Job growth and food safety

By David Hunt

The bustle inside the Wright Foods plant in Troy, N.C., contrasts sharply with the quiet atmosphere of its rural surroundings. The small town, settled by Scottish immigrants on the edge of the Uwharrie Forest before the Civil War, seems a more likely mecca for fishing than food processing. But the company’s year-old factory off N.C. Highway 24 is at the center of a scientific revolution that’s changing the packaged food industry.

It’s bringing the region, long plagued by high unemployment, along for the ride. “We’re in the bull’s-eye,” says CEO Michael Drozd. “If North Carolina wants a model, we’re it. We’re the model for economic prosperity in North Carolina.”

It’s not hard to win converts, including North Carolina Gov. Pat McCrory, who toured the plant in July to see if the company had found matching funds for a $1.5 million economic development grant from the state. Wright Foods didn’t disappoint, announcing a $53 million expansion that is projected to triple the size of the plant, adding 120,000 square feet and more than 500 new jobs.

The company’s growth is particularly welcome news for Ashley Cagle, director of the Economic Development Corporation in Montgomery County, where Troy is the county seat. The region has long prided itself on the diversity of its open spaces — from farms to golf courses — and its wealth of natural resources. But the loss of textile and furniture manufacturing jobs in recent years has cast a long shadow.

“We are one of a handful of counties that have seen a decline in the population of young people every year,” Cagle says.
Like a lot of rural areas, we have trouble retaining residents under 30 because of a lack of opportunity.

The new job opportunities coming to Wright Foods may help stabilize the demographic shift, she says.

“The jobs they’re offering are on the forefront of technology,” Cagle says. “They’re new and evolving. I think those jobs will enrich the workforce.”

GAME CHANGER

Innovation is the watchword at Wright Foods, founded last year by Drozd and NC State food scientists Ken Swartzel and Josip Simunovic, who have received university honors for innovation. The company was born out of a decade of research at the Center for Advanced Processing and Packaging Studies, sponsored by the National Science Foundation.

The success of the venture also stems from a fortunate convergence of consumer demand and industry need. By luck or design, the company seems to have come up with the right product at the right place and the right time.

“If we had launched this five years earlier, we wouldn’t have had nearly the success,” Drozd says. “The timing is perfect.”

The partnership started with a question. In the late 1990s Drozd, then working at an equipment manufacturer in Research Triangle Park, fielded a telephone call from Simunovic at nearby NC State.

“Can you guys heat food that’s being pumped through a pipe?” the researcher asked.

“Why would anybody want to do anything like that?” Drozd thought to himself.

Answering that question would eventually lead to dozens of inventions, 10 patents and a wildly successful startup company, all focused on finding better ways to package and deliver processed foods.

“We’re a game changer,” Drozd says. “We keep the technology moving forward. We’re always looking for ways to innovate.”

Innovation is hardly a new concept in the food processing industry. Since the early 20th century, consumers have relied less on homegrown products and more on grocery shelves stocked with an ever-increasing variety of packaged products to feed their families. Big food brands have led the way in embracing new materials, phasing out glass containers in favor of plastic, for example.

Now researchers at NC State are focused on delivering a knockout blow to one of the last old-fashioned food packages still sitting on store shelves: the metal can. In its place, look for new packages that are lighter, safer and greener, and can hold an amazing variety of shelf-stable foods without preservatives or refrigeration for years.

ASEPTIC SOLUTION

Anyone who’s ever opened a jar of preserves has enjoyed the benefits of shelf-stable food. For generations, people have followed a simple formula: fill a jar with an acidic food like tomatoes or strawberries, and then boil the jar in a pan of water until a seal forms under the lid. The action creates a vacuum in an acidic environment that discourages the growth of bacteria. Canning doesn’t deliver a product with the same flavor or texture as fresh fruit, but it extends the shelf life of many foods well beyond the growing season.

A better system, first tested in the 1920s and then initially commercialized in the 1940s, involves sterilizing both a food product and its container separately, and then combining them in a sterile environment. Aseptic processing, as it is known, is sort of like canning on steroids, delivering a wider variety of shelf-stable foods more reliably, efficiently and safely than home canning. The technology also has a long history in Europe, where aseptically canned milk was first marketed in 1953.

“The jobs they’re offering are on the forefront of technology.

They’re new and evolving. I think those jobs will enrich the workforce.”

— ASHLEY CAGLE
Efforts to perfect the aseptic process have kept food scientists busy since then.

The Schaub Food Science Building at NC State is home to the two food scientists behind Wright Foods. Here, in a ground-floor lab, they’ve built an elaborate testing system to help turn ideas into reality. It’s a time-tested relationship for Swartzel, a pioneer in the field, and his colleague and former Ph.D. student, Simunovic, now an associate professor. The relationship intensified in 2006 when the researchers teamed up with Drozd to found Aseptia Inc., the parent company of Wright Foods.

Together, the professors and their students have created a wealth of new processes, prototypes and products. And they’re not nearly done.

“Chemists, microbiologists and engineers all work together to solve problems. And it’s a very applied science. You see the direct connection between basic science and how it applies in the real world.”

— AN Troung

In fact, pumping products through a system of heated pipes — called continuous flow thermal processing — is a common way to sterilize liquids like soups, sauces, fruit juices and other beverages. The trouble starts when you try to sterilize something like minestrone soup, beef stew or salsa.

“Minestrone has over 10 different solid components, flowing with different velocities and heating at various rates,” Simunovic says. “How do you quantify the amount of heat that each of them has received and how will you deliver the process that will make each and every piece properly sterilized? It’s a very challenging puzzle for a scientist.”

And it’s a puzzle with public health implications. If you improperly or partially sterilize a highly acidic food like strawberry preserves, you most likely risk little more than an upset stomach, assuming you have a healthy immune system. Low acidic foods, on the other hand, can harbor some truly serious pathogens, including Clostridium botulinum, nature’s most heat-resistant pathogenic bacterial spore and the cause of botulism, a rare but sometimes fatal paralytic illness.

Perhaps the easiest way to approach the problem would be to simply overheat the soup until all those bits of green bean, carrot, celery and pasta were reliably sterilized. That’s a nonstarter for the industry. Heat not only degrades the nutritional value of food, it impacts sensory characteristics like appearance, color, flavor and texture. All are important consideration for consumers.

The NC State team began to unravel the puzzle looking for ways to speed up the heating process, to make it virtually instantaneous and uniform at the same time. This process, called advanced thermal sterilization, seeks to maximize both quality and food safety.

Through years of experiments, pumping untold gallons of simulated and real minestrone soup through the lab’s testing equipment, Simunovic and his students have developed a system tailored to the needs of the industry, combining advanced thermal processing with continuous flow monitoring in a completely aseptic environment. Pair it with environmentally friendly cartons, cups and pouches, and the innovative system sets a new standard for food processing and packaging. Ingredients go in one end of the elaborate airtight system, and a box of soup or a squeezable fruit pouch — ready for store shelves — comes out the other.

Early on, just figuring out a way to measure the effectiveness of the system seemed an insurmountable problem. To avoid overheating the minestrone soup, the researcher needed a device that would alert him as soon as each ingredient —

ABOVE: The Wright Foods plant in rural Montgomery County has launched a $53-million expansion after less than two years in business. That’s good news for employees like Marco Torres.
every individual piece of pasta, carrot and celery — was bacteria free.

One of his collaborators, Koray Palazoglu, now a professor of food engineering at Mersin University in Turkey, frustrated at Simunovic’s initial ideas, came up with an elegant solution on his own. He soldered two tiny magnets together, with their like poles facing one another, and embedded them inside a plastic cube about the size of a piece of carrot. Then he placed the plastic carrot into a batch of minestrone soup and ran it through the lab’s continuous flow testing system, a long series of tubes mounted on the west wall of the lab.

Magnetic sensors on the outside of the tubes tracked the progress of the simulated carrot and its tiny magnets on their journey through the system. When the solder melted, the magnets jumped free of each other, causing a spike in the magnetic signal picked up by the sensors.

Because the alloy he used for the solder melts at a temperature just above the temperature required to kill Clostridium botulinum, Palazoglu was able to gauge the position of the carrot at the time it was effectively sterilized.

After his success with the simulated carrot, he and other researchers eventually did the same for every other ingredient in the soup, crafting small plastic peas, onions, beans, peppers, potatoes, celery and pasta for testing. Eventually, the data helped Simunovic define the minimum time required to safely process an entire batch of soup.

“We have hundreds of prototypes of these little simulated food particles now that we can create on a 3-D printer,” Simunovic says. “We have very strict principles regarding how to fabricate them, and they’re simulated very conservatively. They’re better protected than a real carrot. So if we can deliver sterility to that particle, then we know that all the carrots in the process will be done properly.”

THE TASTE OF SUCCESS

At Wright Foods, where workers load bushels of apples onto a conveyor belt that never sleeps, you can taste success — literally. Drozd picks up a pouch of baby food and twists off the top. The fruit is all natural, high in vitamin C and retains more than 90 percent of its natural flavor. It’s a big hit with consumers.

“There’s an interesting dynamic in the marketplace,” he says. “For the first time in history, people are acutely aware of nutrition and what they put in their bodies.”

He describes a recent trip to the grocery store, where he watched a couple read every ingredient on every package before placing it in their cart. In an age of health-conscious consumers, packaged foods that deliver both flavor and nutritional value have a competitive advantage.

Those same attitudes will likely lead to the disappearance of metal cans from grocery shelves as consumers avoid them to reduce their exposure to bisphenol A, a synthetic compound that acts as an endocrine disruptor. The chemical is found in some plastic products and in the epoxy resin used to line the inside of many metal cans.

Moving hundreds of products from cans to cartons will be a challenge for the industry, but one that opens a window of opportunity for Wright Foods — if it can expand fast enough.

“I didn’t really set out to build a business venture. In my mind, I set out to solve a puzzle.”

— Josip Simunovic

ABOVE: Wright Foods is moving from consulting to product development and product packaging. Employee Anita Shek is a 2012 graduate of NC State’s food science program.
“We can produce and package foods that other companies can’t,” he says. “That opens a lot of doors.”

**PEOPLE SKILLS**

Doors also are opening on the research side, where Simunovic is negotiating a collaborative research agreement with the U.S. Army Soldier Systems Center in Natick, Mass. There, he hopes to test further refinements in aseptic technology, including a process for rapidly cooling food that has been sterilized before packaging. Once perfected, that innovation — coupling rapid heating with rapid cooling — could virtually eliminate the differences in flavor and texture between fresh and processed foods.

“They’re in the best position to evaluate food quality,” Simunovic says of the Army center. “They have a world-class team of sensory scientists and trained tasters, and they have chambers for shelf-life testing and simulation climates. I took a tour. On one side of the street they had a tent with a Sahara climate, and on the other side of the street was another big tent with an arctic climate. It’s pretty amazing.”

For all his expertise, the researcher is constantly looking to collaborate, reaching out to colleagues across campus as well as industry professionals like Drozd.

He also values teams with a variety of cultural and international backgrounds.

“At one point we had collaborators from five different continents working on a project that resulted in another North Carolina food processing facility, the first of its kind in the world,” he says.

Over the past decade, collaborators have included researchers Pablo Marcelo Coronel from Ecuador, now working with Aseptia; Prabhat Kumar of India, now at Frito Lay; Cristina Sabilov of Romania, now at Louisiana State University and Yvette Pascua Cubides, an American completing her Ph.D. at NC State.

“Cross-pollination in this industry is key,” he says. “Bringing in experts from different fields can change the game.”

The same holds true for students. Simunovic keeps an eye out for inventive undergraduates and graduate students he can recruit into his lab. Regardless of their background, be it biology or mechanical engineering, students can get an invitation if they impress the professor.

“I’m very selective and critical,” he says. “What I like to see is a spark. I like people who can orchestrate things and coordinate other people and activities.”

At NC State, where entrepreneurship and collaboration play a role in much of the curriculum, it’s not difficult to find students who fit the bill. Graduate student An Truong, who dropped plans for medical school to study food science with Simunovic, is excited about the opportunities to put his research into action.

“It’s such a multidisciplinary field,” he says. “Chemists, microbiologists and engineers all work together to solve problems. And it’s a very applied science. You see the direct connection between basic science and how it applies in the real world.”

Nowhere is that more evident than in Troy, where Drozd is interviewing job candidates to join his growing staff. When he breaks for lunch at a nearby sandwich shop, the manager tells him the new plant has done wonders for the town, lifting spirits in tough economic times.

“That comment felt better than any other accolade,” Drozd says. “We’re having a real impact on the community and on North Carolina. That’s because we’ve combined state-of-the-art technology with the state’s strengths in people and natural resources.”

It’s a model — and a message — he hopes will resonate far beyond the food processing industry and his small town on the edge of the forest.

“Stop focusing on ephemeral service-based industries,” he advises state leaders. “Manufacturing is what will make North Carolina great again. That’s sustainable growth.”