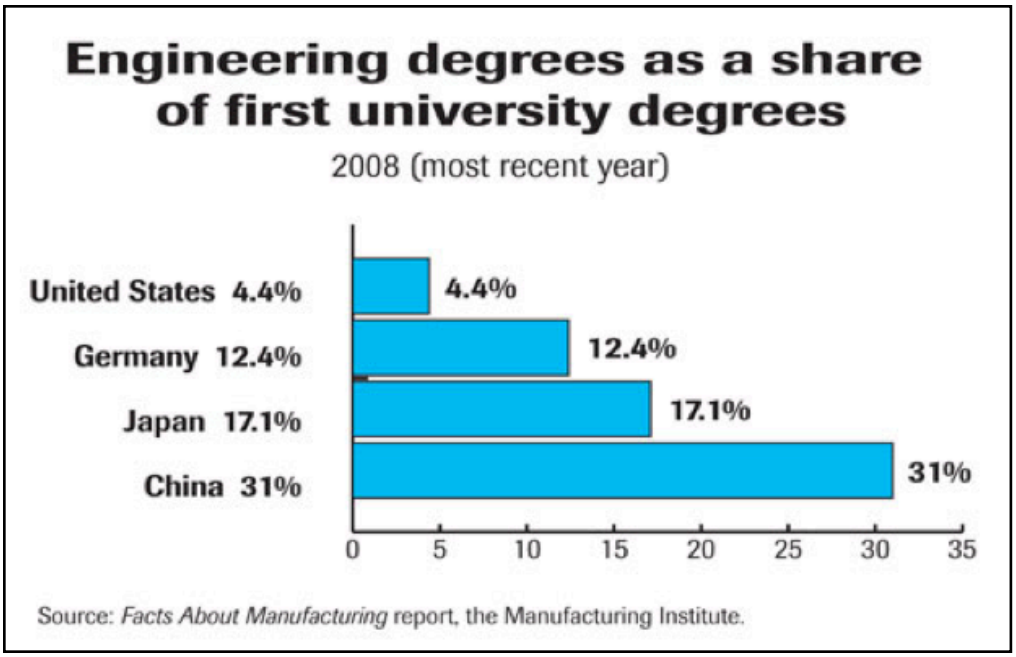
Food Engineering

The employee engagement challenge: hiring, training and retaining key staff

US food and beverage plants are looking in house, on campus, online and at third parties to fill their engineering staff needs as industry advances loom.

by Mikell Knights, Senior Editor



The percentage of US graduates with engineering for their first university degree lag behind both developed and emerging nations. Source: The Manufacturing

According to Facts About Modern Manufacturing, a report produced jointly by the Manufacturing Institute, the Manufacturer's Alliance for Productivity and Innovationand the National Association of Manufacturers, engineering degrees in the United States account for just 4.4 percent of total first university degrees.

This lags significantly behind other developed nations such as Germany and Japan which report their shares of engineering graduates at 12.4 percent and 17.1 percent respectively. "By any interpretation, the US has a considerable challenge with its engineering workforce," according to the report, published in October 2012 and updated in January of this year.

The adoption of lean principles and practices by numerous companies engaged in food manufacturing, following the sharp economic recession in 2008 and protracted recovery, coupled with an ever-increasing requirement for technological advancement, has placed a premium on finding talent either as new hires or to fill the shoes of recent retirees.

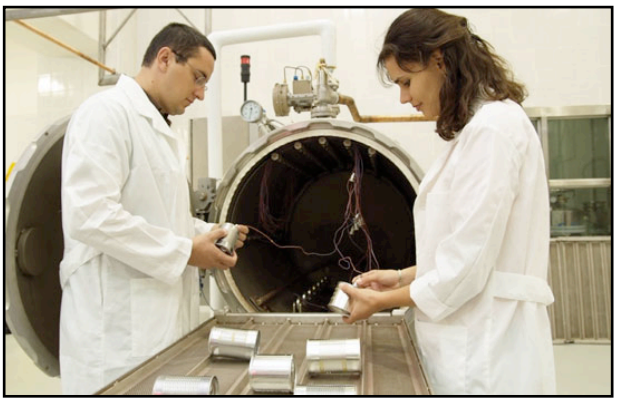
For the food manufacturing industry, finding agricultural, biological, chemical, electrical, environmental, life-science, mechanical, packaging or process engineers with the talent or ambition to work in this sector is even more limited as few schools include food science in their course curricula.

RECRUIT REGIONALLY

"We are having a tough time getting experienced talent recruited into the company for positions requiring five to seven years in the manufacturing industry," says Gregory Lisso, senior director of engineering at J.R. Simplot. "The most difficult engineering positions to fill are senior level project engineer and any level of packaging engineer." The firm often looks for people with in-demand automation expertise that covers control logic skills, PLC and servo motors, and experience with power generation processes like steam.

Lisso says a fairly strong food industry, despite the economy, makes it tougher to draw experienced talent away from other companies, and the limited number of schools offering packaging engineering as a discipline limits the number of new hire candidates. The lack of available engineering talent is especially troubling for Simplot since it is expanding capabilities through new plant construction, technological upgrades to older facilities and business acquisitions.

To solve its engineering problem, Simplot has initiated an innovative management trainee program, hiring talent into the organization, even when a suitable position isn't open. "We may not have titled positions for them, but we've determined they have excellent skills and are the right fit for our company," says Lisso.



Management trainees are put in different parts of the company where they learn the business while waiting for the right position to open up through attrition or growth.

In addition, Simplot has established an internship program directed at new engineering graduates. Part of the company strategy is to always have two to three vacancies open in the program year-round. Engineering staff already onboard can take advantage of an in-house professional development program to pursue continuing education related to their field or take part in a Six Sigma course.

According to Jim Prunesti, vice president of global engineering at The Campbell Soup Company, it is evident the engineering resource pool is shrinking. "I've looked at data that shows the amount of people leaving the engineering force due to retirements is greater than the amount of engineers coming out of school. Even if our engineering team gains additional resources through company acquisition, the additional resources often times has a heavy work load and is supporting their own projects."

Campbell's continually commissions projects of various types that require engineering expertise. "There are growth projects where we add capacity to meet demand; savings projects where investments are made to improve cost structure and may be automation or speed related; regulatory projects designed to meet a quality standard or environmental requirement; or a safety project where we invest to provide a safer place for our employees. Engineering staff is critical to each project type," says Prunesti.

The processor leverages its staffing needs with outside engineering firms, a model common in the food industry, Prunesti states, whereby a certain percentage of in-house resources focuses on core competencies and critical technologies while external resources manage more common aspects such as building works or infrastructure systems.

New engineering hires, training and retention are supported by peer and career mentoring. "The reality is that when a new hire comes into the workplace, the teams they become a part of are not only multi-cultural but multi-generational and multi-experienced. Some team members are tech savvy, and others are old school wise, so the challenge is how to achieve and maintain a high level of productive collaboration," says Prunesti.

Informal coaching or mentoring involves connecting a new hire with a team member or someone outside of engineering who can provide perspective for or partner with the new employee to help him or her navigate challenges. Along with formalized training, this helps to build interpersonal relationships between the baby boomers, generations X and Y and the newest generation of graduates called millennials, says Prunesti. This is extremely important as each age group may embrace different work ethics.

Campbell's wants its employees to feel like asset owners. "We focus on training and building operational readiness; if you do not train from the outset, think about the performance of the line after install. Without it, you are at risk to run more unfavorably because you have sunken costs that can impact your bottom line. Helping to build collaboration upfront makes everyone involved the first line of defense on machine performance, process excellence and product quality," says Prunesti.

SCHEDULING SCHOOL

Karl L. Linck has spent 38 years as an engineer in the food processing industry, currently working as vice president of engineering for Sargento Foods Inc. For Linck, finding and training engineers is a major project. "I got my start at Kraft Foods armed with a general engineering degree, coming up through the maintenance side of the organization which exposed me to a lot of technology, equipment and processes." Subsequently, Linck moved into corporate operations at Kraft and worked in on projects varying greatly in size and complexity.

"I was fortunate because I worked in a large company and could move around and pick up a lot," he says, adding that it is more common for a food processing firm today to farm out its engineering. This leaves new arrivals with less opportunity to learn, and according to Linck, "they come out of school with the basics, but they have no real knowledge of how to handle food. There is a real need to have people understand things from the food science side. There is some complacency in the food industry with trial and error or overdesign, and we just can't rely on those methods anymore."

Although attempts are made to pass on the knowledge base from more experienced engineers to fresh recruits as they come into Sargento, incoming engineers need the basics in a structured educational environment to truly understand the best practices and how theory meets reality in the food industry.

Linck spent two years researching educational programs that provided some link to food science or food processing, landing on a distance learning course that offers advanced degrees (Master of Engineering and Master of Science) or certificate with emphasis in food engineering (for those who a have a bachelor degree in engineering) or food technology (for those who do not have an engineering degree). The programs are offered the Texas A&M University at College Station, through its Department of Biological & Agricultural Engineering.

Before referring the program to his colleagues, Linck enrolled in two of the six graduate-level food engineering education courses to determine the value of their content, whether the program could be completed by someone working full-time and if the time commitment was reasonable. Linck gives both courses high marks. "The first class covered basic food operations and provided an incredibly thorough overview of what is going on in different processes, from thermal processing to deep fat frying to pumping, freezing and dehydration. It touched on every significant process."

The second course focused on food rheology, providing instruction on different foods; how they behave when deformed or subjected to pumping, pressures, temperatures or residence times; tools and methods to measure food rheology; and how shear can destroy certain foods. "Class assignments reflected real-life food manufacturing problems," states Linck.

The course included online PowerPoint and video instruction, along with PDF-formatted reference textbooks and access to virtual labs. Linck says the course taught him, an engineer with nearly four decades of food experience, new things. He is planning to enroll in another course and will suggest the program to new colleagues.

A&M INSTRUCTS THE NEXT GENERATION OF FOOD ENGINEERS

an exclusive Q&A with Texas A&M Assistant Department Head and Professor of Food Engineering Rosana Moreira

The Food Engineering/Food Technology program offered through the Biological and Agricultural department at Texas A&M, College Station, TX, provides instruction on a range of core principles, practices and processes critical to food manufacturing.

Rosana G. Moreira, professor of food engineering and assistant department head at BAEN-TAMU talks to Food Engineering about the program in an exclusive interview.

Food Engineering: Do you agree with the statement that many engineers end up in food and beverage plants but don't necessarily get the training?

Dr. Moreira: Yes. As a professor, I have had the opportunity to teach and advise many graduates who end up working for a wide range of food and beverage companies. My contacts with different companies have expressed the need for a training program for their incoming/junior engineers.

Many of the engineers hired by food companies have little or no food engineering knowledge. Therefore, they develop their own internal training programs to help accelerate the new hires' food engineering skills.

Even their current food engineers require additional education to improve their knowledge to develop their critical thinking skills and remain current with the latest technological developments. A quality control manager of a food company recently told me he wants its employees to get an advanced degree to strengthen their critical-thinking and problem-solving skills.

Food Engineering: Is there a gap between the high demand from food and beverage companies and a lack of qualified food engineers?

Dr. Moreira: In my opinion, yes, at least in the US. The companies cannot find food engineers in the market so they end up hiring chemical and mechanical engineers and training them in house. Most of the time, the big companies offer them courses in food chemistry and engineering properties of foods.

Unlike Europe and Latin America, for example, the US does not offer an undergraduate degree in food engineering. The engineers who have some knowledge in food engineering graduate with ABET accredited degrees from biological and agricultural engineering departments around the country such as Purdue, Ohio, Davis, Michigan, Iowa, North Carolina, Florida, Texas A&M, etc.

At Texas A&M University, for example, the biological and agricultural engineering degree offers different emphasis areas, one being in food engineering. The undergraduate students take elective courses related to unit operations in food processing, food packaging, food microbiology, food chemistry and some process technology courses for meat, baked goods, fresh produce and so on.

Additionally, some of the core courses like heat and mass transfer, properties of biological materials and thermodynamics include many examples related to food. We also encourage students who are interested in food engineering to take a minor in food science to really understand how food materials behave during processing and storage. Without a formal training in food engineering, the newly hired engineers will take at least three to five years to become experts in some aspects of food engineering.

Food Engineering: What type of engineering background goes best with food engineering training and why?

Dr. Moreira: As I mentioned before, the biological and agricultural engineers who were trained in food engineering are preferred. These engineers also tend to have more hands-on experience than the other engineering disciplines. Chemical engineers are the second-best because they have a good background on processing [heat and mass transfer, thermodynamics, unit operations]; however, they are very limited on the knowledge of food science and technology. Also, they have no no knowledge of food chemistry and physical, thermal and rheological properties to allow them to apply engineering principles to manufacture food products. That is why they need more training. In general, the learning curve for biological and agricultural engineers is less steep than for engineers from other disciplines.

A master of engineering degree in food engineering is another option to help engineers become more familiar with the science and engineering behind food processing and technology. I have had chemical, electrical and industrial engineers as graduate students who end up working in many food companies with great success.

Food Engineering: What aspects of the process, equipment, products and basic food safety do the Texas A&M courses cover?

Dr. Moreira: They cover a myriad of topics, which include:

(1) Fundamentals of food processing (heat and mass transfer in foods, thermodynamics refrigeration systems and psychrometics, food rheology, food properties), quality aspects of food (kinetics of food nutrients degradation, shelf-life extension), food safety (kinetics of microorganism death, thermal and non-thermal processes);

(2) Food processing applications: pipeline design and pump selection for Newtonian and non-Newtonian fluid foods, food extrusion, food freezing, food dehydration, microwave principles, thermal and non-thermal processing, food storage, deep-fat frying;

(3) Engineering aspects of food packaging;

(4) Advances in food engineering: nanotechnology applied to food processing, engineering aspects of food irradiation, modeling food processing, microorganism growth, Monte Carlo simulation;

(5) Electives which cover food chemistry and food microbiology.

Food Engineering: The food education program at Texas A&M includes certificate and master-level courses offered as distance learning and onsite programs, is this correct? How do they differ from each other?

Dr. Moreira: We offer two master programs: *Master of engineering in biological and agricultural engineering* (MEng in BAEN with emphasis in food engineering), which requires a bachelor's degree in engineering, 30 credit hours of coursework and a final project. The emphasis is on the applications of engineering principles to the manufacturing of food products.

Master of science in agricultural systems management (MS in AGSM with emphasis in food process technology), which requires a bachelor's degree in food science, AGSM or another related field. The student must take 36 credit hours of courses. This degree is designed for engineers, and the emphasis is on the application of food science and management to food processing technology.

We also offer certificates for students who want to obtain expertise in a specific area. They require at least three courses for certification in food processing engineering, for example. A course that earns students continuing education units is available as well.

Food Engineering: How many students have come through the program, and how many are working as food engineers currently?

Dr. Moreira: The Distance Education degree is still very new. We have one M.Eng. student working full-time in the industry who is graduating in December 2013. Another is set to start in spring 2014. One engineer who is working full time took two courses online. We have had many inquiries about the program and are very positive about its potential for growth.

We also have a traditional (non-distance) master and PhD food engineering program at the BAEN Department, from which more than 60 students have graduated since 1990.

Food Engineering: What are some of the more recent or significant advances in technology in the food industry?

Dr. Moreira: In the past 15 to 25 years, several alternative preservation technologies have been developed for application to food products with the objective of meeting consumers' demands for fresh-like, highly nutritious and safe foods.

These technologies include (1) novel thermal processes such as microwave and ohmic heating, which are much faster than the current canning method to produce shelf-stable foods; (2) non-thermal processes that do not use heat to inactivate microorganisms in foods, such as ultra-high pressure (UHP), pulsed electric fields, ultrasonic waves, high-intensity pulsed light, ionizing radiation and others; (3) new processing technologies like vacuum frying and microwave frying and drying; and (4) new packaging materials such as active packaging or smart packaging that help extend shelf life, monitor freshness, display information on quality, improve safety and improve convenience.

Food Engineering: Are the advances in specific areas such as food chemistry, food microbiology and food irradiation, or in specific processes such as freezing or pasteurization?

Dr. Moreira: All of the above. Advances in food processing technology require multidisciplinary contributions from food science and engineering areas. Development or improvement of a processing technology needs a full understanding of what affects the product, how and why, so the process can be optimized. The science and engineering aspects of food processing technologies cannot be separated. A microbiologist may have an idea for a new sensor for pathogen detection, but most of the time he or she will work with chemists and engineers to develop a prototype and then the final product. Therefore, technology advances can be discipline-driven or process-driven, say, optimization of an irradiation process for high-oil content foods such as nuts.

Food Engineering: How do the distance learning courses differ from the onsite courses?

Dr. Moreira: The distance education students take the same course with the same rigor as the local students. They earn exactly the same degree they would earn if they studied on our campus in College Station, TX. The standards for admission, coursework and graduation are the same, and their diploma is the same as for students who come to campus to study.