CHAPTER 4

ACTIVITY-BASED COSTING

1. Activity-based costing

Once upon a time, the essential things that a business required to produce a product, were its work force (labour) and the materials that the products were made from.

In the modern production environment, manufacturing involves a far higher degree of mechanical and computerised input. **This means that direct labour costs make up less of the total costs, whilst overheads are even more significant.**

Absorption costing and marginal costing can both be too simplistic in their approach to modern production costing. Therefore, many other costing systems exist which aim to give a more accurate production cost.

Absorption costing gives us a way of absorbing fixed overhead costs into the cost of a unit. However, in today's world, it is no longer just a matter of absorbing costs. **We also need to consider *how* the costs are absorbed and if we're doing it in a way that gives a true indication of how the costs are incurred.**

If we get the costing wrong, a whole range of decisions on which the costing is based- in particular, pricing decisions could be wrong, and we could end up selling a product for less than it actually costs. Getting the costing right is absolutely essential, and standard absorption costing sometimes gets it wrong – which is where activity-based costing comes in.

Consider this example:

Let's imagine we make the best apple pie in the country. It's the talk of the town, and every day we're swamped with orders. Realising we can't keep up with our tiny oven

at home, we decide to open a brand new pie factory. Now we've got new machines, new ovens, and a fantastic new facility to operate in.

We're switched-on businessmen, so we figure out that with our increased capacity we can now offer two products – a fresh pie that we'll sell daily to restaurants and cafes, and a frozen pie that we'll sell through the supermarkets.

Our numbers are as follows:

- We produce 5,000 of each pie in the period
- We produce 50 pies an hour
- Our total overheads amount to £50,000
- A total of 200 labour hours are worked in the factory

We decide to absorb our overheads into the cost of our pies based on labour hours, so £250 per hour (£50,000 overheads/200 hours).

Therefore, if we produce 50 pies an hour, our overheads are £5 per pie (£250 per hour/50 pies per hour).

Each pie takes the same amount of time to bake, whether we sell it fresh or frozen. Therefore we decide it seems reasonable that each type of pie is allocated the same amount of fixed overhead.

A new approach

One day our factory manager points out that 10 production runs are required to produce our 5,000 frozen pies for the period. The frozen pies are all produced at once during the first few days of the period and are then frozen and shipped.

However, this is not possible when producing fresh pies. They need to be baked as they are ordered and delivered daily, because if they were produced all at once, they would spoil in storage. For this reason, 90 production runs per period are necessary to produce 5,000 fresh pies.

Our factory manager also explains that overhead costs mostly relate to setting up the ovens and the machinery. This set-up is required for every production run.

In light of this information we decide it would be more accurate to allocate overheads based on production runs rather than labour hours.

There are 100 production runs in the period (10 for frozen pies, 90 for fresh pies). On that basis, we allocate our overheads at a rate of £500 per run (£50,000 overhead/100 runs). So what is our new overhead cost per pie?

Frozen pies	
Overhead cost per run	£500
Number of runs	10
Total overhead cost	£5,000
Cost per frozen pie (5,000 pies)	**£1**

Fresh pies	
Overhead cost per run	£500
Number of runs	90
Total overhead cost	£45,000
Cost per fresh pie (5,000 pies)	**£9**

With this approach, we discover that it's almost ten times more expensive to produce fresh pies than frozen pies. This method of costing is known as **activity-based costing (ABC), which recognises that overhead costs are incurred through specific activities rather than production volume.**

ABC is suitable in the above example because it recognises that producing frozen pies is a simpler operation to producing fresh pies. Traditional absorption costing does not make this distinction.

This is an important issue in modern manufacturing where it is becoming **increasingly rare to see generic products in long, automated production lines. Products these days are much more complex and are often produced in specific stages**, often with significant amounts of overheads that are unrelated to volume e.g. design, development, customisation. Therefore allocating overheads based on volume as we do in traditional costing systems is often misleading. **ABC provides a more accurate method of allocating costs in such an environment.**

2. Cost drivers, cost objects and cost pools

Cost pools

As we saw above, overheads are not always driven by volume.

We saw that our overheads were, in fact, driven by the support functions of setting up machinery, so whether we produced one pie or hundreds of pies this was far less relevant to overhead costs than the number of times we set up the machinery.

If we had spent a little more time snooping around the factory, we may have discovered that things such as storage and maintenance were also costing a significant amount. These would be further examples of support overheads not primarily driven by volume – freezing one pie still requires the whole freezer and making one pie still requires the cleaning of the oven!

Therefore, **to implement ABC we first need to group our overheads into individual activities**. For example, we might have one group of overhead costs that relates to machine set-ups, and another that relates to machine maintenance. **These groups are known as cost pools.**

Cost drivers

The next step is identifying **what causes these costs to be incurred.** This is known as the cost driver.

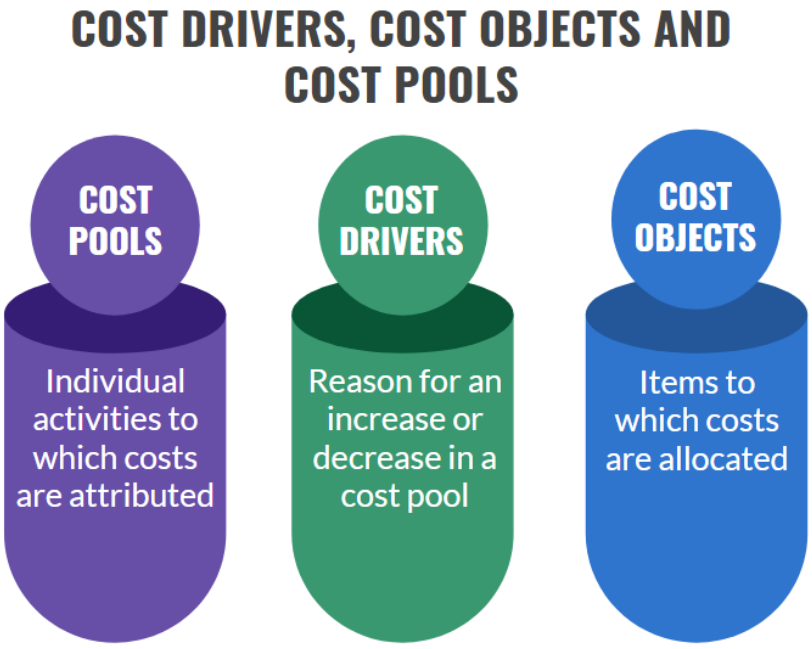
For example, say we have a cost pool that relates to machine maintenance and we know that how often we maintain the machines depends on how long they've been used for. The appropriate cost driver in this instance will be machine hours, because it is the hours of machine usage that drives the cost of the maintenance.

When identifying your cost driver, try to pinpoint the reason why your cost pool increases or decreases.

If your cost pool relates to machine set-ups, then this cost pool will increase with every machine set-up that you do. Therefore the cost driver will be the number of machine set-ups. If your cost pool relates to order processing, the cost pool will increase as the number of orders increase. Therefore the cost driver will be number of orders received.

Cost objects

The cost object is basically **the item or product we want to allocate costs to**. In our example, we want to allocate our overhead costs to our pies. Therefore our cost object is a pie. If we were producing cars, then our cost object would be a car, and if we were producing wristwatches, our cost object would be a wristwatch. Our **aim with any costing system should be to determine accurately the cost of producing the cost object.**



Types of costs

When identifying cost pools and their drivers, costs often fall into certain categories.

Unit-level costs

Unit-level costs are direct costs such as raw materials. They are **allocated in the same way under ABC as they are in traditional costing – directly to the product.**

Product-level costs

These are costs that **relate to individual products**. An example of a product-level cost would be if we wanted to research a type of packaging that would make our fresh pies stay fresh for longer. Since this cost relates to a specific product, i.e. fresh pies, we will allocate it to our fresh pie product line only.

Batch-level costs

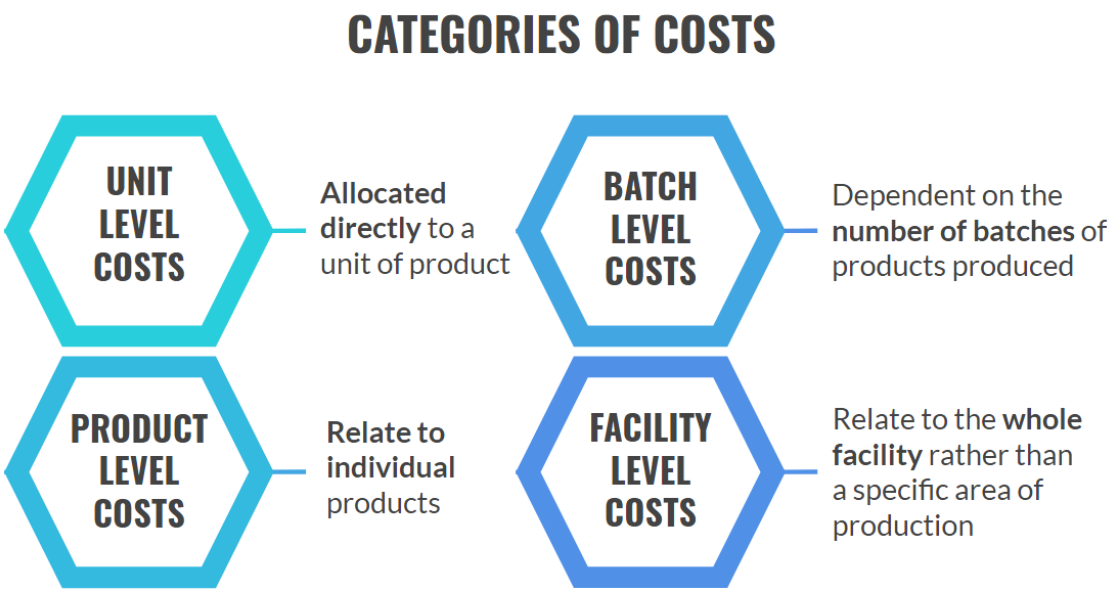
These are costs that are **not dependent on the volume of goods produced, but the number of batches they are produced in.**

In our pie example, we found that our fresh pies were produced in 90 production runs or 90 'batches', compared to our frozen pies which were produced in only 10 batches.

This led to 90% of our machine set-up cost pool being allocated to fresh pies, even though we produced the same amount of each pie. This is a typical scenario in modern manufacturing where the volume of goods produced isn't an appropriate cost driver.

Facility-level costs

These are costs that **occur at a facility level, such as rent, security and depreciation**. It is generally accepted that these are simply costs of being in business and **do not relate to any specific area of production.**



Why group costs like this?

Grouping costs into the above categories is important because it can give an indication of the usefulness of ABC before it is implemented. If the majority of overhead costs are incurred at the unit level and the facility level, ABC will provide similar results to a traditional costing system. This is because unit-level costs are direct costs and their allocation won't change between costing systems, and the allocation of facility-level costs such as rent is also unlikely to change.

However, if the majority of costs are at the batch level and product level, ABC is likely to allocate these costs in a very different way to traditional absorption costing as we've seen already.

3. ABC versus absorption costing

So how do you know which costing system is right for your business? Will each one produce a different result?

Example

Let's say that we run a toy car manufacturing business. We offer three different models (Basic, Platinum and Custom) and our sales are through the roof!

However, we're no longer sure about the absorption costing system we have in place. We believe that an activity-based approach might be more suitable. Let's work through this new example to demonstrate the differences between these two systems.

Our information is as follows:

Product	Basic	Platinum	Custom	Total
	£	£	£	£
Sales	55,000	100,000	120,000	275,000
Direct materials	(18,000)	(28,000)	(40,000)	(86,000)
Direct labour	(11,000)	(15,000)	(21,000)	(47,000)
Production overhead				(100,000)
Gross profit				42,000
Units sold/produced	1,000	1,600	1,000	
Machine hours per car	3	5	9	
Total machine hours	3,000	8,000	9,000	20,000

Traditional absorption costing

Step 1 – Allocate production overheads

We allocate our overheads based on machine hours, which requires 2 basic steps.

Firstly, calculate the cost per machine hour:

Total production overhead	£100,000
Total machine hours	20,000
Overhead cost per hour	£5

Then, multiply the cost per hour by the total machine hours used for each product. This will give us our allocation of production overhead for each product:

	Basic	Platinum	Custom
Total machine hours	3,000	8,000	9,000
Cost per hour	£5	£5	£5
Total production overhead	£15,000	£40,000	£45,000

Step 2 – Calculate gross profit per unit

We now have all the data we need to work out our gross profit for each product line as we can add the newly calculated overhead costs per product line to the direct costs for each product:

Product	Basic	Platinum	Custom	Total
	£	£	£	£
Sales	55,000	100,000	120,000	275,000
Direct materials	(18,000)	(28,000)	(40,000)	(86,000)
Direct labour	(11,000)	(15,000)	(21,000)	(47,000)
Production overhead	(15,000)	(40,000)	(45,000)	(100,000)
Gross profit	11,000	17,000	14,000	42,000

We can also look at this per unit, simply by dividing each gross profit figure by the number of units produced:

Gross profit	11,000	£17,000	£14,000
Units sold	1,000	1,600	1,000
Gross profit per unit	£11	£10.63	£14

Activity-based costing

Step 1 – Determine cost pools and cost drivers

We've learned that, in order to implement ABC, we need to identify the main activities in our manufacturing process and their cost drivers. We manage to determine the following:

Activity	Cost driver	Cost pool £
Machine maintenance	Machine hours	19,000
Machine set-ups	Machine set-ups	31,000
Car testing	Number of tests	21,000
Quality inspection	Number of inspections	16,000
Materials processing	Number of deliveries	13,000
		100,000

Upon analysing our manufacturing process we also determine the following:

	Basic	Platinum	Custom
Budgeted production (units)	1,000	1,600	1,000
Number of production runs	110	300	500
Tests per production run	10	12	25
Inspections per production run	5	8	20
Number of deliveries	200	300	900

We are also told that a new machine set-up is required for every production run.

Step 2 – Calculate the totals for each cost driver

Now that we've identified our 5 cost drivers, we need to calculate the quantity of each. This is no more than simple maths using the information provided above – let's see how they all work.

Cost drivers	Basic	Platinum	Custom	Total
Machine hours (provided)	3,000	8,000	9,000	20,000
Machine setups (A)	110	300	500	910
Number of tests (B)	1,100	3,600	12,500	17,200
Number of inspections (C)	550	2,400	10,000	12,950
Number of deliveries (provided)	200	300	900	1,400

- We were informed that each production run requires a new machine setup. Therefore this figure is simply equal to our number of production runs.

- This figure is calculated by multiplying the number of tests per production run by the number of production runs. Both figures were provided.

- This figure is calculated by multiplying the number of inspections per production run by the number of production runs. Both figures were provided.

Step 3 – Calculate gross profit

Finally, allocate the total costs for each cost driver to each product based on the proportions for each cost driver from step 2.

	Basic £	Platinum £	Custom £	Total £
Sales	55,000	100,000	120,000	275,000
Direct material	(18,000)	(28,000)	(40,000)	(86,000)
Direct labour	(11,000)	(15,000)	(21,000)	(47,000)
Machine maintenance	(2,850) 19,000 x (3,000/20,000)	(7,600) 19,000 x (8,000/20,000)	(8,550) 19,000 x (9,000/20,000)	(19,000)
Machine set-ups	(3,747) 31,000 x (110/910)	(10,220) 31,000 x (300/910)	(17,033) 31,000 x (500/910)	(31,000)
Car testing	(1,343) 21,000 x (1,100/17,200)	(4,395) 21,000 x (3,600/17,200)	(15,262) 21,000 x (12,500/17,200)	(21,000)
Quality inspection	(680) 16,000 x (550/12,950)	(2,965) 16,000 x (2,400/12,950)	(12,355) 16,000 x (10,000/12,950)	(16,000)
Materials processing	(1,857) 13,000 x (200/1,400)	(2,786) 13,000 x (300/1,400)	(8,357) 13,000 x (900/1,400)	(13,000)
Gross profit	15,523	29,034	(2,557)	42,000

The allocations

The allocations of overheads in the gross profit calculation above are computed by doing two things:

Firstly, **the proportion of the cost pool related to that product is calculated,** so for instance, 3,000 of the total 20,000 hours of machine maintenance relates to our 'basic' car product. **This is then multiplied by the total cost for that cost driver**, in this case £19,000 to get the amount allocated to the 'basic' product related to the machine maintenance cost pool.

The calculation for each overhead allocation has been included with each figure to assist you to see how each is calculated.

Alternatively, these allocations could also have been determined by firstly calculating the cost driver rate by dividing the cost pool value by the total cost driver level or quantity. The cost driver rate would then need to be multiplied by the cost driver quantity for the specific product.

So for machine maintenance the cost driver rate is found by dividing £19,000 by 20,000. Then the amount to be allocated to the basic model is determined by multiplying the rate by 3,000. As you can see this is the same as the calculation we carried out using the other method.

Analysis

Let's compare our gross profit figures between the two costing systems:

	Basic	Platinum	Custom
Absorption costing			
Gross profit	£11,000	£17,000.00	£14,000
Units produced	1,000	1,600	1,000
Gross profit per unit	£11	£10.63	£14

Under an absorption costing system, which allocates all production overheads using a single volume-based driver (machine hours), it appears all three products are profitable. Our most profitable product is the Custom model, which might make sense as it has the highest selling price. The Basic and Platinum models both yield a gross profit of around £11, which is also healthy.

Our aim is to maximise profit. Therefore, because all three products appear profitable we will continue to produce all three. It is also likely we'll put a concentrated push on the Custom model – our most profitable.

Now let's take a look at our gross profit calculated under an activity-based approach:

	Basic	Platinum	Custom
Activity-based costing			
Gross profit	£15,523.00	£29,034.00	(£2,557.00)
Units produced	1,000	1,600	1,000
Gross profit per unit	£15.52	£18.15	(£2.56)

As you can see, an activity-based allocation of overheads paints a very different picture. We discover that our most profitable product is actually the Platinum, followed by the Basic. Both products are more profitable than they were under absorption costing. We also discover that the Custom model, which was previously thought to be our most profitable product, is actually being sold at a loss.

Why do the two costing systems produce such different results?

Absorption costing simply allocates our entire amount of production overheads based on machine hours. It assumes that the more machine hours a product requires the more expensive it is to produce. We've discussed how this is not always a suitable approach in modern manufacturing, where products are often manufactured in various different stages that incur different levels of costs.

By implementing ABC, we uncover that only a small amount of our overheads are based on machine hours (£19,000 out of a total £100,000). Therefore using machine hours as the basis of our overhead allocation is inappropriate. This is because producing a toy car also involves testing, materials sorting, quality inspection and machine set-up time, all of which are completely unrelated to machine hours.

The reason the Custom model turned out to be so expensive was because it required significantly more time for testing, materials sorting and quality control than our other models, which is typical of custom-made items. However, traditional absorption costing was unable to account for this. Only through ABC were we able to trace each overhead cost to its individual driver and capture the more complex nature of manufacturing the Custom model.

Improved decision making with ABC

Now, it's worth noting that our o**verall profit doesn't change between absorption costing and ABC.** Obviously our costs are the same, and our revenue is the same, which means our gross profit of £42,000 remains the same. **It is only the cost allocation that differs.**

Therefore the whole point of ABC is to provide new information to help us make changes to improve profitability. In the above example, ABC has given us a wealth of information that can help us make some effective decisions:

Basic model

Gross profit per unit under absorption costing	£11.00
Gross profit per unit under ABC	£15.52

Changing to ABC informed us that this model is more profitable than we originally thought. Not knowing this may have resulted in us rejecting contracts that we thought were loss-making when they were in fact profitable. We can now be more confident with our pricing decisions and should continue to push this product to help drive profit.

Platinum model

Gross profit per unit under absorption costing	£10.63
Gross profit per unit under ABC	£18.15

Under traditional absorption costing we were led to believe that the Platinum was our least profitable product. It turns out it's actually our most profitable! When at full capacity, it is likely we were rejecting orders for this model to give priority to Basic and Custom orders. **We now realise that this has been detrimental to our profitability and that the Platinum should be given top priority when capacity is limited**. We also have more flexibility when it comes to pricing as the model has a higher gross profit margin than we originally thought. We could suggest that our marketing efforts are directed towards this model to increase the volume sold and our overall profitability.

Custom model

Gross profit per unit under absorption costing	£14.00
Gross profit per unit under ABC	(£2.56)

Under our traditional costing system it appeared that this product was our most profitable. This might have seemed plausible given that it demanded the highest price. However, ABC illustrated the significant amount of overhead required to produce this item which turned out to be selling at a loss.

When looking at the breakdown of overhead costs, it is clear that producing the Custom model requires significantly more time for testing, quality inspection and materials sorting (up to 3 to 4 times more) than our other models. ABC is ideal for costing products such as this which are highly customised and diverse; a type of product that absorption costing has a tendency to under-cost.

Due to the improved costing information provided by ABC, we now know that we must make changes to this product line in order for it to be feasible. Some of our options are:

Pricing – Increase the selling price to make it profitable! If it costs you £2 to make, sell it for at least £2.01, and you'll always make profit on the products you sell!

Cost driver analysis – Investigate more efficient methods of testing, quality inspections and materials processing in order to reduce cost. Cost reductions in these areas would benefit all product lines.

Review production process – Determine whether the high amount of tests and quality inspections are necessary. Custom models currently require 10 to 12 times more tests and inspections than a Basic model.

Change product – Consider if we should discontinue production of the Custom model and concentrate on the already profitable Basic and Platinum models. This is an ideal option if capacity is limited.

4. Advantages and disadvantages of ABC

When to use ABC

It is important that you can identify the most favourable conditions for ABC so you know when it might be beneficial to implement.

ABC's improved accuracy over traditional marginal and absorption costing techniques generally occurs at the batch level and the product level. **Therefore ABC is most effective in environments where a diverse product range is being produced and items are produced in small batches rather than long, continuous production runs**. It is also well suited to environments where the method of producing each product is very different. If each product follows a similar production process, it is unlikely that ABC will produce results that differ greatly from a traditional costing system.

It is also important that ABC is implemented in environments where overhead costs are high in comparison to direct costs. Obviously, direct costs such as materials are easy to allocate and do not require a complex costing system like ABC. The service sector or products which require heavy research and development are good examples of environments that may be suitable in this regard.

We know that a key difference between ABC and traditional absorption costing is that traditional methods assume overheads are volume-related whereas ABC does not. Therefore, it makes sense that ABC will produce the best results where costs are not driven by volume, but instead by things such as complexity of product or level of customisation. As we saw in our toy car example, the Custom model was not produced in high volumes but was expensive to make because it was unique and required high amounts of testing and special materials. It is in environments where such types of products are being made that ABC will be effective.

The advantages and disadvantages of activity-based costing are highlighted below:

Advantages

Improved pricing

With ABC, **managers have a more accurate indication of how much a product actually costs to make.** This tells them how much they need to sell it for in order to make a profit.

Improved cost control

By identifying cost pools and their drivers, management has a greater ability to pinpoint inefficiencies and address them. For example, if the machine set-up cost pool is over budget, management can trace that to the associated driver, which is number of machine set-ups. Managers can then look at ways to reduce the number of machine set-ups, perhaps by increasing the size of the batch, or ways to reduce the cost of a machine set-up.

Improved product mix

When producing several products we need to decide how much we should be producing of each. This is known as the product mix. **ABC helps us optimise our product mix by determining which of our products is most profitable.**

Improved profitability analysis

With **more accurate costing information, comes improved profitability analysis of our products, our customers and our overall operation.** This allows us to make effective decisions to improve our profit, which is typically the ultimate goal of being in business, and overcomes the short-termism that is present in traditional marginal costing systems.

Disadvantages

Cost

ABC is not easy to implement. If you thought it was complicated working through our example of three products on paper, imagine a real-world analysis of a factory making tens or even hundreds of different products! **Breaking down products and**

their production process is both time consuming and expensive, which can stop ABC from being viable.

Not always suitable

ABC is of limited benefit if overhead costs are low or are mainly volume related. It is also ineffective if only one product is being produced or if every product is produced in a similar way

Not required by IAS

IAS2 only requires an 'appropriate' amount of absorption of fixed overheads. ABC fulfils this requirement, but such a comprehensive approach is unnecessary, at least for financial reporting purposes.