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Innovation on the menu

Practical solutions for food supply chains

The future of food

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Content

1. The food industry is going through a profound transformation

The food industry is currently undergoing a profound transformation, driven by a multitude of interconnected and standalone trends. This transformation is clearly ongoing and irreversible. The food paradox, which underscores the global challenge where approximately 800 million people grapple with hunger and malnutrition, while a significant portion of the population is confronted with the health repercussions of overconsumption and obesity, gives rise to several significant consequences.

First, an increased awareness around the impact of food on wellbeing and health is leading to customers' buying behaviour changing—more natural (bio) food, products with low sugar concentration and without chemical additives are only a few recent consumer demands. Second, ethical sourcing and an increased focus on ESG (environmental, social and governance) have become a top priority for the food industry.

While post-pandemic global demand, extreme weather, tightening food stocks, high energy prices, supply chain bottlenecks, export restrictions, and taxes have been straining the food market for two years, the recent convergence of all these factors following Russia's invasion is unprecedented and has sent food inflation rates spiking around the world.

As a result of these global events, organisations have no other choice than to adapt their way of harvesting and producing their products. In this article we paint a picture of what the future of harvest and production can look like, as well as how companies are redefining their manufacturing footprint. Together they provide an overview of the transformation that the food industry is undergoing.

2. Redefinition of food production

2.1 The future of harvesting

The substantial need for a drastic transformation of the food industry has led to a rise in sustainable farming practices such as smart harvesting, use of genetically modified and more sustainable crops, and collaboration between corporations and farmers. In most advancements in the harvest industry, increased yield and efficiency go hand in hand with improved sustainability and health, thereby creating a double win for the economy and the community.

2.1.1 Advanced analytics to predict harvesting

One promising trend in this context is smart harvesting. Smart harvesting refers to the use of advanced technologies and techniques to optimise the efficiency and productivity of agricultural harvests. Using drones and sensors provides farmers with real-time data on crop health, yield, and other key metrics. This innovation helps farmers to reduce the use of water, pesticides, and fertilisers, resulting in a more sustainable agriculture. In addition, it offers the opportunity to increase top line growth for farmers. In the fruit industry, for example, the intel gathered from the Internet of Things is used to predict the size and quality of the harvest, which is then used as an input to sales conversations with key accounts. During these conversations, the discussion can be directed easily toward the share of harvest each key account can bid on. By capturing and leveraging the harvest knowledge well upfront in the sales process, the farmer is able to better match their supply with market demand and can increase their negotiation power.

2.1.2 Genetically modified crops

Driven by the changing climate on one hand, and the search for more efficient use of land on the other hand, genetically modified crops are another noteworthy innovation in agriculture. The increased importance in genetically modified crops is also demonstrated in the new EU legislation which opens the door for modern genetic techniques. For years, strict European rules applied to genetically modified food. The new genetic techniques can intervene in a highly targeted and therefore much more precise manner. With the new framework, the Commission is responding to the demands of the agro-industry in the European Union. Outside the EU, genetically modified crops have been tolerated longer and as a consequence the technology is more advanced.

Drought is rapidly becoming a significant global issue, and the availability of water is contributing to social and regional instability. Kenya is presently grappling with a severe water scarcity crisis brought on by four consecutive failed rainy seasons. As a reaction to this crisis, the country has recently opted for genetically modified crops that exhibit increased drought resistance.

General Mills has partnered with The Land Institute to develop the grain Kernza. Kernza stands out as an exceptionally sustainable crop, given its ability to serve multiple functions and its status as a perennial grain, unlike wheat, which requires annual replanting. Furthermore, Kernza boasts high protein and antioxidant content, along with eight times the amount of insoluble fiber compared to wheat, making it an exceptionally healthy choice.

2.1.3 Partnerships between large corporations and farmers

As consumers continue to put emphasis on ethical sourcing, an increasing number of international corporations choose the path of collaborating with and supporting local farmers and communities who grow the food we eat. The fascinating bean-to-bar movement in the chocolate industry stands for the maker controlling every step of the production process, from buying the coca beans to the creation of the chocolate bar. This vertical integration is considered a strong means to protect the fair trade and sustainability label.

However, the collaboration between large corporations and farmers needs to be well balanced since it is not always a level playing field (small business vs. large corporations). An example where it has gone wrong in the past can be found in India, where farmers where trapped in a cycle of debt due to the monopoly of a big international player in the seed sector.

2.2 The future of production

Food producers are drastically increasing their investments to address growing concerns around the environment and people's health. Similar as when it comes to harvesting, investments in more sustainable production processes are combined with efficiency increases to ensure a positive ROI. Concretely, we'll look into sustainable packaging methods, how new products and recipes impact production, and how challenges related to waste management can be turned into opportunities.

2.2.1 Sustainable packaging methods

Innovations in the packaging department have been emerging for several years, as they align perfectly with the goal of increasing cost efficiency while enhancing sustainability and reducing waste.

One of Barry Callebaut's flagship programmes is about rethinking the packaging process of its finished products. The original packaging method, which involved placing chocolate in two bags before packing it into a box, has been entirely replaced. Now there is no secondary packaging (box), and the primary packaging (bag) is made sustainable, with the added option of vacuum sealing. Consequently, a huge amount of cardboard is avoided each year, the new packaging is 100% recyclable, aromas and flavours are protected twice as long as before, and there is an opportunity to transport a larger volume (when vacuum sealed) per pallet, creating a significant business case.

Also, Kellogg's moved to resealable packaging in order to prevent the entry of moisture, oxygen, and other contaminants. In addition, Kellogg's has been working on improving the shelf life of its cereals by adding natural antioxidants (e.g., vitamin E) to extend their freshness. These two actions combined have helped Kellogg's to drastically increase the shelf life of its cereals without compromising on the quality or taste, thereby significantly reducing spoilage by the end consumer.

2.2.2 Alternative ingredients and new recipes

To reduce the product's carbon footprint and provide healthier products, the food industry is continuously searching for alternative ingredients and new recipes. Cargill recently entered into a strategic partnership with Cubiq Foods to allow for a mutually beneficial entry into plant-based products. Cubiq Foods has expertise in the development of innovative ingredients to improve plant-based meat products, while Cargill has a global manufacturing footprint and international existing sales network. As a result, this partnership is instrumental in accelerating the deployment of plant-based meat to market.

Barry Callebaut's movement "Better for us all" focuses amongst other on reducing the amount of sugar in chocolate and looks at offering allergen free options, such as dairy free, no nuts… The challenges associated with manufacturing should not be underestimated. As a company, it is imperative to take action and demonstrate that you are delivering on your promises. To prevent sugar from ending up where it is not intended, costly cleaning procedures between batches become necessary and, in some instances, investments in additional piping and tanks are

Reprocessing waste resulting from inter-process cleaning is a more complex task, as the waste can no longer be collected and redirected to any chocolate production process. In this context, additional inspections and clear traceability between reprocessed waste and the final product are essential to ensure that the company adheres to the claims made on the product label.

Modifying recipes, such as altering the sugar-to-chocolate ratio or omitting dairy ingredients, necessitates that companies possess a deep understanding of the chemical reactions involved in the production process. The challenge lies in how to maintain or even enhance the flavour when the bill of materials is modified. In this regard, a smart factory can be a valuable resource as it aids in comprehending and simulating the impact of various parameters on the appearance, texture, and taste of a product.

2.2.3 Diversification of the end product

The pursuit of waste reduction is an ongoing endeavour. In the chocolate industry, the concept of WholeFruit chocolate involves utilising the entire cocoa bean for chocolate production, offering a substantial potential for waste reduction. Nevertheless, the challenge of ensuring a consistent outcome in this novel production process remains unresolved. Also here, companies are turning to smart factories to expedite progress in addressing this challenge.

Another great example of creating alternative solutions for by- or waste products can be found in the production of jam, where the green leftovers of, for example, strawberries are being pushed to the production of animal food. Not only is waste (cost) minimised, an additional revenue stream is identified by addressing another segment in the food industry.

2.3 Supply chain traceability

Traceability along the end-to-end supply chain, from ingredient sourcing to consumption by the end user, has become a crucial element in confirming and guaranteeing the fair trade and sustainable brand companies claim to have. Nespresso and OpenSC Technology have entered into a collaboration where every bag of coffee can be digitally traced back by the end consumer to the smallholder farm through the public blockchain.

In addition, end-to-end traceability is essential to consumers' safety as it allows to trace a quality issue of an ingredient all the way down to all the impacted finished products. The ethylene oxide crisis of 2021 is a great example of how different food regulations across countries on pesticide use on a relatively small ingredient such as a sesame seed can lead to a multimillion euro call-back action. Transparency on actual pesticide values against the norm together with supply chain traceability are critical to handle these types of crises in a fast(er) and (more) efficient manner—or, even better, prevent them from occurring.

Today, most of this traceability is still provided through paper-based solutions. Especially in case an ingredient is reprocessed into another form during the production process, it is difficult to come up with more innovative and digital solutions. Leading companies are implementing manufacturing execution systems to ensure 100% traceability. This way, issues in a particular production process can be quickly traced and contained in the value chain. Combining this manufacturing technology with smart labelling provides additional opportunities to improve the consumer's experience. Think about the consumer who obtains health and allergy information simply by scanning a QR code, or a consumer who can download cooking instructions … The options are close to endless.

2.4 Revision of the manufacturing footprint

While most innovation in the food industry happens in operational parts across the supply chain, we see an increasing number of organisations looking into fundamentally revising their production footprint. These revisions include investing in a second source of critical raw or intermediate materials, optimising the allocation of products to a particular (set of) site(s), and bringing production closer to the end consumers.

2.4.1 Increased network redundancy

After the salmonella crisis, Barry Callebaut had to withdraw from the market for a significant period for products produced in only one contaminated location. In response to this costly event, the company is now exploring the addition of redundancy to its network to ensure business continuity. This approach not only reduces the risk of losing sales margins but also de-risks the challenging process of restarting production and reestablishing the associated supply chain.

2.4.2 Production reallocation

Another solution that companies are pursuing involves optimising the flow of materials in the network. This concerns reevaluating products that touch a significant number of sites during their production process. To prevent that a single issue in one node disrupts a substantial portion of the network, companies are now looking at simplifying and reducing the number of transfers between sites.

Additionally, companies are reallocating products across the network due to concerns about cross-contamination, such as ensuring that allergen-free products remain as such. As an example, roasting beans as part of the chocolate production process can pose a risk to consumers with nut allergies. Therefore, any nut-free product needs to be produced outside of nut factories.

As changes to the manufacturing network are typically complex and costly, these decisions need to be weighed carefully, balancing the risks of a contaminated, disrupted supply chain and the risk of brand damage against the operational costs.

2.4.3 Localisation of production

A final observed shift in the industry has been to bring critical components of the supply chain closer to home.

A key consideration in assessing the feasibility and viability of localising production is the competitive nature of the industry. Whereas localisation in some segments contributes to increased efficiency of operations, it takes away a competitive advantage in other segments. La Lorraine Bakery Group has significantly localised the production of its bread by sourcing the grain close to its production and sells it further to supermarkets in the close vicinity. Not only does this reduce the total landed cost of the bread, it also contributes to a healthier product (less additives to extend shelf life) and a more ecofriendly supply chain (lower carbon footprint due to reduced transportation). AB Inbev confirms that also the brewing segment has the opportunity to leverage localisation of production to its own benefit: using local crops and local flavours allow to build a strong and recognisable brand, while it also brings the benefit of reduced supply chain costs and risks.

On the other hand, Ardo's fruit assortment is a combination of locally sourced fruits (apples and pears) combined with more exotic fruits sourced from abroad (mangos and kiwis). Keeping a competitive advantage with the customer is the main reason for sticking with this extended assortment. As long as the end consumer longs for the full fruit assortment, companies will provide it by sourcing both locally and offshore—with the mindset that if they don't offer the wide range of fruits, someone else in the industry will.

3. Conclusion

While this is certainly not an exhaustive list of moves food production is going through, it does give a view on where the biggest shifts are happening. There is a need and a desire to innovate and transform the food industry, and as the technology continues to evolve and becomes more accessible, we can expect to see more innovative applications and benefits in the years to come, thereby addressing key concerns of consumers and policy makers, whilst also generating new opportunities for small and large corporations.

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