

Module 4: Operational Excellence



Llywodraeth Cymru
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FOOD AND DRINK WALES



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Operational Excellence

Operations management – Introduction

We saw in part 1 of this toolkit that your business is only viable if it generates profits and cash. We took you through the process of setting up a simple forecast for the first three years. Part 2 then formalised that process and covered the construction of regular annual budgets and the regular monthly review of actual performance in comparison to budget.

This module now looks in some detail at exactly how your business will manage to make and sell the things it needs to in order to make that profit. This process is known as Operations Management.

It is worth considering the context before we begin – this toolkit has focussed predominantly on businesses involved in the food industry. Retailers in UK have a great deal of power and if you are a producer there is therefore little scope for you to increase your profits by raising prices. It is therefore vital that to improve your profits you focus on reducing your costs of production and attempt to increase efficiency wherever you can.

A further contextual factor is that food production is by its nature time-critical, i.e. food goes 'off' within a short period of time. Therefore throughout your operations timing is of the essence as there is limited scope to store raw materials, working-in-progress and finished goods for any length of time.

Definition

Operations management can be defined as the transformation of resources and inputs into desired outputs or goods and services. So operations covers every activity from the sourcing of raw materials through production (using your assets and people) and finally to the delivery of the finished product to your customers. If your business is successful, it will generate a profit while doing this.

If we consider this definition in a little more detail, the three broad components of operations are:

- **Procurement and Inbound logistics** – ensuring you have sufficient supplies of raw materials (and other supplies) of the right quality at the right time to manufacture the quantities you need.
- **Manufacturing** – ensuring you have sufficient capacity at the right time from your assets and labour and that the quality of product they produce is appropriate.
- **Outbound logistics** – ensuring you can get the right quantity of your finished products to your customers at the right time.

Planning and reporting

As well as actually doing the above processes a key component of operations management is planning your activities and then measuring your progress against that plan i.e. collecting data to track whether your operations are working as you expect them to do and taking corrective action if not.

This module will consider the above three components of operations and will also introduce typical plans and reports that large businesses use to measure and monitor their activity.

Finally it is worth mentioning that the operational activities of a manufacturing business are complex and always specific to the particular business being considered. The way that your business operates will be different to the examples we use in this module. Also, as a small but growing business, your operations will inevitably not be as complex as some of the examples we use; however we have

included features and key terms from larger organisations to introduce you to some of the more sophisticated techniques that can be used.

Planning operations

The key to success in any venture is to think about it in advance i.e. to plan, there is a famous quote that says “Always plan ahead. It wasn’t raining when Noah built the ark!”

Hierarchy of plans

It is worth considering where planning your operations fits within the overall business planning:

Business Strategy – your overall long term aims, direction and approach to business (e.g. highest quality products, financial security).

Long term Objectives – more detailed, measurable, but still long term (e.g. 10% market share within 3 years).

Financial Budget – detailed revenue & costs for the coming year. As the year progresses this should be updated into a **Forecast**, based on real orders received.

Operations: Capacity Plan – the plan for what you’ll produce and how you’ll produce it over the coming year to achieve the budget.

Operations: Production Plan (or schedule) – a shorter term plan covering what you’ll produce over the coming few weeks or months, this will incorporate precise scheduling as well as overall quantities.

Larger organisations may even have a specific planning department whose job is (unsurprisingly) to put together these operations plans.

The diagram below shows an example of the entire process of budgeting, planning, production and reporting. The remainder of this module will consider each area of this process.

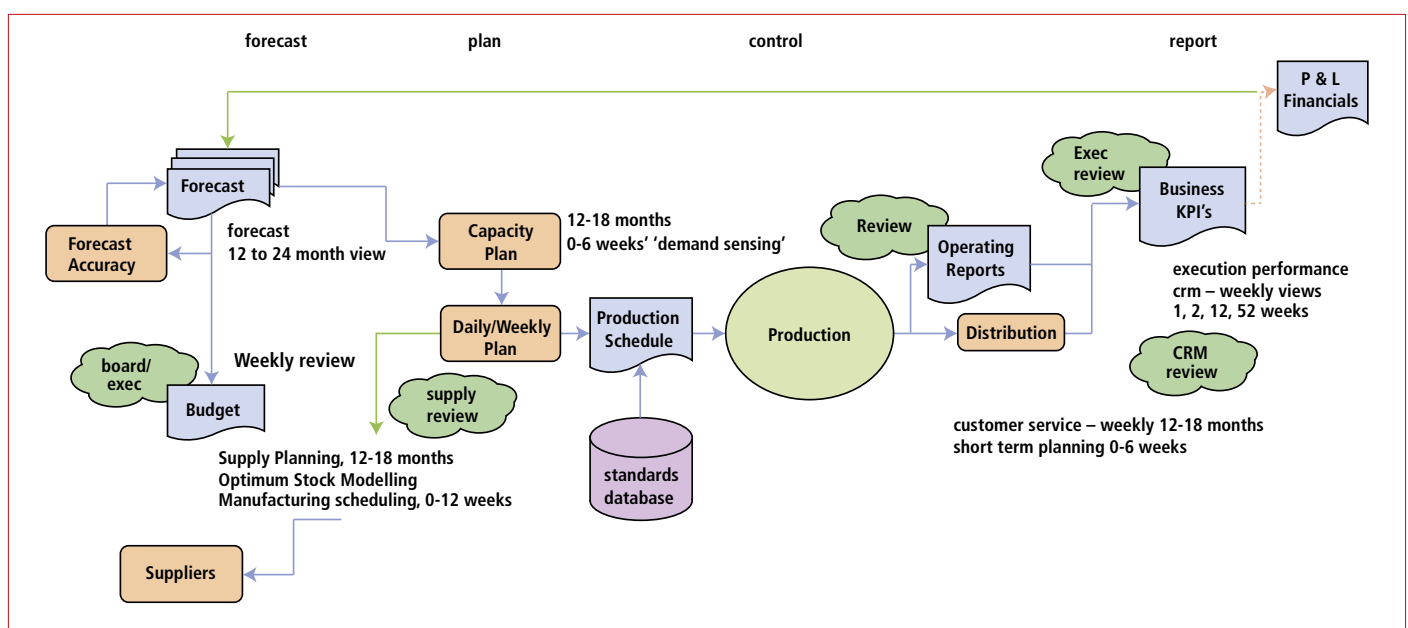


Figure 1: Example manufacturing management control system

Documenting your processes

The most important first step of operations management is to understand and document your current entire production process. By this stage in the evolution of your business you will have a (hopefully) relatively successful organisation which is producing products that customers want to buy. However it is likely that over time staff have “tweaked” the way they do things, or developed workarounds. It is important that you document what is actually happening rather than what you think is happening.

You can do this by walking through the entire process, following a single order or product from suppliers to end customer. As you go, you should identify who does what, which (suppliers, customers), where does it happen, how much (raw material, consumables, electricity, machine time) and how long does it take.

You can use the detailed description to:

- Form the basis of your operations planning.
- Identify improvements in the process.
- Identify exposure and risk in your operations, e.g. if a key member of staff leaves could anyone else do their job?
- Train new members of staff.

The amounts you identify (costs, quantities, times) are known as Standards.

Large organisations may document their production processes using flow diagrams (sometimes known as network diagrams or critical path analyses). These show the different strands of production (e.g. producing jam on one path and the jam-jar on another). They therefore indicate where one process relies on another and which processes are entirely separate.

A second stage to documenting your process is to document the capacity – the amount of output a particular stage, machine or department could produce in a given time (also known as machine and labour throughput rates). This will be key to planning your operations.

An example of a documented process can be seen at the link below. We have made some assumptions about standards that we will use in later examples so you can see the build-up of the process.

This example also demonstrates the value of documenting your processes by making a typical bottleneck easy to see.

Relationship with finance

It can be seen from the above hierarchy, that operations management has a very close relationship with finance and marketing. Very simply if your budget anticipates you selling 10,000 of your product then in operations you need to plan to manufacture and deliver 10,000 items. It is therefore imperative that staff within Operations have a close working relationship with those in Finance.

Finance, operations and marketing staff should work closely together to produce a budget with credible levels of sales and production. Such cooperation ensures that the budget is both robust and will have support and commitment from all departments.

In addition the finance department generally act as custodians of much of the numerical and financial data of the organisation. For instance long-term capacity plans will generally completed by the operations department, but must be agreed with the finance department as they will be one of the building blocks of the annual budget.

You will also note that in Fig.1 above there is a Standards Database also agreed with finance. This would include fixed amounts that are used to plan production (similar to the cost card we discussed in the first module) and would cover for instance typical quantities and costs for the raw materials used to produce each item, or the amount of machine-hours taken to produce that item (known as Operating Standards or a Bill of Materials). These amounts would normally be fixed for the budget period enabling the business to plan its production and model profitability on a consistent basis.

Long-term planning – the capacity plan

Long term planning allows the business to look into the future and determine whether it has enough capacity to deliver the Sales Forecast (this is why it is often known as the capacity plan). Long-term plans can be produced specifically to underpin the annual budget, or can look further out (2-3 years) and consider whether the business will be able to produce the number and type of products envisaged in the business's longer term strategy. In doing so the business can use these long term plans to feed into and justify capital investment plans for new production facilities.

Constructing the capacity plan

As with the forecast we put together in the first module, the starting point for the capacity plan is a sales forecast which breaks down the number of units anticipated by individual product and by time period. Capacity plans are generally broken down into weekly production, but if appropriate you could use a monthly, fortnightly or even daily basis.

Using the detailed understanding you now have of the process including capacities and standards you should now construct the Capacity Plan. This schedules out exactly how the quantities required to satisfy your sales forecast will be produced.

An example of an annual capacity plan, using the data from our example is shown below.

Long Term Plan (Master Schedule)

Key Indicator	Area/Type	Asset/Area	UOM	Standards		1	2	3	52	Total
Volume	Product 'A'		Units	300 gram	0.3	17800	18000	19800	17501	843,891
	Product 'B'		Units	200 gram	0.2	10900	10700	11700	8950	386,184
Value	Product 'A'		Sell price	£2.20		£39,160	£39,600	£43,560	£38,502	1,856,560
	Product 'B'		Sell price	£1.75		£19,075	£18,725	£20,475	£15,663	675,822
	Total Sales £					£58,235	£58,325	£64,035	£54,165	2,532,382
Machines	Process	Vessel 1	Line Hrs	1000 Kg/Hr	1000	7.5	7.5	8.3	7.0	330
	Assemble & Fill	Line 1	Line Hrs	35 units/min	35	13.67	13.67	15.00	12.60	586
	Pack	Packing Lines	Line Hrs	60 packs/min	60	7.97	7.97	8.75	7.35	342
Labour	Process	Vessel 1	FTE's	2 Crew	2	0.4	0.4	0.5	0.4	19
	Assemble & Fill	Line 1	FTE's	6 Crew	6	2.34	2.34	2.57	2.16	100
	Pack	Packing Lines	FTE's	3 Crew	3	0.68	0.68	0.75	0.63	29
	Headcount					3.5	3.5	3.8	3.2	52,004
Raw materials	Material "1"		Kg/Pack	55%	1.1	4136	4147	4554	3872.17	181,722
	Material "2"		Kg/Pack	40%	0.65	3008	3016	3312	2816.12	132,162
	Raw Material Kg Required					7144	7163	7866	6688.29	285,800
Packaging	Cartons		Units	£0.1/unit	0.05	28700	28700	31500	26451	1,230,075
	Sleeves		Units	£0.8/unit	0.05	28700	28700	31500	26451	1,230,075

This process will identify weeks where there will be shortfalls in production. If there is insufficient capacity to cope with the Sales Forecast, then clearly action will need to be taken e.g. reduce sales, expand capacity (more machines, more staff, overtime, buy in capacity, etc.). This process of reviewing sales forecasts and production plans is known as the Sales and Operational Planning Process or S&OP and will be covered in more detail later in this module.

Short term planning – the production plan

The short term plan is known as either the production plan or production schedule. The principles of short term planning are the same as for Capacity Planning although the focus is on the detail of production in Weekly, Daily, Shift-by-Shift or Hourly production schedules (the timeframes that you schedule production for are often referred to as 'buckets'). The schedule defines what needs to be done, when, where and by whom. It is generally accompanied by more detailed instructions (recipes, make-lists, operating and technical procedures). The production plan will typically consider the following detail:

- Production lines and areas and individual assets (for instance per 'Vessel');
- Labour by type (numbers, skill types and levels);
- Operating performance (the standards) is factored into the plans and schedules in more detail;

- Sequencing of production (the order in which products are manufactured) and quantities per run is considered in order to minimise the adverse impact of:
 - Raw materials availability and life (where ingredients need to be consumed within a certain number of hours or perish), Labour and skills availability;
 - Changeovers (e.g. clean downs);
 - Space and material flow (availability of WIP (work in progress) storage space and/or chilling capacity);
 - Delivery slots (for outbound vehicles to reach particular customer depots);
 - Inbound customer orders (e.g. where ad-hoc customer orders are received).

Key Indicator	Area/Type	Asset/Area	UOM	Standards	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Total
Volume	Product 'A'		Units	300 gram	1,780	2,136	2,670	3,560	2,848	2,670	2,136	17,800
	Product 'B'		Units	200 gram	1,090	1,308	1,635	2,180	1,744	1,635	1,308	10,900
	Percentage of the week				10%	12%	15%	20%	16%	15%	12%	100%
Value	Product 'A'		Sell price	£2.20	£3,916	£4,699	£5,874	£7,832	£6,266	£5,874	£4,699	£39,160
	Product 'B'		Sell price	£1.75	£1,908	£2,289	£2,861	£3,815	£3,052	£2,861	£2,289	£19,075
	Total Sales £				£5,824	£6,988	£8,735	£11,647	£9,318	£8,735	£6,988	£58,235
Machines	Process	Vessel 1	Line Hrs	1000 Kg/Hr	0.8	0.9	1.1	1.5	1.2	1.1	0.9	7.5
	Assemble & Fill	Line 1	Line Hrs	35 units/min	1.37	1.64	2.05	2.73	2.19	2.05	1.64	13.67
	Pack	Packing Lines	Line Hrs	60 packs/min	0.80	0.96	1.20	1.59	1.28	1.20	0.96	7.97
Labour	Process	Vessel 1	FTE's	2 Crew	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.4
	Assemble & Fill	Line 1	FTE's	6 Crew	0.23	0.28	0.35	0.47	0.37	0.35	0.28	2.34
	Pack	Packing Lines	FTE's	3 Crew	0.07	0.08	0.10	0.14	0.11	0.10	0.08	0.68
	Headcount				0.3	0.4	0.5	0.7	0.6	0.5	0.4	3.5
Raw materials	Material "1"		Kg/Pack	55%	413.6	496.3	620.4	827.2	661.76	620.4	496.3	4136
	Material "2"		Kg/Pack	40%	300.8	361	451.2	601.6	481.28	451.2	361	3008
	Raw Material Kg Required				714.4	857.3	1072	1428.8	1143	1072	857.3	7144
Packaging	Cartons		Units	£0.1/unit	2,870	3,444	4,305	5,740	4,592	4,305	3,444	28,700
	Sleeves		Units	£0.8/unit	2,870	3,444	4,305	5,740	4,592	4,305	3,444	28,700

Planning in real life

We have discussed how important it is to identify and establish standards, such as amount of raw material per unit of production. You should note however that what actually happens in 'real life' will rarely perfectly correspond to your standards. For instance:

- Budgeted or forecast sales may not be achieved, or actual sales may be higher.
- Amounts change over time, e.g. suppliers put prices up, or the quality of a material goes up or down meaning we need less or more.
- Internal factors change, e.g. new staff join who are less productive, or staff become more productive as they get experienced (this can be modelled using something called the learning curve effect).
- There may be environmental impacts e.g. a hot summer increases demand for ice cream, poor weather in Brazil increases the price of coffee beans.
- There may be seasonal impacts, e.g. demand is low in summer when people are on holiday, or your production capacity dips because your workers are on holiday.
- Strategic shifts may happen in your business, e.g. the launch of a new product takes production line capacity.
- Peak theoretical production line capacity is rarely achieved due to downtime, machine maintenance or changeovers.

You should do your best to identify and incorporate as many of these factors into your plans. If you cannot, simply because you don't know about them or cannot model them with any precision, you should still recognise their existence and not expect your plans to be 100% accurate. You should therefore treat all plans with a professional degree of prudence and scepticism. You should also build into all plans a degree of 'contingency' to cope with the unexpected.

Software

As you can see from the above examples, to document and plan even a relatively simple production process requires a great deal of data and therefore you should consider using IT to help you. Specialised production planning software is widely available but can be very expensive particularly if you need to pay for IT consultants to tailor the package for your organisation. Most small businesses therefore use spreadsheets such as MS Excel. While not designed specifically for production planning, their flexibility makes them eminently suitable.

It is worth mentioning that the flexibility of spreadsheets can be both a help and hindrance. For instance if you adjust the format and structure of a spreadsheet in the middle of a year then it makes it difficult to compare your results to earlier periods. It is worth planning your ideal spreadsheet and then sticking to that format.

Reporting & monitoring

A key benefit of detailed planning is that by creating a plan you have also created a benchmark to compare actual performance against. Put simply if you expected to produce 100 items in a week, at the end of the week you can see how many you did produce, if it was less than 100 you should examine each step of the process, comparing against plan to discover the cause of the variance.

There are a number of key points to make:

- To monitor our performance and make comparisons we need to collect the same data from our production systems as we have included within our plans (e.g. machine hours, material used and price, downtime, etc.) We may need to set up processes to do this.
- Reporting, and even understanding, variances is only valuable if it triggers immediate action.
- Particularly in high volume process organisations, reporting and review **MUST** be taken seriously and performed regularly. For instance a £20 per hour loss not addressed builds up to £6,720 per month (based on a 16 hour day and 5 days a week). This focus on regular review is known as Short Interval Control. The frequency of review depends on the intensity of each operation and can be:
 - In real-time (minute by minute)
 - Hourly
 - By Shift
 - Daily
 - Weekly

Reporting formats

You should define what reports will be produced, when and to whom will they go. You should allocate responsibility for the production of your reports.

Different reports will be needed by different people and may be produced more or less often. For instance managers on the shop floor will need detailed, daily (or even hourly) data on machine and staff performance. Senior management will need summarised information and may only need it at month-end. You may hear the term DWOR which stands for Daily/Weekly Operating Reports.

Data and information

Data is the term for 'raw' facts without context whereas information refers to data that has been processed or arranged to make it useful. Reports rely on data but their key function is to convey information. You should consider both extra data that you may need to collect and how it can be analysed to give it meaning:

- You should attempt to analyse results by a particular category, e.g. by product, by batch. This will enable you to see trends or relationships. For instance a particular batch resulted in production losses implying poor quality raw material, or a particular product always seems to take longer than budget to produce.
- Doing this may require you to collect and track additional data, e.g. linking a particular product to a particular supplier. There may therefore be implications for your procurement and inventory systems.

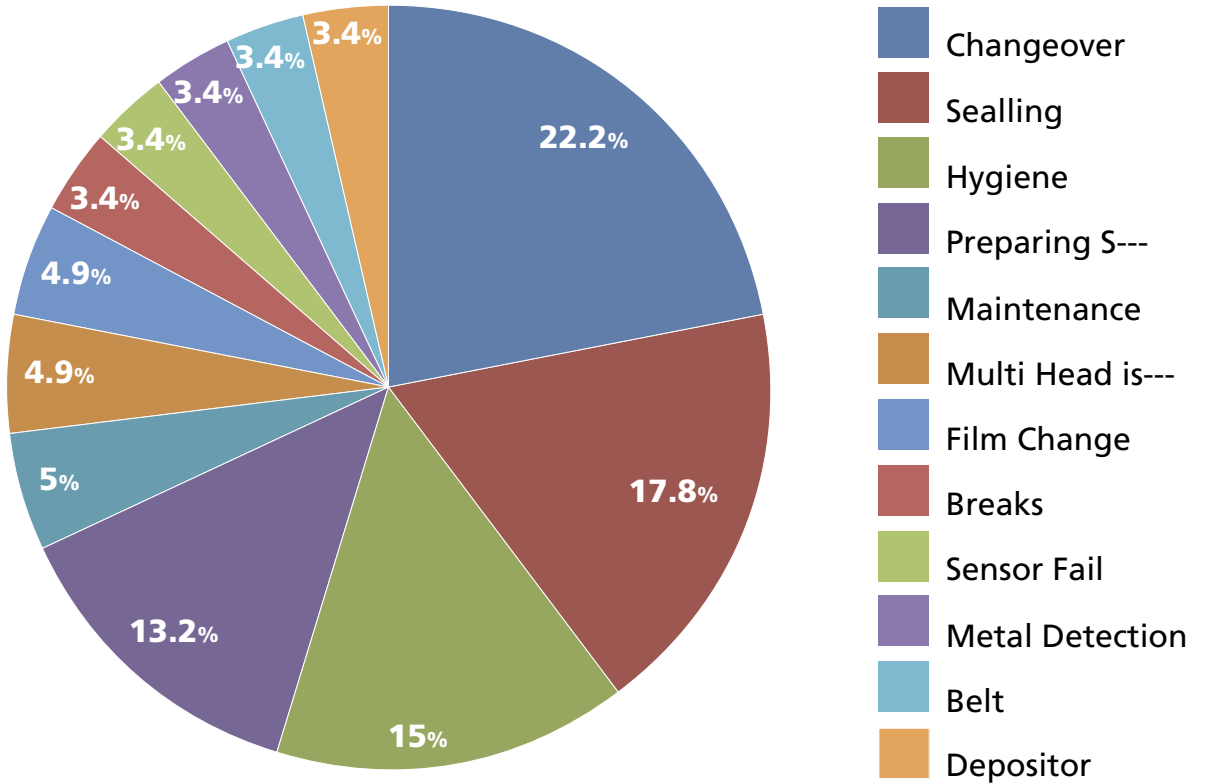
- It may be useful to capture data that isn't directly linked to a particular product, e.g. machine downtime, performance, wastage rates, etc. These may be difficult as in the case of losses you are capturing information that isn't there! You may need to compare inputs to outputs to identify the gap.
- There may be qualitative (rather than quantitative) data that is useful to collect such as customer feedback or commentaries which add 'colour' and meaning to your reports.
- As a year progresses actual performance may drift markedly away from a budget. Large organisations therefore may update their budgets with (say) quarterly re-forecasts and compare subsequent actual performance to these.
- Large organisations may also flex budgets to take account of significant changes in volumes. For instance if sales volumes are 50% lower than budget, but profit is only 20% down, this implies that the business has done well to control costs in the face of a downturn in demand. A flexed budget would restate the budget for changes in volume.

Presentation

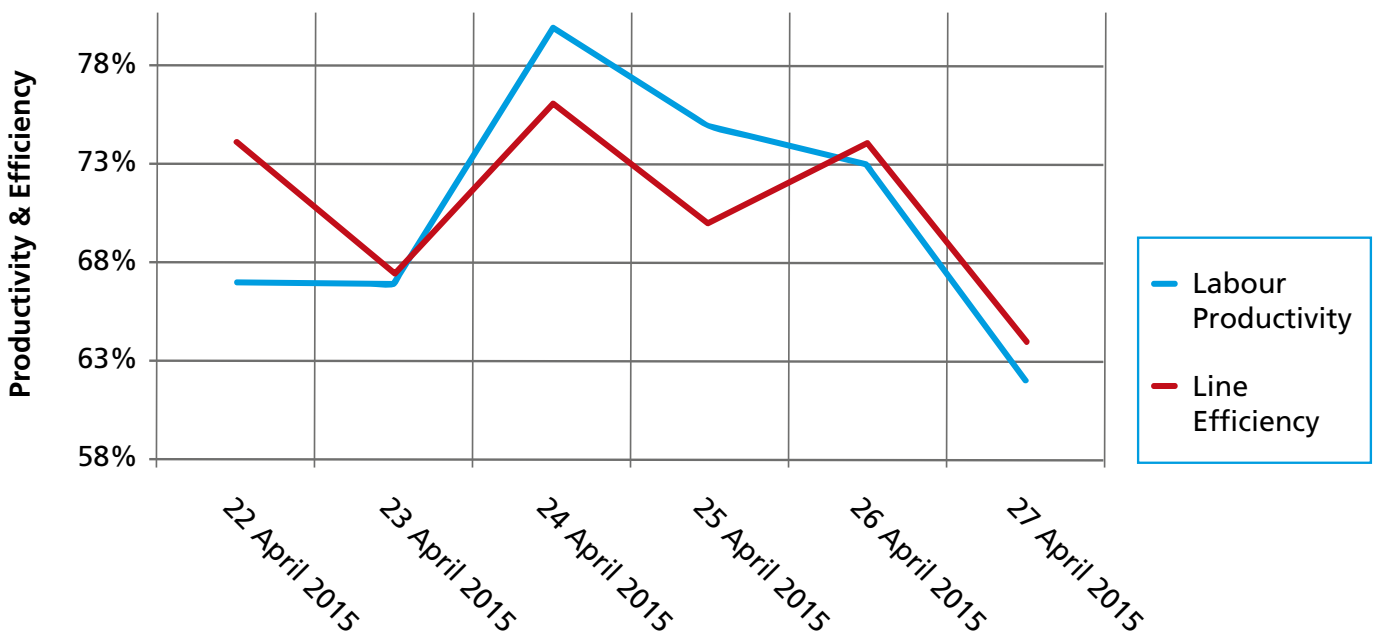
Finally it is worth considering the format of your reports. A typical DWOR report may look like the example below, which contains a great deal of detailed information but makes it difficult to see trends and relationships.

Line	Base	Target	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total								
Direct Hours			65.3	74.5	86.3	96.5	97.0	71.8	90.5	581.8								
Indirect Hours			38.5	50.3	38.8	62.3	62.5	44.5	38.5	335.3								
Total Hours			103.8	124.8	125.0	158.8	159.5	116.3	129.0	917.2								
Direct Productivity			72.4	77.0	72.5	66.6	67.0	79.8	75.9	72.2								
Total Productivity			45.2	45	48.2	40.5	40.7	27.8	51.7	42.7								
Missing Hours			0.5	1.6	3.3	0	0.1	31.3	2.6	39.4								
Total T&A Hours			103.8				159.3			263.0								
T & A Variance			0	-124.8	-125	-158.8	-0.1999999999	-116.3	-129	-654.1								
Total Packs			40,632	47318	43862	68620	58794	29373	56275	344874								
Productivity/Man Hrs																		
Line 1			64.5%	17.9	62.6%	21.9	77.3%	15.6	57.2%	30.0	69.5%	29.6	82.9%	19.9	82.0%	19.9	81.0%	154.8
Line 2			74.3%	3.0	55.0%	4.3	52.3%	5.0	69.4%	17.6	60.3%	14.1	46.8%	3.9	56.6%	9.3	61.2%	57.2
Line 3			82.7%	15.8	81.4%	18.7	52.5%	24.2	79.5%	19.9	73.8%	19.2	80.1%	8.6	62.3%	25.1	71.1%	131.5
Line 6			66.6%	28.0	84.5%	28.0	80.5%	38.2	82.2%	29.0	64.2%	34.0	86.3%	8.1	83.8%	33.6	77.3%	198.9
Total			63.6%	64.7	64.1%	72.9	50.7%	83.0	64.5%	96.5	57.7%	96.9	70.3%	40.5	58.5%	87.9	73%	77
Efficiency/Run Hrs																		
Line 1			64.5%	3.6	62.6%	4.4	77.3%	3.1	57.2%	6.0	58.0%	5.9	82.9%	4.0	82.0%	4.0	67.5%	31
Line 2			74.3%	1.5	55.0%	2.2	52.3%	2.5	69.4%	8.8	60.3%	7.1	46.8%	2.0	56.6%	4.6	61.2%	29
Line 3			82.7%	7.9	81.4%	9.3	52.5%	12.0	79.5%	9.9	73.8%	9.7	80.1%	4.3	62.3%	12.5	71.1%	66
Line 6			66.6%	4.8	84.5%	4.7	80.5%	6.4	82.2%	4.8	64.2%	5.7	86.3%	1.4	83.8%	5.6	77.3%	33
Total			63.6%	18	64.1%	21	50.7%	24	64.5%	30	57.7%	28	70.3%	12	58.5%	27	73%	23
Downtime Percent																		
Line 1			8%	33%	18%	29%	15%	10%	13%	19%								
Line 2			11%	29%	33%	23%	24%	34%	32%	26%								
Line 3			4%	8%	26%	7%	15%	12%	23%	15%								

Graphical output such as the examples below make trends and significance much more obvious:



Productivity & Efficiency



Supply chain management

Supply chain management is “the systematic and strategic coordination of all functions within a business as well as between customers and suppliers for the purposes of improving performance and delivering product on time, in full and to cost”.

Traditionally businesses had a rather adversarial relationship with their suppliers and customers, attempting to maximise their own profitability by paying suppliers less and charging customers more.

However by considering the entire flow from raw materials to end customer businesses are forced to work with rather than against their suppliers and customers. As an organisation you should understand and attempt to be involved in the management of the entire supply chain as if it was part of your own business rather than somebody else’s.

The Supply Chain can therefore not be seen as a single entity, but as a sequential and concurrent sequence of activities from supplier to customer.



Successful supply chain management (SCM) relies on a level of trust and understanding between the companies within the chain. Although there may be higher costs initially successful SCM makes it more likely that the organisation will be able to supply the right product at the right time and right price to the consumer – ultimately leading to more loyal customers and higher profits.

SCM is heavily reliant on accurate information and hence on robust systems – this does not mean systems need to be overly complex in themselves. However there may be complexity involved in ensuring that different systems from different organisations can ‘talk to each other’.

Each interface represents a change of state from one form to another or a transfer between one party and another and requires information to transfer.

The remainder of this module will now consider each step of managing the entire supply chain.

Sales forecast

We have mentioned already that the key to planning what you will produce is the volume of sales you are forecasting. Listed below are (i) some general factors relating to your relationship with your customers and (ii) more specific factors relating to the ‘mechanics’ of orders from your customers.

Customer relationship

Customer influence

Customers play a major part in determining supply chain performance. They can insist on specific ingredients, suppliers and in most cases which distribution channels and networks should be used. In some cases the business has little control of these factors however that does not mean these factors should not be planned and measured. Be careful if customers insist on certain factors (e.g. suppliers) based on their own circumstances, you are unlikely for instance to achieve their economies of scale.

Promotional events

Promotions are common place in the food and drink sector, you therefore need to ensure that your supply chain is capable of coping with the extra volume of a promotion and that it is economical to do so before accepting a promotion. You should ensure you consider the knock-on impact of a promotion on supplies of this and other products to other customers. For instance promoted items may have high volumes but lower prices; if the promotion means you do not have the capacity to supply other high margin products you should factor this lost contribution into your decision.

Joint Business Plans (JBP's)

JBP's are often instigated by customers where the manufacturer commits to contributing to "above the line" marketing activity (see marketing module for description). As with promotional events you should model the entire financial impact on all your production before deciding whether to go ahead.

Forecast Accuracy

It is important to keep track of the accuracy of forecasts compared to actual orders. For instance if product 'A' or customer 'B' is consistently 10% below forecast levels then allowances can be made in the short term and the accuracy of new forecasts hopefully improved.

Customer Orders

Frequency and timing

Frequency and timing of orders received must be considered in managing the supply chain. If a customer expects a rapid turnaround (e.g. delivery on the same day that the order is placed) then either the production process, including the supply of raw materials, must be flexible and quick enough to respond or sufficient inventory must be carried to be able to supply from stock. It is not uncommon in the food industry to receive orders on a daily basis (say at 6am via electronic messaging or "EDI" (Electronic Data Interchange) that are required to be delivered to the customer depot within the same day.

As raw materials and finished goods in the food industry have a finite shelf life the cost of holding such contingency stock (and the potential for it spoiling) has to be balanced against the potential cost of lost customer orders.

Producing "to order" is also not always advantageous as it generally means higher frequency of product changeovers which leads to more downtime and consumes significant capacity.

Lead times

A similar factor is lead times – the time between receipt of an order and when the product is required to be delivered. Clearly the longer this period the better the business can plan the production and minimise the impact on other products and jobs. In fast moving short shelf life products lead times will be narrow (hours rather than days) which means that the supply chain will be under pressure to respond.

Flexibility

It is important that your organisation can adjust manufacturing volumes to respond to (i) actual orders (either ad-hoc new ones, or adjustments to existing orders) (ii) incorrect forecasts or (iii) low or high stock levels.

Seasonality

Understanding demand patterns is key to managing the supply chain. For example strawberries and cream during Wimbledon, turkeys at Christmas. Ensuring sufficient supply of raw materials during those high demand periods is as important as ensuring that you minimise overstocking of components and raw materials in the lower demand periods.

You should ensure you also consider your stocks of packaging. Packaging usually requires high volume print runs to achieve acceptable unit costs, but there is a danger of holding high stocks of packaging during quiet periods as the design may change before the next peak period. For instance Wimbledon 2015 branded packaging will be worthless in 2016.

Manufacturing

The key elements to consider in the manufacturing component of the supply chain are:

Ingredient availability

Clearly to manufacture your final product you need raw materials and ingredients. It is important that you establish good relations with your suppliers so that you both understand what is important to the other and your relative expectations of each other.

In the food industry this includes the simple availability of ingredients with limited lives, the lead time for delivery, the quality, pack sizes and the ordering process.

Contingency supply

Planning for alternative raw material and packaging sourcing with pre agreed lead times and costs is critical to ensure cover for peak demand and also for production or supply outages.

Capacity

Insufficient capacity will lead to supply chain failure – often capacity is compromised because a machine is broken down or it is being occupied by another material/product at the same time. Successful supply chain planning makes allowances for this as it contains contingencies (such as agreeing emergency contract manufacturing elsewhere or extra shifts being worked).

Processing methods

Supply chain management and operations planning need to take account of your production method whether it is in batches or continuous feed or a more flexible 'to order' process. Continuous or large batch production will be more cost efficient, but is clearly less flexible.

Life flexibility

As inventory in the food industry has a limited life it is important to build into all processes some flexibility on dates. Of course technical aspects such as refrigeration, packaging and the production process itself significantly impact life.

This flexibility will be significantly impacted by the relationship you have with your customers, for instance temporary quarantines of items that are close to end of life can be sometimes agreed and the product then released on approval. Alternatively if stock build is essential to satisfy a big promotion, the customer may agree in advance that finished products can be frozen.

Labour and Machines

Often overlooked is the impact of labour availability (due to sickness or absenteeism) or a lack of skills (specific skills required during a specific period), as well as a short term impact of a major breakdown in machinery. In both cases contingency should be identified.

Distribution

Key factors to consider in the distribution stage are:

Inventory accuracy

In order to distribute finished goods to customers it is clearly imperative that you have accurate information. This information includes the quantity of finished goods you have in stock but also includes the inventory that you have as raw material and work in progress. If you understand what is coming through the production process then you can assess what you will have in stock over the coming hours/days.

It is important that your information on inventory includes not just quantities, but information on the life of the product and sizes, flavours, etc.

FIFO (First-In-First-Out)

This is a key principle in food manufacturing; by its nature materials and ingredients have a finite shelf life so using and distributing these in the order they are put into stock is key to maintaining availability of fresh products and minimising the cost of write-offs.

Slow moving stocks

Identifying these is important to managing cost and space. Each business must determine an ideal stock level that suits their particular business. This should be considered on a product by product basis and based on levels of consumption, value vs. size, life vs. time to manufacture, and the likelihood and value of 1-off orders for the product.

Picking accuracy

The costs associated with sending the wrong good to a customer are substantial. There may be penalty clauses, both the correct and incorrect item may have to be scrapped and there will be reputational damage as a result. It is vital that you have a robust process for ensuring the correct item is dispatched.

Shipping times (depot delivery slots)

Customers in the food and drink industry in the UK are demanding, and often have very narrow depot delivery windows. Fortunately the logistics sector servicing the industry is very efficient. You do of course have to consider the impact of distance on these narrow windows – depending on your location delivering to Edinburgh may take 5 hours longer than delivering to Birmingham.

OTIF (On Time In Full) accuracy

This is a common KPI in the food industry. It measures if the supply chain was able to deliver the expected product (reference and quality), in the quantity ordered by the customer, at the place agreed by the customer, and at the time expected by the customer. In most cases there will be a maximum tolerance agreed between supplier and customer. Failure to hit this measure could result in penalties.

A supply chain management system

We have now considered all of the components of supply chain management. You should now be in a position to establish a robust process to help you manage and monitor the supply chain. To recap the components of setting up this process are:

1. Map the entire process by documenting it.
2. The map should include all rules and operating standards for:
 - Capacity including lead times;
 - Quantities required (including min & max) costs;
 - Any penalties;
 - Any service level criteria agreed with suppliers/customers;
 - Life (product and materials);
 - Labour shift patterns.
3. Identify suitable KPIs using a KPI tree (see below).
4. Identify where those KPIs and other measures (sometimes known as metrics) can be found and set up a consolidated report.
5. Implement an S&OP (see below).

KPI tree

It is worth defining what we mean by metrics, measures and KPIs:

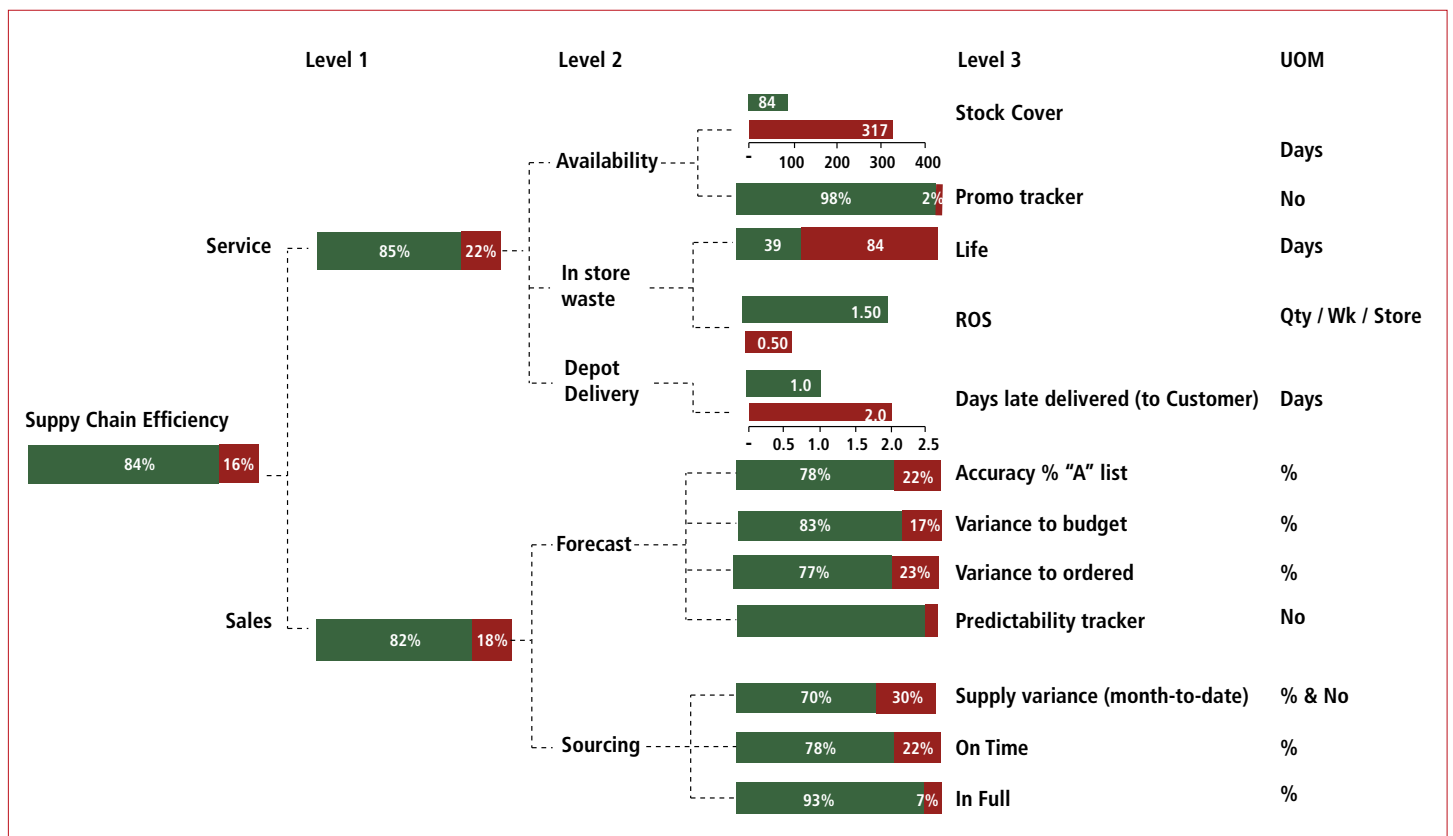
Measures and metrics are the same thing. Simply things that we measure, such as cost per unit for a raw material, or the time taken to produce a product on a machine.

KPIs (Key Performance Indicators) are measures that are important (i.e. Key) to the success of the business or process. There are generally a small number of them that give you a clear indication of something fundamental e.g. number of products produced per day, gross profit margin. You would report your KPIs regularly.

Drawing up a KPI tree is a useful technique to help you identify suitable KPIs for a business process. It helps you drill down into a process.

Taking a non-business example if you wished to measure health you'd ideally have a single KPI for 'healthiness'. As this doesn't exist you could drill down to factors that influence health such as calorie intake per day, hours of exercise done per day. These "feeder KPIs" are measurable, and contribute to the overall 'health' objective. You could then 'consolidate' the feeder KPIs into an overall health number.

The diagram below demonstrates how the same principal can be applied to your overall supply chain, breaking the total supply chain management into feeder activities that can be measured (as you move to the right) and then combining them into an overall percentage KPI (as you add up moving to the left).



“S&OP” (sales and operational planning) process

The final stage of setting up a structured supply chain management system is to put in place regular reviews. We mentioned the S&OP process earlier when discussing your capacity plan. S&OP is the process through which both Sales and Operational delivery success of a business is evaluated so that actions can be taken to reverse negative and promote positive performance.

It is important that you establish a regular process for this S&OP review. You should think about the best format of the reports that you will use for this process, so you are not developing ad-hoc analysis every time. You should consider who from your organisation will attend the reviews. Finally the reviews should be sufficiently regular – rarely enough so that you’ve had time to collect sufficient meaningful data, but often enough that problems don’t drift for too long without being addressed. Most businesses would have an S&OP review every 2 – 4 weeks.

It is important that S&OP reviews have some structure and formality to ensure maximum value. Good practice would include:

- Distribution of agenda and analyses in advance of the meeting to all participants.
- Define a chairperson and secretary for the meeting.
- Note down action points and review them at the end of the meeting.
- Distribute minutes and action points to all participants.

It is important to appreciate that action points resulting from the S&OP review will not necessarily be just internal. For instance if a gap between sales and production is identified, it could be addressed by:

- Internal changes – allocating different resources (machines/people/distribution) to meet demand, note however that this could involve moving resource rather than just increasing resource.
- Discussions with customers to deal with spikes in volumes or changes of delivery criteria, could orders be smoother, could lead times be increased, could inventory be stored for longer?
- A better understanding of where and when spare capacity exists or even under capacity (peaks and troughs over a period of time), to reallocate resource, or consider more flexible work patterns.

S&OP and forecasts

A final but key point to note about the S&OP review is that it should not be just backward looking (i.e. comparing your actual results to budget) but should also review your forecasts and plans. Regular review of your actual results will help you to understand the drivers and dynamics of your business and also the accuracy of your historic forecasts; it is important that you use this information to review the forward looking forecasts and adjust if necessary.

An example of a detailed review of forecast volumes is shown in the link below.

(LINK TO S&OP EXAMPLE – DOC 2)

Supply Chain Systems

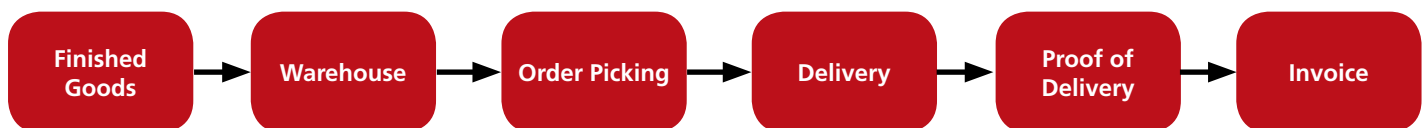
It is possible to buy computer-based integrated supply chain systems. However this sort of software is generally only appropriate for the largest, most complex organisations. Such systems would generally require significant amounts of customisation (at significant cost!) to match your particular operations.

However as IT systems become cheaper, more prevalent and more capable it is likely that they will become more appropriate for small and medium sized organisations.

It is likely that as a small, but growing, organisation the systems you use to help you manage your supply chain will be a combination of specific software packages and good old-fashioned paper. There is nothing wrong with this approach, but you should ensure that you formalise and standardise the process as much as possible so that everyone recognises the key documents. You should also regularly review whether your processes and systems are appropriate for you or whether you need to invest in something more sophisticated.

The link below contains an example of a fully documented supply chain process using a combination of dedicated systems, spreadsheets and paper-based processes.

Distribution and logistics



Logistics is the physical movement of stock across locations within a supply chain and is a critical component in the 'order to cash' process of any operation. It will include key elements of order capture, preparation (picking), delivery and goods receipt.

Distribution also represents a key point of physical contact between a supplier and a customer (i.e. your customer sees your goods being delivered). It is therefore vital that every care is taken to ensure that this interaction runs as seamlessly as possible.

Many customers within the food industry will have very specific requirements regarding how, where and when items will be delivered.

Obviously a critical element in the flow of goods is timing. We have already noted that food items have a limited life. In addition many customers will define a specific delivery time either at the point of order or before delivery.

Due to these complex requirements many organisations choose to outsource their logistics operation to a specialist service provider, known as a Third Party Logistics provider (3PL). These enable you to buy in expertise, have national or international coverage and to free up your own time to concentrate on growing your business.

We have already noted that margins in the food business are constantly under pressure. It is important that you look for efficiencies within your logistics process. For instance a concept known as backhaul is common where vehicles on their way back from making a delivery to a customer collect raw materials for your production process.

We have already considered a number of key considerations within distribution and logistics within the supply chain management overview. The remainder of this section will consider more specific factors relating to this area.

Distribution Solutions

There are a number of models that can be considered when deciding the most effective distribution solution for your business:

In-house direct customer delivery

- Own on-site warehouse and order preparation.
- Own fleet delivery direct to customer.
- Proof of Delivery (POD) returned by driver.

In-house warehouse only

- Order preparation on site.
- Order collection by external haulier for delivery to customer.
- Haulier returns POD.
- Many customers will ask for British Retail Consortium accreditation for warehouse operations (contact Food Storage & Distribution Federation – FSDF for guidance).

Fully outsourced

- Stock cleared from production and loaded onto haulier.
- Goods controlled via Third Party Logistics provider (3PL) warehouse management system.
- Order preparation and picking completed by 3PL.
- Goods delivered to customer by 3PL.
- 3PL confirms receipt of goods to trigger invoice.

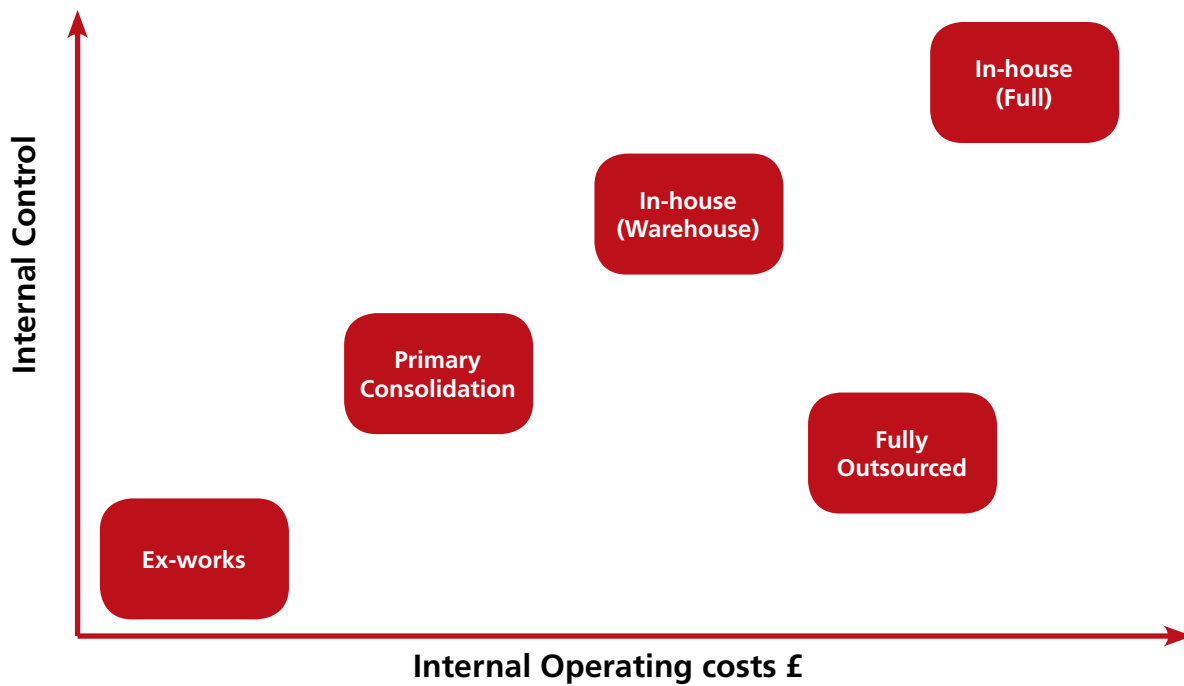
Primary Consolidation Centre

- Dedicated customer facility (usually run by 3PL).
- Stock depth target agreed with customer and managed by supplier.
- Stock transfer to customer as required.
- Customer 3PL confirms transfer for invoice purposes.

Ex-factory or Ex-works

- Customer will ask for cost price for goods excluding any cost for distribution.
- All stock collected from factory by nominated 3PL.
- Transfer of title takes place at time of collection.

The impact on your costs and level of control of these models can be summarised in a diagram:



Increasing transport efficiency

There are a number of key factors, which will contribute to delivering the most efficient transport solution for your business:

Vehicle Fill

You should ensure that wherever possible a vehicle is loaded to its maximum capacity. This could be dictated by one or more factors, for example total weight, cube (see Pallet Fill), and height of pallet or count of base pallets.

Vehicle Utilisation

When operating a fleet of vehicles it is critical that all of them are utilised for as many hours per week as possible (subject to legislation on driver working times). Operators should ensure that routes are carefully planned so that geographical delivery points are visited in a logical order and ensure that vehicles can return quickly to base.

Pallet Fill

Most vehicles are built to a height in excess of 2m, however the average maximum pallet height is only 1.7m. Where weight and packaging allows you should consider maximising the height of pallets and discussing options for 'over height' pallets with customers.

Backhaul

First developed by the retailers in the late 1980's the process of backhaul is simply using a vehicle that has made a delivery to a customer to divert and collect either raw materials or packaging from a supplier either close to the delivery point or on route back to base. Also if a customer's retail or wholesale outlet is close to your factory the retailer may be able to collect from you directly.

Green Lane Receiving

Many of the larger food and drink operators have in recent years developed technology to increase the efficiency of inbound logistics. For instance using barcodes to scan products to confirm receipt or the use of electronically transmitted Advanced Shipping Notes (ASNs) that allows them to prepare documentation in advance and hence reduce the amount of time taken to unload and confirm receipt of all deliveries.

Fronthaul

Similar to backhaul but in reverse. A supplier having delivered to you is re-loaded with product for delivery to a customer's outlet close to the vehicle's base location or return route.

Summarising these options graphically.

Traditional supply chain:



Backhaul removes empty running and so reduces cost



Using technology to improve accuracy

We have discussed the importance of accuracy to the whole logistics and distribution process. If the wrong item is sent to a customer there may be penalty clauses, both the correct and incorrect item may have to be scrapped and it clearly reduces your reputation in the eye of the customer.

There are a number of technologies that can help your improve accuracy and tracking:

Electronic Data Interchange (EDI)

A general term for transmitting data between trading partners electronically. It can be used throughout the entire 'order to cash' process as it allows for the transmission of orders, invoices, advanced shipping notes, POD's and statements. It can be configured to interface directly with planning and financial systems reducing human input and thereby increasing accuracy and reducing costs.

Bar Codes

We have already discussed the application of simple bar codes to the outer case of your finished products. However bar codes can be used throughout the supply chain on raw material, individual finished goods and boxes of finished goods. Data regarding the product held within the bar code can be as simple or as complicated as required to assist with the tracking of goods.

Radio Frequency Identification (RFID)

Rather than a bar code a product, outer case or pallet can be fitted with a Radio Frequency Identification tag. This again holds key data regarding the product (batch, shelf life, factory code etc.) and rather than being read by a hand held scanning device can be captured by specialist readers. The benefit is that the reader does not have to have line-of-sight access to the code, so the RFID tag on an item in the middle of a pallet can still be read.

Warehouse Management Systems

In the last 20 years increasingly capable software tools have enabled businesses to use IT systems to help them manage their warehouses. These range from simple spreadsheets with manual book in/book out processes to specialist tools which link directly with other business systems.

The introduction of a WMS will not only result in greater accuracy preparing and tracking orders but will also give greater visibility of stock, both finished goods and raw materials. As a result levels of stock can be reduced at the same time as improving stock rotation.

Whether a business uses a simple or complex system there will always be a requirement to carry out physical inventory counts and checks to ensure human error has not misaligned the physical stock from that held on the system.

Vehicle Routing & Scheduling

Many organisations now use specialist software, many with links to driver-held PDAs or Smart Phones. These systems allow for more dynamic planning and scheduling of delivery vehicles meaning that deliveries will be faster and more efficient. Often a 'base schedule' with average volumes by customer is maintained and as soon as new orders are taken accurate data can then be uploaded and schedules, vehicle and driver utilisation can be adjusted.

Sources of useful information

There is a great deal of information available from the food industry that SMEs can take advantage of in relation to distribution.

Over the last 3-5 years many of the UK's leading food and drink operators worked together on a sustainable distribution initiative which reduced UK road miles by over 200 million per annum. As part of this activity a number of useful guides and case studies were prepared detailing best practice from across retail, wholesale and manufacturers.



ECR UK, which is made up of Supply Chain leaders from across the food industry has carried out a number of projects and prepared a number of free guides available to download via the IGD website at:

www.igd.com/Research/Supply-chain/Sustainable-supply-chains/3551/Sustainable-Distribution/

The following trade associations can provide useful information and guidance:



FREIGHT TRANSPORT ASSOCIATION



the FSDF are the food logistics specialist federation and can provide guidance on all aspects of food warehousing and transport and in particular the specific requirements for temperature controlled products and services

Waste Management

Investors and customers (both retailers and end users) are increasingly interested in the 'green' credentials of the organisations they do business with. Large organisations are therefore gradually adopting waste management or sustainable operations initiatives as part of their Corporate Social Responsibility strategies. The next time you pass an M&S vehicle on the motorway look out for the 'Plan A' reference along the side. In addition 2015 is the eighth successive year that land fill tax has risen. Nobody should expect the cost of disposing of waste to decline in the future, nor for the associated legislation to reduce.

It is therefore important that as your business grows you start to put in place processes to manage both the amount of waste produced and your processes for dealing with that waste.

The key to successful management of environmental impact is to put in place processes and reporting for each of the specific activities or silos in the business where waste can occur. Typical areas which can generate waste are shown below:



The food waste & packaging hierarchy

Developed by ECR UK and hosted by the IGD the food industry has challenged itself to reduce by 200,000 tonnes the amount of food being wasted from factory to outlet. They have developed a number of tools and started with a waste hierarchy (see below), whereby organisations put in place initiatives designed to move waste up the chain. More details can be found at the link below:

www.igd.com/Research/Supply-chain/Waste-Prevention/



Examples of steps that businesses can take to move up the hierarchy:

Minimise Waste

Divert to Charity/Clearance/Give-Aways

- Improved demand planning
- Maximise production runs
- Minimise line 'clear-downs'
- Short shelf life reporting
- Donation to FareShare

Animal Feed

Recycle/AD/Compost

- Links with local farms/zoos
- Many local authorities now compost
- Energy conversion for both food and packaging

Energy Recovery



Examples of steps that organisations can take to reduce the environmental impact of energy use, packaging and water:



Many organisations are now installing rainwater harvesting systems to collect water for use in non-critical environments e.g. vehicle washing.



Managing electricity consumption is key to controlling costs, particularly in a cool-chain environment. Ensuring that plant equipment is properly maintained is critical as is contacting your energy provider about using 'off peak' tariffs or supplementing costs through the installation of solar panels or wind turbines.



Many food retailers, wholesalers and suppliers have introduced plastic crates both internally and across supply chains to minimise the reliance of cardboard.

Technical and its role in Operations

The importance of Technical

Technical activity in any Food or Food related business exists to protect consumers from contamination (bacteria, foreign bodies, allergens and similar) and the business from costly financial and legal repercussions by defining, controlling and managing the safe handling, storage, processing, packing and shipping of raw materials and finished product. If the consumption of a company's food products puts a consumer at risk of illness, repercussions to the business can be extremely serious and can in certain circumstances lead to loss of trust from consumers in the brand, a loss of trust from customers in senior management's commitment to food safety, and ultimately can put the very existence of the business in jeopardy.

All food and food related manufacturers, processors and operators have to comply with appropriate industry specific technical standards. These will need to be audited internally by themselves and externally by the authorities who exercise legislative authority to do so, and there is also the likelihood of trade customers carrying out their own inspections.

The technical function within a business is critical to the protection of both the consumer and the business and should work very closely with Operations. However, technical functions and activity in any operational environment must be independent of Operations and be accountable directly to the Exec/General Management level – this is to ensure impartiality and appropriate decision making authority is executed when conditions arise which results in the integrity of products and/or raw materials being held in question.

Levels of Technical Accreditation

The type of operation, production methods, raw materials used, processing methods employed will dictate to what extent technical compliance is subscribed to, is designed around and finally implemented and maintained.

For example, a business growing tomatoes on an agricultural holding sends whole tomato to their customers in the produce sector, who then pack and deliver the tomatoes onwards to supermarkets will in all likelihood not need to be BRC accredited (British Retail Consortium technical standards and audatory criteria compliant), but will more likely need to subscribe to and conform to the 'Red Tractor'.

A processor producing ready meals from various raw materials for direct supply to the UK high street retail sector will in all likelihood need to comply with and successfully navigate those retailers' internal audits (e.g. Tesco PIU) along with industry-wide technical accreditation, e.g. BRC.

The production, processing, distribution, retail, packaging and labeling of foodstuffs are governed by a mass of laws, regulations, codes of practice and guidance, this chapter cannot possibly serve as the definitive guide to Technical processes in UK based Food SME's however to determine what level of technical accreditation and on-going delivery is required in your business the best place to start your research would be with the UK Food Standards Authority (www.food.gov.uk/enforcement/regulation).

Food Safety – Legislation and the Requirements on the Company

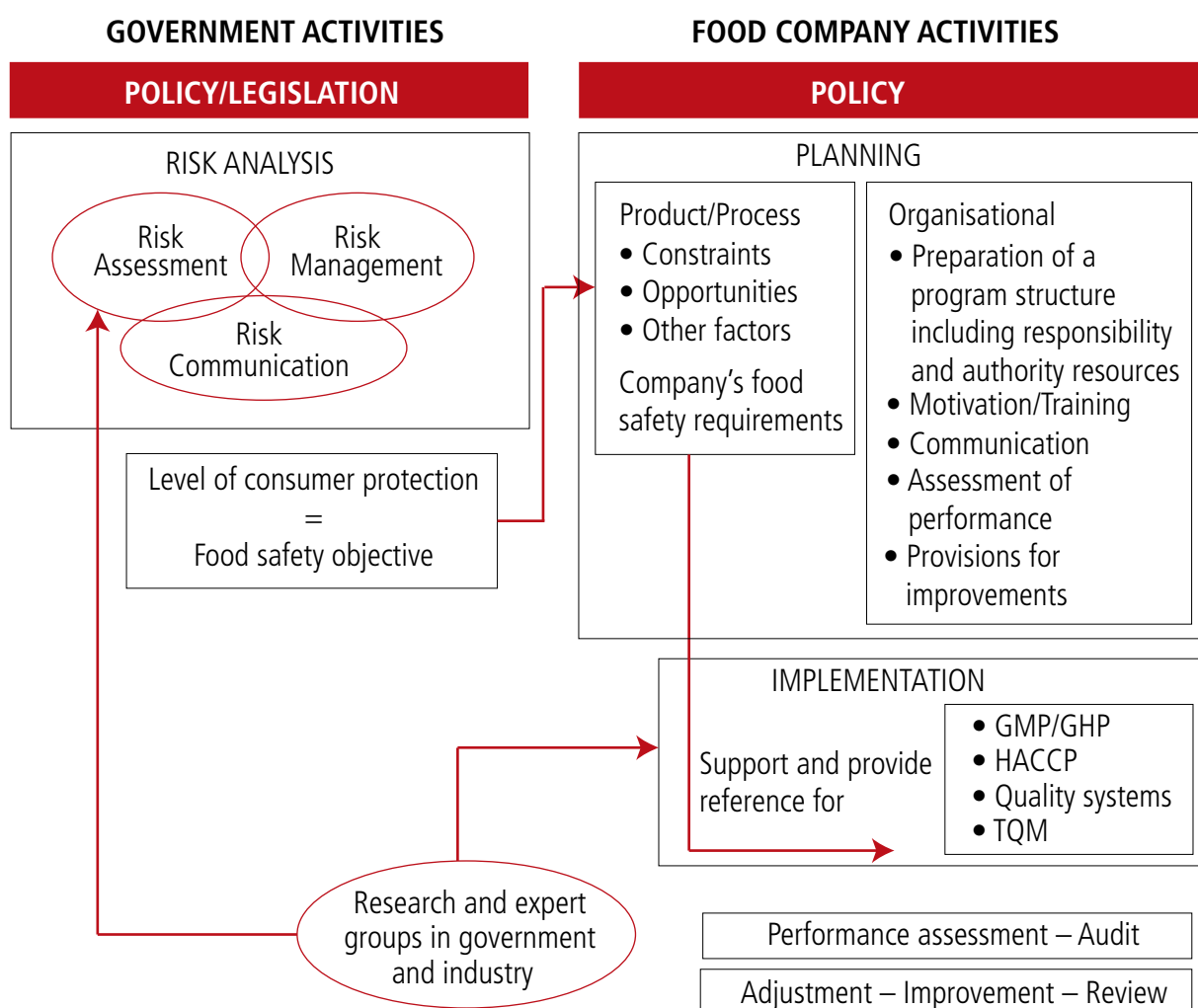
To place the Technical elements of your business into context of how it needs to function and comply with Food Safety legislation we can summarise as follows;

With input from specialist and expert groups, Government sets legislation to protect consumers from unsafe food and food products.

Companies need to have clear policies as to how they respond to legislation. For example:

- How to plan for both product, process and organisational (internal) requirements.
- How to implement those plans, and review how they perform against all the criteria.
- How to then demonstrate that they can adjust and improve.

It is an on-going process which never reaches a final destination as new methods, processes and risks are understood and become evident in the food supply chain.



Research and expert groups in government and industry

Even for the very experienced food industry professional, there may seem to be a whole host of different options or methods for ensuring the safety and quality of food products. The situation is not helped by the acronyms arising from these methods i.e. ISO, GMP, GHP, HACCP, TQM seeming to have a life of their own and coming into modern usage as words in themselves, and sometimes used without an understanding of what they mean.

Methods to manage quality and safety

So, what is there in existence to manage quality and safety, and how do they relate to each other? Below are listed the most well known methods to manage quality and/or safety, and these will be briefly discussed individually and then how they integrate with each other.

- Good Hygienic Practices (GHP) / Good Manufacturing Practice (GMP) or Standard Operating Procedures (SOP's).
- Hazard Analysis Critical Control Point (HACCP).
- Quality Control (QC).
- Quality Assurance (QA) / Quality Management (QM) – ISO standards.

Good Hygienic Practices / Good Manufacturing Practices

The terms GHP and GMP refer to measures and requirements, which any establishment should meet to produce safe food. These requirements are prerequisites to other and more specific approaches such as HACCP, and are often now called prerequisite programs.

Hazard Analysis Critical Control Point

Hazard Analysis Critical Control Point (HACCP) is a systematic approach, which identifies, evaluates, and controls hazards, which in turn are significant for food safety. HACCP ensures food safety through an approach that builds upon foundations provided by good manufacturing practice. It identifies the points in the food production process that require constant control and monitoring to make sure the process stays within identified limits. Statistical Process Control systems are relevant to this operation.

Quality Control

It is an important subset of any quality assurance system and is an active process that monitors and, if necessary, modifies the production system so as to consistently achieve the required quality.

Quality Management

This can be defined as all the activities and functions concerned with the attainment of quality in a company. In a total system, this would include the technical, managerial and environmental aspects as alluded to above. The best known of the quality assurance standard is ISO 9000 and for environmental management, ISO 14000.