FOOD FACILITY DESIGN/BUILD PLAYBOOK

Trends, Strategies and Get-It-Right Tips

PROFOOD WORLD™

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NEWLY UPDATED

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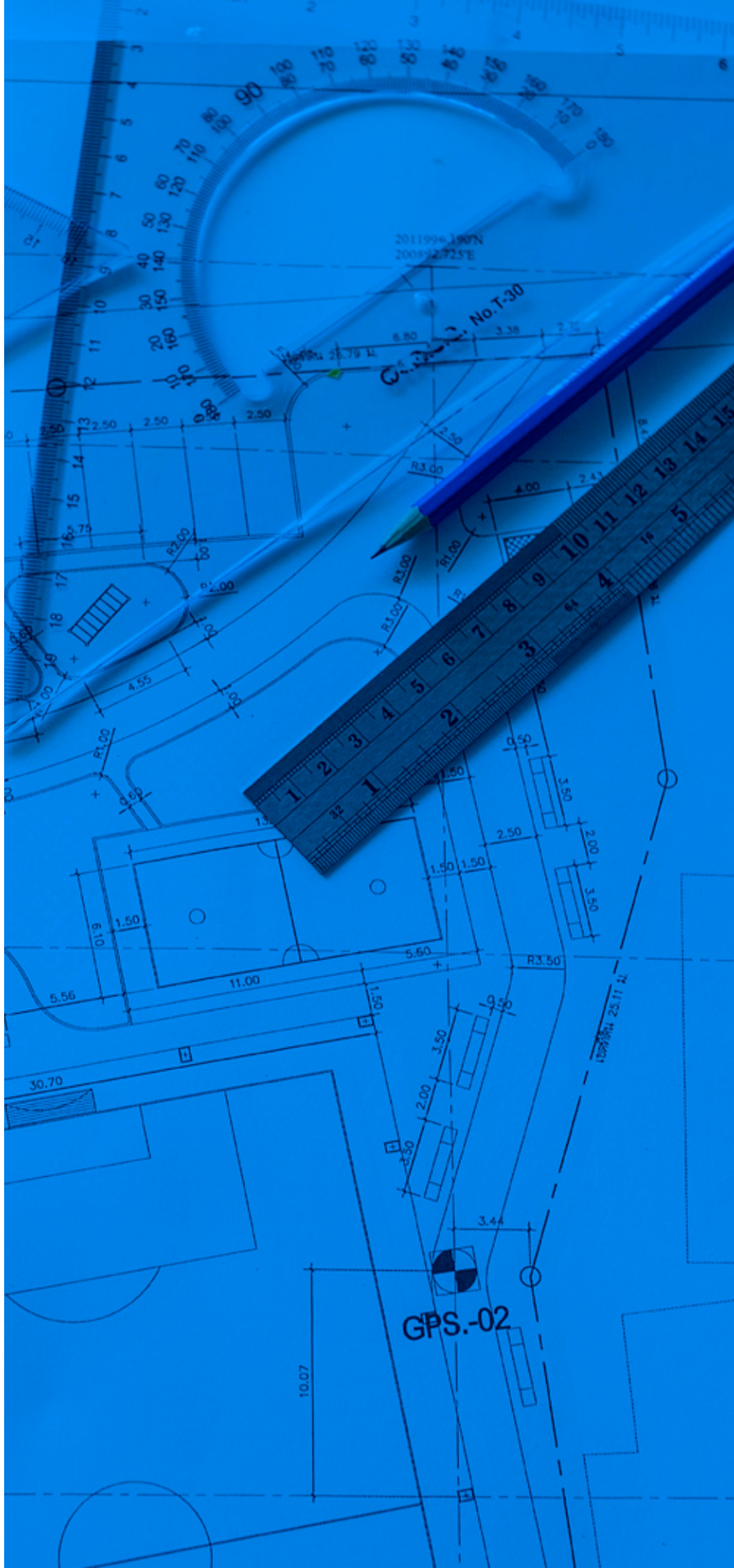

Dear Reader,

Those who work in food processing face some of the most challenging—and rewarding—facility projects around. Every aspect from line productivity to desired level of food safety are factored into these projects. Done well, expansion or building new can lead to higher profitability for years to come and better ability to adapt to market challenges.

All too often, however, results fall just shy of initial goals, with many of these complex projects falling victim to scope creep, missed opportunities and/or cost overruns.

With this in mind, ProFood World decided to interview some of the top experts in facility design/build about what food companies could do to better position their projects for success.

Within you'll find highlights of these discussions, including:

- Practical advice—and lessons learned—on building a solid business case
- Identification of areas and decision points most vulnerable to driving up unnecessary cost
- Tips for minimizing the need for costly change orders
- Key considerations for future-based planning, including recommendations for establishing effective pathogen control, meeting demands of e-commerce and achieving sustainability without breaking the budget
- And much, much more!

We hope you find the information within practical and actionable for your next project. And we thank you for your continued readership.

Aaron Hand
Editor-in-Chief
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Making the Best Facility Decision for Your Storage Solution

Admittedly, 61% of food and beverage executives respondents to an AIB International study did not have an adequate plan in place to deal with COVID-19. One area that caught food processors off guard was extra storage capacity.

"Post-COVID, we are seeing food processing customers need for greater storage capacity, both in new and existing operations," notes one interviewee. "We believe this is due to an ever-evolving food landscape with new and growing consumer demands, regulatory requirements, and digital transformation. The pandemic has only amplified these ongoing trends."

As processors look to increase on-hand inventory amid supply chain issues, they must decide which type of facility makes the most sense for them: expanding their existing facility, moving into and retrofitting an already-built location, constructing a greenfield site, or renting a third-party warehouse. The final decision depends on the individual needs of each client.

"It is difficult to say that, across the board, one option prevails over another," says one interviewee. Design/Build experts offer their insight regarding the pros and cons that should go into making this tough, long-term decision – one that has been amplified by the pandemic.

EXPANSIONS HAVE TO IMPACT THE BOTTOM LINE

As construction costs continue to escalate and interest rates start to climb, experts expect that food processors will focus on how to get more out of existing operations through process upgrades, automation, and facility expansion. If you have land around your building, and the square footage of an addition allows for throughput to return investment, then designers agree adding on to an existing site makes sense.

"We can add on 10,000 feet, but if it doesn't increase revenue then it doesn't make sense to spend the money," says one interviewee. "An expansion increases throughput, you are not waiting as long as a greenfield, and elements of scale start to work in your favor."

On the other hand, expanding an existing facility can cause production disruptions. “We have actually found that most of our customers have already run out of expansion room as their facilities are already built to pre-pandemic size.”

BEWARE THE SIREN SONG OF A RETROFIT

The “Siren Song” of retrofitting an existing site may draw you in, but design experts warn of these possible challenges.

Compromise. Like the current housing market, the inventory of usable storage buildings is lacking. And those that do exist will likely cause you to make compromises regarding space. “These buildings have an existing footprint, so you wind up trying to fit your needs into a space that not meet your exact needs,” says one interviewee.

Incorrect/inadequate structure. Often, there are not adequate utilities to support your needs. And, it common for these units not to have adequate height requirements for material handling equipment. “What’s left out there in the market is probably not the best solution, especially for larger operations,” advises one interviewee. “In fact, to be blunt, most of the inventory out there is probably junk, which is why it’s still available.”

Time and money. To make the necessary retrofits, prepare to tear down the existing site, which will likely take more time and more money than building a greenfield where you can get exactly what you want.

GOING GREEN“FIELD”

When time provides, design/build experts will recommend building a greenfield facility as the most cost-effective option.

One interviewee recalls a client that wanted to go greenfield, but the project got pushed back because of uncertainty due to COVID. “This client began

studying its existing facility to determine if any capacity could be unlocked," the interviewee recollects. "At the end of day, they went back to exploring greenfield because it made the most sense."

Although new projects are increasing, rising costs and shortages in construction materials — including lumber, metals, and plastics — have contributed to slowdowns in those projects actually getting built at a time when more product is needed. Some designers are recommending that their food clients scale back on building size, when possible, to get projects done faster, cheaper, and with fewer materials.

"We don't want to discourage new construction and projects," says one interviewee. "Some locations and sites are easily expandable while other sites don't lend themselves to expansion, and some existing sites cannot be retrofitted, making a new location the best solution. We ultimately believe processors will continue to build new operations, when possible." ■

TIP! SHINING A LIGHT ON THIRD-PARTY WAREHOUSING

Industry insiders agree that it has become almost impossible to plan for inventory amid supply chain disruptions. Design/Build experts say food processors do not think these issues are permanent, and hope to see a return to lean and just-in-time manufacturing operations. Until then, they are renting third-party warehousing – even if it costs more to do so.

"As an industry, we have to look at storage and warehousing under a new light," says an interviewee. "In the past, our supply chain allowed for reliable delivery every so many weeks so space could be planned accordingly. Now, it's not easy to plan that way. You may now be getting larger deliveries without knowing their frequency. There is a balancing act of knowing how much to order, how much to hold in inventory, and the cost of holding that product internally or renting a nearby third-party warehouse. Either way, storage costs increase and that price is now reflected in the total cost of production. This will take a while to unravel."

One way to begin unraveling is to think ahead and plan well before you expand, update or develop a new facility, concludes one interviewee. "Well-developed design requires detail and discussion. Make sure your timeframe expectations reflect the reality of the industry. And, as an industry, we have to move forward. It's just how we do it."

Food Facility Design/Build Playbook

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Lessons Learned During COVID Will Drive Future Plant Design

A recent study from AIB International finds that 78% of food and beverage executives are actively preparing for a future global pandemic; one-third of respondents expect another pandemic within four years, and half expect one within the next decade.

"Indeed, people are leery about what's going to happen when the next variance comes and how that will that impact the market," says an interviewee. "So, they are being very diligent about what their processes are and how they get there."

One way to get there is with a design/build delivery model. This means bringing in vendors and subcontractors into the design process earlier so that equipment and building materials can be ordered as early as possible. "COVID reinforced the value that the Design/Build delivery method brings to a project," reveals another interviewee. "Design/Build is the most flexible delivery method as it has the ability to pivot at a moment's notice to the ever-changing COVID environment."

The following are lessons learned from COVID that will drive future design/build food processing projects.

MORE COLLABORATION THROUGH TECHNOLOGY

One lesson learned from COVID is finding new ways of communicating and collaborating. For many that meant Zoom meetings. In the design/build industry, it means virtual 3D modeling and cloud-based sharing. Design/Build companies claim that creating and sharing a 3D model virtually with all team members at once allows more specific questions to be asked, more insightful decision making, and real-time project progress.

One interviewee describes the value of a 3D scan on an out-of-state project. "We were tasked with replacing an outdated piece of equipment. We planned to travel to the job site throughout the course of a

year on this design. Right before the pandemic hit, we did a 3D scan of the space we were working in and we modeled the space. We wound up doing 100% of the design work without ever traveling to the site. We didn't see any more design errors or change orders than we would have had normally. And it gave us the ability to ask more specific questions. We would have never attempted to do this, but we were forced to try it. We went into construction February 2021 and completed the project in August 2021. Now that client wants us to do this on every job."

AUTOMATION COULD REPLACE PEOPLE

Automation to reduce labor has always been paramount to food processing facilities, but the pandemic has intensified the need for automation as a result of a shrinking labor pool. "The Great Resignation that came from COVID has increased the awareness of its value beyond labor savings to include reduced lost-time injuries, increased uptime, higher levels of quality, and freeing up workers to perform more value-added tasks. This demand has grown as technology has become more accessible and affordable. As a result, design/builders are tasked with focusing not only on what automation can be implemented today, but also to design and build facilities that can accommodate technology in the future."

Robotics and automation can perform specific tasks, such as cooking protein, loading smoking rooms, and, in a few cases, meat trimming. "It used to be that automation would take away jobs from people; now if people don't want to work, we need automation," says an interviewee.

BE WILLING TO PIVOT

Another lesson learned is having the confidence to pivot and adapt to the current changing environment. Simply put, it takes longer to build a facility than it did three years ago because

of supply chain issues. Design/Build companies are getting more creative in the materials they procure and how they schedule projects, all while keeping costs reasonable and not sacrificing quality.

Product substitutions for faster delivery. Steel, resin, insulation, paint, roofing materials, and electrical components are all in short supply. And finding alternatives for these items is not easy. One interviewee says maintaining flexibility in a design/build project is possible by changing building materials or suppliers. “For example, a client was in need of additional dry storage warehouse space,” explains the interviewee. “In this location and market, pre-engineered metal building are the most cost effective, but lead times doubled to almost tripled from our suppliers, and at one point we were over 36 weeks. To combat this, we piecemealed materials from different suppliers cut the lead time down to just over 12 weeks.”

Another interviewee recollects designing for components earlier in the process. “Predicting shortages is a basis of knowledge that is so vast,” adds another interviewee. “In one case, we paid extra and ordered more for panels than usual, but then something else delayed the project so we have panels sitting at a job site. It’s just chasing your tail.”

5 TIPS FOR A POST-COVID DESIGN/BUILD

1. **Plan early.** The design process needs to start much earlier so that equipment and materials can be ordered without the lead times impacting the planned construction schedule and startup date.
2. **Be Flexible and realistic.** Make sure your timeframe expectations reflect the reality of the industry. Be prepared for a different world.
3. **Be Proactive.** Labor, and logistics are volatile, so acting proactively in these areas will ensure successful project initiatives.
4. **Reevaluate budgets.** The cost and timelines of construction materials has changed the landscape of how a project will be executed. So, it is important to have reasonable capital outlay expectations.
5. **Don’t stress the tech.** Technology is growing and adapting to fit into a manufacturing world. Talk to your Design/Build partner to make the best technology decision for you.

Even if the materials are available, they are available at a higher cost. One interviewee says 85% of its business is repeat business, and its clients know that five years ago project estimates were $150 per square foot. Today, the total cost is 50% higher. “And vendors don’t give exact pricing until materials ship,” says the interviewee. “So, owners can’t get pricing and we have to inflate the price or guess the amount.”

Don’t compromise on quality. In some cases, materials

can be substituted without a significant effect on quality. Materials in the processing environment still need to be cleanable and durable, so any substitutions must be evaluated. Design/Build organizations emphasize that they are reluctant to substitute a material for one of lesser quality, even if it means a lower cost and faster delivery. “We are reluctant to use an alternative material until it is proven,” says an interviewee. “Sometimes owners want us to use something not proven because they are on a schedule. If they want to change something it’s on them.”

“We’ve never compromised quality with a substitution,” concurs another interviewee. “If it gets to that point, we won’t do it. If we have to wait a year, then that’s what we will do. Equal or better substitution is what we strive for. No project should compromise on quality.”

A new reality in project scheduling. It is not uncommon today change the order of a structural design to minimize impacts on a project schedule. The new normal is having engineers and designers forecast equipment and materials before a full design cycle has been vetted and purchase those items as soon as possible to meet construction deadlines.

“Building owners used to expect to get projects underway in 12 to18 months, based on size and complexity,” recalls an interviewee. “That is not a reality anymore.”

What is reality is that the longer it takes to build a plant, the longer it takes to realize a return on investment. “There is no doubt that ROI is skewed because there can be no payback until there is a return to production,” admits one interviewee.

DESIGN FOR EMPLOYEE MOVEMENT

Historically, the meat processing industry is manual and requires many people working in small spaces.

Post-COVID, attempts are being made to separate people where possible, such as in locker, break, and conference rooms to minimize infection.

"We are designing for employee movement," says an interviewee. "The quantity, location, and size of rooms are of greater significance now. We are getting requests for creating multiple conference rooms, for instance, instead of one large space to control movement and interaction."

Preventing infection is also why more plant owners are paying closer attention to the cleanliness of those spaces. Many are requesting upgrades to filtration, ventilation, and air exchanges to maintain good air quality and reduce pathogens.

BE READY FOR THE NEXT PANDEMIC

Moving forward in the food processing world, all stakeholders need to be aware of the potential risks associated with exposures to infections/diseases and work to minimize the frequency and possibility of exposure for all involved. One way to do that is with a reasonable and realistic Design/Build delivery model.

"The Design/Build delivery method offers flexibility and real-time feedback," concludes one interviewee. "These benefits allow processors to immediately see the impact of a decision. The pandemic reinforced the necessity to remain nimble and stay resilient as situations and circumstances outside of our control change. As we look to a post-COVID world, these experiences will only help us serve our customers as the next challenge arises." ■

Designing a Floor That Can Take a Beating

As food and beverage manufacturers struggle to compete in an ever-changing marketplace, it's essential that their equipment run at optimal efficiency, maintaining uptime at its highest levels. But there's one system that takes a beating like no other and helps to support every other system in place: the flooring.

That production floor has to stand up to impacts, harsh chemicals and caustics, thermal shock, and moisture vapor transmission, and provide a stable and slip-free surface for workers to walk on. And today more than ever, the flooring is being asked to provide an extra level of bacterial protection and offer more sustainable options as well.

In a search for cleaner, more robust flooring, the industry has shifted largely from epoxies and dairy bricks to urethane cement. Food and beverage plants are looking for materials that can stand up to the harsh realities of clean-in-place (CIP) processes and be installed in less time to minimize plant downtime or to shorten project schedules.

THE LATEST ALTERNATIVES

Cementitious urethane provides a chemistry that is very close to concrete, making it a good alternative to epoxies. "It can take very hot, even boiling steam-type applications in a food processing plant that weren't able to be handled in the past," one source notes.

Resin technology has also come a long was over the past 10 years, creating extremely robust urethane cement. "It is harder and more durable than the concrete it's laid on, and it has the capabilities of expanding and contracting to withstand any extremes, be it high-pressure washing, huge temperature changes, and amazing chemical resistance," an interviewee explains.

An added benefit of the urethane cement is that it is a completely seamless, monolithic system. This is unlike the dairy brick or quarry tile traditional to many

food and beverage facilities. Though dairy brick itself was a very robust option, the grout and adhesive were not, causing dairy brick flooring to require a lot of maintenance.

“There are grout lines that can harbor bacteria, and we’re able to go in and remove that. But then when you remove it, you might find something else below,” notes one flooring specialist, recalling a time his company repaired dairy brick for a dairy customer. “In this case, they had issues with ponding water, which is a problem for a food plant.”

A different type of alternative than seamless polymeric flooring systems comes from fully vitrified tiles, which provide a tile aesthetic

without the problems faced by dairy brick. It's a resilient option because the material has such a low absorption rate that no microbes or contamination can get into the pores. Much narrower grout lines also contribute to the floor's hygiene level. "It becomes almost like a seamless floor, which means you don't have standing water in there," a source explains.

KEEP IT CLEAN

Food safety and hygiene have been getting pushed further and further to the forefront, particularly with the Food Safety Modernization Act (FSMA). Listeria breakouts in food facilities have caused product recalls, halted production, and prompted plant shutdowns, and cleaning processes are not always adequate in avoiding this issue. "From a food and beverage standpoint, there's been a lot of heightened sense of harmful bacteria such as listeria or salmonella," one source notes. "What we are seeing industry-wide is really the heightened importance of the hygienic solution, with a flooring system that can withstand the elements but also help you to move the water, get it to the drainage systems, and get it out of the facility as safely as possible."

This heightened awareness comes in part from changing processes such as the introduction of CIP processes, which require very hot water, sometimes steam—and extremely aggressive chemicals. Although that does a great job of sanitizing the equipment, all those cleaning chemicals and hot water have to go somewhere. If you don't think enough about that process ahead of time, you'll see premature failures and damage to floors, as well as walls, drains, and curbs.

Some flooring systems add antimicrobial treatment to the surface coat or to the flooring mix itself, but that varies on how it is done and how effective it is. And some argue that there is little need for antibacterial additives in an industry that already has rigorous cleaning regimens as well as monolithic

systems that don't allow the harborage of bacteria.

CONSIDER THE DRAIN

It's important to consider drains as well in efforts to curb bacteria growth. Food processing facilities could be fostering unsafe amounts of bacteria in drainage areas, with more and more facilities discovering bacteria such as listeria in drains.

Sanitary drainage has been required more consistently lately. "Whereas before you could just have a trench drain or a couple area drains, set it and forget it, now you have to be concerned with salmonella, listeria, all that kind of issue popping up in food," an interviewee says.

The drains need to have the same kind of washdown focus that the floors themselves have. Stainless steel provides a non-porous surface with hygienic characteristics that help control the risk of bacteria. Food-grade stainless steel is vital for the food industry, but it's important is making sure that stainless steel is also strong enough and that the drains are designed in such a way that the stainless steel won't pit, bend, or break. If a forklift creates a bend in a drain, thereby creating a crevice, that's exactly the sort of place that could harbor bacteria.

Another possible drain material is glass-fiber reinforced polyester, used in food and beverage applications for its ability to withstand high fluid temperatures and fluctuations in hot and cold temperatures.

There's been a trend over the past few years to convert from long trench drains to smaller box drains, simply to reduce the amount of surface area that could potentially harbor bacteria. But that can lead to more sloping and pitching.

Because of all the ramifications of the drain choice, that selection needs to be made earlier, during the design phase of a project, one source insists. "The design of the floor should really be happening when you're selecting the drain," he says. "It should be grouped together as one larger decision because it is really one integral system working together."

A drain supplier agrees: "It's all like an ecosystem that works together. It is best, we find, to work with people from the ground up. You don't want to come in for projects and they've already figured out room layouts and such and then are just using drainage as an afterthought."

YOU WANT IT WHEN?

What has changed perhaps the most in recent years for flooring is the increasing desire for customers to want to fast-track the construction of the floor. Requests for fast install have become very common, whether it's for a new build with tight construction schedules or for an existing facility that's trying to reduce shutdown time.

That is driving much of the R&D in flooring today, with suppliers developing flooring solutions with shorter curing times and easier installation. In many cases, they've been able to cut days off of installation schedules, getting manufacturers back up and running in a fraction of the time previously required. ■

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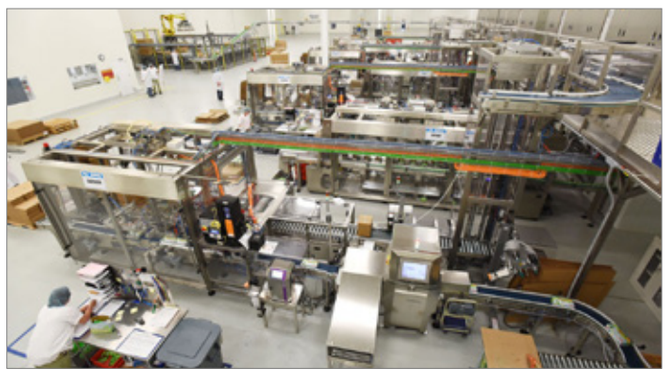

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Optimizing Space Use in Your Food Processing Facility

Space is tight on the plant floor, and particularly in food processing facilities. Many decisions on how space is used are inherently dictated by ROI expectations.

Creating new square footage for a food plant requires significant time and investment. Core in consideration are food safety and clean design requirements, manufacturing equipment and scale of production.

CHALLENGES UNIQUE TO THE ENVIRONMENT

Food facility planning poses unique challenges. Utility infrastructure required for most spaces can be costly and complex, from accommodating refrigeration and process utilities to supporting CIP (clean in place) infrastructure.

Food plants also typically include areas dedicated to processing, dry materials and perishable food storage. All of this space requires special consideration for design, construction and operation. Even a dry storage area for packaging material can require special planning for humidity control and temperature. These requirements make the processing space more costly than is seen in other types of manufacturing facilities.

“Such a high capital expense and the complexity involved in meeting operational needs means owners must strive to optimize efficiency and maximize utilization of space,” notes one interviewee. Food manufacturers trying to compete and grow their business often have to get creative with use of their existing facility before making hard decisions about expansion or taking on the significant challenges of greenfield projects.

Building new is not an easy process to get through. Expanding or reconfiguring existing space may mean the difference in getting a system up and running in six months versus a year or more.

SHIFTING DEMANDS ON SPACE USE

Recently, pressures on space in food processing facilities have only compounded. Many owners are finding themselves on a faster path to rethinking floor plans and making design/build decisions. Some of the biggest drivers of the need for more space include:

Expanding SKUs. Consumer preferences are shifting on a regular basis, and demand has been growing for variety of size, new products, smaller pack counts, artisan flavors, organic labeling and seasonal variation (*Trends and Advances in Food Packaging and Processing, PMMI*). Such shifts impact owner decisions on how facilities will support line addition/expansion, space for equipment changeovers, shifts in maintenance and more.

E-commerce. Packaging lines have traditionally served grocery and food service, but e-commerce is increasingly part of the mix as well. By 2024, it is predicted that 70% of consumers will be grocery shopping online in some form (FMI and Nielsen, 2018). More space is needed in food production facilities to accommodate the additional and more complex packaging and logistics processes as part of this new supply chain.

Changes in equipment use. Owners also are focusing on more flexible, easily scalable and less manual production processes. Over the past 10 years, production lines and equipment significantly increased their throughput per hour with a relatively small increase in footprint. One consequence of this shift is that more changeovers are necessary when producing products with lower volumes and high-capacity equipment.

Historically lean operating environments. And, in some ways, many manufacturers are challenged by their own success with space use to date. The food industry is very competitive. and margins are always a concern. As a result, efforts around utilization of space, particularly for manufacturers who have facilities that

are landlocked, often have already been maximized. The “low-hanging fruit” has already been seized.

Growing need for segregation. In the past, some manufacturers have looked to utilizing existing storage areas by building processing in that space. Such use results in taking storage off site. Experience is showing that having processing shoehorned into an existing space can compromise the principles of sanitary design. Much greater care is now being taken to dedicate separate space for allergen control.

And, of course, COVID-19 has led to reconfiguring processing lines, installing acrylic glass barriers to keep workers six feet apart while still achieving optimal output and other measures that are putting a squeeze on available space—and budgets. Manufacturers are challenged with how to rearrange workplaces to separate stations and adjust work practices to allow for added distance. This space comes at a cost.

TOP IDEAS TO OPTIMIZE SPACE USE IN YOUR FACILITY

Given so many pressures, what’s a food company to do? Those interviewed for this report offer a few tips for optimize existing space:

Think vertical. You can’t stretch the walls. But you might be able to stretch up. Facilities with high ceiling heights can go vertical with the installation of structural mezzanines as a way of effectively increasing footprint without expanding the building itself. Locating central plant utilities—electrical distribution, air compressors, spare parts storage—to an upper level can save valuable floor space.

Some processes are more amenable to this type of expansion strategy. For example, dry mix plants can place ingredients on the mezzanine level and use gravity, versus pumping equipment that would take up valuable floor space, to move product to mixing and blending equipment. “Your building isn’t only length and width, but length, width and height,” notes one interviewee.

"Instead of using the floor for a non-production function, such as storage, can you take advantage of a mezzanine or create a second floor?"

Consider modular. Modular design also can be an efficient and cost-effective way to optimize the footprint within an existing plant. Production lines that are designed to utilize equipment that can be moved in and out of the line can make it easier and faster to reconfigure a processing line for multiple products, adding flexibility while optimally utilizing floor space.

Warehouse strategically. Some food companies have also changed supply-chain models to a just-in-time delivery of raw materials and packaging, which helps minimize the space needed for raw warehousing and results in a much more effective, spacious layout.

Approach layout with a fresh eye. And sometimes, it's just a matter of tapping the right creative source. A design firm often can recommend ways to modify existing use. Examples may be things such as reorienting existing production lines, adding automation more thoughtfully to use less space or even an innovative approach such as replacing an old central dust collection system with multiple smaller units near the point of use. With

READYING FOR FUTURE SPACE NEEDS

How agile is your food processing plant? Key areas to consider when assessing your ability to competitively innovate and meet changing space demands include:

- **Ample column spacing**
- **Clear height**
- **Utility distribution**
- **Water and sewer supply and discharge locations**
- **Structural capacity (floor and ceiling)**
- **Dock locations**
- **Exterior space for large process utility equipment**

Source: Location Trends in the Food Industry, Area Development, areadevelopment.com.

the aid of experienced designers, some organizations are making concentrated efforts to review space use under the roof and between walls as a means for storing all utilities and non-production equipment. (This approach has the additional benefit of separating non-production and hard-to-clean equipment from the production area!)

Regardless of the particular approach, design/build firms hold the knowledge and industry expertise to walk through a facility and understand where retrofitting a part of the plant can improve production. They can also help enact change to the space and make knowledgeable suggestions for equipment updates.

READYING FOR THE FUTURE

Of course, sometimes you can only do so much with your existing facility. That's where creating a business case for expansion, establishing the right design/build partnership and collaborating on an effective basis of design comes into play. ■

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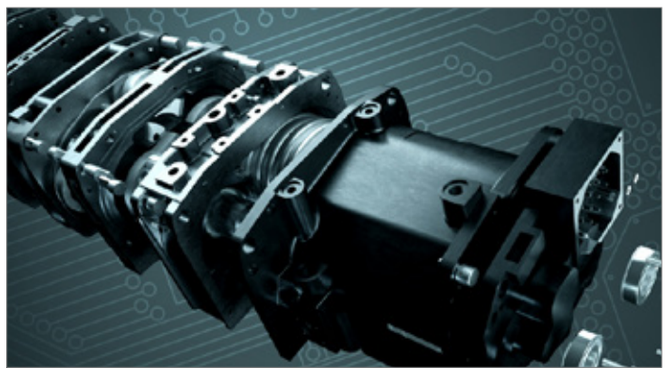

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Making a Business Case for Design/Build Projects

Making a business case for large capital investments can be challenging, especially when it comes to facility projects to support food processing functions. In addition to the upfront capital costs for design and construction, impacts to consider will include operations, energy use, safety and maintenance needs to name just a few. And, of course, the biggest uncertainty: time to realize return on investment.

Such complexities make it vital for leadership to invest the necessary time and resources toward developing a sound business case. Given the margins companies must work under, any miscalculation or interruption affecting operations can have serious detrimental effects on the organization.

READYING YOUR BUSINESS CASE

When making a business case for investing in a facility project, most food processing professionals follow several key steps.

Gather the right stakeholders. Yes, you probably already know whom you will assemble for your core planning team, including brand owners, facility managers and operations leaders. But also be sure to solicit input and buy-in to your project goals and scope from those stakeholders involved in overseeing day-to-day facility use, including quality assurance, maintenance and the plant personnel that will be most impacted.

Identify goals and impact. Define the key business drivers of the project. Be as specific as possible regarding the ways the project will benefit the organization and how it will add to profitability.

Poorly defined project objectives will generally lead to unanticipated cost. That’s because projects without definition inherently don’t have stakeholder alignment and are therefore more vulnerable to scope creep. If an expansion project begins taking

on operational and maintenance add-ons for every type of issue once under way, you'll often find yourself with a project that becomes so bloated or delayed that it is no longer financially sound.

Define the deliverables, taking into consideration impact on product quality and specifications, capacity requirements and factors that can contribute to the cost of goods sold. A full understanding of utility, labor, transportation, raw materials, packaging costs, tax impact and depreciation expenses is necessary for your business case to be meaningful.

Similarly, understanding underlying components is necessary to predict financial impact of automation, energy efficiency and likely production performance. At this stage, your company should be able to recognize whether expectations relative to project costs and schedules are realistic.

Although it may be tempting, don't rush this stage. "Owners often will base their financial analyses on incomplete or preliminary cost information that is not representative of the required scope," notes one interviewee. "Unanticipated costs during the design phase can have significant impact on the final budget. In addition, an organization's failure to make key decisions early in the design process often leads to rework or change orders downstream that will add expense and slow the project schedule, heightening overall cost of the project."

Develop a strategy and projection for the near term (3 to 5 years) as well as long term (5+ years). Detailed forecasting also is imperative. Among near-term considerations are startup curve and commissioning costs, which typically includes engineering personnel, equipment supplier's technicians, and plant operations and maintenance staff for several weeks while the line

will be fine-tuned/de-bugged and training occurs. Also, production ramp-up curve can take several weeks until full production.

Planning out further, it's important to also factor in maintenance costs and the time required for scheduled and unscheduled service. When applicable, equipment and infrastructure systems should be considered in terms of life cycle versus one-time capital cost.

Also, don't treat space as a uniform cost when weighing areas to cut or keep for future use. The most expensive spaces are usually in essential production areas, where there is piping and electrical conduit. Reserving space for, say, additional warehousing may not be as costly as one might initially think once realizing there won't be as many turns or lengths of piping as in the same footage devoted to active food processing and production.

TIPS FROM THE PROS

Approaches to building the business case for facility projects vary. Companies can use internal resources or turn to a design/build partner to estimate the total cost of designing, engineering and constructing an expansion or new plant project. These experts typically have a template

TIP! RECOGNIZE FLUCTUATING DEMAND WHEN ASSESSING SPACE NEEDS

Many in the food industry experience fluctuating demand for their products. Factors such as weather, geography, holidays, seasonality, cyclical buying and consumer trends may cause demand to ebb and flow. A common planning challenge is that companies will use "average demand" when they are sizing their facility, since they don't want assets to be idle. But unless demand is fairly constant, taking this approach can result in significant inaccuracies. Not factoring in peak seasons can cause facilities to be undersized. When production is ramped up, space challenges will most often become evident in warehouses and employee service areas (break rooms, locker rooms, automobile parking, etc.).

to help the food company navigate this process. However, it is still paramount to have an internal team that is engaged throughout the process.

When moving through the steps of building a financial case, food processing and packaging professionals should consider the following recommendations from interviewees to avoid common project missteps.

Don't underestimate secondary benefits. Not all benefits are direct, and it's easy to overlook impacts across the line. For example, when an investment is made in automation, the benefits may include not only reduction in labor, but also the consistency and efficiency of performing a function that will improve output or reduce waste.

Companies often fail to fully account for cost savings that will be derived from expansions in particular. Upgrading utility infrastructure or installing new production equipment generally will reduce bottlenecks or downtime on existing equipment, leading to greater throughput and/or a lower cost per good sold.

Examine potential impacts from external programs. Will you be able to garner lower insurance rates after adopting a different fire suppression system? Will you be eligible for tax incentives from local governments when the project results in supplying training and creating jobs? Be sure to examine whether your project could change eligibility for any sorts of credits, incentives or other financial benefits from external entities.

Include quality and safety advisors in earliest discussions. Projects involving food processing carry needs that are far different from other types of manufacturing expansion or build projects. As such, having quality and safety members from your team as part of planning at the outset is imperative. Your whole design may hinge on these matters. For example, consider how controlling pathogens

in a ready-to-eat product environment is most effective through the separation of raw and cooked areas and the circulation of materials and people through areas external to the processing space. Experts know that to prevent cross-contamination, employees working in each of the two areas should have separate entrances to the production areas, as well as segregated lunchrooms, locker rooms and restrooms. Circulation corridors should be provided so that people do not have to walk through the processing area to get to their assigned work space. All of these space requirements add square footage to the facility, and thus will likely have an impact to the cost of a project. Having the the right quality and safety leaders to give input over each of these areas at project outset is vital so as not to overlook key details.

Don't view price in a vacuum. The "how much is this going to cost" discussion shouldn't happen all at once, as it will depend on each key decision made and should occur collaboratively during the design phase. Ideally, you'll want to capture cost information in a very granular sense and then determine ways adjustments may occur based on options pursued, such as finishes on the building, automation expectations or desired level of food safety.

Keep your plant's long game in mind. How are facility needs likely to change over time? You may not be ready to make a full investment at present on, say, a different energy source, expanding a product offering or incorporating a different packaging line capability. But identifying ways you may someday want to adapt can help ensure your facility has the needed flex. Adaptability is key to realizing best return on investment.

WORKING WITH EXTERNAL EXPERTS

A schedule that results in an earlier start-up for the facility can dramatically reduce costs. An experienced design/build firm can help guide

your organization by not only highlighting various options and their respective benefits, but also by identifying lost opportunities and cost avoidance from a long-term perspective. “Additionally, a good facility planner will always have an eye to the future and consider long-term investments, likely market changes and expansions into their thinking,” notes one interviewee. A comprehensive site masterplan is the best way to set the stage for future expansion. Careful planning and a competent team can keep you on track for a successful project. ■

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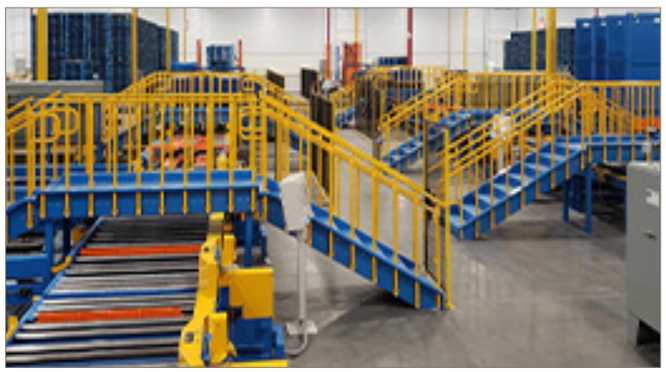

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Dos and Don’ts When Choosing a Design/Build Partner

Many criteria will factor into identifying the right design/build firm for your food facility project. The decision shouldn't be rushed. When vetting firms, consider the following "dos and don'ts" from interviewees.

DOS AND DON'TS WHEN VETTING FIRMS

Do look for expertise, and not just experience. What is the firm's experience with your type of project? This is critical, as food processing plants require a certain type of facility, an understanding of food safety requirements and expertise on both the processing and packaging sides. Even type of product can influence the quality of match. As one interviewee notes: "There are different needs in plants, including those that manufacture shelf-stable food, such as baking and snacks, and those in the meat industry. You want someone who understands the issues seen in your particular environment."

Don't underestimate culture. Fit between organizations is often a determinant of overall satisfaction. What will collaboration look like? Questions to consider include: How often will you meet? What is the firm's expectations of you? Will you have a designated contact when you have questions? What does it look like if you disagree on approach? Does their team have a track record of working together in the trenches?

Do seek a broad team. What will their team look like? Will you have access to fully integrated expertise—designers, architects, engineers and construction specialists?

Don't be enamored with the sales team. Get comfortable with the technical experts who will actually be doing the work.

Do right-size for your project. The size of the design/build firm should also be a consideration. If you're a small, privately held company, you might get more personal attention from a company that is also privately held. If you have multiple locations

and market internationally, you might to need to engage a firm that has multiple locations and a larger support team.

In both scenarios, it's important to understand the roles each project team member will play – both within your company and within the firm you hire. Successful projects have a senior manager, a design manager and a field construction manager. Know who the decision makers are when it comes to approval of the final design. Will the firm you hire be working directly with equipment installation and commissioning?

Whether you're heading into an expansion or greenfield project, you will, of course, have an eagle eye on your budget. But lowest cost shouldn't always be a determinant. The overall value that a firm can bring to your project will result in the most successful project.

Don't put design/build firms in a competitive situation before the scope of the project is clearly defined. You need specific information to get an apples-to-apples comparison of bids. A low initial bid can sometimes result in added cost down the road if you need to make revisions in scope. ■

TIP! CREATE A SUCCESSFUL BID ENVIRONMENT

Certain conditions make it easier to find a good partner than others. Some experts suggest limiting your bid list to around three to four bidders. Longer lists can discourage high-quality firms from bidding and dilute the evaluation process. Also, be sure to allow adequate time for bidding.

Must-Knows for a Successful Basis of Design

Developing a basis of design document with a comprehensive definition study is extremely valuable. The basis of design gets the entire design team aligned on scope, expectations and goals. For example, for some projects, adhering to a capital budget is the highest priority, while other projects prioritize speed to market. Having alignment around the chief goal and cascading objectives earliest in planning will ensure greatest satisfaction.

In some instances, food companies will supply a user requirements specification (URS) that can serve as the design basis. These documents can be very detailed, entailing hundreds of items.

More often, the basis of design results from a definition study that an experienced design/build firm puts together in the earliest planning stages. During the definition phase, the majority of items are identified, such as site and facility needs, storage capacity, employee services requirements, administration, maintenance and production. A detailed budget and milestone schedule are also part of this effort.

Developing a basis for design often provides food companies with an important “reality check” on projects. You may think you know what you need—but you don’t want to go too far into planning before understanding costs. A project that is significantly over budget will waste everyone’s time. At this stage, the manufacturer works with experts to evaluate the facility project and underlying assumptions to arrive at a realistic plan that will achieve cost and goal targets.

While balance between capacity and cost is top of mind, it’s not the only consideration. Be willing to take a bit of time and money in order to define your goals. It is tempting to jump right into expansion or building mode, as many food companies mistakenly believe this will most quickly lead to an improved way to produce their product. But of just as much importance is understanding

what needs to go into expanding a plant or an equipment line—and that's where the design/build experts' input is needed.

As one design expert noted: "I couldn't tell you the idiosyncrasies of, say, making a french fry. But I certainly know what it takes to put a fry line in a plan. Project owners need to spend time talking to the design/build experts to come up with the right plan. It's not something that somebody can just pull out of their hip pocket without this collaboration."

One reason why this research phase is so important is that costing is often complex with this type of facility project. As another interviewee notes: "Facilities for food processing aren't as simple to build and manage as other types, such as a warehouse or cold storage. Multiple variables impacting cost must be considered, from equipment needs to energy use to allergen controls to process flow. Without owner and design/build firm sharing their expertise with one another, it's easy to begin making decisions on faulty data."

WHY YOUR BASIS OF DESIGN MATTERS SO MUCH

Projects that go through a comprehensive definition phase are much more likely to be successful. In particular, benefits of developing an accurate basis of design include:

TOP MISSTEPS WHEN CREATING A BASIS OF DESIGN

- **Unrealistic expectations around schedules and budgets**
- **Lack of meaningful information**
- **Data dumping—providing massive amounts of detail that may or may not relate to the project**
- **Poor communication as to overall facility objectives, output and expectations**
- **Inadequate or inexperienced owner's team to communicate, make decisions and provide direction**

Improved cost management. The basis of design drives the total cost of the project. It is imperative to provide company standards or specifications for factors that drive cost, whether it's desired levels of hygiene; preferences around materials or uses, such as types of drains or rooftop equipment; or required level of automation. The more fleshed out the plan, the more accurate the cost assumptions and timing for the project will be.

Underestimating the costs of construction when developing a basis of design is an all-too-common misstep many in the food industry make. It's very easy for "eyes to be bigger than stomach," where budget is exceeded in the scope of the initial design. An experienced design/build firm can help the food company develop a realistic design plan to harmonize needs and budgets.

Also important in having a solid basis of design is reaching a point of "scope freeze" where all the options have been considered and decisions made so that the design phase can then shift to a "production" effort that is focused on efficient project delivery.

Future proofing. Another benefit to creating a detailed basis of design is that it offers added assurance that the build team will keep in mind future growth options and won't pursue options that could inadvertently create barriers. For example, selection in utility placements can play a role in ease of future build out projects. Now is the time for owners to start thinking about ways the facility might need to flex going forward, so the design team can create a plan that would best facilitate future change.

Operations optimization. The basis of design is defined by the main goals of the project in terms such as throughput per hour, capacity per year, quality standards, variety of products and targeted date for completion. It also outlines the thought processes and assumptions behind major design

decisions being made to meet the project's requirements. This information helps the entire team understand the intent of the design. Developing and keeping these goals memorialized at project outset aids the project team in ensuring sacrifices to the plan's integrity aren't unknowingly made along the way. Subtle or indirect drags on day-to-day productivity may be more challenging to spot, such as a move in piping that could result in users needing more time to access. Checks on process assumptions and careful pre-planning when developing the basis of design can help avoid unintended consequences.

Better communication. The basis of design is fundamentally about transferring the vision of the food company to the design/build team so that everyone has shared understanding. The more fleshed out the ideation of the design, the easier it will be to work with the construction team to achieve the goals. One benefit to early collaboration with a strong architect, engineer and construction firm is that they can jointly solve design challenges using their specific expertise at a stage when the most options are available.

BASIS OF DESIGN CONTENT

Approaches vary, but common elements in a basis of design document include:

- **Project objectives**
- **Specification of core elements of the design (occupancy, shipping docks, fencing, etc.)**
- **Site details (information on zoning, wastewater treatment, etc.)**
- **Utilities design information**
- **Specs associated with the production and/or packaging lines impacted**
- **Preliminary drawings, including engineering**
- **Preliminary cost estimates of key deliverables**
- **Preliminary project schedules**
- **Assumptions**

The information above is supplied by Dennis Group. See a sample document from them at https://www.flipsnack.com/DennisGroup/dg-sample-project-definition-report.html.
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If you don't spend enough time up front to create and define your plan, you often end up unintentionally omitting things or skipping over important steps, which will often add extra cost to fix later. Or, miscommunications can limit options down the road. As one interviewee notes: "You never want to get into a project and have to say 'Oh, I thought you were going to do this,' and hear the builder respond, 'No, that's not what we talked about. It was never factored in.' It's just so very important to build a unified definition of what you want to accomplish."

WHAT TO EXPECT DURING BASIS OF DESIGN DEVELOPMENT

The basis of design should be a living document that is utilized from the start to plan and document decisions, assumptions and changes throughout the project design phase. The time it takes to put together a comprehensive basis of design is entirely dependent on the scale and complexity of the facility project.

For a smaller project, it might take 8 to 10 weeks to complete. Larger projects often take 12 to 14 weeks. And, some experts note, it may be measured not in time but in a total percentage of the total cost of a project, sometimes 20% to 30%.

Regardless of scope, it's best to include the pre-construction and construction team on this design planning to get the full benefit. The culmination of all of that experience together will lead to a shared visual understanding, a documented cost basis for the project and a scope and execution that's reflected in a solid schedule and budget.

The main thing is: Just do it! A comprehensive basis of design will get your project moving in the right direction and keep your entire team on the same path to success.

Looking Ahead at Food Facility Design: 5 Trends to Watch

The pace of change is rapidly accelerating in food production. Companies are looking at the dynamic landscape and focusing on ways to make the right decisions to stay competitive. Interviewees for this report noted that several trends in particular will dramatically affect design/build facility projects going forward.

MORE SEGREGATED SPACES AND INCREASED EMPHASIS ON SANITATION

The risk from contagions, whether COVID-19 or any other communicable disease, is changing views on facility use, and is likely to continue to shape designs in the years to come. Many organizations are focusing on creating more segregated spaces, improving HVAC filtration and using ultraviolet light to reduce the potential for disease spread. As one interviewee noted: “Traditionally, most manufacturers have been seeking common employee entrances as a means to control access. But now, there’s more complex considerations around employee flow. Companies are asking themselves, ‘How do I separate this part of my workforce from that one?’"

Many manufacturers have started modifying design of common areas, such as meeting rooms, restrooms, locker areas and break spaces, to allow for greater physical distance or limited interaction between employees. Other changes have included transitioning to contactless fixtures and self-opening doors throughout the facility.

Of course, the concept of segregating space is nothing new to food companies. Already, many facilities are used to considering hygienic controls to manage pathogens, such as separating raw ingredients from post-processing ingredients, or storing pre-cooked products separate from cooked or sterilized products. Allergen handling also is contained. “Air control is another area that we’ve seen growing focus on over the past few years to minimize transmission of both particulate and airborne contaminants as well as

TOP FACILITY PRACTICES FOR CONTAGION CONTROL IN THE ERA OF COVID-19

IDEAS TO SUPPORT GREATER SAFETY AT YOUR FACILITY INCLUDE THE FOLLOWING:

- Reconfigure layouts to control people flow and support social distancing
- Minimize overlap of shared resources and meter time between uses (implementing shift differentials, increasing time between equipment sharing, minimizing number of operators using each equipment station)
- Improve cleanability and sanitization of workspaces
- Segregate space use or create workforce “pods” independent of each other to minimize number of contacts and contain potential transmission
- Increase the monitoring and automation of equipment sterilization
- Modify HVAC and environmental management systems to improve filtration and clean airflow
- Accelerate automation of production and packaging processes
- Leverage cloud-based technologies to aid remote monitoring and management of equipment and facilities
- Increase availability of sanitation stations for workers
- Transition to contactless fixtures and self-opening doors throughout the facility
- Consider making use of ultraviolet light to sanitize air before it flows through the building and to sanitize the manufacturing floor during off hours when workers are not present

contagions," notes one interviewee. "It's really been about gaining more control of your environment."

Going forward, those interviewed anticipate even more emphasis on washdown capabilities of facilities and ease of sanitation. "Owners are taking a cue from other industries and focusing on ease of cleaning not just equipment, but also floors, walls and ceilings. Facility owners want cleanability in and around pipe, conduit and the surfaces in a space," notes one architect. "This has been a trend over the past 5 or 10 years, but it's even more of an emphasis now as contagion control takes on new levels of concern."

A challenge for many food companies will be designing space to allow for greater separation of activities without losing efficiencies. For years, focus has been on optimizing space and supporting lean layouts guided by time and motion studies. Building for greater distance between workstations and controlling the pace of people flow and minimizing cross flow is in some ways counter to many past assumptions around space use.

GROWING AUTOMATION

Food companies are automating their operations to a greater degree than ever before. Years ago, manual labor was considered more affordable than investing in robotics and automation. But as the labor pool has become more expensive and less dependable—and contagion control is prioritized in the era of COVID-19—many food and beverage manufacturers are fast-tracking automation projects.

This shift is impacting facility use not only in terms of a reduction in headcount, but also frequently with the need to rework plant floor layout. Most notably, proximity of maintenance resources is changing. Instead of having their maintenance staff centralized away from the plant floor, organizations with higher levels of automation are choosing to locate small, satellite maintenance workstations throughout the facility near equipment to facilitate a more timely response to maintenance needs.

SUSTAINABILITY–WITH AN EMPHASIS ON SAVINGS

Over the past 10 years or so, many organizations have focused on LEED certification. These days, some interviewees noted a shift in prioritization: "The focus is still there in terms of sustainability, but 'LEED certification' itself is not focused on as heavily," notes one interviewee. "Our clients want to employ the most energy efficient solutions not for the purpose of having a plaque on the wall, but to create year-over-year cost savings. We're more apt to be having conversations around balancing initial cost versus total cost of ownership than meeting certification criteria. It's really a financial focus."

Interest in improving energy utilization, lowering carbon footprints and reducing landfill use remains high. At the same time, a lot of uncertainties exist on the most economical approach to support sustainability, and some organizations are being deliberate in achieving what is best for their business now while at the same time building in greater flex should the landscape shift. As an example, the cost of energy fluctuates, and oil has been so low in recent years that it can be tough to make a business case to support a shift to solar. Rather than make a decision based solely around short-term factors, some organizations are instead designing for maximum flexibility to allow themselves to more easily incorporate solar at some point down the road.

"We lay out our electrical systems with some enhanced gear to accept secondary power feeds coming off of cogeneration-type equipment. We look at the use of low-grade energy. So there are some subtle things that can be done to prepare yourself so that at a later date if you choose to make the investment, it's not as obtrusive or disruptive to your operations," notes one interviewee.

REWORKING LAYOUTS TO ACCOMMODATE SHIFTING CONSUMER DEMANDS

Consumer preferences are very dynamic. Two areas where this is having significant impact on facility planning is the growth of e-commerce and SKU proliferation.

Consumers have become increasingly accustomed to the convenience of online shopping, with the largest businesses setting trends and establishing expectations of fast and trackable delivery. As customers have come to expect rapid delivery of products, food companies are pushing more frequently toward direct-to-consumer (DTC) models, shipping items directly from their own warehouses.

The adoption of the DTC channel has seen significant uptick recently, particularly with many staying home during the global pandemic and shifts from food service toward retail, with some estimates showing around 32% overall growth in 2020 (eMarketer). (That said, DTC shipping is still only a fraction of CPG businesses.) As supply chains shift, some owners are rethinking their traditional models of "high throughput followed by shipping truckloads to large warehouses." Instead, facilities may need space to accommodate additional lines or fast changeovers and identify warehousing and logistics more proximate to operations. Use of robotics for end of line efficiencies also becomes an accommodation of growing consideration.

SKU proliferation is also shifting views on facility use. Consumer demands for smaller and special pack sizes are necessitating the need for changes in the packaging line in terms of flexibility and quicker changeovers. From a facility planning perspective, this means brand owners need to examine ways to flex space (Can little-used storage be converted? Would a modular layout be useful?) and deliberately reserve space for potential future use. "I think a lot of companies have done a good job realizing that if you plan for some flexibility in space, you have much more ability to be nimble as consumer preferences change," notes one interviewee. "The more progressive companies see the value in keeping options open, so they can grow or make their line changeovers more quickly in a less disruptive manner."

MORE TIGHTLY CONTROLLED ACCESS

Today's food companies are becoming far more vigilant

about threats from unauthorized access to plant facilities, whether it be a risk of product tampering or threats to intellectual property. Inside, the use of technology, such as RFID badges, will continue to be used to restrict employee access to sensitive areas. Access controls are being used to guard entry to not only specific areas in the plant but also around network equipment cabinets, application workstations and controls. Outside the plant, the enactment of the FDA's Food Defense Plan requires facilities to implement vulnerability assessments. More facilities are opting to fence in their perimeter and maintain a secure, single point of entry.

Also a focus of security is increased use of remote access. A PMMI survey recently showed CPG use of remote access technologies ramped up dramatically in the months immediately after the impacts of Covid-19 began to emerge (April-June 2020): Respondents reported a 60% increase in converged network use, a 50% increase in black box use, a 25% increase in external managed secure network use, and a 23% increase in direct VPN use (PMMI, *Trends in Adoption of Remote Access,* 2020). As plants continue to increase their reliance on remote systems, facility planners must work with IT and other plant staff to ensure facility optimization and security plans keep pace.

POSITIONING FOR SUCCESS

As food processing companies pivot to take competitive advantage of shifts in consumer preferences, production efficiencies, sustainability opportunities and advances in safety, they are seeing their facility planning and management efforts take on increasing significance. As a whole, the food industry is in an incredibly dynamic state, with constant change the only foreseeable norm. Investments in one's plant to become more useful and agile will play an important role not only in positioning organizations for success now but in the years to come. ■

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