BIG DATA & FOOD PROCESSING

A GUIDE TO *leveraging analytics* AT YOUR FACILITY

stellar
TAKING SOLUTIONS FURTHER®
stellar.net | 904-260-2900

Big Data and Food Processing:
A Guide to Leveraging Analytics at Your Facility

Stellar
2900 Hartley Road
Jacksonville, FL 32257

Content + Design by Stellar | **stellar.net**

TABLE OF **CONTENTS**

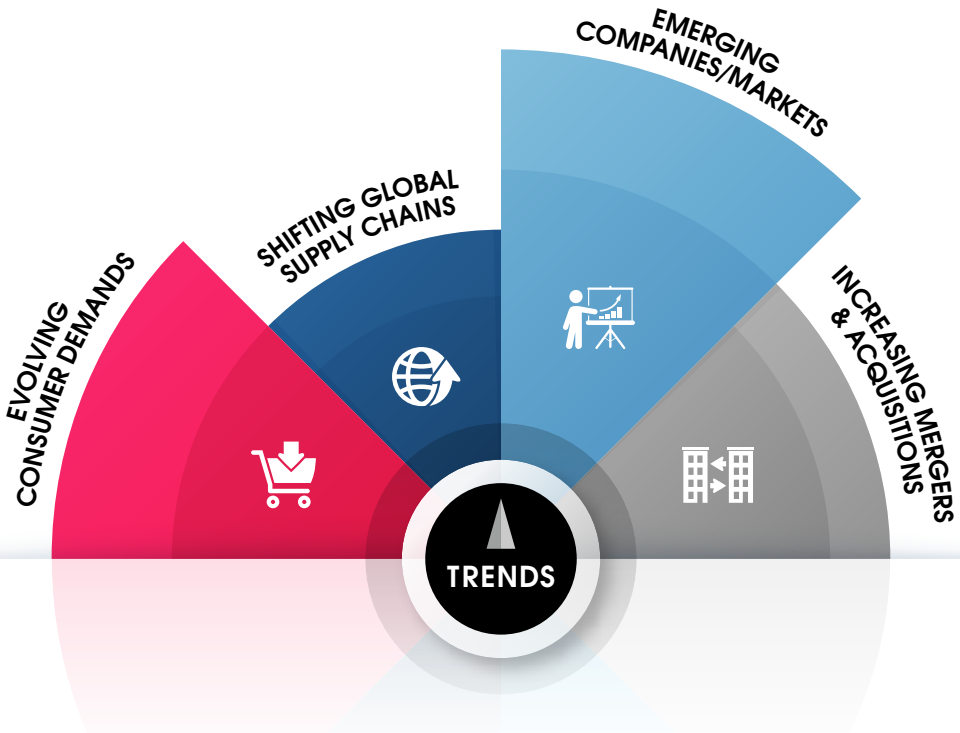
a worthy investment

TODAY'S **FOOD INDUSTRY**

THE FOOD & BEVERAGE INDUSTRY IS SPEEDING UP

Food and beverage companies today are competing in a fast-paced industry where speed to market is more important than ever. With customers' expectations increasing, food companies must be able to deliver quality products as quickly as possible.

While emerging companies continue to disrupt the landscape, more established businesses are acquiring new brands to better reflect growing consumer interests. Among all these rapid changes, global supply chains are shifting, affecting how and where companies are sourcing raw materials.



In a sink-or-swim environment, food companies must be able to quickly adapt to changing market trends and optimize processes. **An extraordinarily powerful tool for maximizing efficiency is one that food companies already own: their data.** However, there's a big difference between simply collecting data and leveraging it to take your business to new heights.

YOUR FACILITY IS CURRENTLY PRODUCING MOUNTAINS OF DATA. THE QUESTION IS:

Are you taking advantage of it?

WHAT IS **BIG DATA?**

BIG DATA IS NOW A BIG DEAL

Big data comprises the large volume of data that businesses collect on a day-to-day basis. But it represents a lot more than just an accumulation of statistics. By leveraging analytics tools, manufacturing companies can use big data to:

- **Easily evaluate operations**
- **Uncover key insights**
- **Make better strategic decisions**

Traditionally, the different departments at a food plant collect their own data and then share it with each other – an often cumbersome, if not impossible, task for busy employees. The result is that valuable data often goes to waste.

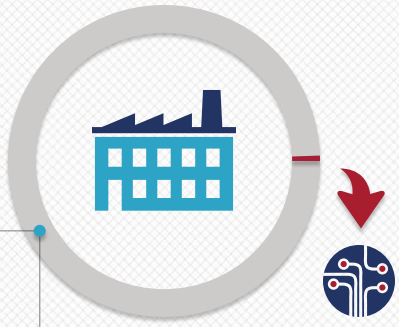
With new analytics tools, food companies can now seamlessly integrate their diverse data sources into one unified platform, allowing decision-makers to **gain a real-time, holistic view of their operations**. These analytics can also be utilized to power automation technology that increases production efficiency while freeing up your staff to focus more on high-level strategy rather than day-to-day operations.

A WORTHY INVESTMENT FOR FOOD COMPANIES

Big data analytics and technology can create new efficiencies for your facility, potentially saving millions of dollars over time depending on the size of your plant and production. If you work with the right design/engineering partner, they will implement analytics technology that yields major cost savings and pays for itself within 2-5 years of implementation.

THINK OF IT THIS WAY:

If you're investing a hundred ***MILLION*** dollars in a new food plant,



why wouldn't you spend a couple hundred ***THOUSAND*** on technology to interpret your data and take your plant to the next level?

HOW DOES **BIG DATA TECHNOLOGY** WORK?

The first step to reaping the benefits of your facility's data is collecting it. At a food plant, this is achieved with strategically located sensors connected to the internet.

THE SENSORS

Sensors are the backbone of your big data system. They can be placed throughout your processing lines, as well as used for inventory management and distribution. Once installed, sensors continually collect and send data to analytics tools, which will interpret the raw numbers to provide insights.

Sensors for processing include:

- **Flow meters**
- **Inspection systems (X-ray, metal detecting, etc.)**
- **Level sensors**
- **Load cells**
- **Moisture sensors**
- **Photocells**
- **Pressure sensors**
- **QC instruments**
- **Servo motor feedback**
- **Temperature transmitters**
- **Vibrations sensors**

Utility monitors are also available for:

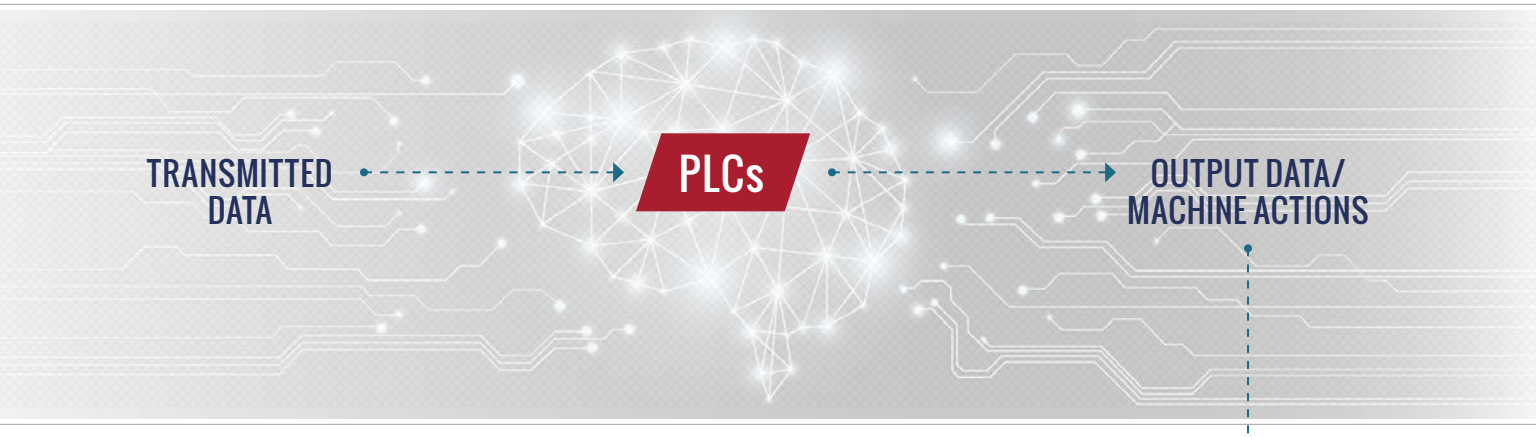
- **Compressed air**
- **Electricity**
- **HVAC**
- **Natural gas**
- **Steam**
- **Water**

THE BRAIN POWER

Once sensors collect the data, it is transmitted to your **programmable logic controllers (PLCs)**, which provide the brain power behind big data. The PLC is the main controller of the machinery with each machine typically having its own PLC.

Every electronic component of the machine (devices, sensors, motors, actuators, etc.) is wired to the PLC as either an input or an output. Linking multiple machines and their PLCs together — typically via ethernet — creates a network in which a PLC can "talk" to the machine (motors, devices) as well as to other PLCs on the network.

The programming in the PLC takes the input (from the sensors) and converts it to outputs (machine actions) based on how the machine is supposed to operate. Some systems use a "supervisory PLC," which all other PLCs are connected to, that processes data and performs global actions.



For this information to be useful, it must be "visible" so operators can interpret the data. This is where programming comes into play.

Many machines will have a **human-machine interface (HMI)** where an operator can see the metrics and status of a machine in real time and make parameter adjustments. These parameters are used by the PLC program to drive outputs.

Machines can also talk to one another to relay data and status information. For instance, if one machine goes into alarm and stops, the PLC will tell the upstream equipment that it also needs to stop in order to avoid a crash when product backs up. When the faulted machine is cleared of the alarm, the PLC can tell the upstream equipment that it is running again and allow everything else to continue automatically.

PLCs also forward data to the Supervisory Control and Data Acquisition (SCADA) system.

global actions

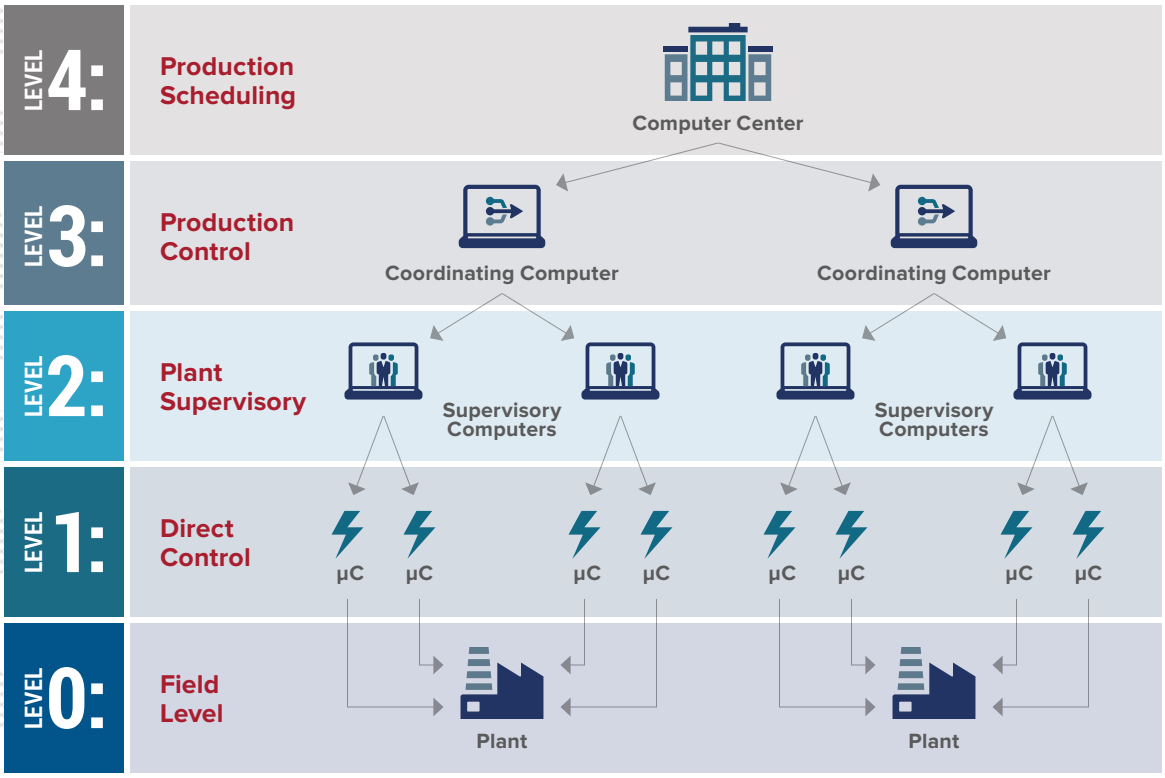
THE SUPERVISOR

A SCADA system seamlessly integrates all of a facility's equipment, enabling your various machines and storage silos to communicate with each other and provide real-time feedback.

But a SCADA system does more than just coordinate different technologies. It acts as a supervisor over the PLCs, monitoring and reacting to real-time data to improve the efficiency of product flow. It can also prompt personnel to address problems occurring on the line and accurately track downtime, replacing manual logbooks.

Essentially, the SCADA system synthesizes data from all sources and then leverages that feedback to automatically optimize processes and share data insights with your team.

Supervisory Control and Data Acquisition (SCADA) System



SCADA systems have come a long way since their introduction as hard-wired relay systems in the 1970s. Thanks to today's technology, SCADA now allows for real-time plant information to be accessed from anywhere around the world.

Today, an employee can monitor the performance and metrics for facilities in South Carolina, Ohio and Nevada simultaneously from an office in California.

Creating the Perfect Cup of Coffee

Royal Cup Coffee & Tea worked with our firm to install a SCADA system to automate processes and simplify the production of the perfect cup.

Capabilities of its system include:

- Continually displays updated readings of coffee bean silo levels
- Monitors weight discrepancies to ensure accurate inventory
- Prompts the cleaning tower to automatically adjust conveyor speeds based on the weight of green coffee bean sacks received

ACCOUNTING INTEGRATION

Automation and analytics can extend to your accounting as well. Accounting software can be integrated into processing equipment controls, allowing it to communicate and respond to activity on the plant floor. If inventory monitoring is automated, the software already knows what products are in stock when you receive a purchase order. Additionally, it's capable of projecting future demand to help you better anticipate upcoming orders and expenses.

projecting future demand

APPLICATIONS OF **BIG DATA & ANALYTICS** IN A FOOD PLANT

Analytics tools can be customized to meet your facility's unique needs and goals – whether you simply want to gain insights to resolve certain pain points or install system-wide automation technology that takes your efficiency to the next level.

Here are the **9 TOP APPLICATIONS OF BIG DATA TOOLS** for food plants today:

1. **Minimize raw ingredient waste**
2. **Improve workforce productivity**
3. **Enhance communication for better product flow**
4. **Streamline material running**
5. **Upgrade packaging efficiency**
6. **Plan predictive maintenance**
7. **Optimize sanitation and cleaning**
8. **Increase food safety**
9. **Boost traceability**

1. Minimize raw ingredient waste

One of the biggest wasted costs at food plants is unused raw ingredients. Shifting from a "made to stock" to "made to order" mindset can increase your plant's efficiency and decrease waste. Analytics and automation are critical to adopting the made-to-order strategy, also known as just-in-time (JIT) manufacturing.

YOU CAN USE PREDICTIVE ANALYTICS TO ANTICIPATE WHAT CONSUMER DEMAND WILL BE LIKE THROUGHOUT THE YEAR,
so that you're only manufacturing what will sell.

Your plant can also minimize waste and the need for extra storage by sharing analytics with key suppliers. This supplier collaboration is accomplished by installing sensors that detect the level of raw ingredients in storage or a silo. The real-time data is then provided to suppliers, who are able to ship ingredients only as needed rather than a standard bulk amount.

Analytics allow you to measure another important metric: **material usage variance**, which can be expressed as a cost or as a percentage of raw material wasted. By adding level sensors and load cells throughout your entire manufacturing process, you can understand exactly where waste is happening and resolve issues costing your plant money.

2. Improve workforce productivity

Automation powered by big data not only eliminates human error for more routine tasks, but also frees up employees to work on more complex issues. While your team is focused on top-level thinking and strategy, the automated system monitors packaging needs and can notify suppliers accordingly. For example, it will alert a supplier if more or less bottles are needed as processing ebbs and flows. **Supplies arrive *just in time* rather than being stored for months,** allowing facilities to be leaner.

3. Enhance communication for better product flow

While it may seem like people would be better at communicating with each other than technology is, plant owners often find that automated systems make it easier for their teams to coordinate.

A common issue for many plants is miscommunication between processing and packaging personnel. For instance, the packaging team may have changed over while the processing team is still producing the same product. This type of miscommunication may be occasional, but it is costly. With analytic tools, however, the processing staff knows exactly when packaging is conducting a changeover, so they can switch products to match.

Sometimes food plants discover they need more product because of a surge in demand. Instead of last-minute changeovers, they can anticipate potential shortages and schedule resources earlier. **Both plant owners and employees are empowered with the increased visibility provided by real-time data.**

next level efficiency

4. Streamline material running

Consumables like plastic film, bottles, corrugated boxes, packaging tape and labels are constantly being used and replenished when empty. If a line goes down while waiting for the supply runs to come back, this can be costly. Many facilities rely on a line operator to relay to a supervisor when a supply run is needed, but if that person gets distracted (since that's usually just one part of their job), that can cause delays.

ANALYTICS-DRIVEN AUTOMATION CAN SEND A RESUPPLY REQUEST TO THE TEAM *as soon as a sensor detects a low supply.*

5. Upgrade packaging efficiency

A well-connected plant can **virtually eliminate costly packaging errors** by catching them in real time. Traditionally, a packaging discrepancy may not be detected until much later after it happened. With an automated system, sensors are programmed to understand the correct SKUs for various products. If there is a discrepancy, the sensors immediately halt processes.

An automated system can streamline packaging by downloading labeling parameters from the server. Instead of an operator manually typing in the date, timestamp and plant code, the information is directly pushed to internet-connected equipment and the operator can concentrate on verifying it.

6. Plan predictive maintenance

When it comes to maintenance, a **proactive approach** saves time and money compared to a reactive one. An analytics system can detect potential issues before they escalate, so you can schedule downtime rather than face an unexpected and costly error during peak production.

Let's look at a few examples:

- Internet-connected sensors can detect abnormalities or thresholds, such as a motor exceeding 80% of its amperage. This could indicate a variety of problems down the line from the motor failing to something binding up somewhere down the line, like a bent shaft or jammed conveyor belt. Additional sensors, such as speed sensors and infrared cameras, can go a step further by pinpointing the exact cause of the problem quickly.
- Data may reveal that it's taking longer than previously observed to heat or cool a process, indicating there might be an issue with the utility system. Again, coupling this with a network of other diagnostics, you could look at the performance of the utility (boiler, chiller, etc.), identify leaks in a pipe, or detect fouling in a heat exchanger. It may just be a stuck valve, which can be detected by using limit switches on the valve electronics.
- In a filling or packaging process, an inline checkweigh system verifies product weights. Some machines, like a bottle filler or vacuum pack depositor, might have multiple stations, and one of those stations might have an issue on an infrequent or intermittent pattern. You can configure a checkweigher to track where each weighed package originated from, allowing you to narrow down which station is causing the variance.

Predictive maintenance gets smarter over time. As you run a piece of equipment and log its issues — such as breakdowns, jams and worn part replacements — the predictive maintenance software will begin to predict when a repeat issue will occur.

It's also worth noting that modern day maintenance teams need to consist not only of wrench-turners and pipe-fitters, but also control programmers who can manage these systems appropriately.

---

7. Optimize sanitation and cleaning

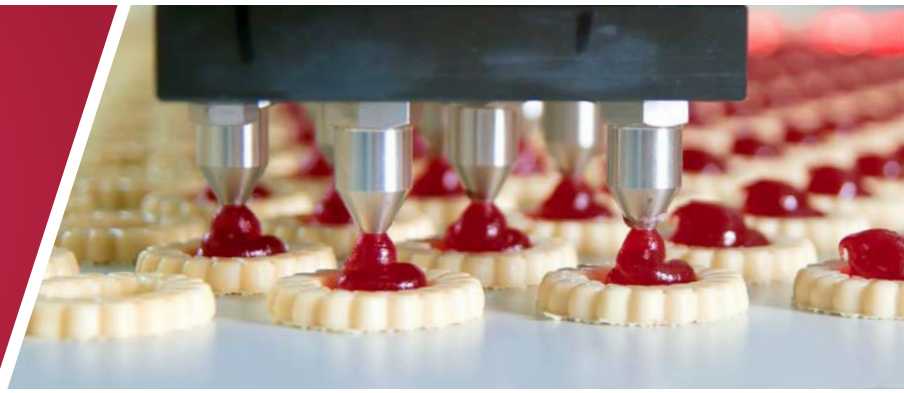
Analyzing data from sanitation processes can reveal inefficiencies and improve the cleanliness of your facility. You can use analytics software to track your **clean-in-place (CIP) process** and discover where bottlenecks may be occurring. This data could result in a new approach that reduces overall downtime, such as strategically staggering CIP procedures. Another application is preventing unnecessary over-cleaning. Sensors monitor the amount of food debris in a machine and clean when a certain threshold is met rather than at timed intervals.

8. Increase food safety

Food companies are only as good as the safety of their products. Automation powered by big data can reduce food safety risks by ensuring the right ingredients end up in the right products. Operators on the plant floor can use the system to easily see what ingredients are required for a recipe and where those ingredients are stored in the facility. Modern batching systems can also automatically add raw ingredients, removing the risk of human error.

In addition, you can improve food safety by using **vision systems** and AI to identify and remove low-quality or defective products. These systems may be able to detect visual anomalies like shape or color based on aggregated data from past product samples.

ENSURE THE RIGHT INGREDIENTS END UP IN THE RIGHT PRODUCTS *at the right time.*



9. Boost traceability

In the event of a recall or contamination issue, speed is vital in resolving the situation. Big data tools make tracing products much easier compared to manual paper trails.

If a supplier issues a recall on a particular batch of ingredients, you can input that information into your system and scanners will prevent any of the flagged ingredients from being used. Likewise, if there is a contamination incident, the system allows you to pinpoint the exact batch in question rather than disposing of otherwise good product en masse.

speed is vital

HOW TO IMPLEMENT **BIG DATA TOOLS** IN YOUR FACILITY

Whether you're building a new food plant or making upgrades to an existing one, the key to proper implementation of big data tools is **partnering with an experienced design/engineering firm**. They will guide you in deciding which analytics tools to use, as well as develop and install the proper sensors and programming.

Bell & Evans Poultry Plant, Fredericksburg, PA designed by Stellar

FOR NEW FACILITIES

If you're building a new facility, it's crucial to work with a firm to develop a big data plan.

INSTALLING SENSORS & AUTOMATION INFRASTRUCTURE IS MUCH MORE COST-EFFICIENT DURING CONSTRUCTION RATHER THAN AFTER THE FACT *because it minimizes downtime.*

Startups opening their first facility should think about installing sensors as well, even if they have budget constraints. They may not be able to implement a full analytics system right away, but they will already have the infrastructure in place for the future.

FOR EXISTING FACILITIES

Starting an analytics system may have a higher capital cost for some existing facilities because of the need to retrofit existing equipment and network infrastructure, such as changing out PLCs or transitioning from older communications like ControlNet to wireless systems. **But that doesn't mean it's not worth the investment.** In addition to gaining analytics and automating processes, retrofitting can extend the life of older equipment and lead to new insights on optimal maintenance.

NO MATTER THE SIZE OR STATUS OF YOUR FACILITY…

A robust network is vital to the success of your analytics tools. Everything from sensors to the SCADA software is internet-based, which means if you don't have an adequate IT infrastructure in place, your system won't function properly. This is where your design/engineering firm comes into play. They can plan and put in place the exact infrastructure you need to ensure a smooth implementation.

WHAT TO EXPECT FROM YOUR **DESIGN/ENGINEERING PARTNER**

When implementing data analytics tools, a good firm will do the following:

- **Educate you on the available technology and which is relevant to your business**
- **Tour your facility, including possibly attending an operations meeting**
- **Examine existing paperwork and operations to analyze the status quo**
- **Ask about your business goals and pain points**
- **Identify opportunities where big data and analytics tools can have the greatest impact on operations and yield the highest ROI**
- **Design tailor-made recommendations for your facility**
- **Coordinate ordering and installation of equipment**
- **Ensure a smooth startup by logically planning implementation steps, proofing the control system before any programming is done, and troubleshooting any issues when the system turns on**
- **Host a workshop to educate your team members on how to use the technology and maximize its benefits**

The Stellar Advantage

At Stellar, our philosophy is to approach big data, analytics and automation projects from a holistic perspective. As a **fully integrated firm**, we work on all assets of design, construction, engineering and automation, so we know the importance of getting the whole picture. Prior to making any suggestions, we strive to truly understand each business we work with — by touring facilities, talking with owners and employees and/or attending team meetings.

Once we fully comprehend a client's unique needs, we can create a customized plan that will solve pain points, assist them in achieving short- and long-term goals, and yield a high return on investment. In today's fast-paced food industry, our mission at Stellar is to empower our clients with the tools and technology that will keep them ahead of the pack.

READY TO REAP THE REWARDS OF BIG DATA?

We can help you leverage analytics that will take your plant to the next level.
Contact us at **1-800-488-2900** to schedule a complimentary, no-obligation consultation.

ABOUT STELLAR

Stellar is a fully integrated design, engineering, construction, refrigeration and mechanical services firm serving commercial, industrial and public sector markets across the United States and around the world. More than 750 Stellar employees worldwide design, build and maintain award-winning food processing plants, refrigerated warehouses, distribution centers, commercial buildings and military facilities. In addition to its Jacksonville, Florida, headquarters, Stellar operates support locations and offices throughout the United States. Stellar also serves Central and South America, Europe and India. For more information, visit **stellar.net**.

2900 Hartley Road
Jacksonville, FL 32257

Phone: **904-260-2900**
Toll-free: **800-488-2900**
Email: **info@stellar.net**

stellar.net

stellar
TAKING SOLUTIONS FURTHER®