FROST PROCUREMENT ADVENTURER | Mintec

Mintec Insight Series

Is cost the final driver for mass plant-based adoption?

Series 2 The Meat Comparison

This report aims to answer four key questions

1. What are the adoption factors that will drive plant-based meat consumption?
2. How will the costs of plant-based meats evolve and what impact will this have on consumer uptake?
3. What are the market dynamics between conventional and plant-based meats?
4. What could the plant-based industry look like in 20-30 years' time?

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Mintec
Benchmark Prices

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Mintec's proprietary prices, known as Mintec Benchmark Prices (MBP), have a strict methodology to ensure all published prices are representative of market value and bring unbiased transparency to the commodity world.

WWW.MINTECGLOBAL.COM/METHODOLOGY

Introduction

In our previous Mintec Insights Series we compared dairy milk against its plant-based alternatives. Even more high profile than this battle is the rapid development of plant-based meat and the challenge it is giving to conventional meat. In terms of market share, plant-based meat, accounts for just 1% of the total meat market; on the face of it, not exactly game changing! But this 1% doesn't tell the whole story. In today's world, the consumer is much more aware of what they are eating and the impact it has on their health and the environment. Add to this an entrepreneurial spirit to set up disruptive challenger brands and surges forward in technology that enables businesses to attract consumers at scale, means change is happening quickly. The question is just how quickly will the 1% share of plant-based grow and the 99% share of meat decrease?

In this white paper, we address the following questions:

1. What are the adoption factors that will drive plant-based meat consumption?
2. How will the costs of plant-based meats evolve and what impact will this have on consumer uptake?
3. What are the market dynamics between conventional and plant-based meats?
4. What could the plant-based industry look like in 20-30 years' time?

To do this, Mintec has teamed up with Simon Frost, founder of Frost Procurement Adventurer, and Marta Zaraska, freelance science journalist who writes for Scientific America, National Geographic and has published the bestselling book 'Meathooked'.

Adoption

For plant-based meat alternatives to grow their share there are a number of adoption factors that need to be satisfied. We've identified 6 key factors:

#	Driver for adoption
1	Taste & appearance
2	Fit for purpose
3	Ease of preparation
4	Available to buy
5	Emotional Connection
6	Cost

So, how well are plant-based meats measuring up?

For a plant-based meat product to have any chance to rival conventional meat, it has to taste delicious and have similar characteristics of texture and colour. Ultimately, the consumer which is 90% flexitarian has to trick themselves into believing they're eating real meat. Many of the plant-based meats are now such good mimics that it can be hard to tell the difference, to the extent that top chefs and food journalists have been fooled in blind taste tests.

Nutritionally, plant-based meats need to have similar nutritional properties to conventional meat – i.e. similar protein, fat and carbohydrate levels. Broadly speaking they do.

The consumer and professional chef will find they don't need to adapt their habitual cooking skills to prepare and cook plant-based meats as it's no different from when they cook meat. Companies such as Beyond Meat, Impossible and THIS have refined their products so that the consumer can fry, grill or prepare the plant-based product in the same way as the meat product would be prepared.

Over the last couple of years there has been an explosion of plant-based meats and we can buy them more easily. Supermarkets in the US and the UK have done an excellent job with their positioning and display of products – they're positioned alongside meat rather than tucked away in the furthest freezer. The out-of-home market is undergoing a rapid adaptation to consumer needs too. Many chefs will now include plant-based meat offers on their menus in canteens, pubs and restaurants. Even fast food chains, bastions of meat, are changing – McDonalds, Burger King and KFC all have plant-based offers. Supermarkets in other countries, like France or Germany, are still lagging behind with plant-based products still hard to find in many supermarkets.

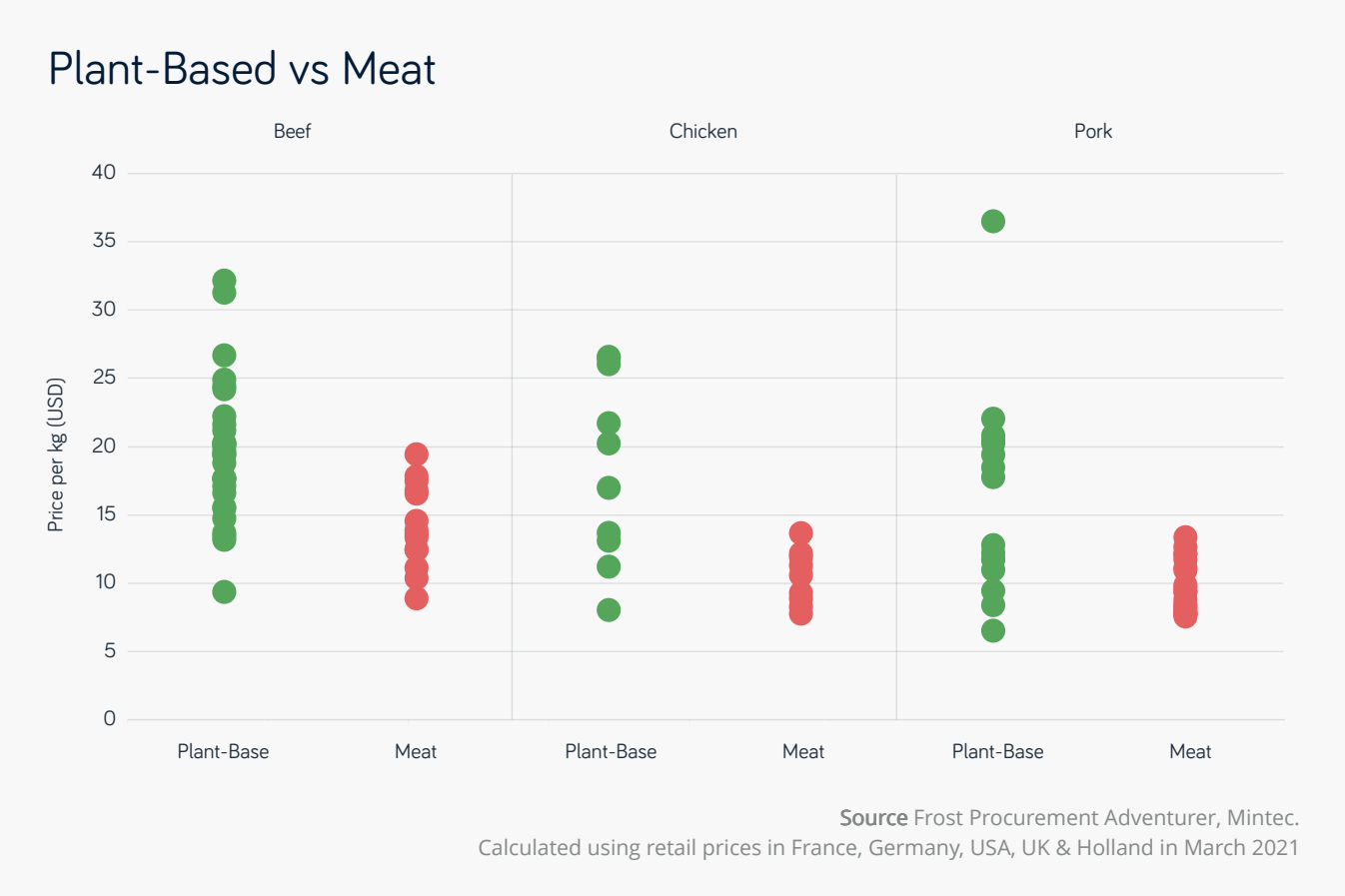
How do we feel about plant-based products? Barely 10-15 years ago, being vegan or vegetarian risked the consumer being an outsider. It wasn't cool. This is starting to change now - celebrity chefs, bloggers and plant-based brands have done an incredible job to raise the profile of the plant-based revolution. One only needs to type in the word 'vegan' in Instagram to appreciate the array of delicious recipes available.

So, factors #1-3 are a strong pass and factor #4 is coming on leaps and bounds in some countries (e.g. UK) but taking longer in others (e.g. France). Factor #5 is progressing quickly, but still depends heavily on the country and demographics of the consumer. This just leaves the final factor of 'cost' and this is where we'll focus for this white paper. How closely to the prices of plantbase products align to meat and how could the evolution of these prices affect the mass adoption of plant-based meat?

The Plant-Based Price Premium

Analysis shows that on a per kilogram basis, plant-based meats are currently priced, on average, at 60% more than their conventional alternatives.

Considering that many consumers are already prepared to pay this 60% premium for plant-based meat, just think what will happen to adoption when plant-based meat reaches parity with real meat. And if we dare to think beyond this, could plant-based meat prices drop below real meat?



Source Frost Procurement Adventurer, Mintec.
Calculated using retail prices in France, Germany, USA, UK & Holland in March 2021

Seth Goldman (chair of the board of Beyond Meat) was recently quoted as saying, it's not about the 'Tipping Point' but about the 'Flipping Point'. As plant-based meats reach parity on taste and price, the question is not "why do we need plant-based meats?" but rather "does humanity still need meat?". Seth predicts the flipping point could be reached within the next 5 years.

Seth's point was echoed by Agri and food tech investor Jim Mellon who was recently quoted in the Financial Times as saying, "it won't be long until you get to griddle parity (meat will be like for like on the BBQ in terms of all adoption factors) – then you'll get mass consumer adoption."

> "it won't be long until you get to griddle parity (meat will be like for like on the BBQ in terms of all adoption factors) – then you'll get mass consumer adoption.

Production and Consumption of Meat

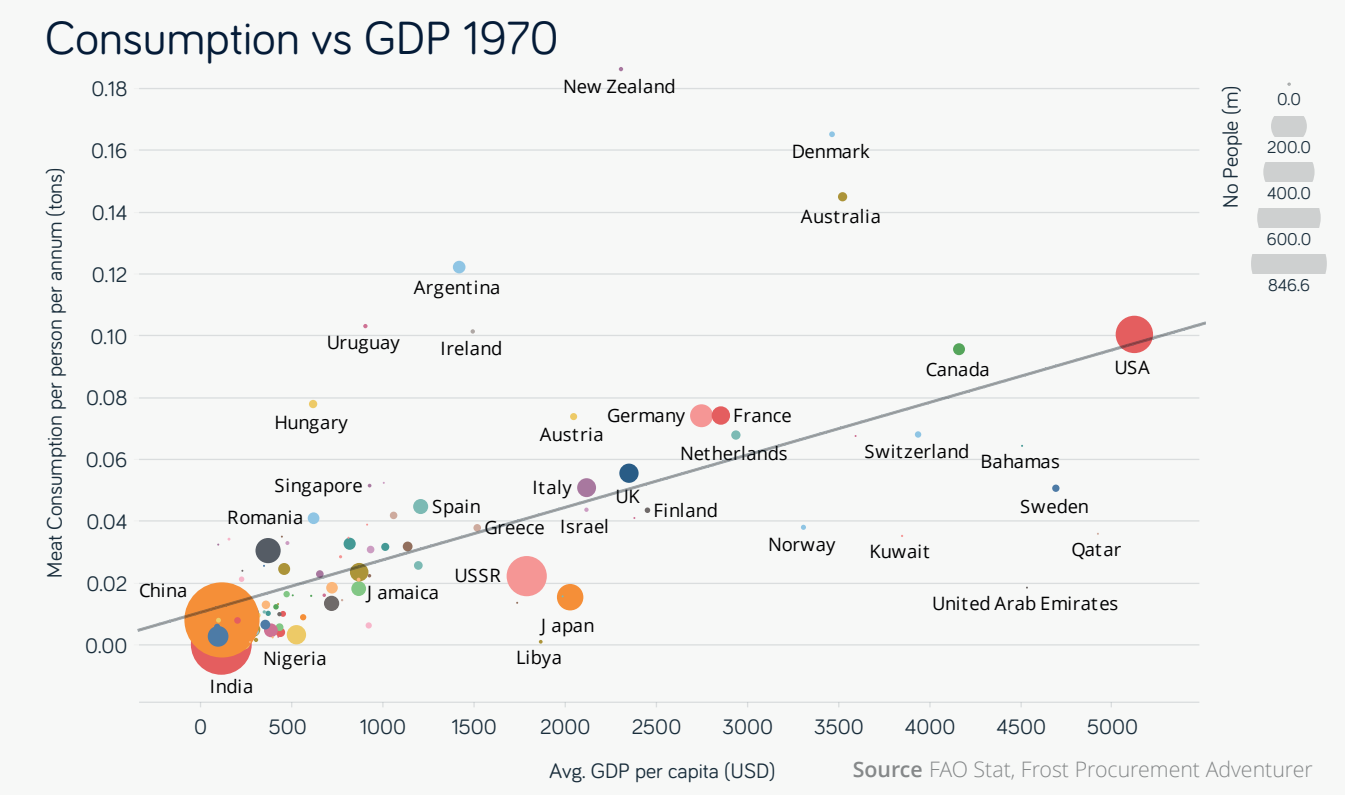
To understand the cost of plant-based meat alternatives and how their prices will evolve over time, we need to first look at the production and consumption of conventional meat.

In 2021 the total world consumption of meat is forecast to be at just under 350 million mt, more than the entire weight of all 7.8 BN humans on earth (if we all got on the scales, we would weigh 316 million mt). Compare this to 1960 when the global meat production was just a fifth of what it is now (65 million mt) when the population was 3 BN (we all weighed 122 million mt then). So meat consumption per person has doubled in 60 years.

What do we eat most of?

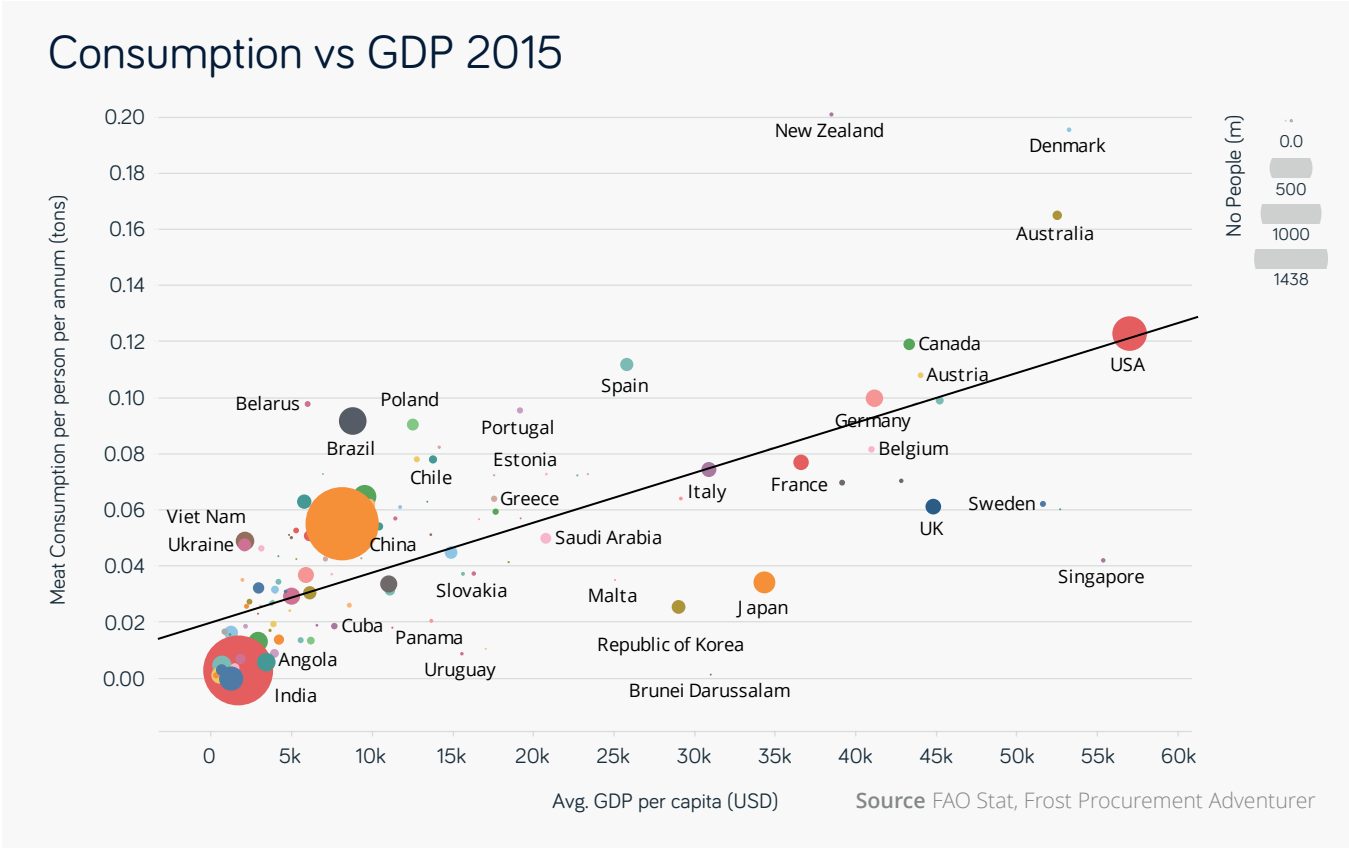
Rank	Product	Consumption	Percentage
1	Pork	125 million mt	37%
2	Poultry	124 million mt	36%
3	Beef	74 million mt	22%
4	Lamb	16 million mt	5%

Access to land and to cheap and nutritious animal feeds have helped production. So too has the ability to scale and drive efficiency gains throughout the food chain. Animal breeding, indoor production facilities, abattoirs, transportation, cold storage and packaging has certainly helped the supply of meat to feed our growing population. This is inevitably an area where the meat industry is decades ahead of the plant-based market which still needs to grow its economies of scale.

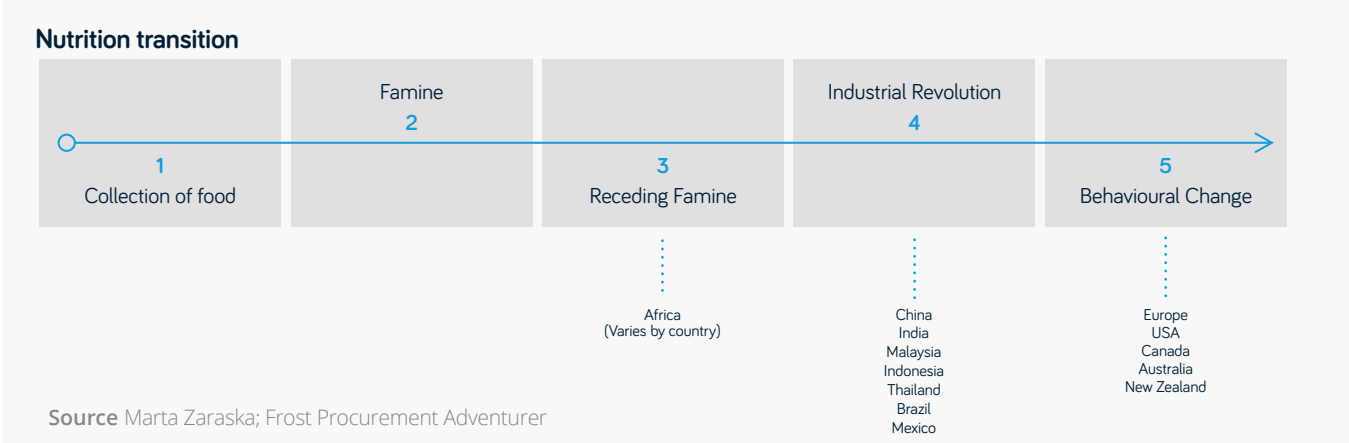


Except for very few countries, an increase in a nation's wealth increases that country's meat consumption proportionately. In no country is this dynamic more visible than in China as can be seen from the graphs.

In 1970 the average meat consumption in China was 8kg per person per year. With China's 'Great Leap Forward' and rapid wealth creation, consumption had jumped to 55kg pa in 2015. If/when China's wealth reaches parity with the US, then with their current population of 1.4BN, they would consume 140million mt of meat, 40% of the current global production:

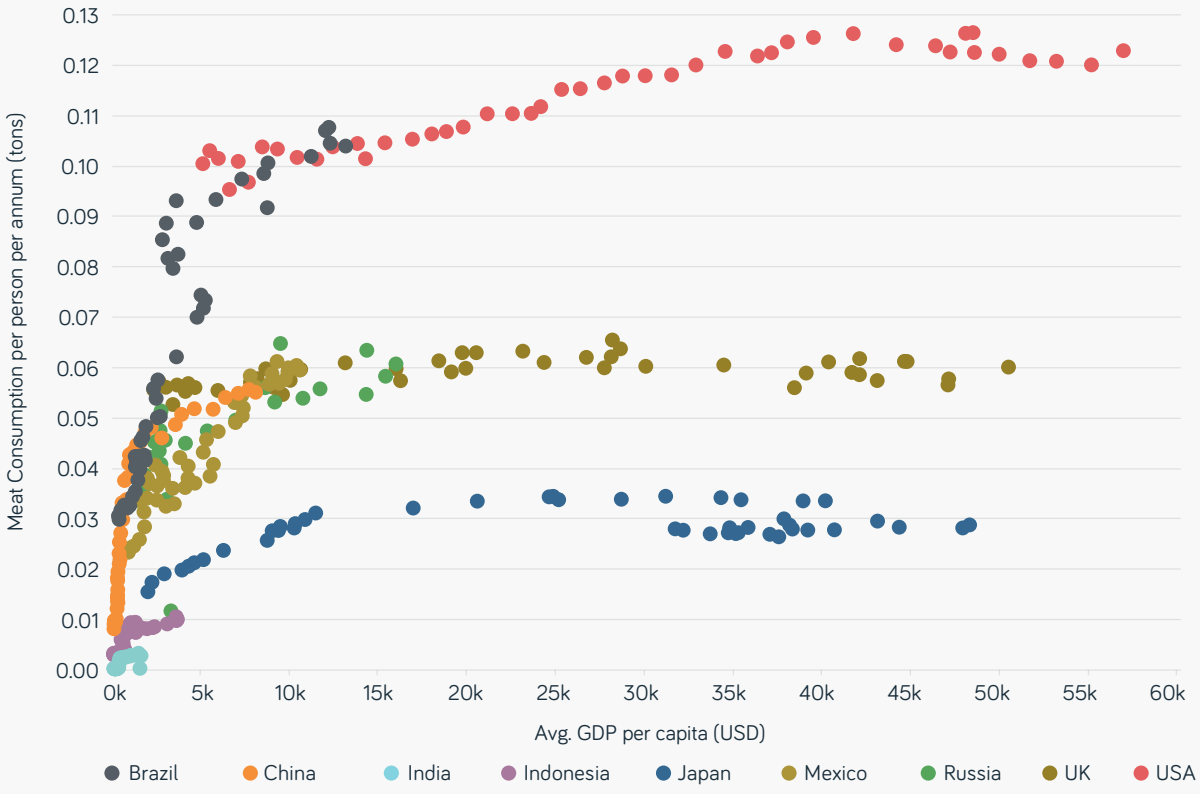


Societies/Countries typically go through a nutritional transition. This starts with the collection of food (the hunter-gather stage) through the cultivation of crops to the Industrial Revolution when the creation of wealth and mechanisation results in a significant increase in meat consumption. Developed countries have had many years of industrialisation and so their meat consumption is now relatively stable. Developing countries see rapid surges of meat consumption as they industrialise. It's only when a country has enjoyed the benefits of industrialisation might they then start questioning, "what is the impact on our health and the planet of our high meat consumption?" At this point the fifth stage (behavioural change) can begin when diets become less meat based.



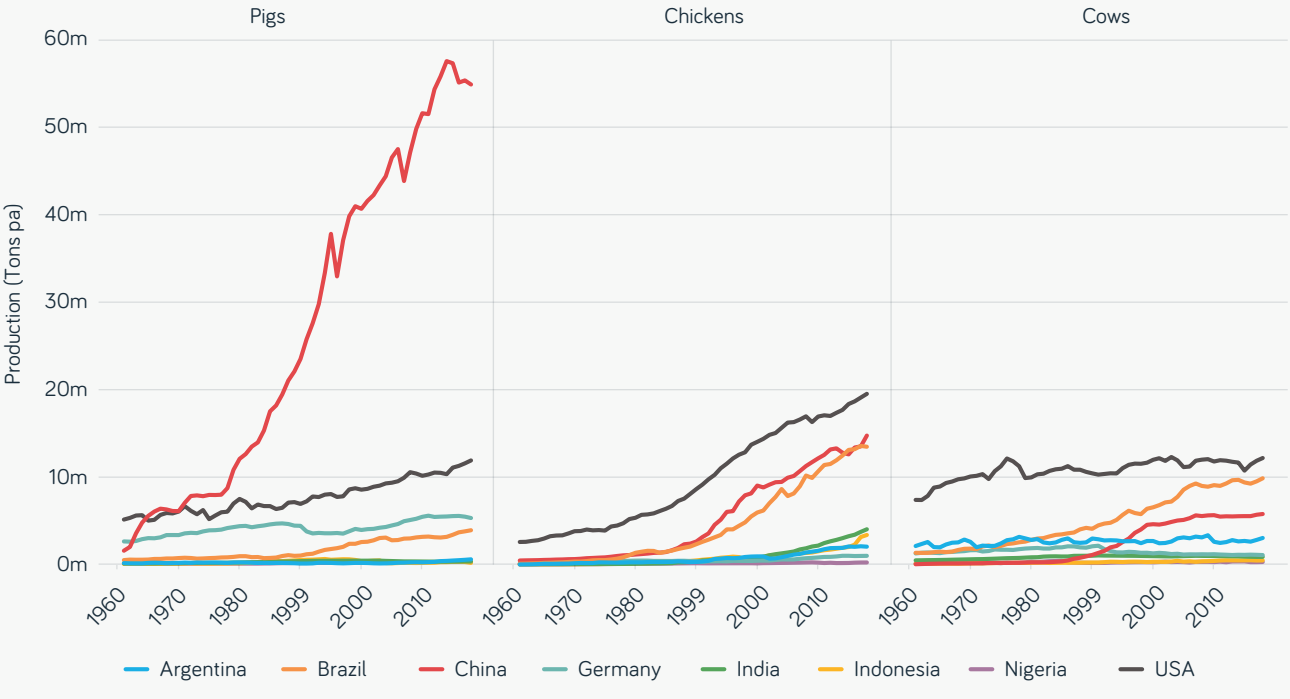
Of course, the relationship isn't exactly linear for every nation. Why, for example, at like-for-like GDP per capita is the consumption of meat in Brazil higher than in China whereas Indonesia and India are lower, and Japan is flat with an increase in GDP? Of course, historical diets, regional cuisines and religious and cultural factors come into play.

Meat Consumption vs GDP by year (1970 to 2015)



Source Frost Procurement Adventurer

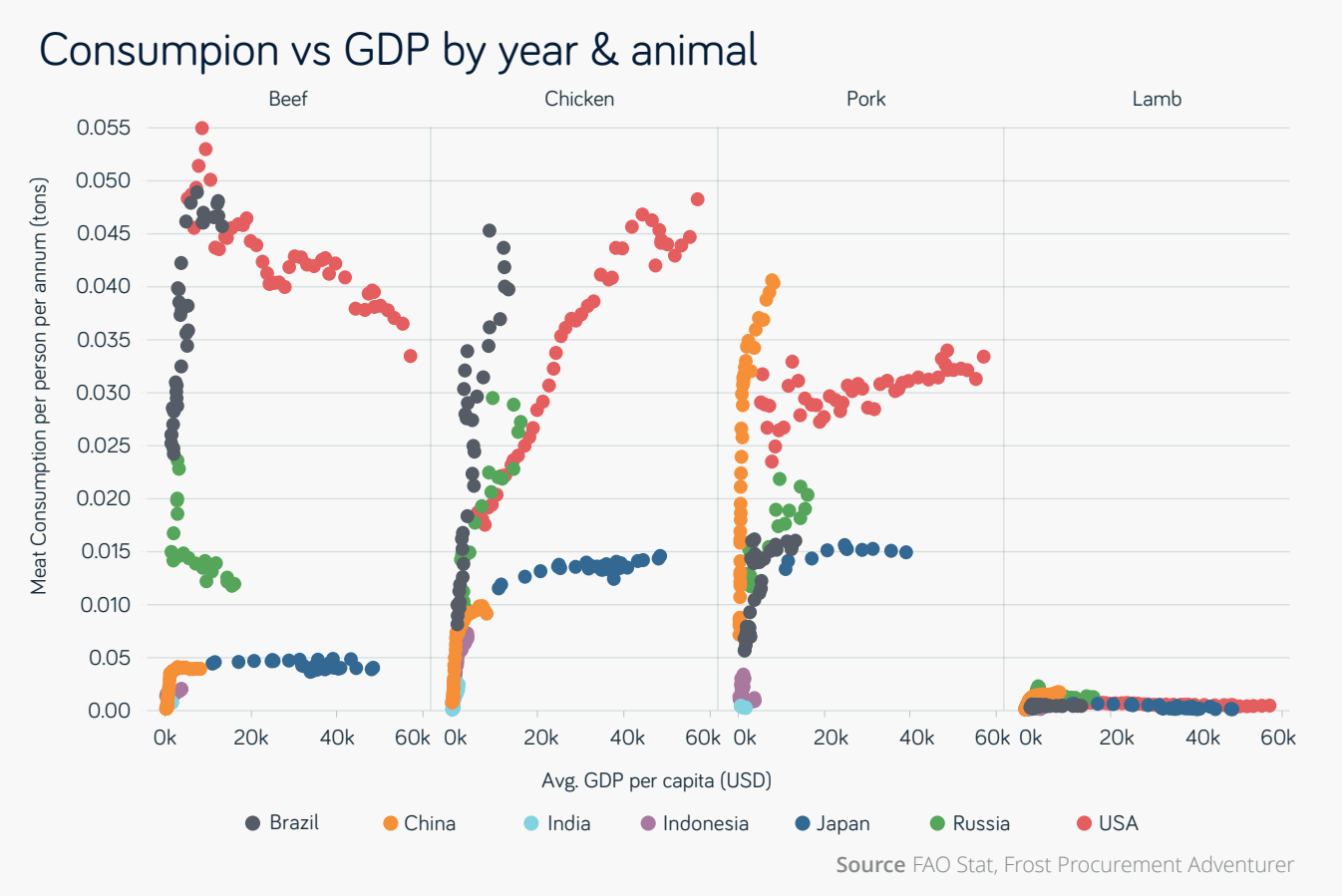
Animal production



Source FAO Stat, Frost Procurement Adventurer

The desire for different types of meat will vary considerably by country. In China the pig is a symbol of wealth and security, particularly favourable given China's famine ridden past. As pigs can be reared quickly and cheaply they have seen a surge in production with China's wealth creation. Beef was the most preferred meat in the US but consumption started falling from the 1970s due to scientific findings concerning the health impacts of saturated fats. Chicken became a natural alternative.

Let us go back to our notion of 'adoption' and remind ourselves that we are looking at 60 year time horizons during which meat products were adopted, certainly in countries such as China. So, looking at the steps forward the plant-based industry has already made during the last five years indicates that 'adoption' of plant-based products is on track to be faster than that of meat.



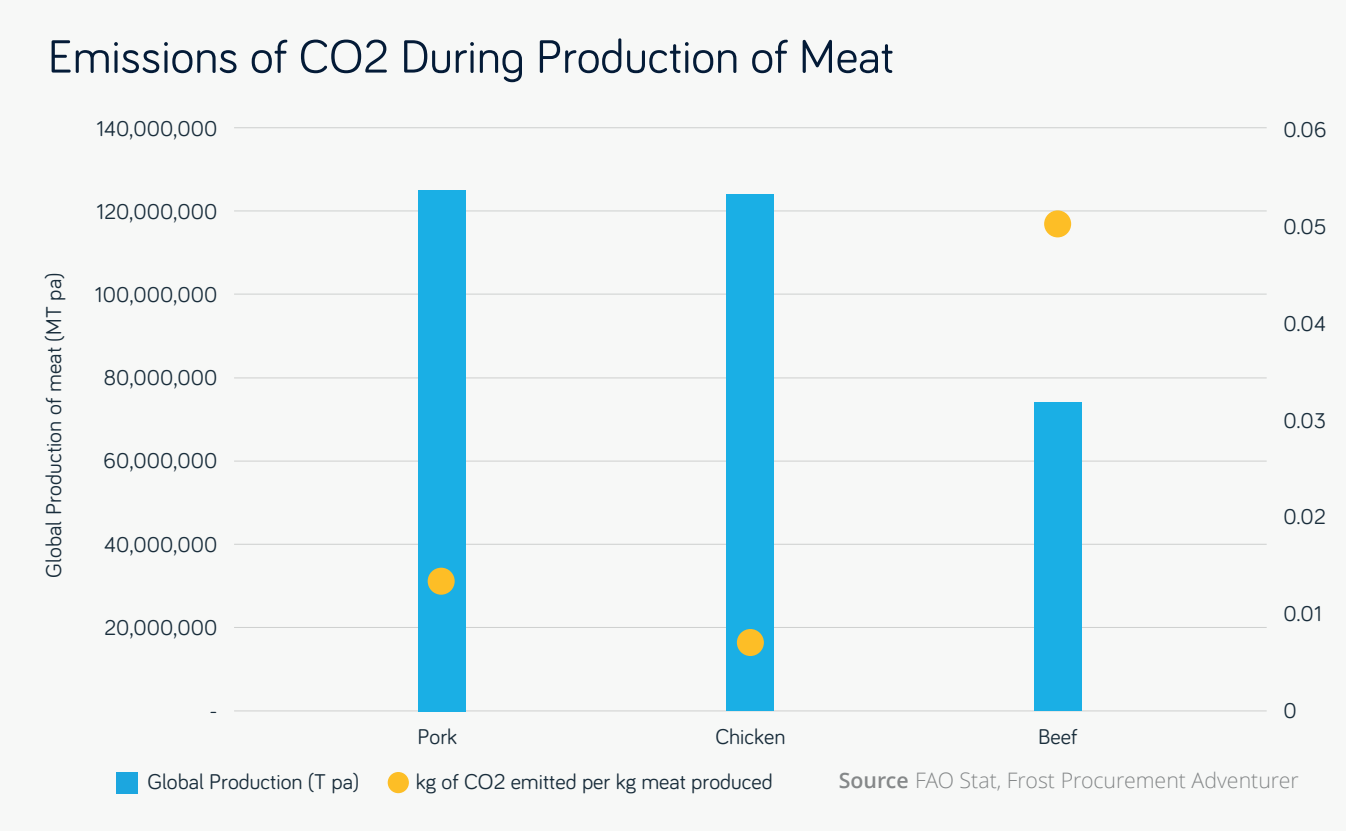
Another takeaway from this analysis is also that plant-based meat brands will need to tailor their product range by country. Contrasting and comparing one country with the next will reveal significant differences that will influence the adoption of a plant-based product. For Brazil, beef and chicken are key; whereas in Russia, beef consumption has been going down with chicken and pork picking up. For India, the entry point is chicken. For the Japanese it's less about meat; the consumer needs to be tempted with fish alternatives.

Plant-Based Alternatives to Beef

We're now going to have a deep dive into the costs of meat - we've chosen to focus on beef and their plant-based alternatives. Why beef? Because the beefburger 'wars' are intense and with many plant-based burger brands it provides the most meaningful like-for-like

comparisons. Furthermore, beef is the greatest polluter of CO2 and methane emissions of all the meats and therefore the plant-based alternative also has the most positive sustainability impact.

Thanks to emission certificates and CO2 allowances, which are now exchange traded, it is possible to estimate the cost, or negative externality, that producing and transporting meat creates.



The Unaccounted Cost of Emission on Beef Consumption

Using the information from the diagram as well as data from a study of the Food and Agricultural Organisation of the United Nations (FAO) which estimates that for every kilogram of beef transported, 67.8kg of CO2 are emitted, we can approximate the total negative externality of producing and transporting beef.

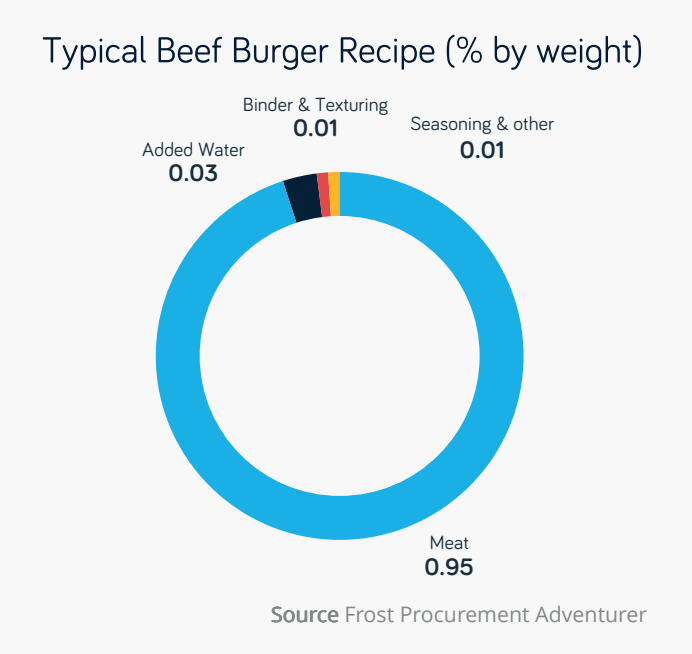
Mintec Analytics shows the price for CO2 emission per kilogram in Europe, converted to USc per kg at 6 USc/kg in May 2021. If we use this price as a guide, this brings the cost for global CO2 emission from beef production and shipping to $4.49 for each kg of beef consumed. In contrast, the retail price for a kilogram of grass-fed Rump Beef is $21.54/kg according to the Mintec platform. This negative externality however is not incorporated in the beef price as emission certificates are a European phenomenon and a significant amount of beef production and transportation occurs outside of Europe.

The price for beef should be around 20% higher, and the $4.49/kg should be used to tackle climate change issues. Naturally, if this negative externality would need to be paid, the beef burger cost model we will look at in later sections would become more expensive and likely make adoption of plant-based alternatives easier from a cost competition stand-point.

Recipes

Beef Burger Patty Recipe

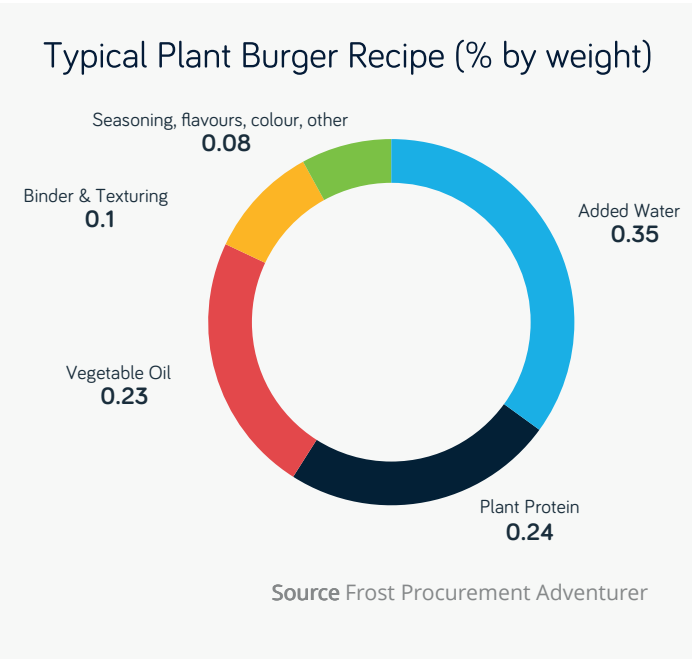
The recipe for a real beef burger patty is extremely simple, and in the case of a high-quality burger, made almost entirely of meat, often up to 95% of the total product. The only additions are a small number of binders, spices and seasoning. So, the cost of the recipe is dictated by the cuts of meat used and the market dynamics for beef. Beef burgers are typically made from the chuck and flank cuts:



Plant-Based Burger Patty Recipe

In stark contrast, a plant-based burger patty has a much more diverse range of materials. To mimic real meat there needs to be an amount of plant-based protein, vegetable oil instead of animal fat and binders to hold these materials together. Flavours, colours and other additives are also needed as the plant proteins lack palatable flavours and appetising colour.

And water gets added as plant proteins come in powdered form - no different from meat having a percentage of moisture already in it.



The two powdered plant proteins of choice are from pea or soya. Soya is choosen for its excellent 'gelling' properties and water retention whilst pea is considered more sustainable, with a low allergen risk. Other plant proteins sometimes used are derived from rice or wheat. More adventurous recipes might use mushroom based materials or jackfruit. Mintec is the only company that publishes audited and assured plant protein prices making Mintec the leader in price transparency and thought-leadership in the plant-based space.

The Difference in Ingredients and the Scope for Plant-Based Products to Evolve

The additives in the plant-based products are still a point of contention as several market observers ask the question how sustainable and 'healthy' it is really if a product that has, on average, five ingredients is replaced with a product that averages three times the number of ingredients of the meat product.

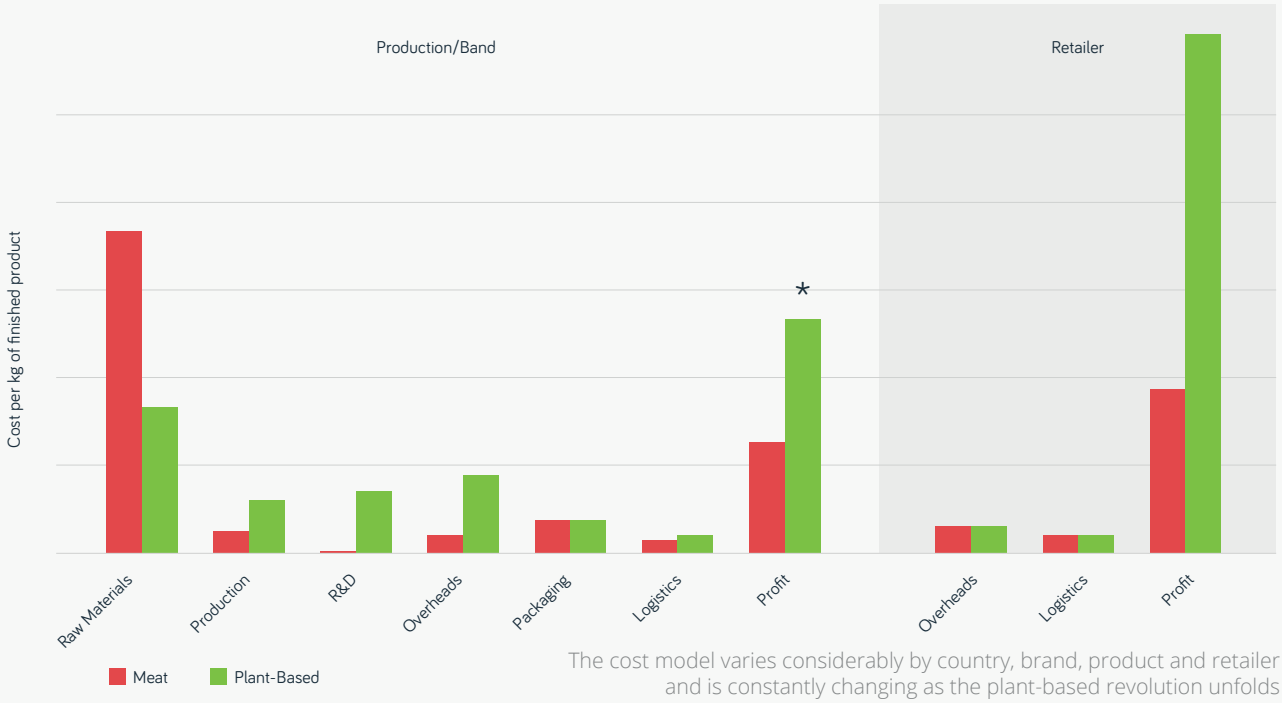
As part of this thought leadership piece, we have analysed the typical ingredients of a range of manufacturers for minced meat patties and plant-based patties. The table clearly shows how many extra ingredients a plant-based patty needs to carry to achieve a similar texture and flavour to the meat product.

Item	Av. number of ingredients	Typical ingredients
Meat Patty	5	Minced Meat, Yeast Extract, Salt, Pepper, Sodium Metabisulphite
Plant-Based Patty	18	Pea or Soya Protein, rapeseed oil, coconut oil, water, yeast extract, Methyl Cellulose, Asorbic Acid, Soya Lecithin, Niacin, Zinc, Vitamin B6, Vitamin B2, Salt, Onion Powder, Yeast Extract

Cost Comparison

The cost model comparison shows that raw materials are by far the greatest driver to produce both conventional beef and plant-based burgers. Profits for both the plant-based patty manufacturers and the retailers are significantly healthier for plant-based products than for their meat counterparts. Though profits are typically re-invested to drive new product development (NPD), geographical expansion, and the acquisition of new consumers. Some brands are also re-investing considerable funds into new production technologies and factories and backward- integrating to secure supply. The graphs show that retailers can make strong profits out of plant-based products which would explain why several retailers have developed their own fully branded products – as opposed to just own-label, which attracts lower profit margins. So, like-for-like on-shelf, plant-based products should attract higher profits for the retailers than conventional meat:

Comparison of Meat Patty vs Plant-Based Patty



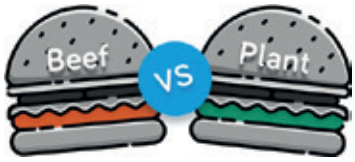
The cost model varies considerably by country, brand, product and retailer and is constantly changing as the plant-based revolution unfolds

*** typically reinvested**

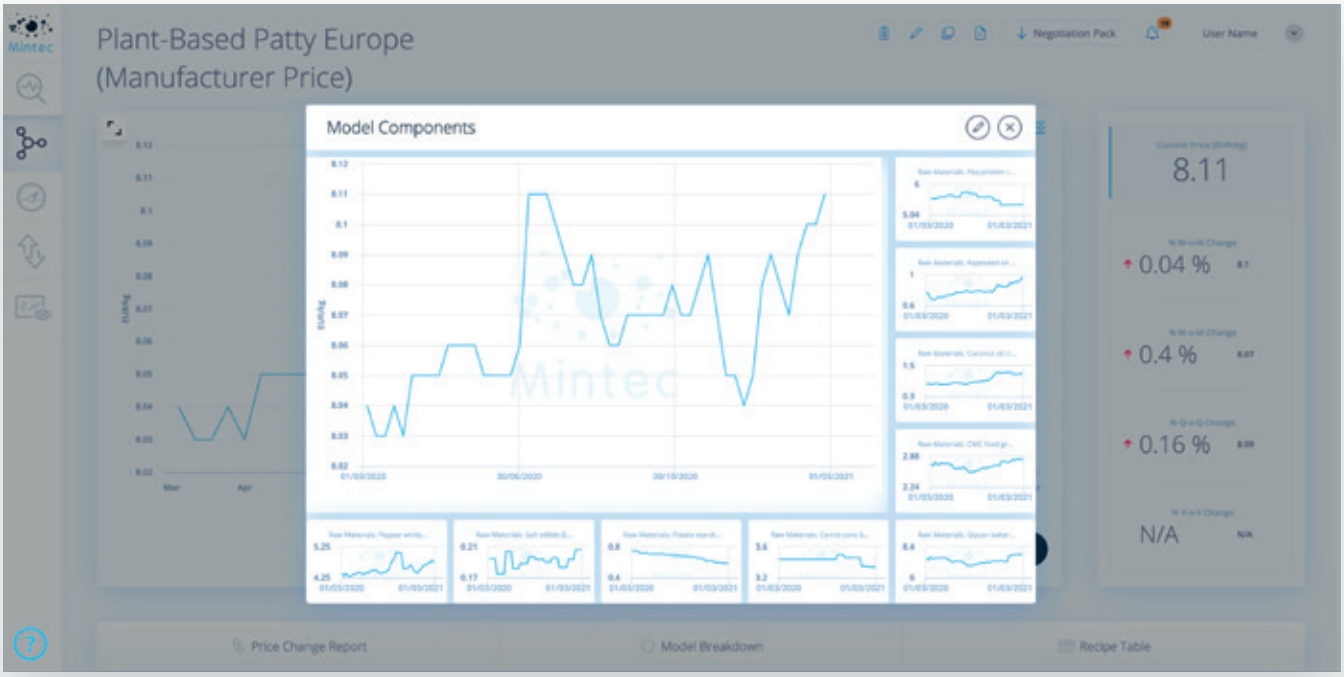
Source Frost Procurement Adventurer, Mintec Analytics

MINTEC COST MODELS

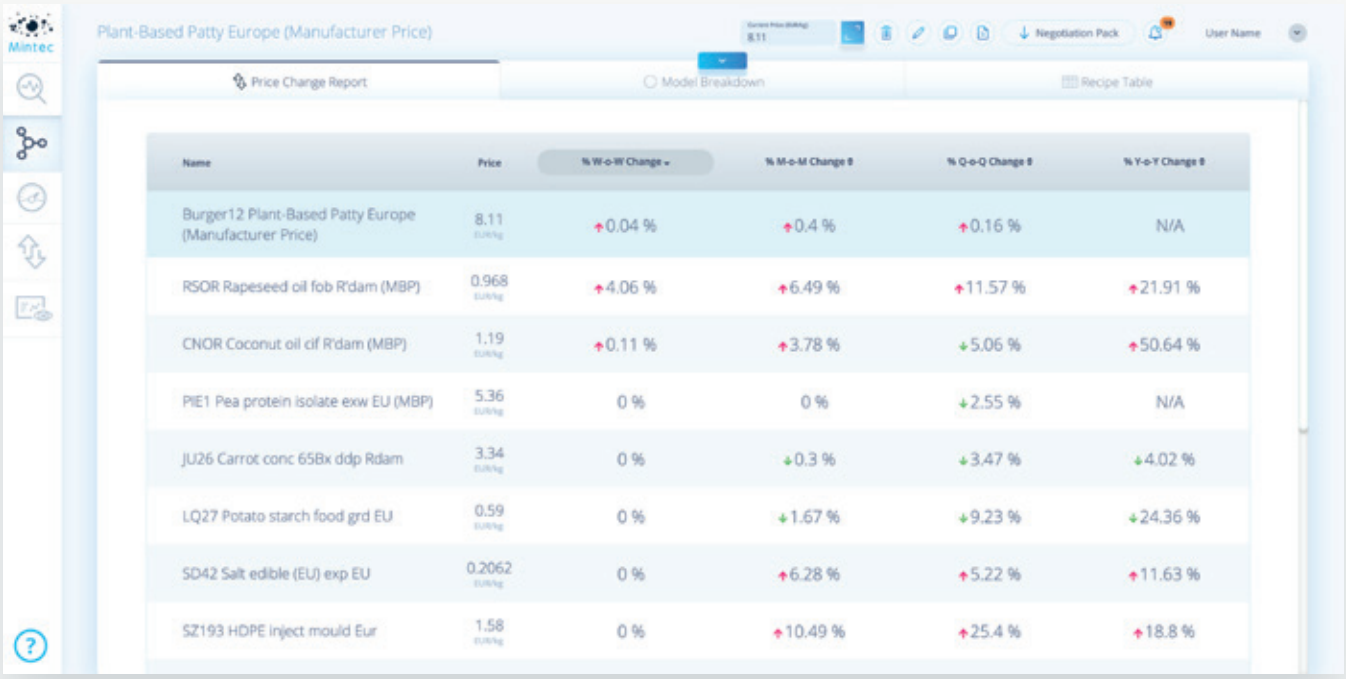
Get a Clear Picture of your Plant-Based Product Costs



Compare Your product ingredient costs based on Your individual product specifications



Burst your Cost Model to see individual price graphs for each product ingredient or costs - all in one place.

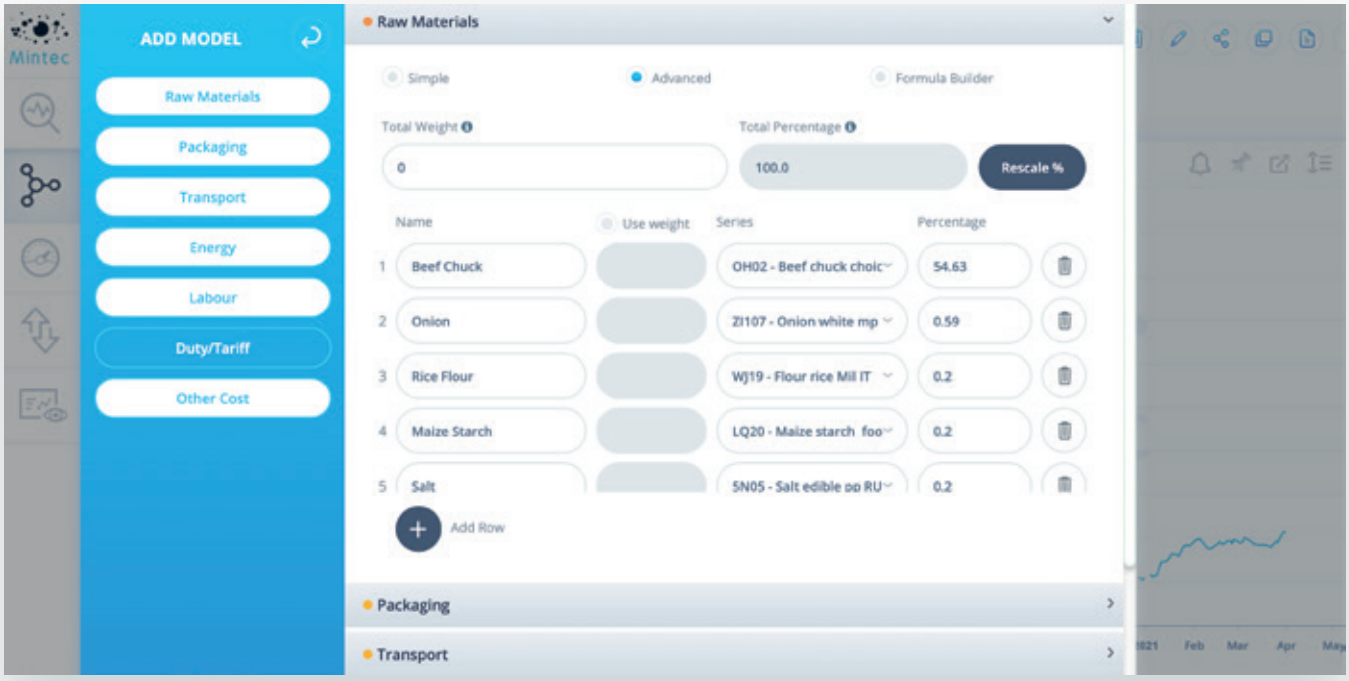


Build individual product Cost Models for all your products to visualise, chart, track and compare the impact of price changes on your direct costs.

Whether it's a meat product or plant-based alternative Mintec Cost Models ensure you have complete visibility over all your ingredient costs.

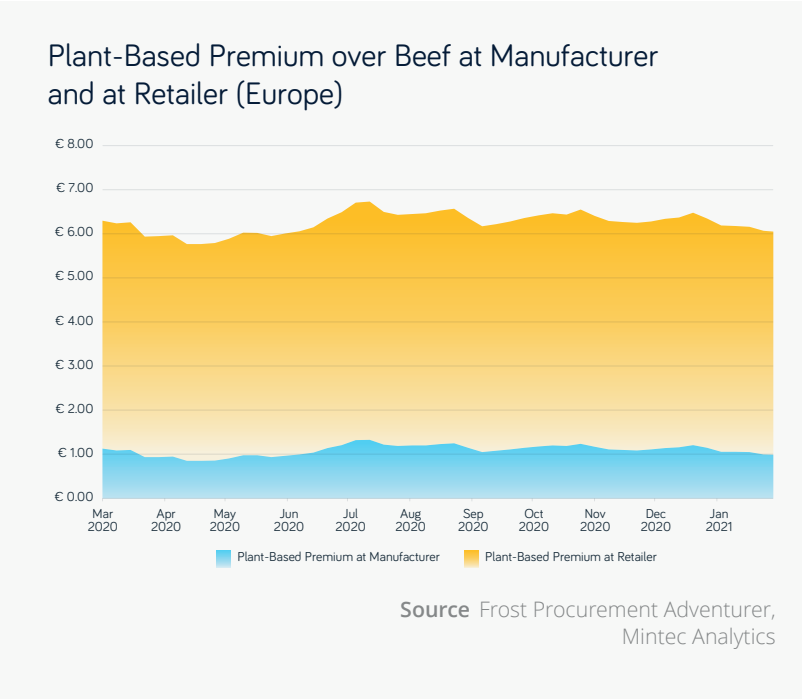
www.mintecglobal.com/costmodels

Drill down and interrogate your product specification to gain insights into the trends and patterns behind what is driving your overall product costs.



Mintec Analytics enable you to build Cost Models based on the exact product specification, using all the weights and measures for all ingredients quickly and easily.

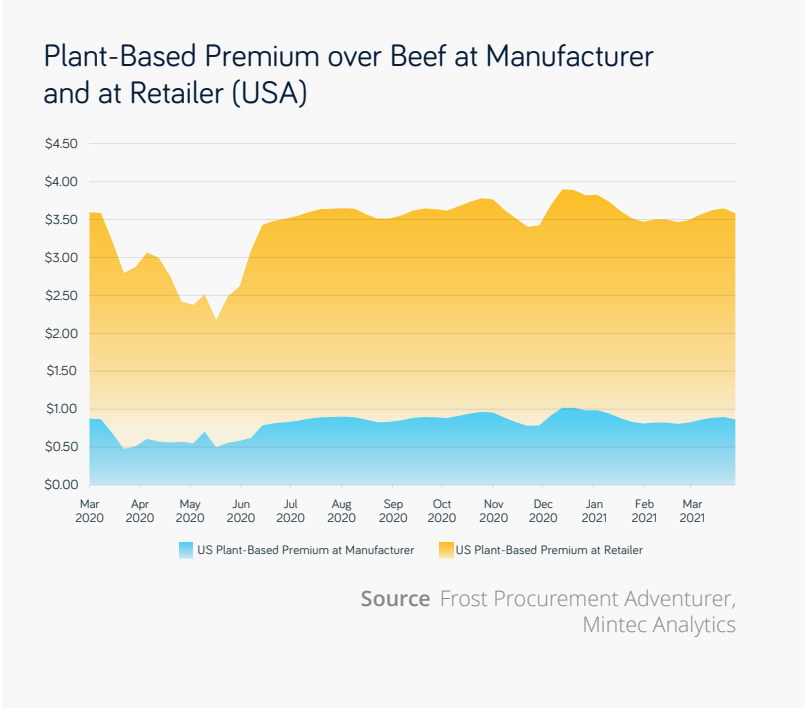
After leaving the manufacturer the plant-based patty is €1.05/kg more expensive in Europe and $0.87/lb more expensive in North America than the meat patty. Interestingly, once the product is available on shelf at the retailer the price difference between a plant-based patty and a beef patty has increased threefold in the USA to $2.71/lb and increases by a factor of five to €5.12/kg in Europe.



These price differences are significant and spell out why cost is the driver to mass adoption. With grocery spend having increased since the beginning of the pandemic, buying plant-based adds another layer of cost, one which the average consumer may not (yet) be willing to pay.

However, the reason for the significant price increases at the retailer also needs to be discussed. Most meat products do not need extra 'advertising' in a supermarket as humanity is used to meat products, knows what it tastes like and how to prepare it. This is different for plant-based products, in particular when we consider that 90% of plant-based food is consumed by flexitarians; consumers that eat both: meat and plant-based products. Therefore, attention needs to be drawn to where the products are in store, how good they taste and how easy they are to prepare. All this costs the retailer, and sometimes the manufacturer, money.

Furthermore most plant-based products remain on the shelf for a longer time than meat products as there simply is more demand for meat products. Therefore, when the retailer 'makes space' for the plant-based product by substituting meat products out, the plant-based alternative either needs to sell as fast as the meat product or, if it doesn't the price for the plant-based product needs to be increased so that the profit margin can remain similar even if the product sells in smaller volumes.



These are important points to consider when looking at the cost of plant-based alternatives at the manufacturer and retailer level and it is vital not to interpret the 'six times higher margin' as 'extra profit taking' by the retailer, but rather as a means to mass adoption. The more plant-based products consumers buy, the lower the price for the product can be as less needs to be spent on marketing while a similar margin can be achieved over the same time period.

The Mintec platform, Mintec Analytics, and its cost modelling tool has enabled us to combine all costs that make up the plant-based and beef patties. This means, for the first time, the true costs of plant-based and beef patties can be analysed by taking raw materials, transport, labour, overheads and profit margins into account to produce a streamlined cost model that produced manufacturer and retailer prices for plant-based and beef patties in Europe and America.

The table below shows average prices for Q1 2021

Product	Price	Plant-Based premium over Beef Patty
Plant-Based Patty Europe (Manufacturer)	€8.10/kg	€1.05/kg
Beef Patty Europe (Manufacturer)	€7.05/kg	
Plant-Based Patty Europe (Retailer)	€14.56/kg	€5.12/kg
Beef Patty Europe (Retailer)	€9.44/kg	
Plant-Based Patty USA (Manufacturer)	$3.28/lb	$0.87/lb
Beef Patty USA (Manufacturer)	$2.41/lb	
Plant-Based Patty USA (Retailer)	$6.21/lb	$2.71/lb
Beef Patty USA (Retailer)	$3.50/lb	

Materials

As the earlier graph showed, raw materials are a significant driver for the cost of the product and the greatest determining factor for finished product cost. In this section we will dive deeper into how the raw material prices have behaved over the recent years and what the expectations are going forward.

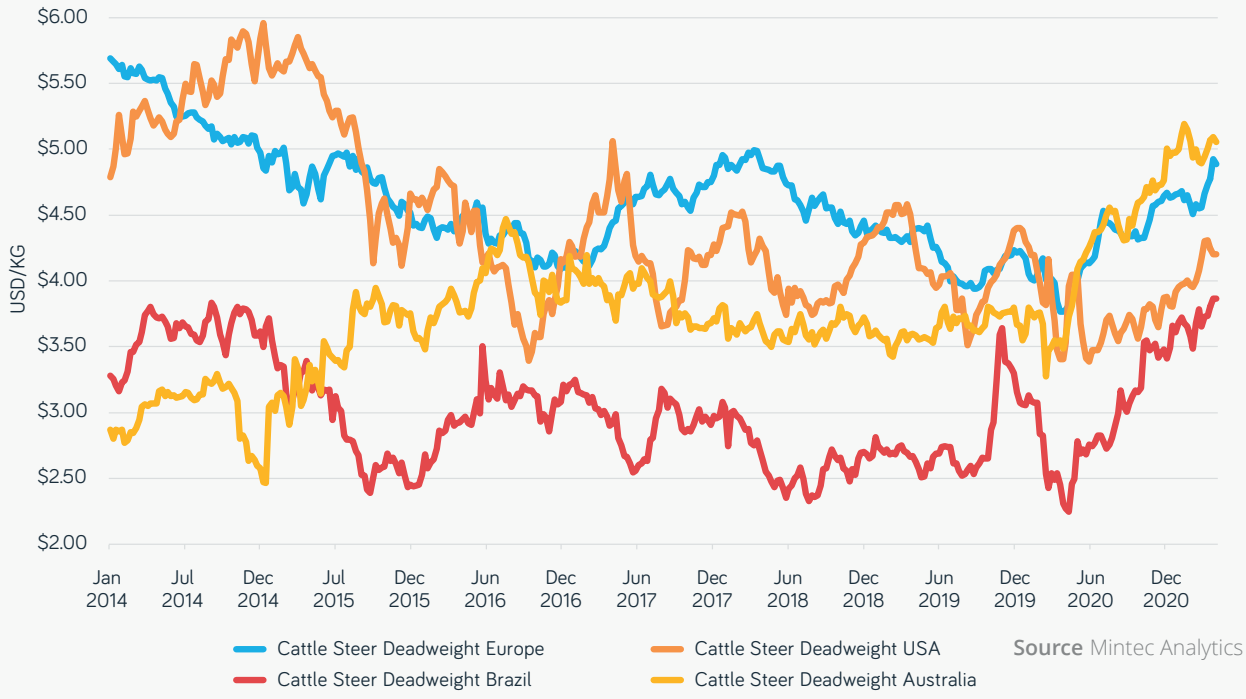
Beef Price Behaviour

While global beef prices have largely remained stable over the past six years, the pandemic has had an upwards price impact on the beef complex as the graph depicts. Despite beef consumption globally decreasing during the pandemic, as restaurants were shut, prices increased. This is largely the result of two reasons:

- Feed prices increased significantly since the start of the pandemic. The price for soybean meal in the Mintec Analytics platform rose by 49% between March 2020 and May 2021

- Container shipping rates increased from an average of $2,000 per container during Q1 2020 to $11,000 per container during Q1 2021, according to the Mintec Analytics platform

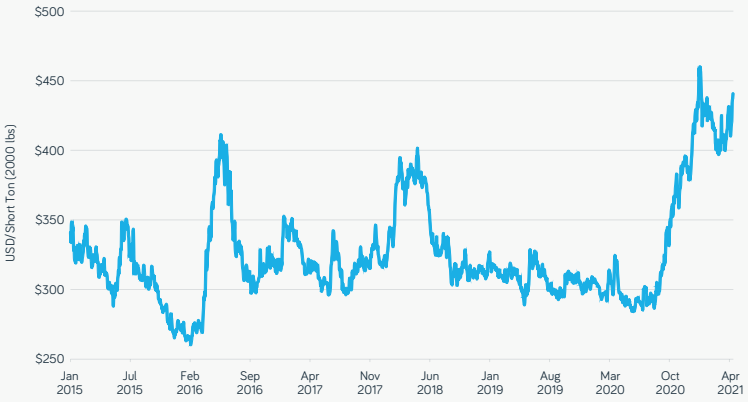
Global Cattle Steer Deadweight Prices (USA, Europe, Australia, & Brazil)



Source Mintec Analytics

Looking forward market expectations are that EU beef prices are likely to continue to increase in 2021. Low market supplies with a substantial reduction in the total number of cows available for slaughter and an increase in export demand from markets such as Japan and Mexico are likely to support upward price movement in Europe, according to Mintec's beef analysts. On the demand side, recovery in demand from the foodservice sector and a seasonal rise in the sales of steak cuts are expected to exert further upward pressure on EU beef prices.

Soybean Meal 48% CME Price ($/Short Ton)



Source Mintec Analytics

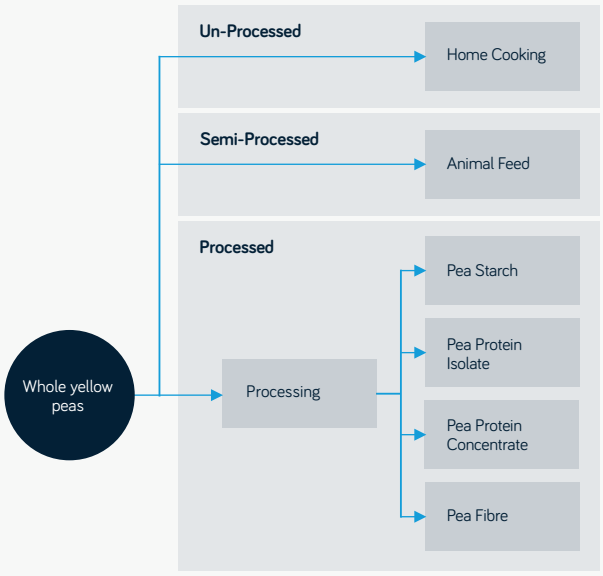
Turning to the US, market expectations are that the average price of US beef is also to increase further on the back of strong export demand. An increase in feed costs and low imports from Australia may further support US beef prices. In addition, the expected recovery in foodservice demand with the COVID-19 vaccine roll-out is likely to be the key price driver for 2021.

From a plant-based perspective, increasing beef prices are generally a good sign. However, in this case one of the key driving factors behind the price increase is the soy price increase, and 80% of plant-based products are soy based so this is a double-edged sword.

Pea and Soya Protein Overview

The biggest percentage inclusion and cost driver for plant-based products are plant proteins. Although plant-based proteins have been in existence for many years, it is only in the last decade that they have been used at any great scale. The costing of plant proteins is more complicated than real meat as there are a number of value streams that are derived from the unprocessed whole soya beans or yellow split peas. Furthermore, as materials like yellow split peas are used unprocessed for cooking and sometimes as animal feed too, this factor can come into play too.

The diagrams outline how raw materials such as yellow peas are used to make plant proteins, animal feed or are used for home cooking.



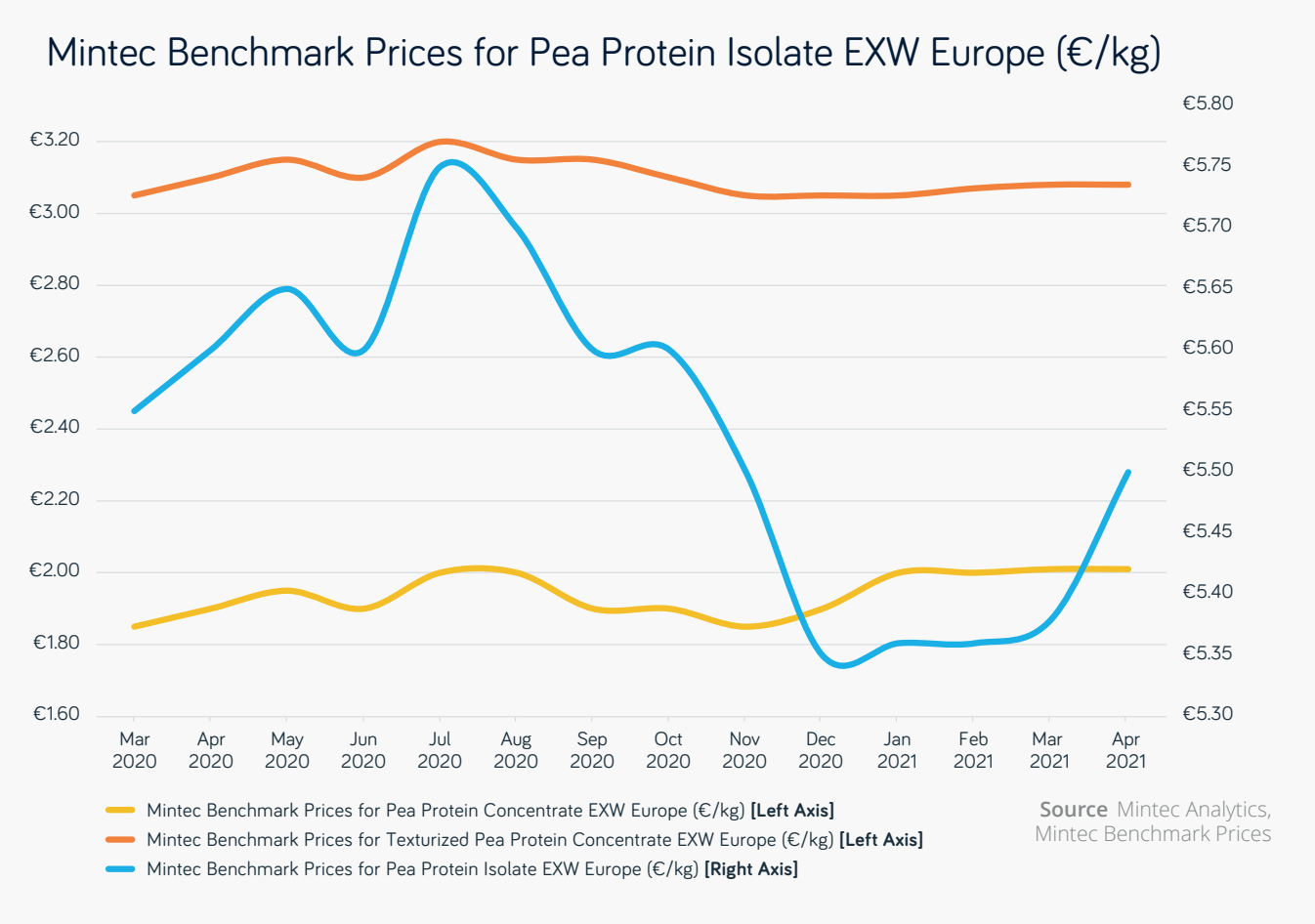
Source Frost Procurement Adventurer, Mintec

In this section we will now look in more detail at the cost drivers and price behaviours of the raw materials involved in making plant-based meat alternatives.

Mintec is the leading provider of independent, proprietary plant-based protein prices and the only company in the world to have its plant-protein prices assured by an external auditor according to the IOSCO principles set out by the G20.

Pea Protein Price Behaviour

Starting with the yellow split peas, like with soya, the pricing has been stable for the last 4-5 years although the story has changed rapidly over the last 12 months with price hikes for both.



The pea protein processing market is still very much in its infancy and in fact the value of pea protein was totally overlooked for many years. The story of pea protein is believed to have originated in China. For many hundreds of years mung beans were processed in Eastern China to extract their starch for noodle production. When the mung beans became too expensive, production switched over to using yellow peas. The by-product from the noodle production was at worst discarded (along with the protein in it) or otherwise used as animal feed. Over the last 10-15 years, the value of the protein in the by-product was realised along with the demand for plant proteins and so pea protein isolate and concentrate have gained a foothold.

Looking at the Mintec Benchmark Prices for North American Pea Protein Isolate the graph shows that the price remained stable during the early part of the pandemic as lower overall demand from the foodservice sector offset the bullish price impact that some of the delays to bringing more manufacturing capacity on stream in 2020 had. However, starting from the end of 2020, the North American pea protein market has seen quite some volatility as increased purchasing appetite initially moved prices higher, on a shortage availability in the very short term, but as availability issues eased prices eased off again.






Canadian Yellow Peas $0.28/kg €0.23/kg	Yes	No	No	Yes	Pea Protein Concentrate EXW **North America** $2.45/kg	Pea Protein Isolate EXW **North America** $6.50/kg
	Yes	Typically	Typically	Yes	Pea Protein Concentrate EXW **Europe** €2.01/kg	Pea Protein Isolate EXW **Europe** €5.50/kg
	Yes	Yes	Yes	Yes	Pea Protein Concentrate EXW **China** $2.20/kg	Pea Protein Isolate EXW **China** $4.20/kg

Source Frost Procurement Adventurer, Mintec Benchmark Prices

In Europe, the Mintec Benchmark Prices for Pea Protein Isolate behaved in a less severe manner since the pandemic started in early 2020. European Pea Protein Isolate prices declined during the majority of 2020 which market participants stated as due to stronger competition in Europe and weaker US demand. Other industry players were also pointing to the fact that yellow pea prices are marginally cheaper in Europe compared with Canada.

Looking ahead, Industry expectations across European and North American pea protein markets continue to be towards greater economies of scale and pea protein availability in particular out of North America, led by Roquette.

For pea protein Chinese material is a growing competitor for European and North American manufacturers. Comparing the supply chains shows us some interesting distinctions.

China's significantly lower price than for North America and Europe is possible given their lower labour rates and ability to gain better returns than other origins on their starch value stream (used for noodle production). However, China, who imports North American peas, must overcome the sustainability question of shipping materials around the world. Processing capacities are being increased globally which will further weigh on the prices.

Soya Protein Price Behaviour

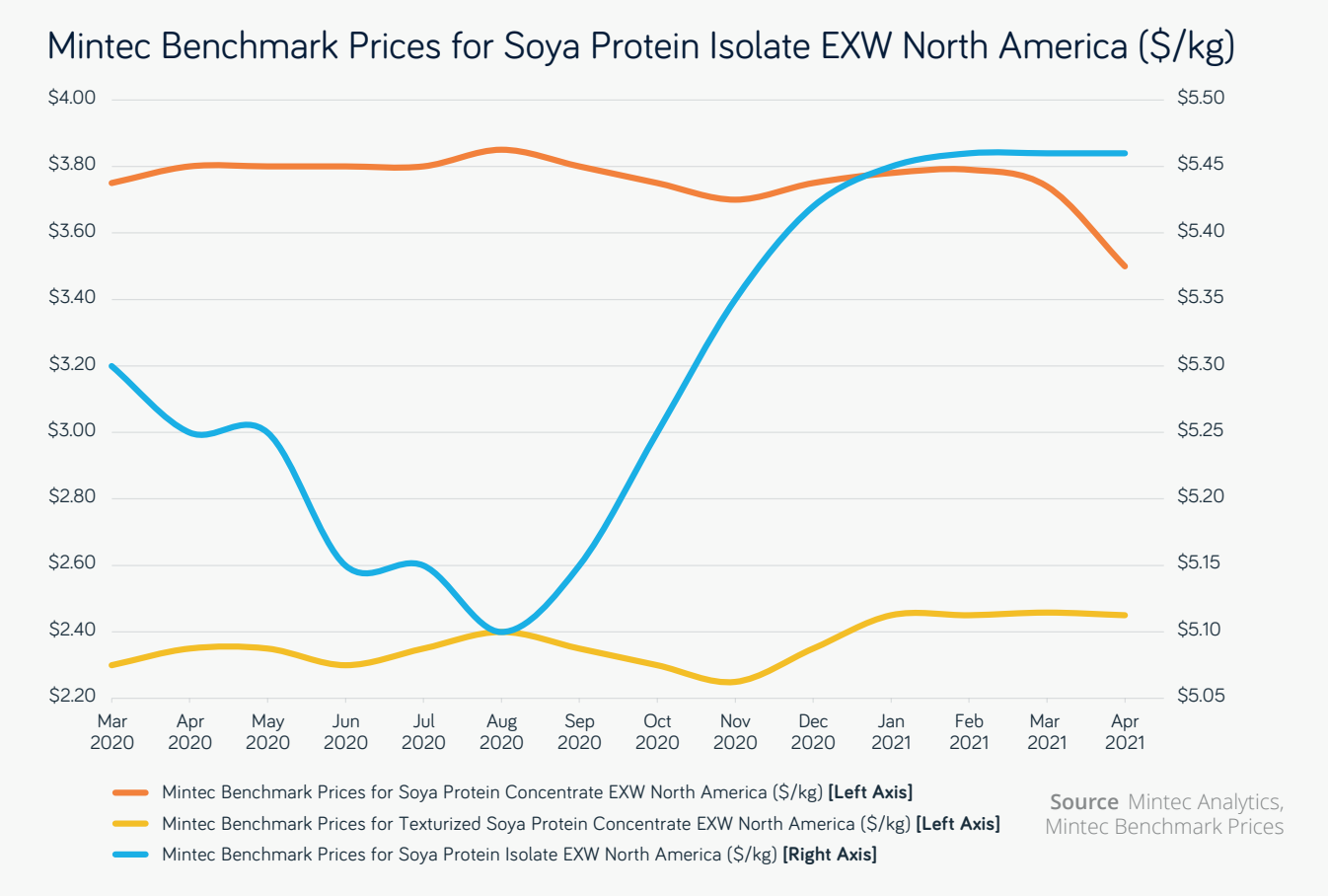
As discussed in the beef section, soya prices have seen a steep price increase since August 2020 as the Soybean No 2 CME contract shows.

The increase in soya prices is caused by three key factors:

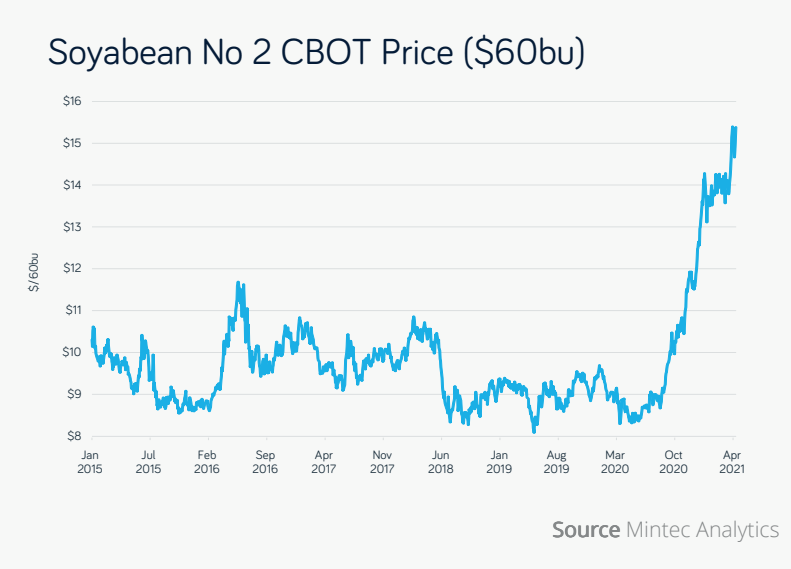
1. 3-year low stock usage ratios

2. Strong Chinese demand

3. High shipping freight rates



Looking forward however, while market participants are not expecting an easing in the underlying soybean price in the near future, soya protein buyers and sellers are expecting prices to come down in the medium term as economies of scale develop, competition gets fiercer and newer generations of soya proteins are developed.



This will be an important factor to master the 'cost' driver for mass adoption of plant-based alternatives. While we have already seen in the cost model section that plant-based raw materials are cheaper than their beef counterparts, a further reduction in processing and manufacturing costs for plant-based proteins will only help mass adoption.

Rapeseed & Coconut Oil Price Behaviour

The Mintec Benchmark Prices for Rapeseed Oil FOB Rotterdam, which is the bellwether product for the European vegetable oil market, is trading at a 10-year high due to a 30% decline in rapeseed production since 2015. The decline in rapeseed production comes as a result of a regulatory change in the EU which banned the use of neonicotinoids,

Rapeseed & Coconut Oil Price Behaviour

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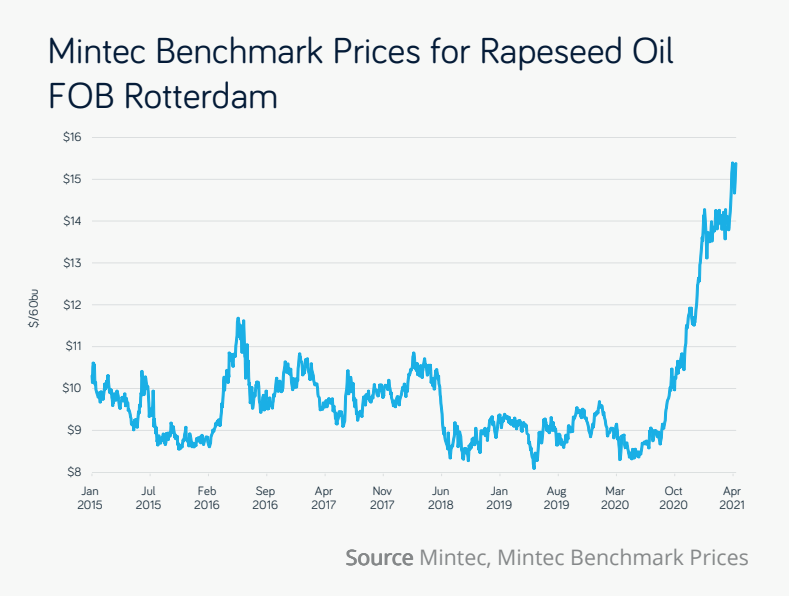
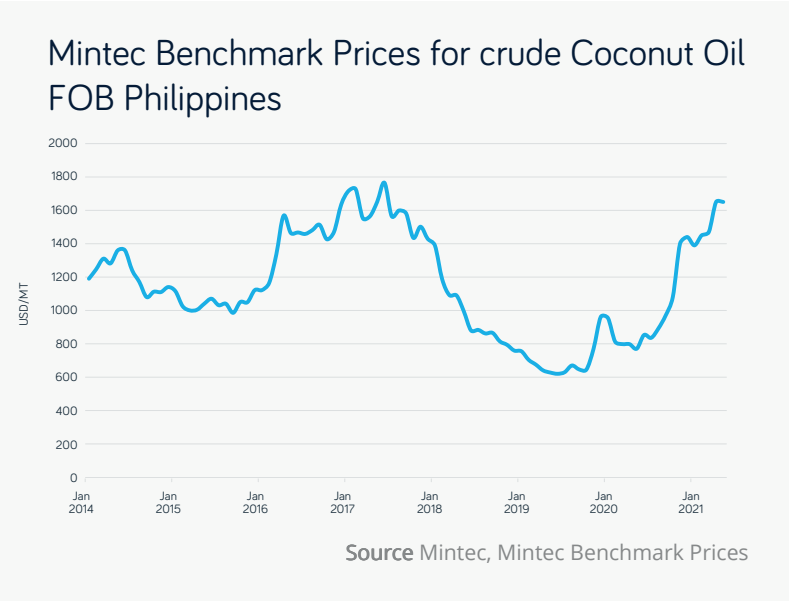


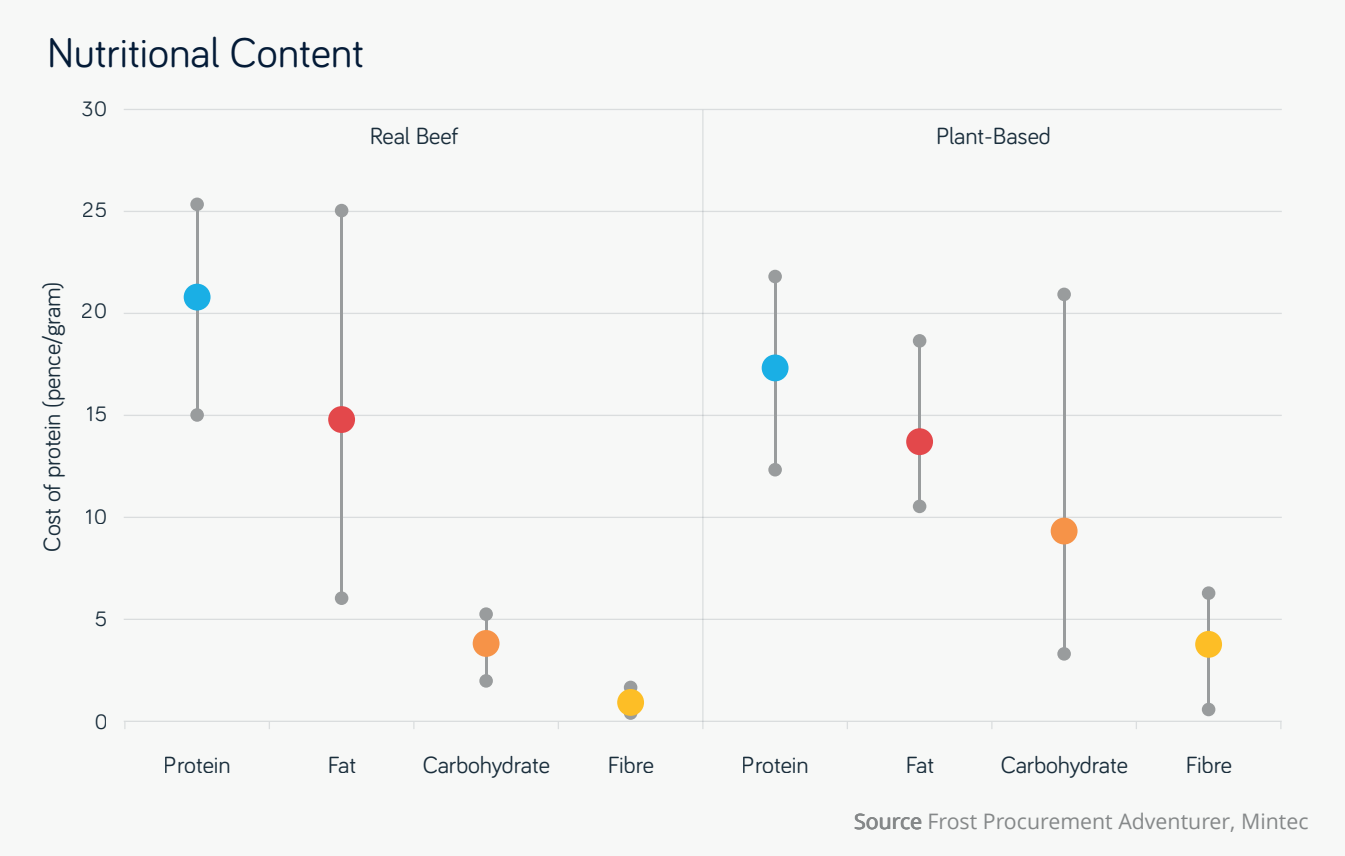


In North America, for example, the Mintec Price for Canola Oil FOB Canada remained stable for five years between 2015 and summer 2020 when the lack of European material was starting to filter through to the global markets and increased Canola Oil prices by a third.

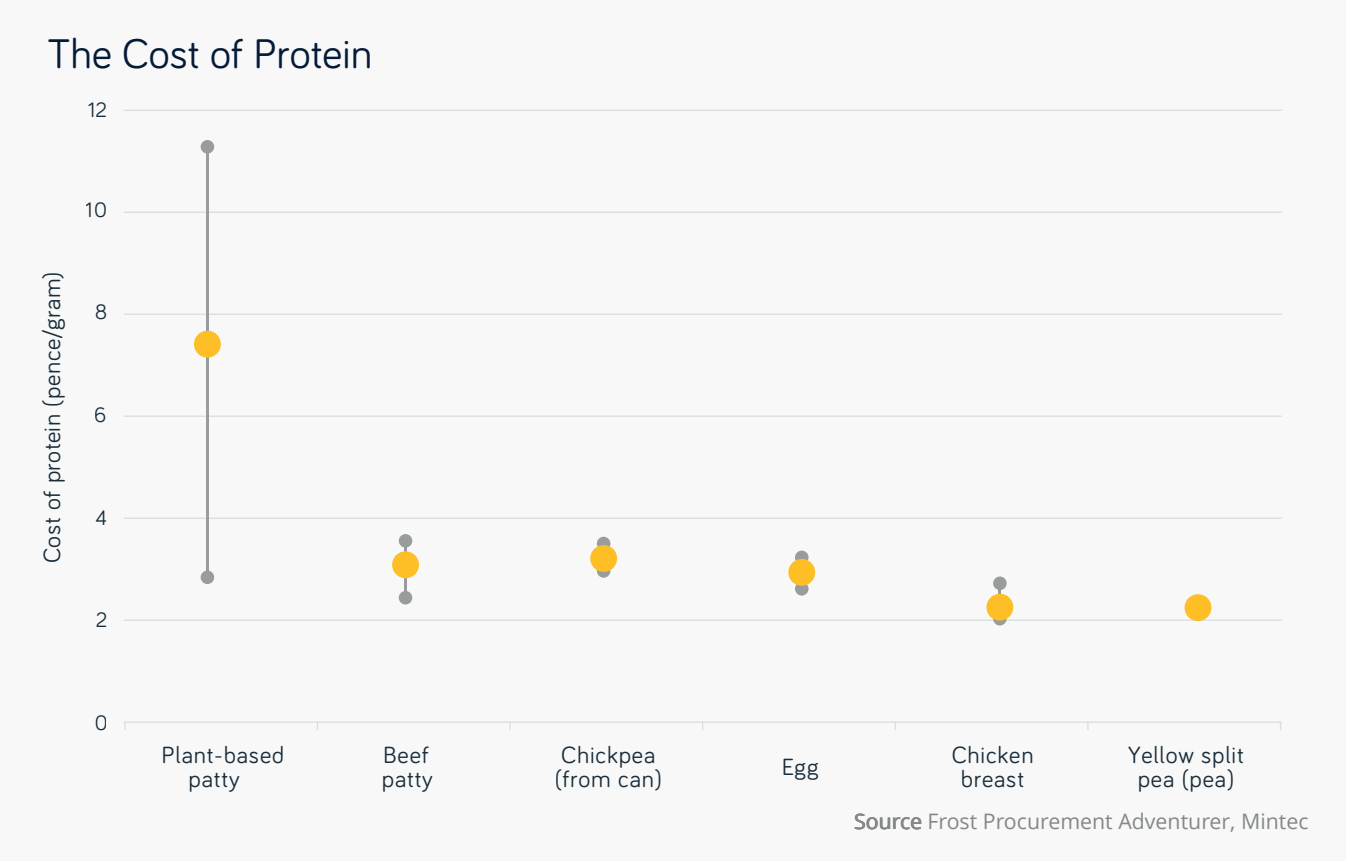
The Mintec Benchmark Prices (MBP) for crude Coconut Oil FOB Philippines, the key supplying region for Coconut Oil, have been on a rollercoaster ride since 2017 when a study by the American Heart Association cautioned against the consumption of coconut oil due to high levels of saturated fats which resulted in prices nosediving. In fact, between June 2017 and June 2019 the MBP for crude coconut oil shed more than 60% of its value. However, more so because of supply, shipping and complementing edible oil markets increasing in value rather than a mass return of demand, the MBP for crude Coconut Oil rebounded to 2017 levels by April 2021.

Nutritional Levels

A note on nutritional levels – a sample of real beef burgers compared to plant-based alternatives shows that the percentage of protein is a little lower in plant-based. The most noticeable difference is that the real beef burgers will tend to use fat as the cheaper 'filler' component, plant-based products will tend to use carbohydrate. There are clear processing and cost related reasons for this of course. It is cheapest to use the fat already attached to the meat. Whereas for the plant-based, pea has a low-fat content but is higher in carbohydrate so it makes sense to use the carbohydrate. Fat, or rather oil, then gets added back into the product to give the right organoleptic properties:



Zeroing in further on the protein content, when it comes to meat, it is not usually a key marketing story, even in this current world where almost every food seems to be branded up with the word 'protein'. But if we are to look at the cost of the protein to the consumer, eating a plant-based burger sure is an expensive way to get your fix of protein! Gram for gram it's more than two times as much as real meat or, as another comparison, two to four times as much as chickpeas, eggs, chicken or the very peas it was derived from.



The future of meat and plant-based consumption

Thus far, we've focused on the adoption of plant-based meat. Naturally, this goes hand-in-hand with reducing or relinquishing the consumption of animal meat. The question is, *"how quickly can humankind wean itself off meat and will we do so completely?"* There are few better experts on this topic than Marta Zaraska, world acclaimed author of 'Meathooked – The History and Science of our 2.5-million-year obsession with meat'. Marta shares her personal views:

Although in one 2019 global survey as many as 40% consumers claimed to try to have reduced their intake of animal protein, appetites for meat and dairy are still growing across the planet: in 2011 the Food and Agriculture Organization of the United Nations projected that by 2050 meat consumption will be up by 73%, and that of dairy by 58%. Two obvious reasons for this are the population growth surging upwards from its current level of 7.8BN and wealth creation in the developing world, there are other reasons besides.

Humanity's switch to plant-based diets won't be straightforward because consuming animal protein is about much more than simply eating food; it is also about consuming culture, symbols, and history. From the time our ancestors started eating animal meat 2.5 million years ago, it has become a symbol of power, wealth and masculinity. Our cousins, the chimps, use it in a similar way — alpha males exchange meat for political support and to attract female attention. In hunter-gatherer societies women are often forbidden certain meats, sometimes under death penalty, while ancient Egyptians put mummified meat into tombs of high-status individuals to show off their power. Meanwhile, modern research confirms that people connect masculinity with foods such as steaks and hamburgers, and femininity with chocolate and fruits.

Such symbolism won't go away easily, especially since the meat industry plays on it to sell consumers more animal protein — hence adverts such as that for Burger King where men are "too hungry to settle for chick food" and need a Texas Double Whooper to "Eat like a man". Steaks are still often chosen by top managers during power lunches, while in Washington, DC, steakhouses are where politicians and executives make deals. On the flip side, negative images of vegetarians as 'weaklings' and 'wimps' are among the top barriers for why some people, men in particular, resist substituting meat with plant-based products. This could soon change, however, with more influencers who are perceived as powerful, masculine, and wealthy publicly embracing plant-based products.

Besides meat's symbolism, research shows that it's the expectation of tastelessness of plant-based diets and lack of cooking skills that prevent many people from reducing their intake of animal protein. Taste-related concerns should diminish in 10 to 20 years, as the quality of plant-based meat replacements goes up and as people come across such products more and more often (experiments reveal that after about 20 exposures people's liking of meat-like products tends to increase). This is why offering free samples of plant-based products works well to overcome any reluctance, and why an important role in adopting plant-based foods is played by the workplace, school and university cafeterias. Introduction of obligatory plant-based options during school lunches, as it has been done in France and Finland, could mean new generations learning to enjoy dishes without animal protein, speeding up the mass adoption of plant-based products.

However, an important obstacle to success of such schemes remains the lack of cooking skills among chefs supplying the vegetarian meals. In France, school vegetarian meals were initially met with resistance because children were often offered highly processed, unappetizing soy burgers. However, since the government provided training to chefs, vegetarian options are now picked by 18% of primary school students – on path to mass adoption.

As France's example illustrates, teaching cooking techniques for plant-based proteins both among chefs and the public can boost their sales, since they make the switch away from meat relatively easy (and lack of cooking skills is among top barriers to plant-based diets). Yet, as people habituate to vegetarian cooking, uptake of plant-based meat replacements could go down in 10 to 20 years, with more focus on pulses, tofu, and other whole plant-foods.

Another obstacle to the growth of meat and dairy substitutes may be increasing concern over the healthfulness of such products. In 2019 scientists from Harvard T.H. Chan School of Public Health wrote an opinion piece in a prestigious scientific journal warning of potential detrimental health effects of plant-based meat alternatives. In the last three years several studies have been published calling attention to unhealthy vegetarian diets, linking them with cardiovascular disease, diabetes and stroke. It can be expected that some policymakers may come out against ultra-processed vegetarian foods — restricting marketing or requiring labelling, for instance — something that has already been suggested by the WHO Regional Office for Europe. It is important to note, however, that health motivation for reducing animal protein consumption is losing importance to environmental concern, especially among young people.

Outside of the US and Europe, in countries such as China or Brazil, where climate change is already a lived experience, environmental concern can be a particularly strong motivator for dietary change. This can also be a sign of things to come in the West — with the effects of climate change more and more pronounced, consumers may soon become more open to plant-based products to reduce their carbon footprints. However, in developing countries, both in Asia and in Latin America, meat's symbolism as a food for the wealthy and powerful is still an important factor behind rapidly rising consumption of animal protein. In 10 to 20 years, though, plant-based eating may become something to aspire to, as people in developing countries observe influencers in the West (actors, sports people, etc.) pursuing vegetarian eating.

It's highly unlikely that in the next few decades meat will disappear from our plates. Cheaper meats, such as chicken nuggets or fast-food burgers, will likely be in great part replaced by highly processed plant-based substitutes, extremely similar in texture and flavour, while another niche, for healthier products, will be filled by relatively unprocessed "clean label" plant-based foods. More expensive meats could be partially replaced by cultured meat, which could also take over traditional meat's symbolism of power and wealth. The remaining meat may become a luxury product, with local, grass-fed, and organic cuts highly prized — an outcome that the meat industry is well aware of, and plans to use as a strategy to defend its existence.

Conclusion

One senses the adoption of plant-based meats will take a degree of time: time for supply chains to optimise and consumer prices to reduce; time for countries experiencing surges in wealth to break the linkage between wealth and meat eating, time for the consumer to challenge their beliefs and time for us to adapt how we feed our children. It will also require major governmental intervention and it will require some sectors to face hard truths and make fundamental shifts to their visions, missions and strategies. But we can see that paradigms can and are being broken:

- The car industry, backed by legislation, is undergoing a transformational change to electric.

- Italian energy major ENI converted two of its petroleum refineries to bio-refineries where vegetable oils, animal fat, algae and by-products are used as the feedstock for fuel rather than crude oil.

Will the all-powerful meat industry continue to lobby for the protection of their industry?

Three years ago at the European Food Trade Show SIAL in Paris several meat free brands positioned themselves in the meat hall. Rumour has it, this plucky tactic wasn't well received by the incumbents. The following year at ANUGA trade show in Germany, several large meat players launched meat-free products. In April 2021 one of the largest global meat processors, JBS, bought Vivera, Europe's largest plant-based brand. Change is happening quickly.

Our conclusion is:

- The quality, convenience and availability of the plant-based products are advancing so quickly, that the consumer will have little reason not to buy them.
- The stigma of eating vegetarian and vegan products is reducing. Indeed, eating a plant-based diet is now something the consumer connects with.
- The marketing of plant-based products is strong and backed by the ability to spread the word through mobile phones and social media. Even the furthest corners of the world will be engaged with the revolution.
- Plant-based products should become more 'clean-label' and will stand up on their own two feet, with confidence.
- The remaining factor of cost, inhibiting mass adoption of plant-based meat, will diminish as set-up costs reduce, supply chains are optimised and competition increases.
- It may take a bit of time, but the 'flipping-point' could be reached at some point in the next 5 to 20 years.

The Future - What does this mean for me and the business I work for?

As a reader, your perspective will be very different depending on your profession and the company you work for, your nationality, culture, age and whether you are an ardent meat eater, flexitarian, vegetarian or vegan:

I'm a.../We are a...	What does this mean for me and the business I work for?
Consumer	This will be different for each and every one of us. For vegetarians and vegans it means more choice and being able to select any restaurant rather than restaurants focusing on vegetarians – suddenly everyone is focusing on you! The biggest change will naturally be for the 'hard-core' meat eaters, though, will it? Meat consumption will not go away, but what is likely to change is the price of meat (more expensive?) and the oftentimes negative prejudice to meat alternative products. If petrol heads can get excited about electric vehicles and Formula E, allowing a plant-based burger on your barbecue is entirely possible.
Meat company	Understandably, this article or others like it, may make your business uncomfortable. Do you protect your industry or embrace the change? It might be worth reflecting on the changes in the car and tobacco industries. You're unlikely to face something as strong as a 'Kodak-moment' but not adapting could be a risky strategy.

Plant - based brand	You know yourselves this is an exciting time! You're driving the revolution. Your watch out is competition – there's lots of it. But there is still so much opportunity for growth and if your products are excellent and marketed well, you will fly. You are likely to face questions about clean-label and food miles. Consider how to shorten supply chains and minimise processing of materials.
Co-manufacturer	A number of the plant-based meats are made by or in partnership with traditional meat companies. Developing new production technologies to make even better plant-based products. Continue to embrace the future and you will continue to have a great business.
Retailer	Retailers are where the rubber meets the road and are vital in how both current and potential consumers experience the products as well as providing range and availability. Planning for increases in plant-based products can clash with internal challenges around pricing of traditional meat products, so working across functions to 'max the mix' and establish pricing points that are both competitive and not harmful to someone else's bottom line is critical. In addition, shelf space is of course at a premium, but messaging counts – when shopping, can your customers see plant-based products as a viable alternative to meats, or do they see a niche product tucked away in the corner?
Investor	We only need to see the eye watering valuations of some of the plant-based brands that you believe in the future. The plant-based sector is delighted to have your investment. Crack on!
Plant-based ingredients producers	You have done a fine job already developing new ingredients – harnessing the protein from the by-product was a great invention. You will strive to develop new technologies and develop new materials. You will need to adapt to more clean label products.
Farmer	You are the life-blood of the plant-based revolution. Not all farmers will see immediate changes. Your soya will still be used, it will just be used differently. But you might need to adapt your crop portfolio. The world will for sure need more split peas and mung beans.

Food for thought...

Will any rapidly developing countries buck the correlation between GDP and meat consumption?

- How will the meat industry respond to the plant-based revolution?
- How many generations will it take to break deeply ingrained paradigms?
- What will a typical recipe book or menu look like in 20 years' time?

More in-depth analysis and information on this Mintec Insight is available by contacting the email addresses below. You can also reach out to us to discuss this Insight and share your thoughts with us.

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