escape into the market place perhaps only one gets reported back to the supplier. However each of the dissatisfied customers tells ten of their acquaintances and the bad quality issue is expanded by word of mouth.

Examples

- Visual aspect, tolerance or other specification defects.
- Inadequate documentation.
- Return of hard copy or electronic documents for amendments, as in Figure 19.

A stack of documents requiring amendments

- Not implementing project review actions.
- A customer carries out an incoming goods checks. From the results of the distribution curve, in Figure 20, they can tell if the supplier is filtering out products outside the specification via inspection. The inspection would not show any products with results below and above the limit lines i.e. the two tails of the results curve would be cut off. Ultimately the customer carries the cost.



Distribution curve of checks on incomng goods can indicate if the supplier is filtering out bad quality

Benefits Of Elimination

The benefits of reducing bad quality waste are:

- Improved Not Right First Time, Delivery Schedule Achievement and Supplier Quality Rating performance.
- Reduction in costs associated with bad quality and poor Delivery Schedule Achievement.
- Improved confidence in schedules and reduction in overproduction.
- Improved People Productivity, OEE and Value Added Per Person performance (depending on how units are costed.)

1.8 The Eighth Waste: Untapped Human Potential

Required for NVQ BIT.

> Not using the creative brainpower of employees for continuous improvement.

Characteristics

When an organisation misses the opportunity of utilising its employees' skills and experience to improve, it runs the risk of stagnating and losing any competitive edge.

This can happen in organisations where:

- There is no recognised method or system for capturing employees ideas. Having a formal system to document ideas is one of the ten key enablers associated with sustainability.
- Employees ideas are not listened to or acted upon. When this happens, employees soon loose interest in making further suggestions.
- Employees believe that only managers should come up with ideas. This scenario is likely to be found in organisations that do not embrace a continuous improvement culture, as it is contrary to the philosophy of continuous improvement. This states that an organisation should "involve everyone in the improvement process" and "cascade the know how for continuous improvement" in order to harness the potential of all it's employees.

Examples

- Running training courses that enhance the employees skills but are not relevant to improving the organisation.
- Running relevant training courses, but then not providing the opportunity to put into practise what was learned.
- A suggestion scheme that recognises the idea but does not ensure that the improvement is implemented.

Benefits Of Elimination

The benefits of eliminating the waste of untapped human potential are:

- Improved utilisation of employee's skills and experience. Employees may have recognised skills and qualifications either from a previous employer or other training and this may not be known by the current employer. The organisation needs to find out what each employee can offer and then providing suitable opportunities to use these skills for the benefit of the organisation.
- Improved morale and reduced employee turnover. This will come about as employees realise that their ideas are acted upon and their skills better utilised.
- Identification of issues throughout the entire organisation. If all employees are involved, then ideas to improve will be made in each department of the organisation.
- Improved QCD performance and associated financial benefits. These can be calculated depending on the type of improvement made.