FOOD SORTING TECHNOLOGY 2020:

AN IN-DEPTH LOOK INTO AN EVOLVING INDUSTRY

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CONTENTS

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INTRODUCTION:

In recent years, evolutions in detection technology and intelligent software have given optical sorters new capabilities – allowing food processors to reach their product quality objectives, maximize yield and better understand critical aspects of their processing operations. However, as this evolution continues, today's manufacturers are still faced with several unaddressed challenges – such as systems that are relatively difficult to operate and costly to maintain.

All of this begs the question: how far will digital sorting technology evolve in the coming years? And what will that evolution mean for food processors everywhere?

Based on in-depth interviews with professionals in the field, from the experts who develop the digital sorting breakthroughs at Key Technology to food processors globally, this eBook will explore three factors expected to impact and evolve the food processing industry over the next five years:

- **Evolution #1** – Advanced detection enabling ever increasing product identification
- **Evolution #2** – Breakthrough machine intelligence and automation to reduce human intervention
- **Evolution #3** – Cutting-edge information analytics to power performance optimization up and down the line

EVOLUTION #1:

ADVANCED DETECTION

> "FOOD PROCESSORS ARE LOOKING TO GET AS CLOSE AS POSSIBLE TO 100% DISCRIMINATION OF UNDESIRABLE FOREIGN MATERIAL (FM) AND CRITICAL DEFECTS."

As consumers continue to become more and more demanding of product quality, there is a thrust toward improving sort performance to discover ever smaller and more subtle defects. "Food processors are looking to get as close as possible to 100% discrimination of undesirable foreign material (FM) and critical defects," says Tim Justice, Systems Engineering Manager at Key Technology.

A 2015 article from *Food Engineering* magazine credits the development of hyperspectral sensors and near-infrared (NIR) technology with driving the increased precision of detection. The article cites that in recent years high-speed camera technology has increased inspection capacity up to 7 meters per second, while resolutions as low as 0.09mm allow for unprecedented levels of defect detection.[1]

And Justice predicts that future sorting technology will utilize more ways of generating contrast between different objects. This could mean more laser frequencies, new hyper or multispectral cameras or potentially other modalities that are not electromagnetic in nature – or utilize EM in a different spectrum, such as microwave or x-ray. "Sorters will have an increased ability to perform non-destructive interrogation of customers' products," comments Justice.

Such modes of detection can lead to effectively identifying product conditions that are invisible through external analysis. Marco Azzaretti, Product Manager for Advanced Inspection Systems at Key Technology, believes that in the next five years sorters will advance to a point where they can detect an increased range of chemometric aspects of product characteristics. This means that sorters will be able to detect quality issues that lie below the surface – sugar levels or oil content, for example. This level of detection could offer a host of advantages to processors in terms of quality and efficiency.

"Today, testing product conditions below the surface of a product is something that has to be conducted offline," notes Azzaretti. "Bringing these tests inline would mean they could be conducted in real time, making it possible to inspect one-hundred percent of the product as opposed to just a small sample. The ability to conduct tests in real time can eliminate the time and resource-consuming effort of lab testing, and allows processors to take immediate action on the findings."

The "Holy Grail" of detection is full identification of the material being inspected – this will probably

require not only an ever-broader set of surface detection modalities but also the development of real-time subsurface detection technologies.

That said, Louis Vintro, Key's Senior Vice President of New Products and Business Development, is optimistic: "So, maybe we can't always fully identify products, foreign material and specific defects, but increasing the level of discrimination may already provide increased value to our customers. It's just that no one's figured out a way to crack that yet."

> "MACHINES WILL BE ABLE TO DO A LOT MORE PROCESSING TO HELP IDENTIFY AND COMMUNICATE TRENDS, WHILE AT THE SAME TIME MAINTAINING PERFORMANCE OF THE MACHINE."

EVOLUTION #2:

MACHINE INTELLIGENCE AND AUTOMATION

According to *Food Production Daily*, system automation of the future should ultimately answer five key points – total cost of ownership (TCO), time to market (TTM), total productive maintenance (TPM), overall equipment effectiveness (OEE) and return on investment (ROI). And, with recent and continued advances, it seems this is where the evolution of automation will take us in 2020.[2]

As sorters become more and more advanced in their automated capabilities, the end game is for sorters to be capable of running on their own – not just over the course of one day, but throughout the production cycle – without requiring human intervention. The ultimate goal for the sort process, according to Key's Azzaretti, is "automating the process of managing the sort so that it delivers the required product grade at the maximum yield – every time."

System automation has undergone many advancements in recent years. While sorters used to operate with only a two-way stream – one for acceptable product and one for rejected product – there are now more options. New software developments have focused on user-friendly machines that give processors the power to control specifications about rejections. For example, one stream dedicated to minor imperfections that can be used to make Grade B product and another stream that rejects bruised products that can be used to make things like juice. Advances like this have allowed processors worldwide to improve yield and minimize waste.[1]

So, the challenge then lies in developing machine automation to the point where machines take into consideration the variability that is inherent in sorting organic products, like food. But it is a tall order when you consider the aggressive and dynamic environment of sorting.

Reuven Pauker, Food Technologist at Israel's Milotal Frozen Vegetables, cites self-learning and adjustment as the determining factor of successful automation in the future. "You will always need some level of intervention at the beginning. You need to teach the machine what is right and what is wrong. From there, I just want to show the machine what good product looks like and have it adjust itself. The color changes. The shape changes. The type of product changes, whether it's beans or corn. Either way, you program the sorter once, say 'here's what's good, and whatever is not, please sort accordingly.'"

Over the next five years, sorters will also likely adopt more sophisticated algorithms that allow them to better understand and process the data collected by sensors, and to start understanding when there are issues with those sensors and what adjustments may be required. Louis Vintro notes that this aspect of automation has been slow in the past. But, with the advent of more powerful computing platforms, "Machines will be able to do a lot more processing to help identify and communicate trends, while at the same time maintaining performance of the machine."

Aside from being able to deliver better quality product while maximizing yield, advanced system automation will provide cost effective solutions to the industry labor shortage. With the cost of labor rising every day and the availability and reliability of skilled workers decreasing, plant owners will inevitably turn to sorting technology that requires little to no human intervention when it comes to operation or maintenance.

"The skilled labor we need is increasingly hard to find," states Pauker. "The right direction for the future is: simple, easy to maintain, easy to repair."

EVOLUTION #3

INFORMATION ANALYTICS

Future sorters will be developed to add value beyond just sorting product – providing additional information beyond what is required to perform the sort function. Making greater use of the information that a sorter naturally knows will allow processing lines to run more efficiently, unlocking business intelligence that can extend beyond the production floor.

Marco Azzaretti says, "Information about the product and the process the sorter sees is valuable to the food processor. It allows them to make more effective decisions about processing operations up and downstream from the sorter. Food processors are increasingly automating the management of their entire processing line through higher-level factory automation systems – like SCADA and line Management Execution Systems (MES). Increasingly, the sorter will be asked to be an integral part of the overall factory management systems and to provide more information to them."

Key's Vintro agrees. "Our ability to detect characteristics about the product other than what's needed for a sort can be helpful for a food processor to make adjustments about the plant. For example, being able to tell if the product has too much peel can indicate the need to adjust the peeler. Even though you're collecting information you're not sorting on, you're sharing it to improve other parts of the line. Today, there's a whole Internet-based infrastructure that allows you to do that."

Increasingly, sorters will also become sources of business intelligence for food processors, capable of identifying everything from trends in product characteristics over time (such as from one season to the next) to reflecting batches from different raw suppliers. Azzaretti provides an example:

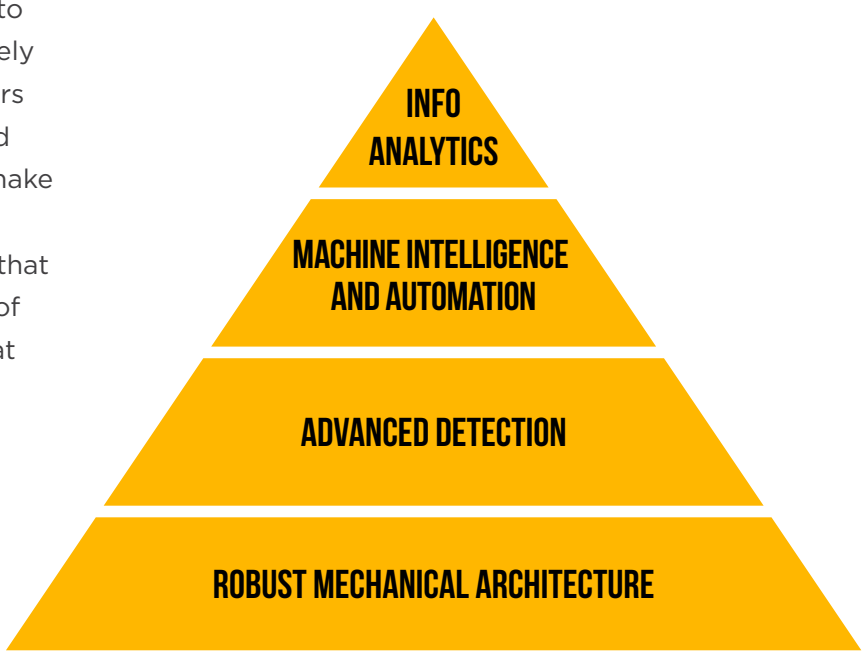
"Say I'm a food processor and I want to trend FM [foreign material] occurrences over time. Now, I can get a report that shows the frequency of glass FM findings, which allows me in turn to correlate if that FM is linked to a certain time of day or product that is coming in from a specific batch. With that information, I can isolate the potential source of introduction for that FM into the product stream. Or, I can see at what times incidents occur and understand if there are specific issues around plant conditions or labor at that time. I have a fully informed view of what is happening, that allows me to understand root cause in order to eliminate the problem."

Tim Justice believes that the ultimate benefit of these advanced analytics will be profitability. He says, "Future sorters will allow our customers to achieve profitability more flexibly and effectively based on changing conditions. While customers can't predict or control things like weather and variability of raw materials, they still need to make a product and a profit. And, future sorters will have the ability to help them deal better with that variability, allowing them to put a raw stream of material in and extract the maximum value that meets the demand."

THE INNOVATION PYRAMID

In thinking about the future of sorting technology, one other fundamental area our experts identified is mechanical innovation to help the sorter withstand the dynamic, aggressive plant environment. While advancements in electronics will help processors accomplish much, they still need their sorter's mechanical architecture to be more able to withstand the heat, humidity, product and debris they endure during operation.

With a robust mechanical architecture at the base, the ongoing innovation in sorting can be thought of as a pyramid – layering on advanced detection capabilities, automation intelligence and analytics. As food processors evaluate their sorting technology going forward, they can evaluate the amount of innovation at each level. Clearly, the sorting technology with the strongest mechanical foundation and the greatest functionality and integration all the way to the top will deliver the greatest value and performance.



CONCLUSION:

As digital sorting technology continues to evolve and the innovation pyramid begins to grow, food processors have a lot to look forward to, including:

INNOVATION	BENEFIT
Sorting technology that utilizes more ways of generating contrast between different objects	Develop a greater ability to perform non-destructive interrogation of customers' products
Sorters that can conduct subsurface inspection for QC inline, for every piece of product, as opposed to testing a sample offline	Ensure quality for 100% of the product sorted; throughput and yield benefits from the ability to make real time decision from inspection results
Self-learning sorters that can run on their own, with minimal human intervention	Provide cost effective solutions to expensive labor shortages, and the ability to deliver better quality product and maximize yield
More sophisticated algorithms that allow sorters to better understand data collected by sensors	Determine trends and improve communication for optimal line management, while maintaining performance of the sorter
Sorters that can collect information in order to improve the product line beyond just sorting	Create better quality product and a higher profit for processors worldwide
Sorters that understand and take into account the inevitable variability of food products	Allow processors to drastically improve yield and minimize waste

When you put the various innovations predicted for the coming years together, the result is a digital sorter that functions much like the human brain – a sorter that delivers the intelligence, quality, efficiency and profitability that food processors are looking for.

SOURCES

[1] "Optical Inspection: A finer line of separation," *FoodEngineering*, **http://www.foodengineeringmag.com/articles/94423-optical-inspection-a-finer-line-of-separation**

[2] "B&R: Firms turning to automation as production process complexity grows," *FoodProductiondaily.com*, **http://www.foodproductiondaily.com/Markets/Cooperation-between-humans-and-robots-increasing-in-F-B-industry**

ABOUT KEY TECHNOLOGY

Key Technology (NASDAQ: KTEC) is a global leader in the design and manufacture of process automation systems including digital sorters, conveyors and processing equipment. Applying processing knowledge and application expertise, Key helps customers in the food processing and other industries improve quality, increase yield and reduce costs.

With its new VERYX™ digital sorting platform, Key is setting a new standard for transformational intelligence, offering for the first time a comprehensive solution that delivers 100% sustained product inspection, pixel data sensor fusion, intuitive user experience and advanced automation and analytics.

An ISO-9001 certified company, Key manufactures its products at its headquarters in Walla Walla, Washington, USA and in Beusichem, the Netherlands; Hasselt, Belgium; and Redmond, Oregon, USA. Key offers customer demonstration and testing services at five locations including Walla Walla, Beusichem, and Hasselt as well as Sacramento, California, USA and Melbourne, Australia; and maintains a sales and service office in Santiago de Queretaro, Mexico.

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