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WHITE PAPER

Automation in Food and Beverage Equipment Sanitation

PMMI Business Intelligence

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ABOUT THE REPORT

PMMI is the leading global trade association for the packaging and processing industries. Our core purpose is to unite the packaging and processing industries across the supply chain, helping our members to exchange knowledge and ideas so that they can continue to succeed in a rapidly evolving global market. We represent over 1,000 companies from across the value chain, and we work with them every day to ensure they can keep on developing innovative manufacturing solutions.

ABOUT VISION 2030

PMMI's Vision 2030 focuses on discovery, discussion and solutions to the industry's most significant challenges for original equipment manufacturers (OEMs) and for the consumer packaged goods (CPG) sector. It is a critical component of PMMI's suite of continuous improvement forums for its members and the CPG companies they serve.

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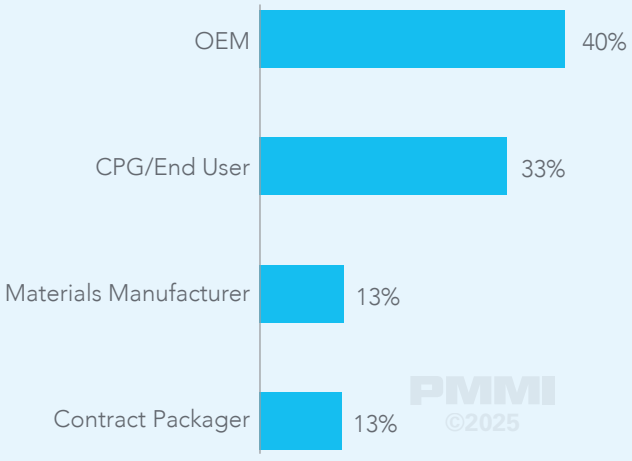
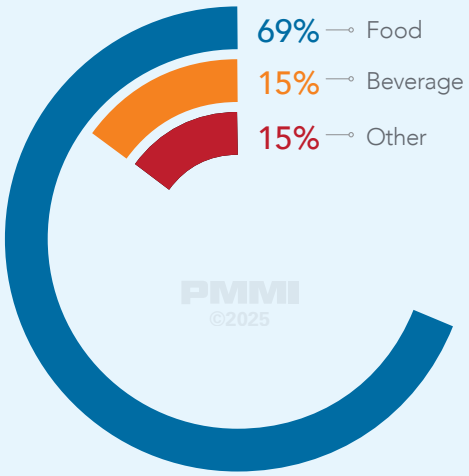
This white paper presents a summary of the Vision 2030 session entitled ***The Dirty Work: Automation in food and beverage equipment sanitation of the future***, which took place at PACK EXPO Las Vegas 2025. Drawing on feedback from a pre-event survey, the session featured a question and answer portion with expert panelists at the start of the event, followed by roundtable discussions with mixed tables of participants from various industries and sectors. The session focused on barriers to automating sanitation and what types of automation could make the biggest impact. Suggestions included the use of mobile and flexible sanitation solutions, turnkey robotics products, enhanced training and better collaboration between OEMs and end users, and identifying the simplest and most beneficial areas to address when adopting automated sanitation.

More than two-thirds of participants (69%) in the discovery session were from the food industry, and a further 15% were in the beverage sector. Almost 60% of attendees were end users, including CPGs and contract packagers, while the remaining 40% worked for OEMs.

Here is a snapshot of who was in your session





The vast majority of participants (84%) in the session were from the food & beverage industries

What are the biggest challenges when it comes to hygiene and sanitation?

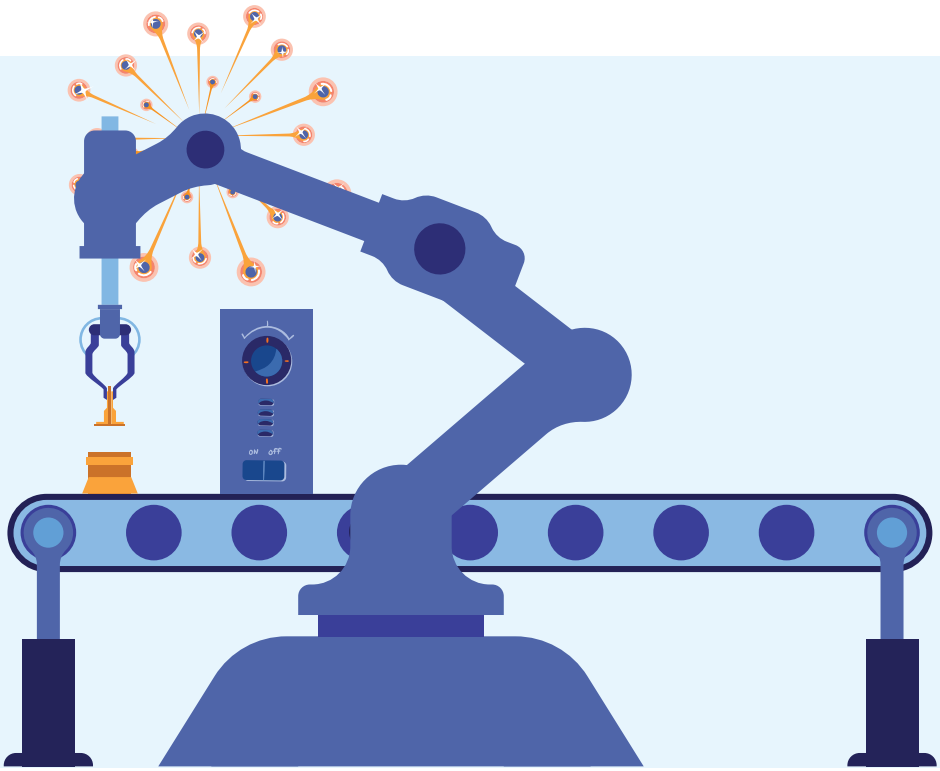
Many participants identified training and skills gaps as major concerns. High turnover among employees leads to many new workers requiring training. This is a major challenge in sanitation because of strong regulatory controls. Sanitation processes must be carried out correctly to remain in compliance with regulations, avoid unnecessary downtime, maintain consistent quality, and reduce the risk of product contamination. Poor training, lack of experience, and lack of supervision can also result in damage to machinery.

Poor Training

Lack of Experience

Lack of Supervision

Damage to Machinery



Challenges that arise from poor or unsuitable design of equipment were discussed, such as machines without completely hygienic design or problems with water ingress during steam cleaning or wash downs. It was noted that inappropriate sanitation processes, such as intense cleaning, can damage equipment, while failure to ensure that the last piece of equipment to touch food during packaging is properly sanitized for production can lead to regulatory breaches or contamination. As one respondent wrote in the preliminary survey,

> The biggest hygienic design and operations headaches are a mix of equipment-level design flaws and human factors.

Where does responsibility for effective sanitation lie?

There was clear consensus among panelists that the design of a piece of machinery or of a new manufacturing line must be done collaboratively to ensure that all aspects of the operation are optimized. This includes ensuring there is access to all hardware and room space which requires sanitation. Lack of collaboration or incomplete collaboration where sanitation issues are not considered can result in there being hard-to-reach spaces that cannot be easily accessed for cleaning purposes. End users want to be involved from the design stage to ensure that machines are easy to clean and keep sanitary.

A panelist from a CPG explained: "In that design phase, getting as many people from who's going to be utilizing it, who's going to be working on it, with all their different perspectives, engaged early is so much easier than if you only get half those people in at the design stage and then you bring them in two or three tollgates later and they say, 'Hey, what about this?'"

Participants agreed OEMs have a key role to play in effective sanitation. The representative of an OEM declared:

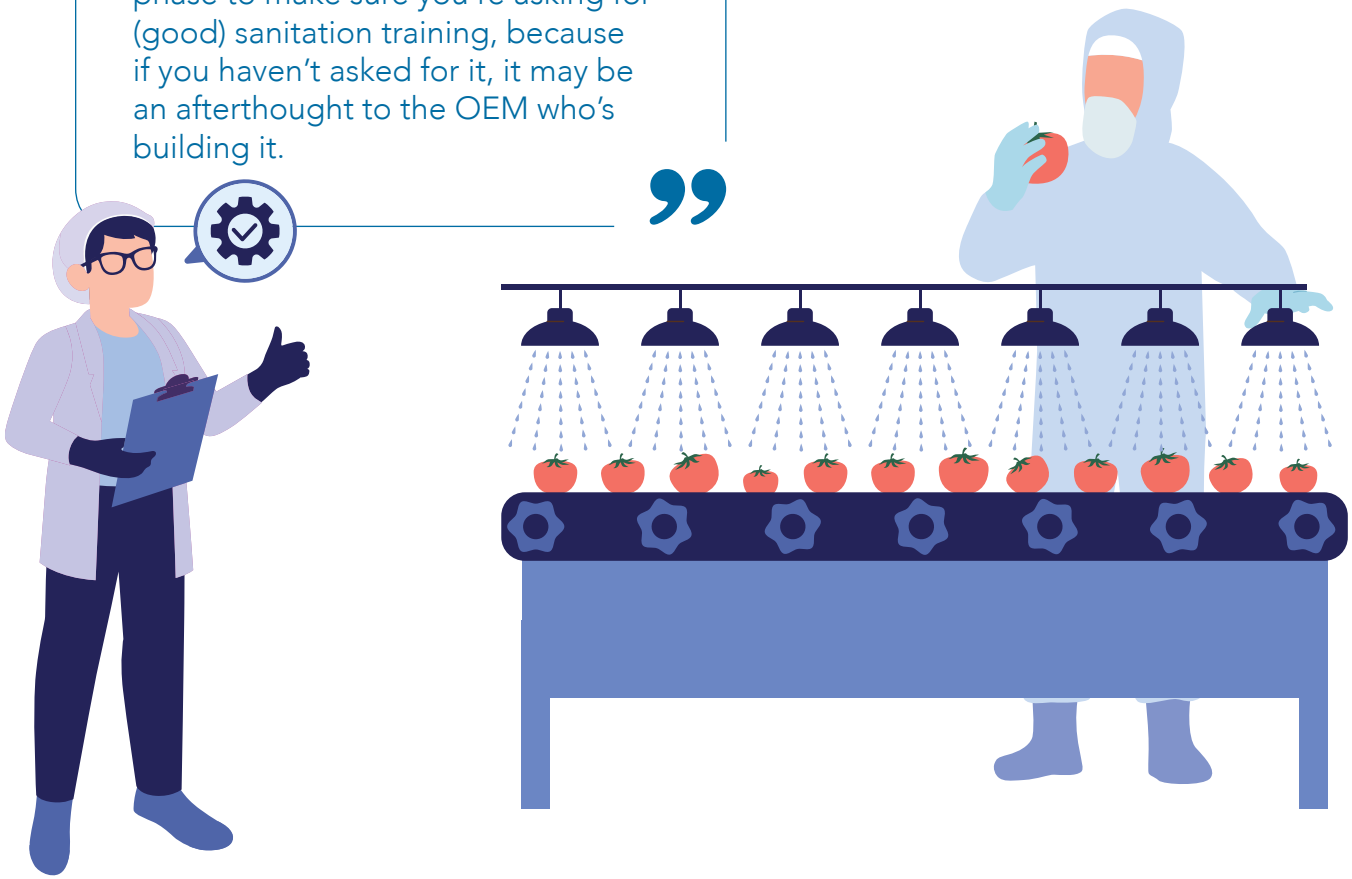
> I think it's the OEM's responsibility to continue to iterate and innovate based off hygienic design principles. So going from tubular frame to flat frame, making sure that we have proper slope surfaces, no pooling, our own internal testing, that's the responsibility that we can carry. That's us doing our due diligence as an OEM, making sure that we're doing our part to mitigate risk for a potential recall or something along those lines.

Beyond the design phase, it is essential that OEMs provide a comprehensive standard operating procedure (SOP) for end users. While the design stage must be collaborative, once the machinery is installed and commissioned, it's the responsibility of the CPG to operate machinery according to the SOP. This makes good, careful selection of equipment critical. As one end user put it: "Once I bought it and it's installed and it's commissioned, it's my responsibility to make sure that it is sanitized properly and cleaned and maintained the way it was intended." However, good documentation and training from the OEM regarding processes is also vital. One of the panelists mentioned a case where their company had to recall a fleet of robots on a line because it was not clear in the documentation what types of chemicals could be used for cleaning them.

Training and collaboration for effective sanitation

End users said they often look for OEMs to help them with SOPs, to have appropriate training in place, and to produce equipment that meets both their needs and their regulatory responsibilities. End user participants also expressed a desire to work closely with OEMs to create training tools, rather than generating them by themselves. One panelist from a CPG stated:

> I'd tell the end user during the design phase to make sure you're asking for (good) sanitation training, because if you haven't asked for it, it may be an afterthought to the OEM who's building it.



An OEM representative on the panel described how their company completes manual sets on all their equipment and conducts a two-week-long training schedule, including training documents and a PowerPoint presentation, involving two of their engineers. During this training, they run the equipment in the presence of a person with process authority from the Food and Drug Administration who makes sure all processes are compliant.

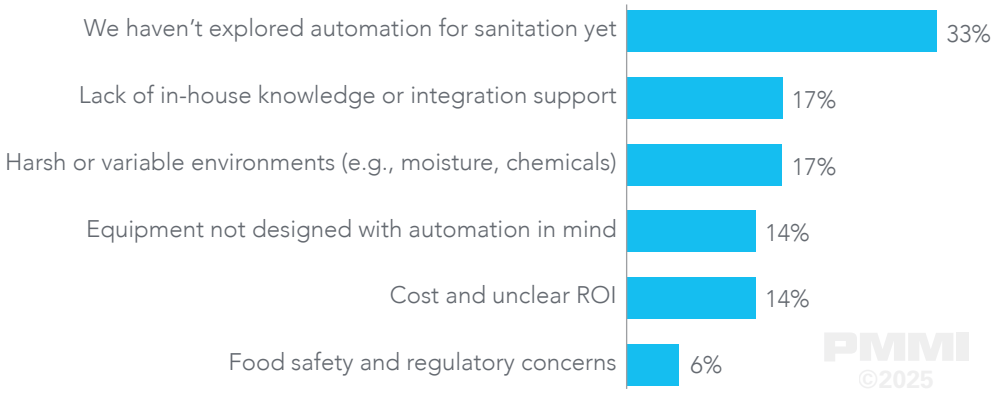
In response, a panelist from a CPG said having a two-week training process, during which someone walked them through the processes, making sure equipment is sanitized correctly, would give their teams confidence. They added the company would then build on this training by including materials from the OEM in their own internal training bank and make it part of their standard training going forward.

The concept of a 'chain of ownership' was raised, the idea being that, once a machine is installed, it continues, in part, to be the responsibility of the OEM. One panelist from an OEM remarked: "[With a machine] we have to warranty it, but at the end of the day, we like to think about it almost like an employee. It's got to have the support ecosystem within the CPG to be successful for a long term. And so, when you start thinking about it like that, that brings up options and resources and strategic partnerships from an OEM's perspective."

Barriers to automating sanitation

The pre-event questionnaire circulated among participants revealed there are a series of key obstacles to companies automating sanitation and that one-third of participants (33%) have not yet explored automating sanitation equipment. It is clear that this is an issue that needs further exploration and debate.

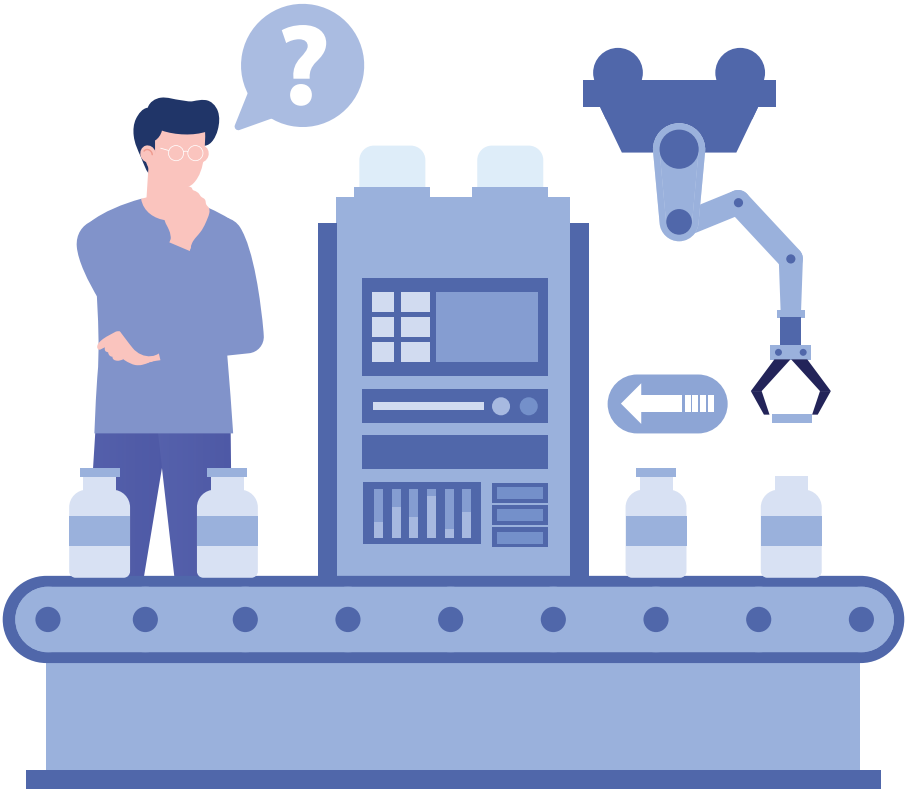
What is the biggest barrier to automating sanitation in your facility or equipment design?



Among companies that have explored automation for sanitation, lack of knowledge, harsh environments, equipment designed without automation in mind, and cost are all obstacles to adoption

Responses to the pre-event questionnaire indicate automation is something that everyone seems to be talking about, but not a lot of companies are taking the plunge. A lack of in-house knowledge, high turnover, lack of clear ROI, and regulatory concerns are all barriers to automation investment. Cost can also be prohibitive, as the perception is that automated solutions are always expensive. While this might be less of a hurdle for large, multinational companies, for smaller companies the potential cost of automating can be daunting, and they can have different needs from larger operations.

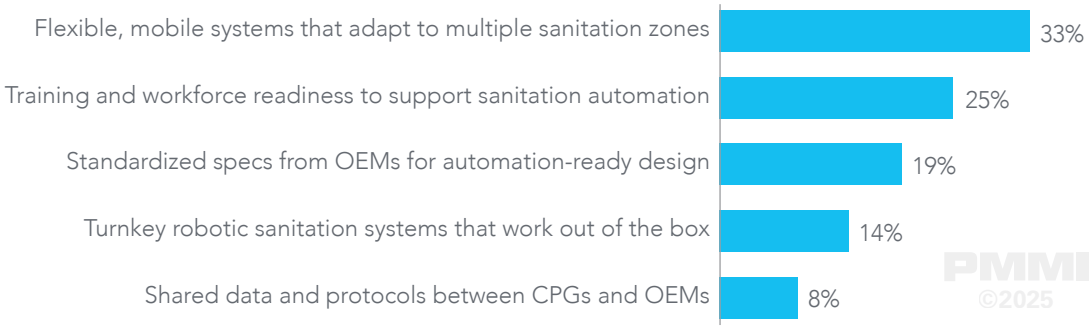
There are also practical challenges which hold back investment in sanitation automation. Machinery must be designed to be easily cleanable and a lot of the machinery currently on production lines is not. Even if a line is automated, there still needs to be humans monitoring cleaning processes and they need to have the right skills and knowledge. There are perceived risks in relying completely on automation, as regulatory and safety concerns are a key priority for food and beverage companies.



What are end users' priorities for sanitation automation?

During the roundtable discussions, participants discussed what would have the biggest impact on their operation when it comes to sanitation automation. Mobile, flexible systems, deployable in a range of sanitation zones, were a high priority, as was the need for effective training, and standardized design specifications from OEMs.

When it comes to sanitation automation, what would make the biggest impact on your operation?



Flexible, mobile solutions, training, standardized specs and turnkey solutions were all popular suggestions

Turnkey simplicity versus flexible, mobile sanitation

Panelists debated the trade-offs between flexible, mobile automated sanitation systems that are easier to clean and maintain, with turnkey robotic solutions that have minimal setup and commissioning. It was noted that plug-and-play systems can free up operators for other tasks, but good training on more flexible and mobile equipment can bring added value, improve standards, generate better ROI, and deliver long-term benefits. More flexible solutions may also be easier to use with existing and legacy machines.

A panelist from an OEM highlighted the potentially high costs associated with developing and building sanitation robots and automated systems. They explained that standardization helps to manage costs, adding:

> We can design the most automated system in the world. We can make the most effective sanitation equipment, but if customers aren't willing to pay for it, it doesn't get made. And so that's where I want to highlight the idea of having those close OEM-CPG partnerships and looking for OEMs that are willing to work with you, the customer, to be able to understand your hygienic design principles, your sanitation processes and programs, your SOPs, so we can then design a piece of equipment.

How can companies get started with automated sanitation?

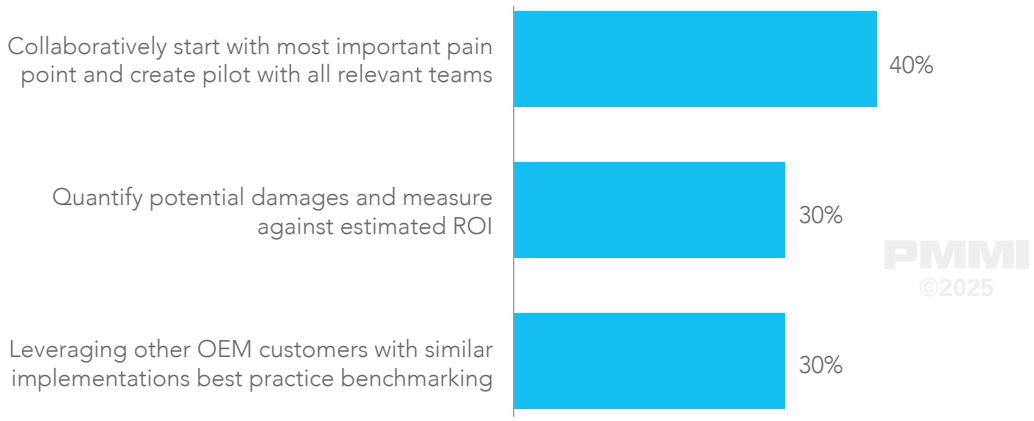
Many CPGs and OEMs haven't explored automation yet and participants examined which first steps would help organizations begin their automation journey. It was suggested that the best approach to exploring automation is to collaboratively start with the most important pain point and create a pilot with all relevant teams. Strong communication between departments, used to gather input and identify where automation can be most effectively implemented, has proven to work well. It's also a case of properly quantifying the ROI of an investment into automation technology beyond simple labor saving.

During discussions about how companies can start to adopt sanitation automation, starting small was also a key factor, and ROI is of high importance. For example, conveyor belt cleaners are common in the food industry and an automated belt cleaner can be purchased for relatively low capital outlay. This can generate significant ROI in terms of labor savings and can encourage the purchase of more equipment. In each case, participants noted it is a case of looking for simple, repeatable processes that can easily be automated.

A single tank clean-in-place (CIP) system is also a feasible entry point. A boiler is not required as water can be heated with an electric heater, meaning there is no need for additional expenditure on a steam generation system. One OEM revealed: "What we've actually been looking at from a ROI standpoint is if you reduce 40 minutes of CIP in a mid-range company with let's say four to five sterilizers, in a month that saves you almost $43,000 in chemicals, steam, water. It's drastic. So once they start seeing lower utility bills, lower operational costs, they get hooked. That's when they start saying, 'Okay, can you automate this legacy line with that single tank CIP that you rolled in and connected?'"

One table discussed the value of benchmarking best practice across an OEM's customer base, and then monitoring data against that benchmark to improve sanitation.

What first steps would help organizations confidently enter the automation journey?

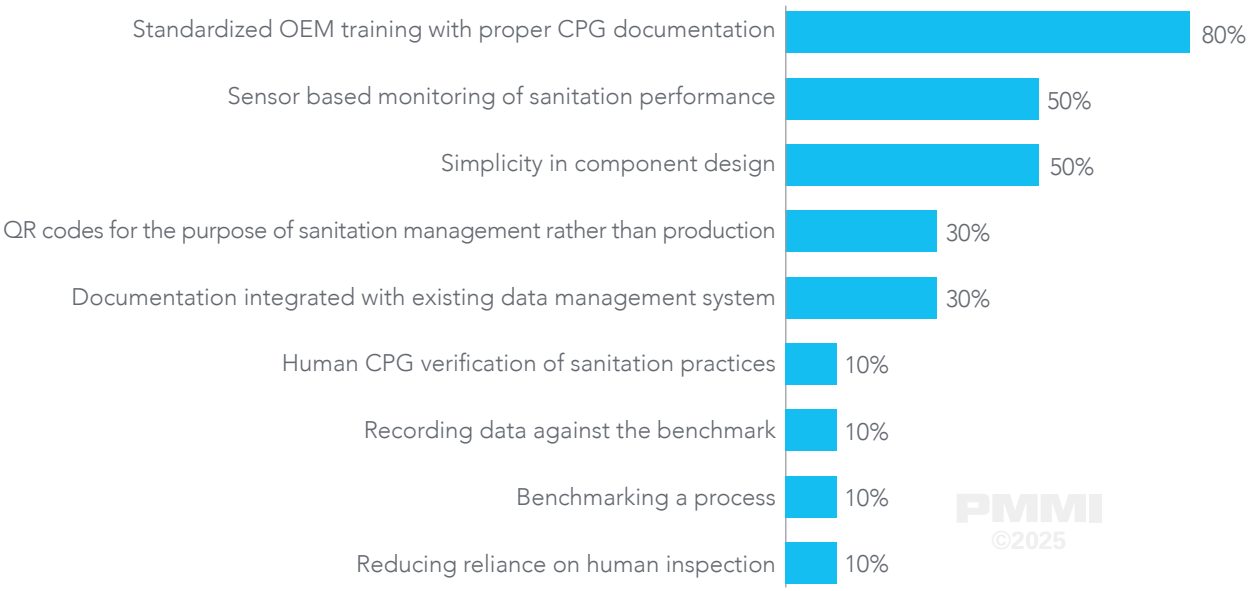


How can user-friendly design features and better CPG practices maximize the potential of equipment?

During roundtable discussions, reducing the risk of human error was high on the agenda. Simplicity of equipment design is considered crucial: for example, reducing the adjustments operators make using detents which restrict the full range of motion to only the positions required, or introducing a scale that can be easily followed. Simplicity of component design was mentioned, making it easier for components to be disassembled, cleaned and reassembled. The installation of sensors to monitor sanitation performance and the use of AI were also highlighted as potentially beneficial during the session.

In a poll of participants on the ideas generated during the roundtable discussions, almost 80% said that standardized OEM training organized before the installation of machinery and followed up with comprehensive and easily accessible documentation could improve operations. Benchmarking of data and the integration of production data with ERP (Enterprise Resource Planning) systems could help CPGs "to more timely address preventive maintenance tasks, as well as replacement of consumables like chemicals used in a CIP process." Meanwhile, placing QR codes on machines for the purpose of sanitation management also proved popular

Could new design features reduce reliance on operator skill? Or could better CPG practices maximize the potential of current equipment? (Select All that Apply)



Responses underscored the importance of design and technology in improving sanitation and the need for clear training and documentation

Conclusion

This session explored how automation and collaboration between OEMs and end users can modernize sanitation processes while addressing labor, training, and cost challenges. Discussions emphasized that, although automation is increasingly talked about, adoption still remains slow due to barriers such as lack of exposure, high perceived costs, and limited in-house expertise. Sanitation training gaps, equipment design constraints, and regulatory requirements were identified as major obstacles. Participants also highlighted the need for flexible, mobile cleaning solutions balanced with plug-and-play simplicity to improve ROI, consistency, and compliance.

Both OEMs and end users agreed that automation success depends on partnership and collaboration. The session highlights the shared responsibility for hygienic design, training, and effective sanitation. OEMs must engineer equipment with sanitation in mind, while end users must ensure ongoing compliance through proper use, training, maintenance, and documentation.

For additional insight into the sanitation realities facing CPGs and OEMs, from labor and training challenges to chemical durability concerns and the next wave of hygienic machine design, see PMMI's comprehensive *Food Safety and Sanitation Trends* report."

PMMI Business Intelligence

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