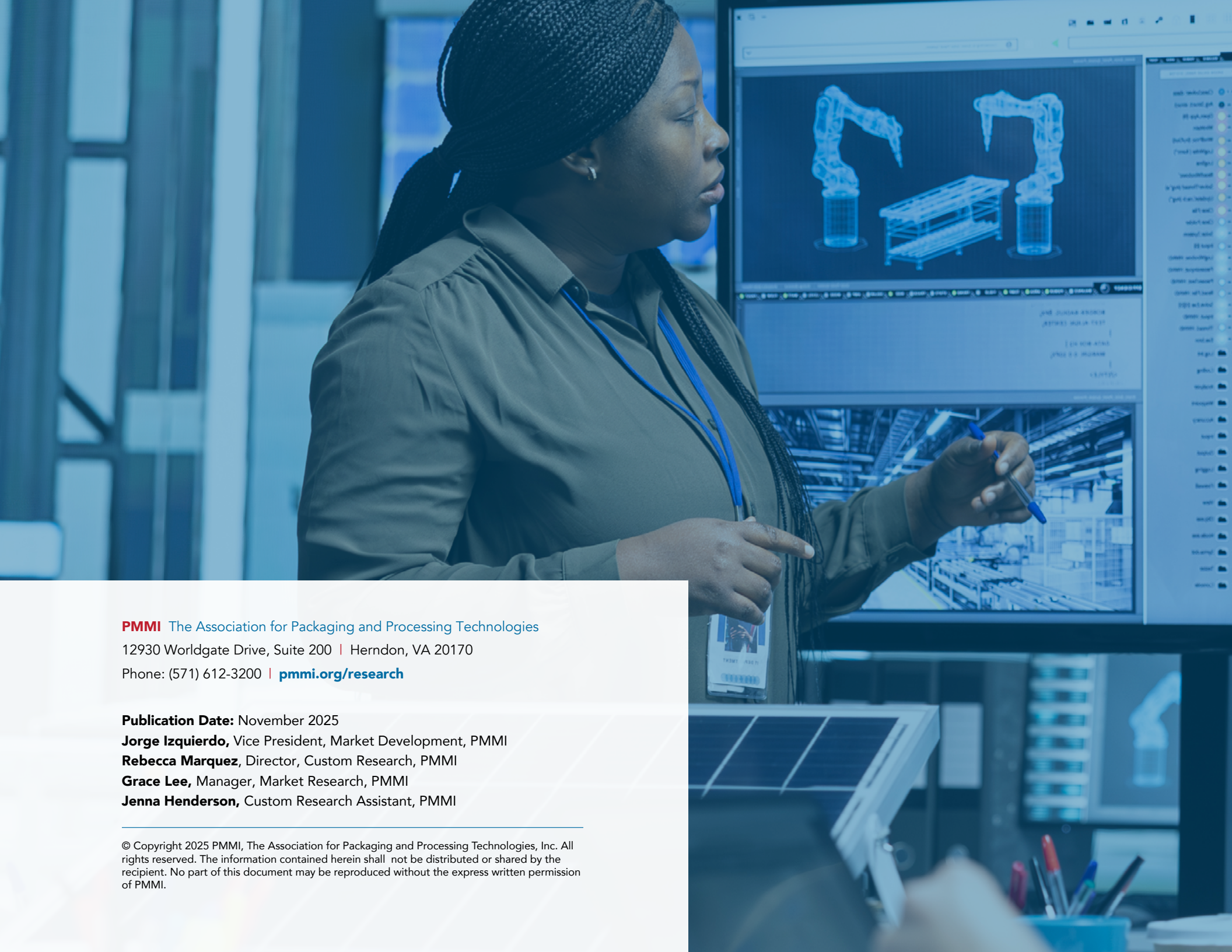


NOVEMBER 2025

2025 Inside the Workforce Gap





PMMI The Association for Packaging and Processing Technologies

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Publication Date: November 2025

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WHO WE ARE AND WHAT WE DO

PMMI is a global resource for the packaging and processing industry, unifying the industry across the manufacturing community. PMMI members promote business growth in a variety of industries by developing innovative manufacturing solutions to meet evolving consumer demands, today and in the future. PMMI membership represents more than 1,000 manufacturers and suppliers of equipment, components, and materials as well as providers of related equipment and services to the packaging and processing industry.

PMMI Business Drivers support the industry by delivering a variety of valuable resources, such as in-depth market research, practical best-practice tools and reports, specialized technical training, networking events, and other essential services.

PMMI connects consumer goods companies together with our members' manufacturing solutions through the premier PACK EXPO portfolio of trade shows, including PACK EXPO International, PACK EXPO Las Vegas, PACK EXPO East, PACK EXPO Southeast, EXPO PACK México, and EXPO PACK Guadalajara.

INTRODUCTION

The packaging and manufacturing industries are navigating a period of significant disruption, driven by persistent workforce challenges. From high turnover and an aging labor force to evolving technology and rising difficulty in talent acquisition and retention, companies are under pressure to adapt.

According to the U.S. Bureau of Labor Statistics, an additional 3.1 million jobs in maintenance and repair occupations are projected to be added by 2031. Yet, many manufacturers report that attracting and retaining a quality workforce remains one of their most critical hurdles.

These labor dynamics are placing increasing strain on both Consumer-Packaged Goods companies (CPGs) and Original Equipment Manufacturers (OEMs) and suppliers, who must find new ways to:



Sustain operations
with learner teams



Reduce downtime
and human error



Manage and
transfer knowledge
efficiently across
generations of
workers

This research explores how workforce gaps are impacting packaging and processing operations—particularly in plant-floor roles like machine operators and technicians—and how technology, machine design, support services can ease the burden.

Specifically, this report aims to:

- Explore workforce-related challenges from the perspective of both End Users and OEMs
- Quantify the operational impact of turnover, onboarding, and skill loss
- Evaluate the effectiveness and adoption of current support tools and training methods
- Identify which technologies and support formats are most viable for the next 1-3 years
- Surface actionable insights to help End Users and OEMs reduce the learning curve, improve retention, and strengthen frontline performance

METHODOLOGY

ONLINE QUANTITATIVE RESEARCH

Data collection: June 19 – July 15, 2025

8 to 10-minute length survey

TOTAL RESPONDENTS	136
End Users (CPGs, CPs and Retailers)	81
OEMs (OEMs and Technology Providers/Suppliers)	55

VIRTUAL QUALITATIVE IN-DEPTH INTERVIEW RESEARCH

Interview: July 7 – August 13, 2025

30 to 40-minute length of interview with End Users and OEMs

Total number
of interviews

14

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This report covers the following sections that highlight the current workforce challenges, skills gaps, and emerging technologies that OEMs and End Users are implementing or plan to implement to help address workforce-related challenges in the packaging and machinery industry.

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KEY TAKEAWAYS AND IMPLICATIONS

A photograph of two industrial workers, a man and a woman, wearing hard hats and high-visibility vests, standing in a factory. A robotic arm is in the foreground, slightly out of focus. The background shows various industrial machines and equipment.

1

WORKFORCE CHALLENGES HEARD AND EXPERIENCED

Hiring Difficulty and Outlook

OEM View of Customer Challenges

Operational Impact of Workforce Gaps

FINDING SKILLED TECHNICAL STAFF IS A MAJOR WORKFORCE BARRIER AND MANY SUSPECT THIS CHALLENGE TO PERSIST—OR WORSEN

95% of end users struggle to find skilled operators/technicians (38% 'very difficult', 57% 'somewhat difficult').

When OEMs were asked how often their customers discuss workforce challenges with them, nearly 2 in 3 OEMs say customers 'often' or 'always' discuss workforce challenges.

Additionally, when end users were asked about outlook on this issue, nearly 60% expect these issues to become 'somewhat' or 'more' challenging.

Interviewed end users reinforced this, citing retirements of experienced staff (amplified since COVID), high turnover among new hires, and intense competition for technicians who can "name their price," leaving many companies unsure how the labor pool will improve.

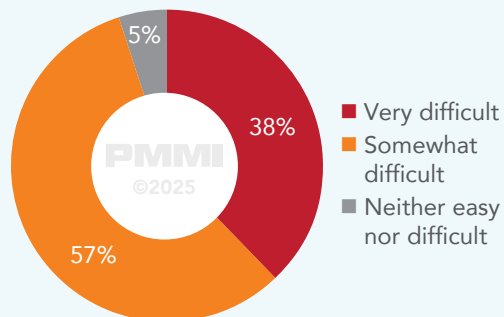


Since COVID, it's gotten worse—there aren't as many people wanting to enter this section of the workforce"

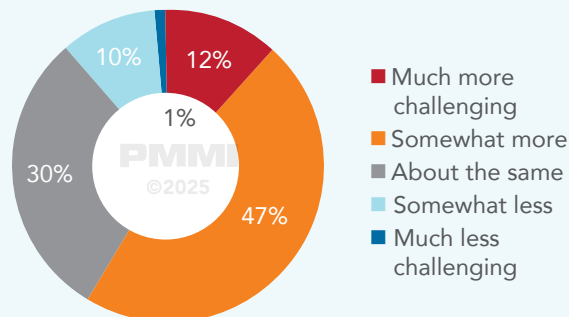
Electrical Engineering Manager,
Cosmetics/Personal Care

END USER PERSPECTIVE:

How difficult is it to find skilled operators or technicians?

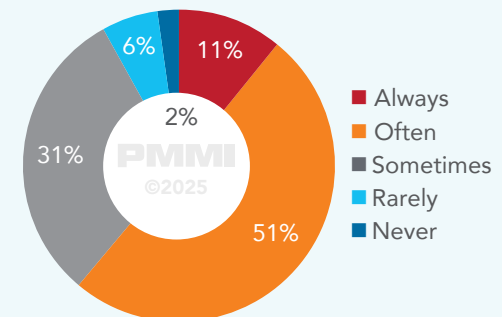


To what extent do you expect workforce challenges to become more or less challenging over the next 1-3 years?



OEM PERSPECTIVE:

How often do your customers discuss workforce challenges?

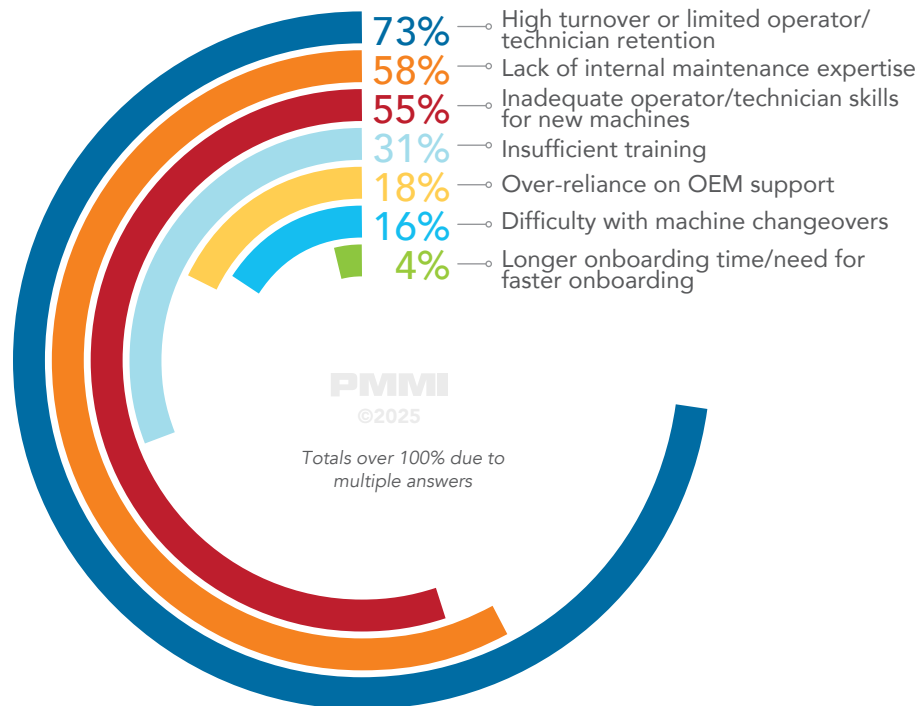


RETENTION, SKILLS GAPS, AND MAINTENANCE EXPERTISE ARE TOP CUSTOMER PAIN POINTS

Customer workforce challenges reported by OEMs



What specific workforce-related challenges do your customers most often raise? (Choose up to three) (OEMs)



Additional concerns include insufficient training (31%), over-reliance on OEMs (18%), and changeover difficulty (16%).

End user interviews reinforce these pain points, noting that when experienced staff retire or leave, undocumented “tribal knowledge” goes with them, creating skill and training gaps that make it even harder for newer operators to succeed, especially as machines become more complex.



It’s almost like an art for them [experienced operators] to get a piece of equipment to run well.. And if you lose those operators, it takes a while for new operators to get the line to run as well.”

Engineering Team Leader, Food/Beverage Manufacturer



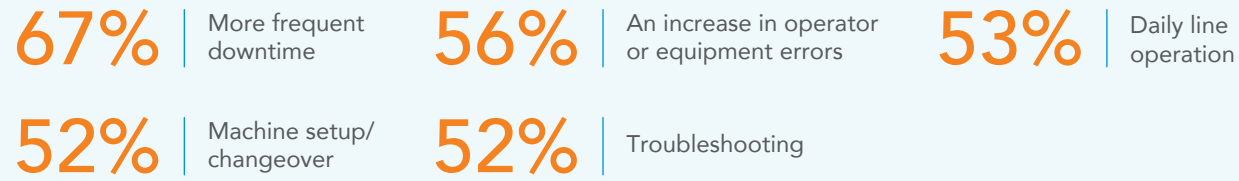
A lot of the older generation knew the tribal knowledge of all the older equipment... that do not have detailed SOPs. Someone from the older generation would get it back up and running in half an hour instead of taking a day to research it.”

Process Engineer, Life Sciences

WORKFORCE TURNOVER DISRUPTS ROLES AND OPERATIONS

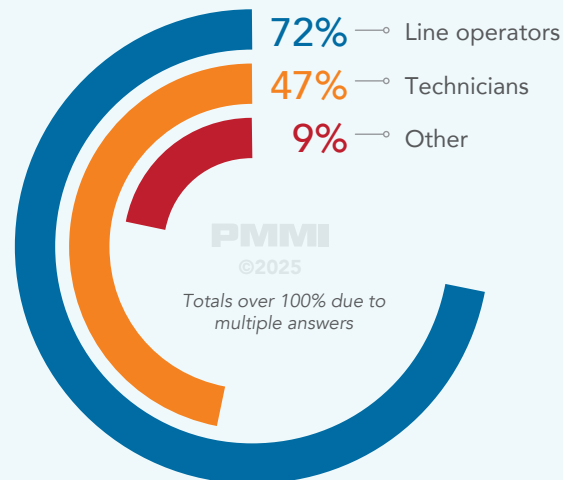
72% of end users report high turnover among line operators, who are essential for daily operation, and 47% say technicians have also been impacted.

This turnover has tremendous impact on their day-to-day operations:



Interviewed end users confirm these disruptions, describing shutdowns from too many call-ins, efficiency losses when untrained staff cover new lines, and more frequent errors and quality slips from inexperienced operators.

Thinking about the past 12 months, which of the following roles in your operations have been most impacted by turnover? (End Users)

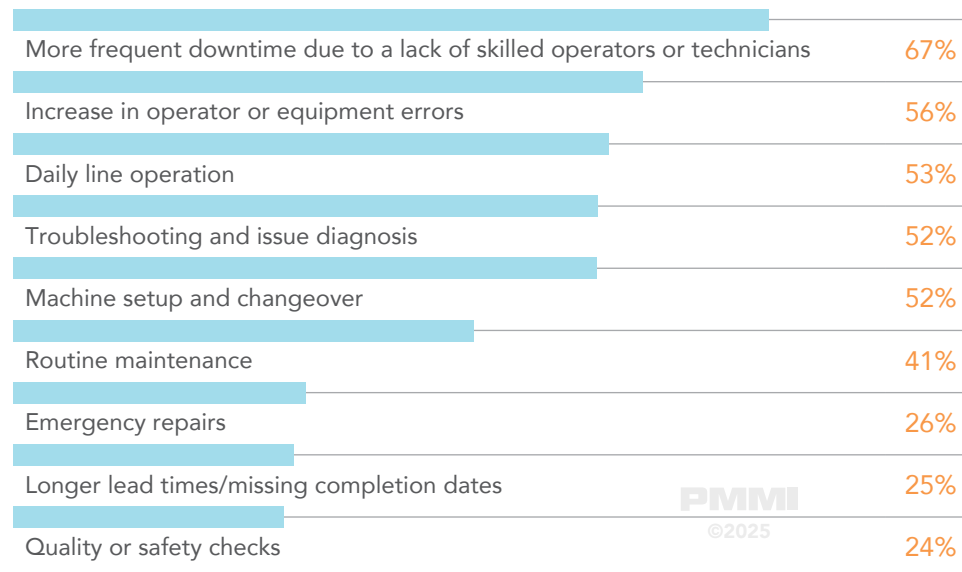


“For operators, it takes a long training process, maybe three to six months, but then retention becomes a problem. It’s tough to keep someone past two years.”

President, Food/Beverage Manufacturer



Which aspects of your operations are most impacted by workforce turnover?
(End Users)



Totals over 100% due to multiple answers



These people [experienced] leaving, takes a three-minute fix, but that ends up taking a new technician or operator four hours of downtime to correct."

Vice President, Food/Beverage Manufacturer



Sometimes new operators have a lot more call ins which have caused us to have to shut down some of our lines occasionally, because we just don't have enough people available to operate certain equipment."

Engineering Team Leader, Food/Beverage Manufacturer



AND THE IMPACT ON DAY-TO-DAY OPERATIONS IS LIKELY CAUSED BY UNDOCUMENTED KNOWLEDGE LOSS WHEN EXPERIENCED EMPLOYEES LEAVE

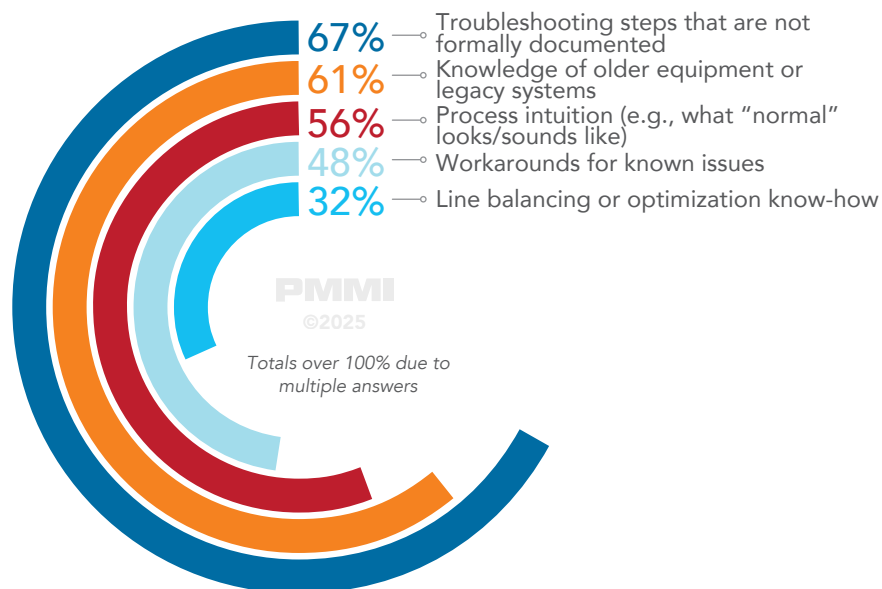
When experienced employees leave, critical undocumented know-how walks out the door. Survey data shows:

67%	Informal troubleshooting
61%	Knowledge of legacy systems
56%	Process intuition
48%	Known workarounds

Interviewed end users echo these pain points: critical 'tribal knowledge' often lives only in the heads of seasoned staff, when it's not formally documented, it disappears when they retire or leave. Companies described how this undocumented expertise, like quick fixes, intuition for how equipment should 'sound' or 'feel,' and legacy system know-how, can be the difference between minutes of downtime and hours of disruption.

This highlights the urgent need for digitizing expertise, whether through embedding troubleshooting guidance into equipment or using smarter documentation practices to capture tribal knowledge before it's lost.

When experienced team members leave, which of the following knowledge or capabilities—if lost—have the greatest impact on your operations? (Choose up to three) (End Users)



A cover needed to be removed and put back on, but that knowledge was forgotten or was not transferred [when personnel changed], then we had some downtime."

Automation Engineer,
Food/Beverage Manufacturer

IN FACT, HALF OR MORE REPORT LOSING AT LEAST 11% OF PRODUCTIVITY DUE TO SKILL GAPS

As seen earlier, a lack of internal maintenance expertise and inadequate operator or technician skills are among the top concerns OEMs hear from their customers, and end users' responses confirm the scale of the impact.

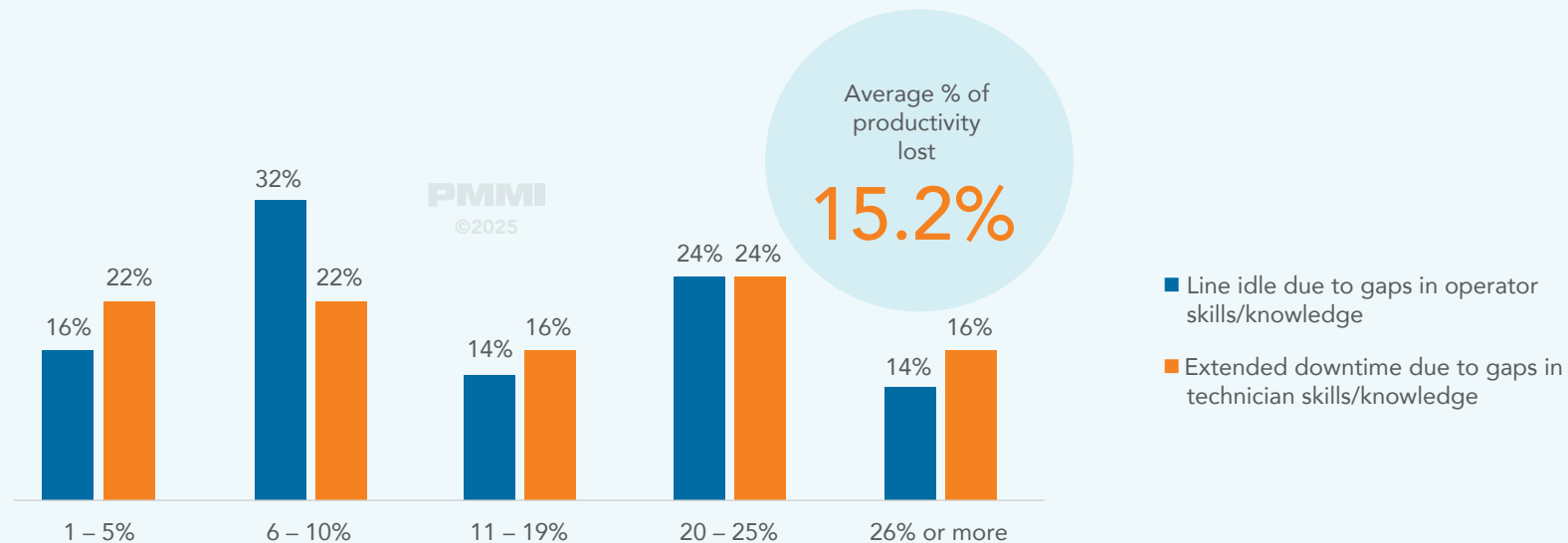
When asked to quantify productivity lost due to workforce gaps:

50% Of end users say that 11% or more of their productivity is lost to line idle caused by **operator skill** or knowledge gaps.

57% Say 11% or more of their productivity is lost from extended downtime caused by **technician skill** or knowledge gaps.

These findings underscore that workforce limitations extend beyond talent acquisition and retention—they are core to operational continuity and business outcomes.

Approximately what percentage of productivity is lost due to the following workforce gaps/limitations? (End Users)



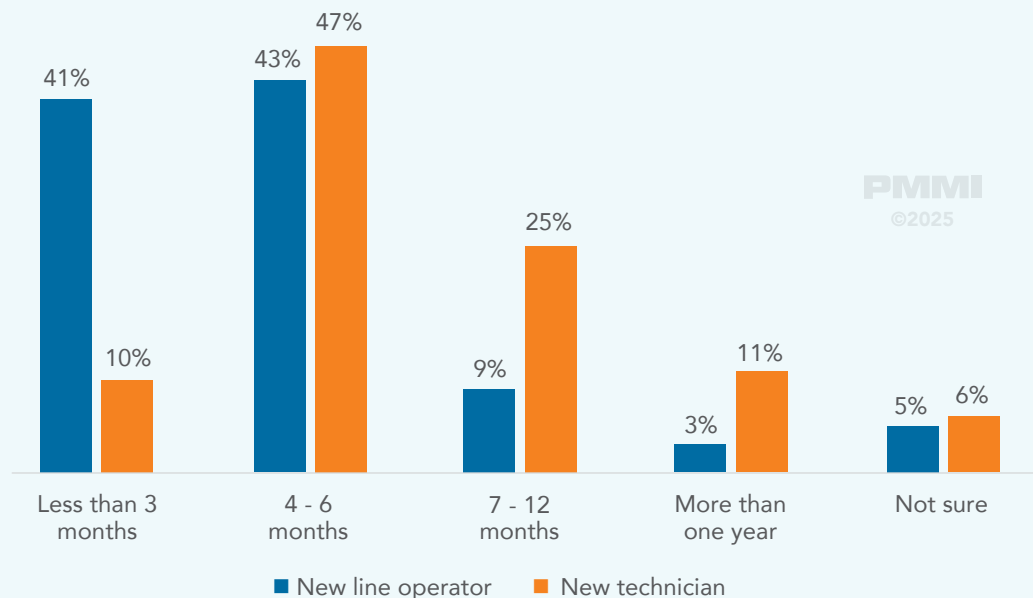
MOST OPERATORS TAKE 3-6 MONTHS TO ONBOARD; TECHNICIANS TAKE EVEN LONGER

41% say it takes <3 months to fully onboard or train to become independent (or with minimal guidance) while 43% say it could take anywhere from 4 – 6 months.

Technicians take even longer, with 47% needing 4 – 6 months and 25% requiring 7 – 12 months.

End user interviews highlight that extended timelines stem from the growing complexity of today's equipment, the amount of hands-on repetition required for new hires to gain confidence, and the lack of consistent guidance when experience staff are not available to support them.

On average, how long does it take to fully onboard/train the following roles in your operations? (End Users)



CRITICAL SKILL GAPS ARE SLOWING DOWN PRODUCTION AND TROUBLESHOOTING EFFICIENCY

LINE OPERATORS:

59%

Of end users say mechanical aptitude is the most commonly lacking skill among line operators, followed closely by basic operational troubleshooting skills

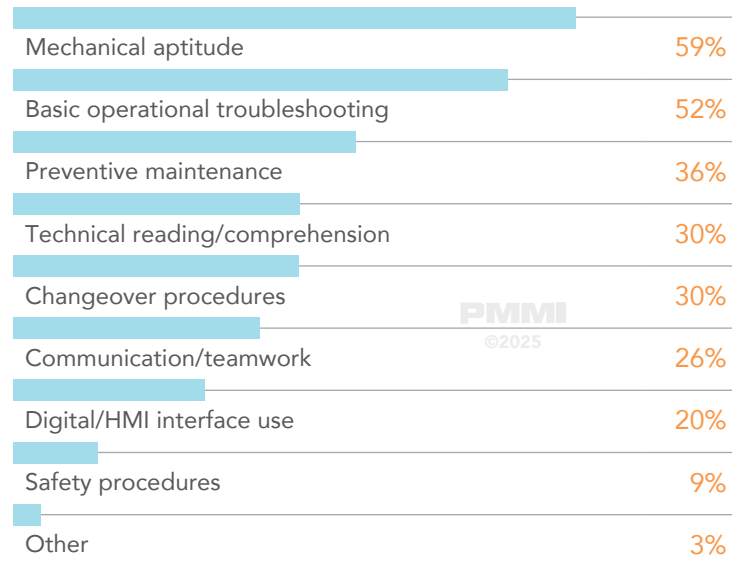
Additional deficiencies in preventive maintenance, technical reading, and changeover procedures can further impact uptime and operational flexibility.



Within two years, most of the people who have trained, 2 out of 3 them are gone and move onto a better job"

Electrical Engineering Manager, Cosmetics/Personal Care

Which of the following skills are most commonly lacking in your line operators? (choose up to three) (End Users)



Totals over 100% due to multiple answers

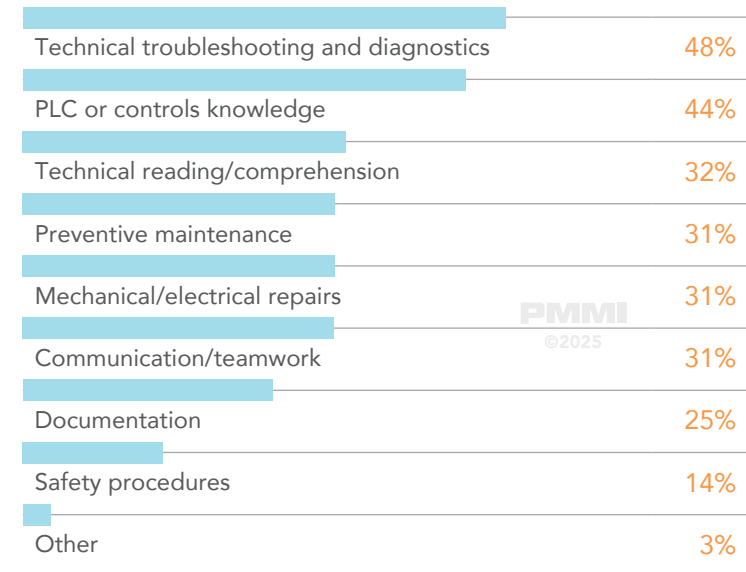
TECHNICIANS:

Technicians lack key skills essential for maintaining uptime and performing advanced tasks.

48% of end users cite deficiencies in troubleshooting/diagnostics, while 44% report gaps in PLC or controls knowledge, highlighting the need for more advanced technical training.

Additionally, around 31% report skill gaps in communication, repairs, and preventive maintenance, limiting technicians' ability to respond quickly and effectively.

Which of the following skills are most commonly lacking in your technicians? (choose up to three) (End Users)



Totals over 100% due to multiple answers



2

CURRENT TOOLS AND SUPPORT LANDSCAPE

Tools In Place Today

Looking Ahead—What's Worth Investing In?

Why Tools Look the Way They Do: Changes in Support Tools & Services

OEM Readiness and Constraints

Escalation & Support Behavior

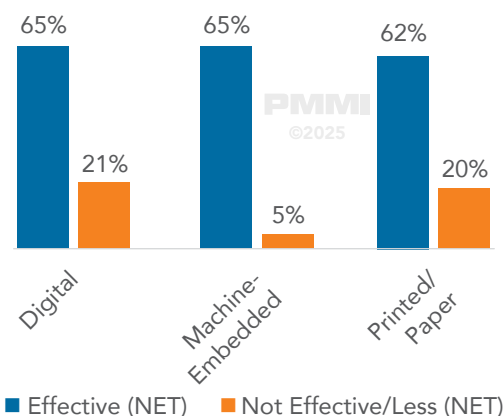
OEMS OFFER A BROAD RANGE OF SUPPORT TOOLS, BUT END USER ADOPTION REMAINS LOW—ESPECIALLY FOR ADVANCED FEATURES

End users report greater access to traditional tools, with 74% having printed manuals and 47% digital manuals available. By contrast, tools like predictive maintenance alerts, HMI-based troubleshooting or on-machine instructional videos are less commonly reported by end users.

OEMs, however, report offering a broader range of tools; 89% offering digital manuals, 80% remote OEM support, and 65% HMI-based troubleshooting.

This gap may reflect limited integration or awareness, but end user interviews suggest it also reflects real differences in what's provided or applicable. Some end users noted digital manuals or training materials are not always offered or are fee-based, while others pointed out that even when available, they may not fit customized equipment, limiting day-to-day usefulness on the plant floor when issues arise.

Of the tools you selected, how effective is each in supporting your team during operations and troubleshooting? (End Users)



Which of the following does your company currently offer? (OEMs)
What support tools or machine features are currently available to help less experienced operators in your operations? (End Users)

	OEMs	End Users
Digital manuals	89%	47%
Remote OEM support (virtual assistance, customer portal, etc.)	80%	22%
Printed manuals	76%	74%
HMI-based manuals/troubleshooting	65%	26%
Automated changeover	35%	9%
Predictive maintenance alerts	32%	17%
QR codes linked to training content	28%	11%
Subscription-based or "training-as-a-service"	26%	6%
On-machine instructional videos	17%	19%
Mobile/tablet-based operator tools	6%	21%
AI-based diagnostics or guided workflow	4%	6%
Machines that adapt to operator skill levels	2%	5%
AR/wearables (e.g., smart glasses)	2%	6%
Other	2%	5%

Totals over 100% due to multiple answers

▶ OEMs report broader tool availability than end users experience—pointing to gaps in adoption or implementation, potentially tied to awareness or cost.



The manual [we got from OEMs] was a generic one. We ordered XYZ customizations, and they aren't mentioned in the manual and the pictures are all wrong. How are we supposed to troubleshoot with a manual that isn't even for our machine? "

Automation Engineer, Food/Beverage Manufacturer

END USERS ARE PRIORITIZING SMART, EMBEDDED, AND REMOTE TOOLS FOR NEAR-TERM EXPANSION

When asked which tools would be most cost-effective to expand over the next 1-3 years, end users favored predictive, remote, and machine-embedded tools—many of which are currently underutilized. Traditional tools, like printed manuals ranked lowest.

End user interviews reinforce this preference, with many saying that machine-embedded HMIs, on-machine videos or step-by-step instructions, and mobile/tablet tools would be far more effective in helping less experienced operators troubleshoot in real time. They also stressed the need for training content that is intuitive, visual, and multilingual, rather than dense text manuals.



In a perfect world, it would have a large HMI screen that walked you through every part of the equipment... every possible issue that could happen with troubleshooting guides right on the screen."

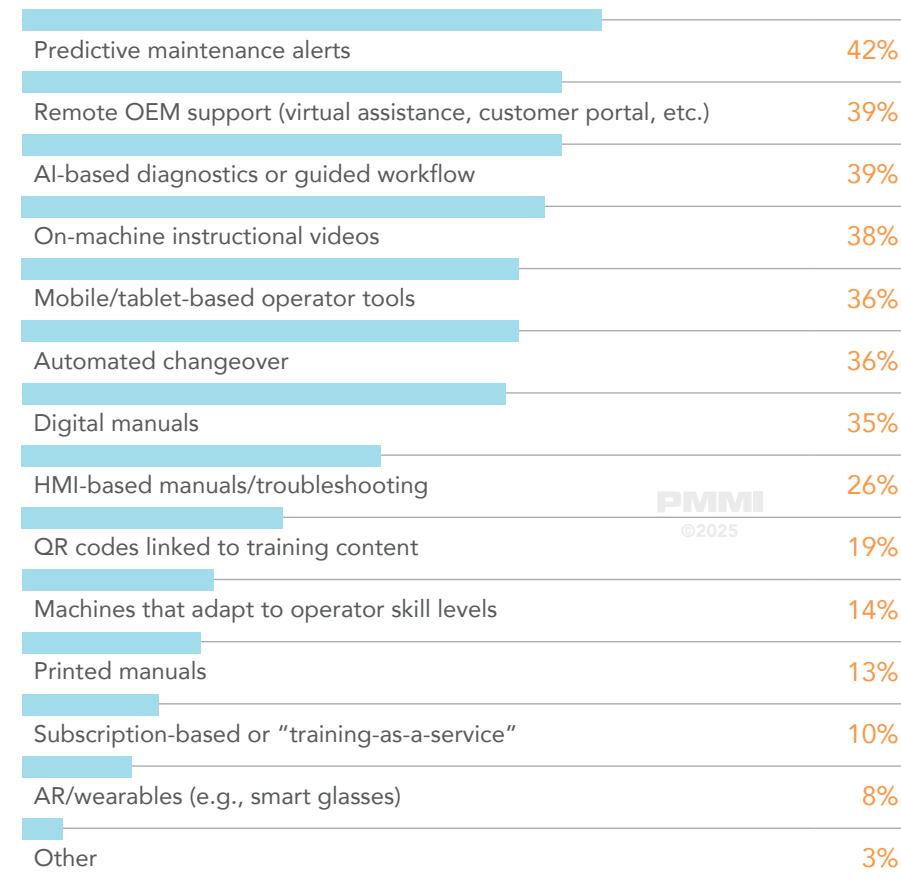
Packaging Engineer, Food/Beverage Manufacturer



I would love OEMs to create some basic training videos. If we bring in a new person and had a 20-minute video to give a general operational theory, not specifics.... To give that type of knowledge in a non time intensive or labor-intensive way."

Project Engineer, Food/Beverage Manufacturer

Considering your company's current budget, in-house engineering and innovation capabilities, internal resources and current plans/road maps, which of the following do you think will be most effective in helping your organization address workforce challenges, and most cost-effective to expand on or develop in the next 1-3 years? (End Users)



Totals over 100% due to multiple answers

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OEMS PREDICT RISING DEMAND IN ALMOST PERFECT SYNC WITH END USER PRIORITIES—REMOTE SUPPORT, EMBEDDED GUIDANCE, AND PREDICTIVE CAPABILITIES

OEMs expect rising demand for more remote, smart tools, such as:



70%

Remote support



70%

HMI-based tools



66%

Predictive alerts



66%

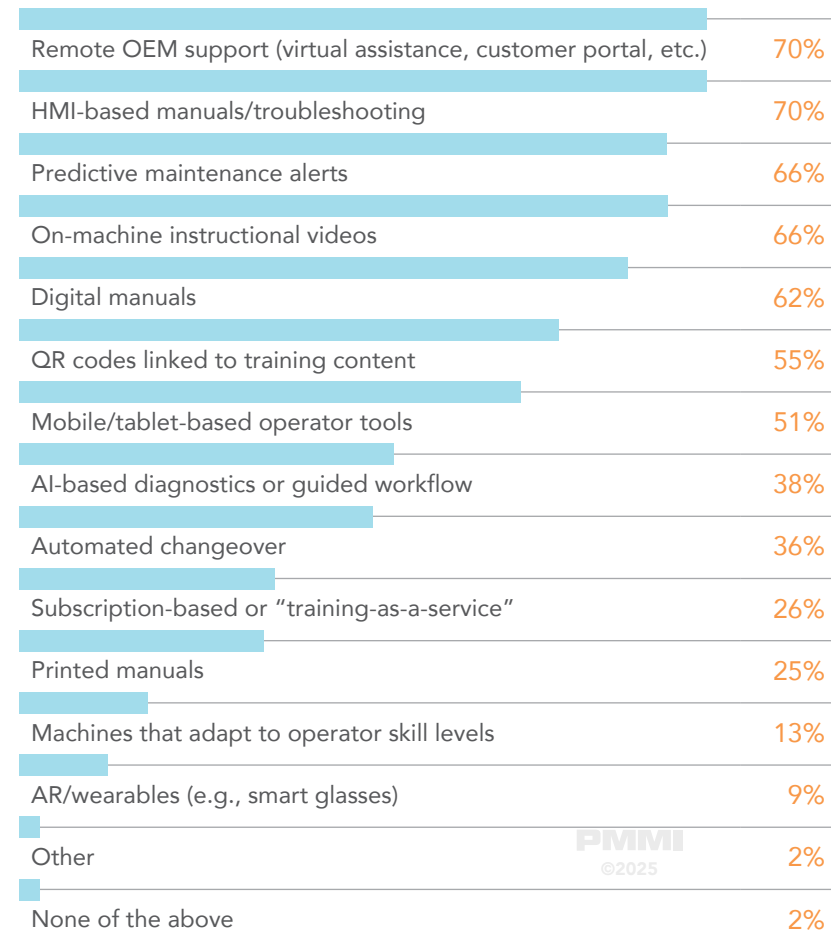
On-machine instructional videos

There is also strong anticipated demand for mobile/tablet-based tools (51%), AI-guided workflows (38%), and automated changeover (36%).

There is strong alignment between what end users say they need and what OEMs expect will be in demand. Both sides point toward embedded, automated, and remote support systems.

OEMs and solution providers that align with these priorities by offering smart, embedded features and remote-enabled services will be better positioned to meet evolving customer expectations.

Regardless of whether your company currently offers them, which of the following do you anticipate your customers will demand more of over the next 1-3 years to help address their workforce challenges? (End Users)

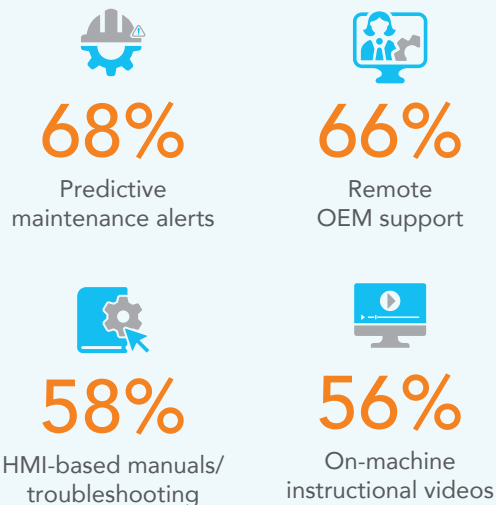


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Totals over 100% due to multiple answers

OEMS IDENTIFY PREDICTIVE, REMOTE, AND EMBEDDED TOOLS AS MOST EFFECTIVE AND FEASIBLE TO DEVELOP IN THE NEAR TERM

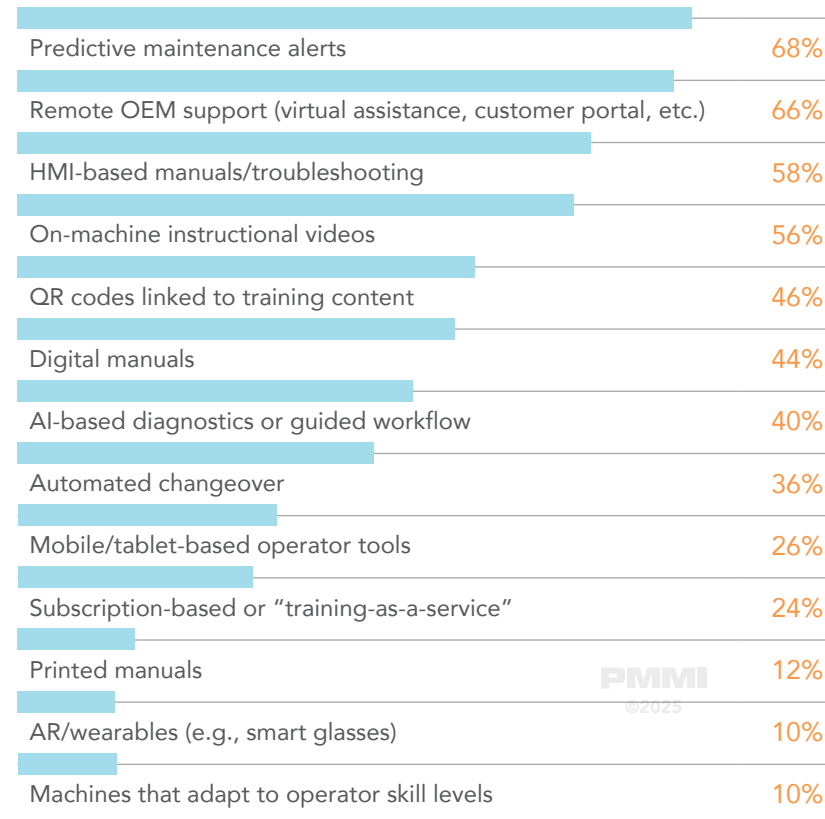
Given their own budgets and internal resources, OEMs and technology providers say the most impactful and cost-effective tools to expand over the next few years are:



These mirror what end users say they plan to expand, suggesting strong potential for alignment.

This reinforces that OEMs are not only expecting demand but are anticipating to build or expand solutions to meet the end user expectations, signaling a path forward that aligns with what end users may be looking for.

Considering your budget and internal resources, which of the following do you think will be most effective in helping your customers with their workforce challenges, and most cost effective for you to expand on or develop in the next 1-3 years? (OEMs)



Totals over 100% due to multiple answers



We started five years ago with industry 4.0; we started with both augmented reality and virtual reality to give the ability to have an offline training and understanding of the operation of the machine in a virtual world; providing an iPad where you can learn step by step change over in bullet points."

Managing Director, OEM

OEMS ARE MODERNIZING SUPPORT OFFERINGS TO BALANCE CUSTOMER NEEDS WITH INTERNAL CAPABILITIES

71%

Of OEMs and technology providers report expanding remote services in the past 1-3 years.

Other enhancements include:



62%

Greater integration with HMI/control systems



51%

More customized training



46%

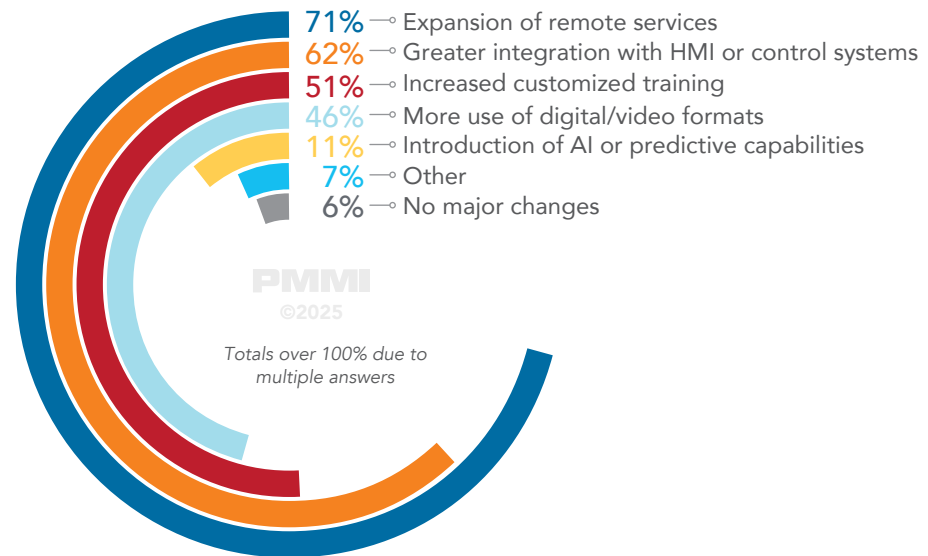
Increased use of digital/video formats

When designing support tools, the top three factors are customer feedback, competitive differentiation and internal engineering capacity. Training limitations on the customer side also play a role.

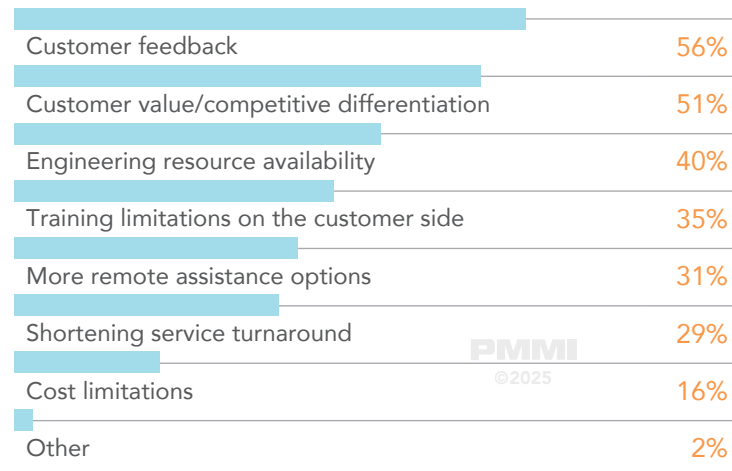
While AI and predictive features are emerging, adoption is still limited (11%), highlighting opportunity for future growth.

Together, these trends point to a strategic shift toward more accessible, tech-enabled support models.

How have your support tools or services changed over the last 1 -3 years? (OEMs)



What factors most influence how you design or offer support tools? (OEMs)



Totals over 100% due to multiple answers

OEMS GENERALLY FEEL PREPARED TO MEET WORKFORCE-RELATED NEEDS, BUT ANTICIPATE RESOURCE AND INFRASTRUCTURE BARRIERS

65% of OEMs and technology providers say they feel very/somewhat prepared to meet workforce-related needs over the next 1-3 years, while only about 20% feel less prepared.

The biggest barriers to expanding support include internal development strain (54%), limited customer budgets (52%), and lack of digital infrastructure at customer sites (40%).

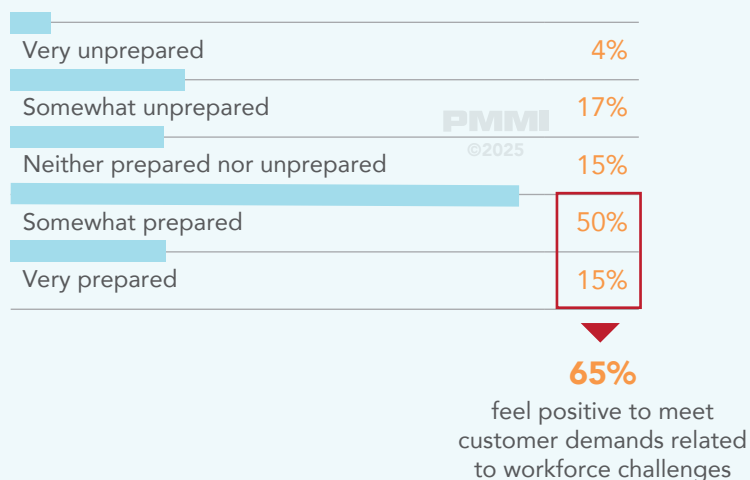
These responses suggest that while OEMs recognize the growing demand, they are having to balance ambition with real operational constraints –both internal and customer facing.



We're going to spend what it takes to do it, but, for the convincing the customer to purchase the tools that are going to be helpful for them on the training side, there's a cost. Some companies that realize the need upfront are being much more proactive in investing in that type of technology and tools though."

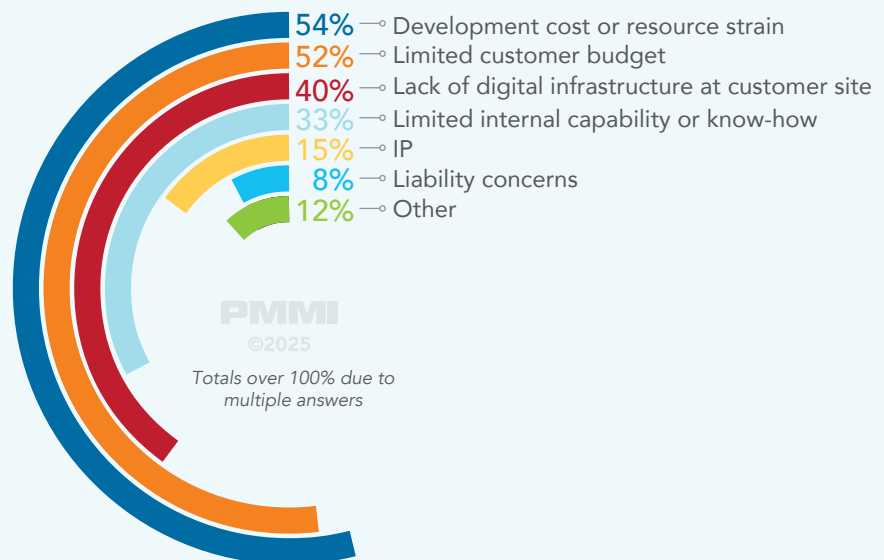
Managing Director, OEM

How well prepared do you feel your company is to meet customer demands for machine features, training, or support services that help address workforce-related challenges over the next 1-3 years? (OEMs)



Totals over 100% due to multiple answers

What are the biggest barriers to offering expanded training or support tools to customers? (Choose up to three) (OEMs)



END USERS TURN TO IN-HOUSE EXPERTS FIRST—OEM SUPPORT IS STILL CRITICAL IN COMPLEX SCENARIOS

When operators face equipment issues, the majority of end users (58%) turn first to a senior in-house technician. However, even if OEMs are not the first contact, they are vital when in-house resources hit a wall.

81%

Contact OEMs when internal staff can't resolve an issue

64%

Cite inconsistent machine performance

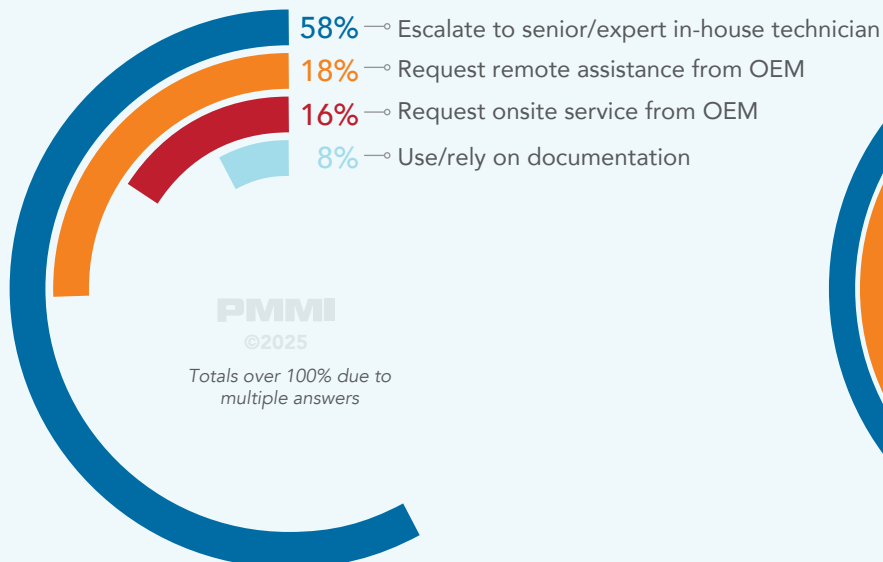
56%

Report complete machine stoppages as triggers for seeking OEM help

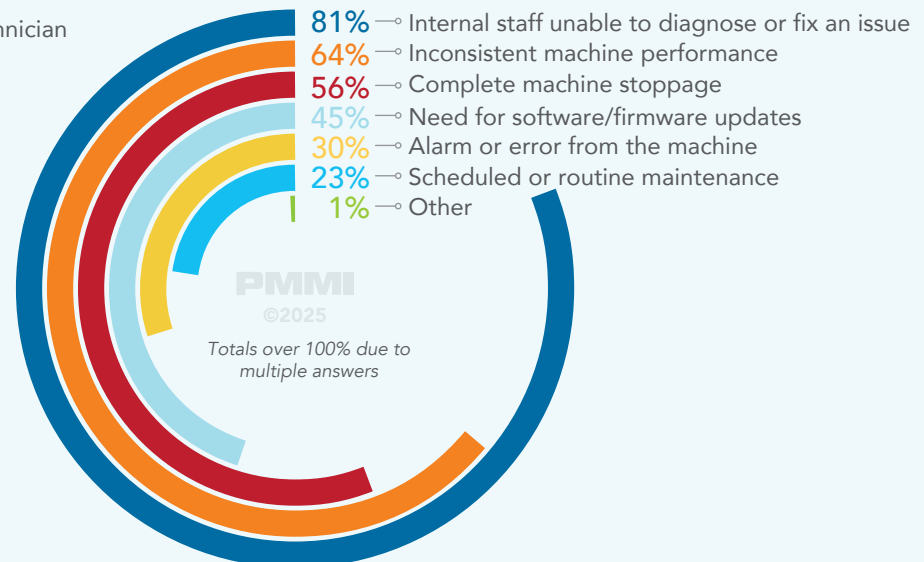
Interviews confirm this pattern—operators and line staff escalate to in-house experts first, but when those experts aren't available or reach their limits, downtime grows quickly.

These findings highlight the importance of tools that could reduce the burden on both internal teams and OEMs. Providing clearer documentation, embedding HMI-based troubleshooting, and enabling remote support can speed resolution, cut downtime, and empower less experienced operators to act with confidence.

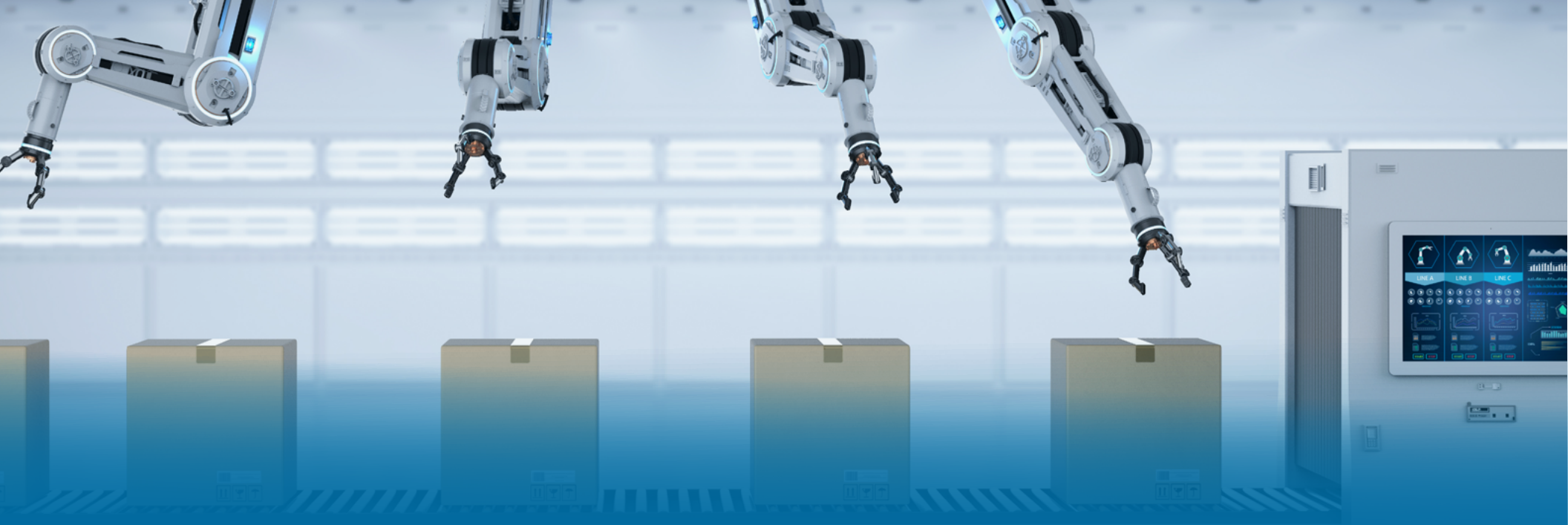
When your operator can't troubleshoot or maintain a machine, what is your next step? (End Users)



Which of the following are likely to lead to contacting the OEM for assistance? (End Users)







3

AUTOMATION TODAY AND TOMORROW

Current Automation and Future Expansion
View on Automation

AUTOMATION ADOPTION IS LIMITED TODAY—BUT PLANS TO EXPAND FOCUS ON HIGH-IMPACT TASKS

Currently, automation adoption appears limited across the operational areas asked about in the survey :

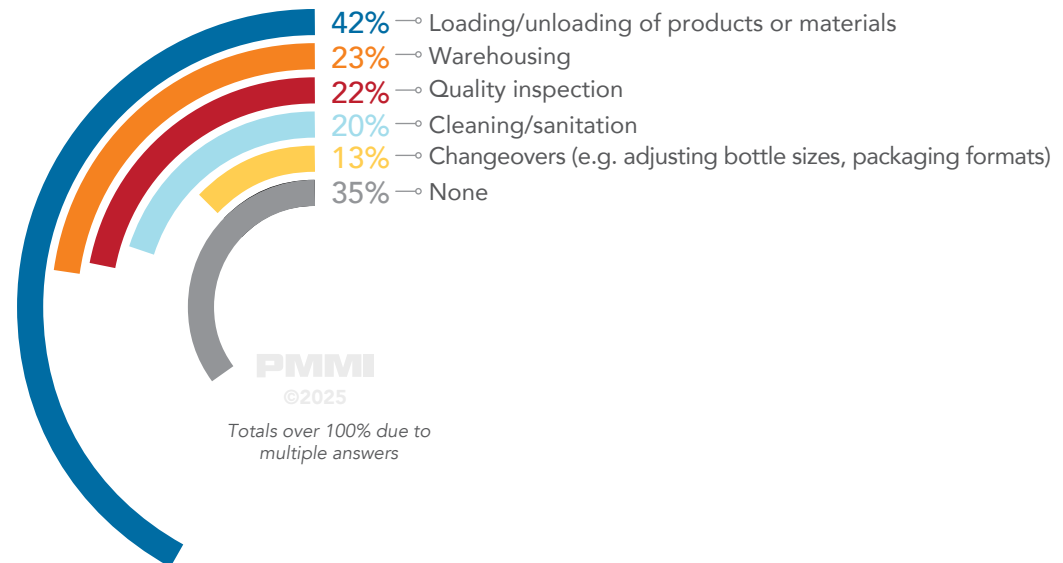
- Loading/unloading is the most automated task (42%)
- Other areas such as warehousing (23%), quality inspection (22%), and cleaning/sanitation (20%) see lower uptake

Interestingly, 35% report no automation in any of the listed areas.

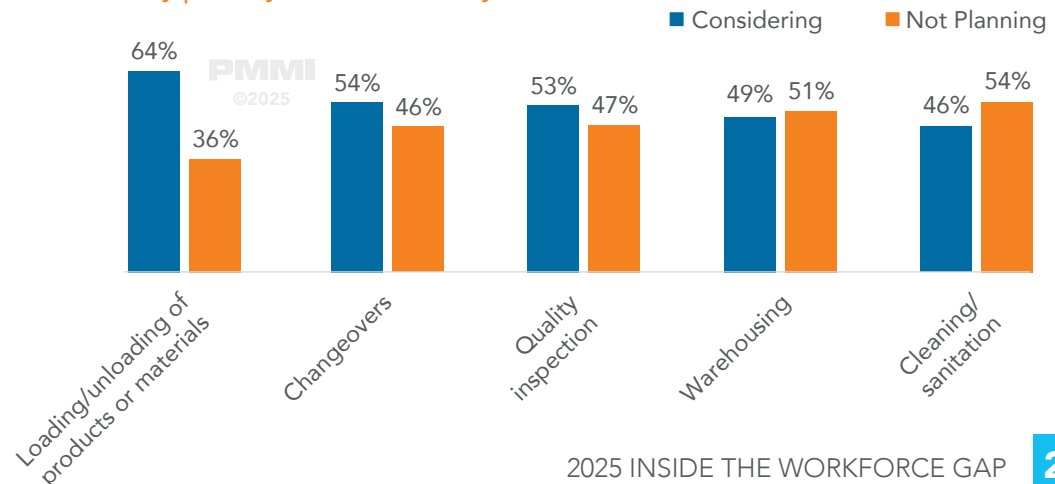
Looking ahead, there is some momentum to expand. 64% plan to automate or expand loading/unloading, and over 50% anticipate expansion in changeovers and quality inspection.

It is important to note that these results reflect only the tasks included in the survey—other areas of automation may already be in place. Still, the findings highlight where end users see the greatest current gaps and near-term opportunities. For OEMs and technology partners, the opportunity lies in designing automation that supports and empowers the workforce, reducing physical strain, improving safety, and allowing staff to focus on problem-solving, quality, and continuous improvement.

Which of the following tasks are currently automated in any capacity in your operations? (End Users)



Please indicate your future plans over the next 1-3 years, even if the task is already partially automated today (End Users)



END USERS VIEW AUTOMATION AS A SOLUTION TO LABOR GAPS, BUT COST, SPACE, AND COMPLEXITY ARE BARRIERS

End users view automation as essential—especially palletizing and inspection.

For many, automation is less about replacing jobs and more about compensating for workforce shortages and making existing staff more effective, by ‘augmenting’ the workforce.

However, barriers remain. End users cited high costs and uncertain ROI, space constraints that make it difficult to fit automated equipment onto crowded lines, and the need for flexibility when packaging multiple product types that a single automated solution cannot yet handle. Additionally, with limited downtime available for major projects or upgrades, many are taking a piecemeal approach to adoption or investment in this area.

COST/ROI



It really is just the financial thing.”

Process Engineer, *Life Sciences*

What is the payback of new technologies? Second consideration is capital availability. Companies prioritize differently and may de-prioritize automation.”

Director of Engineering, *Food/Beverage Manufacturer*

SPACE & FLEXIBILITY LIMITS



One of the hinderances to increasing automation is; to get the flexibility to automate, you need space.

Our factory is a little space constrained. If we need the area to pack 15 different pack configurations, the automated solution that fits into that space can only do five. So, it's balancing some of that and trying to standardize packaging to accommodate automation.”

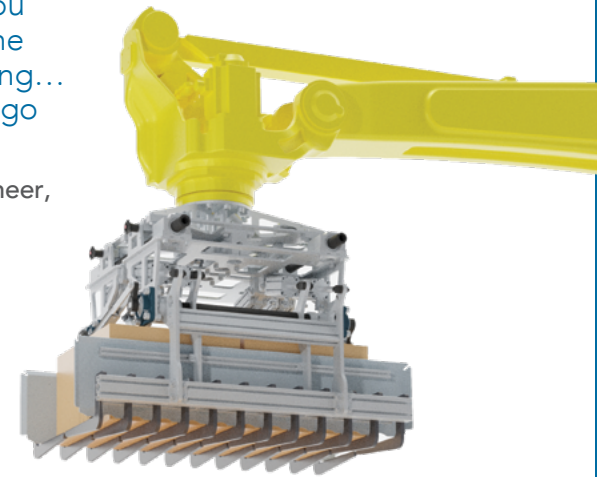
Project Engineer, *Food/Beverage Manufacturer*

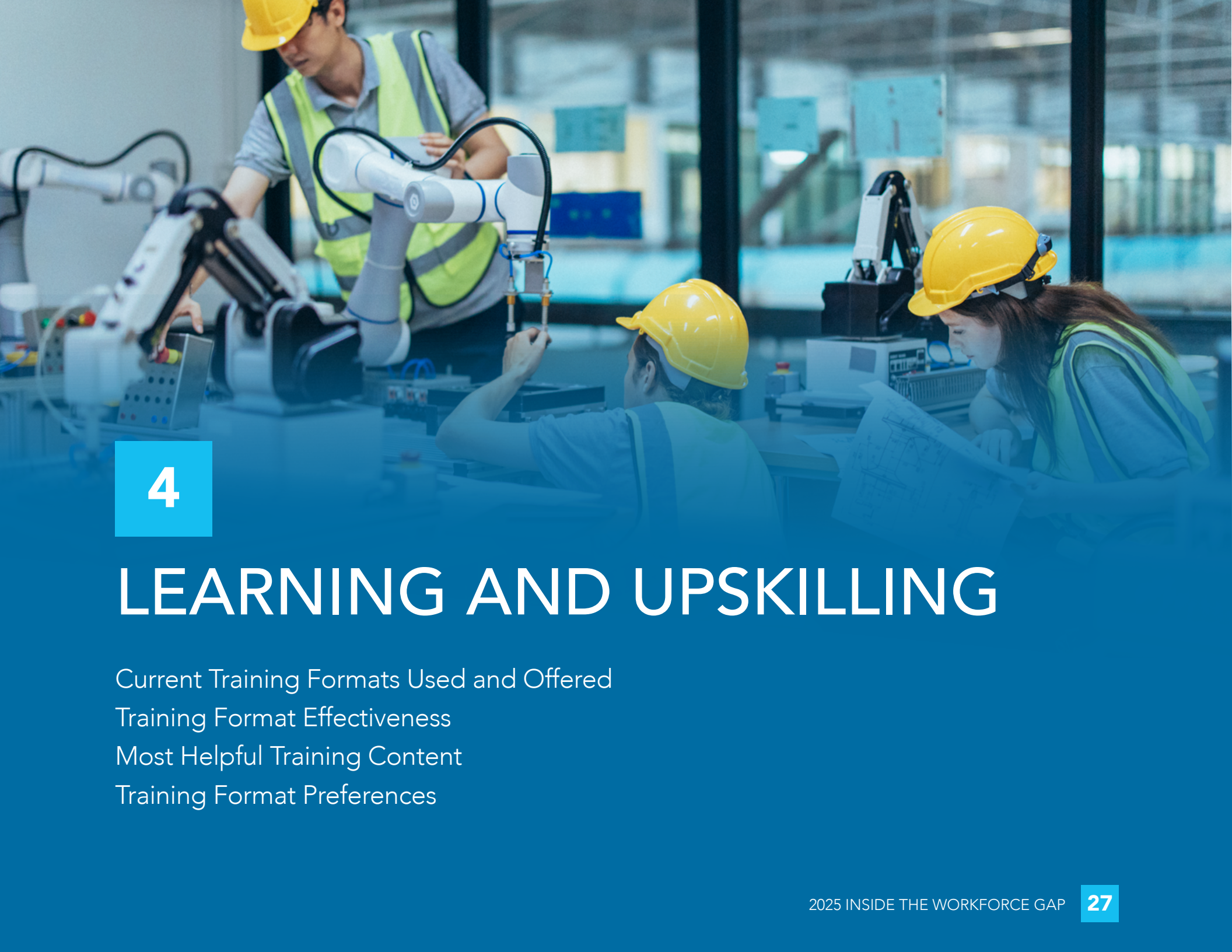
LOGISTICS/DOWNTIME RISKS



There's not much downtime in our business, so bigger projects [automation] have to wait. You have to keep the company running... so you have to go piecemeal.”

Automation Engineer,
Food/Beverage Manufacturer



A background image of a modern manufacturing facility. In the foreground, a worker in a yellow hard hat and safety vest is working on a robotic arm. Another worker in a yellow hard hat and safety vest is standing nearby, observing. In the background, another worker in a yellow hard hat and safety vest is working on a different robotic arm. The scene is brightly lit with large windows in the background.

4

LEARNING AND UPSKILLING

Current Training Formats Used and Offered

Training Format Effectiveness

Most Helpful Training Content

Training Format Preferences

TRAINING APPROACHES REMAIN ROOTED IN TRADITIONAL FORMATS, BOTH IN WHAT'S USED AND WHAT'S MOST REQUESTED

OEMs report offering a variety of training formats, with instructor-led training most common, followed by printed SOPs/manuals, on-machine guidance. Digital formats are emerging but remain limited, with only 20% offering self-paced video modules, 6% interactive platforms, and 4% VR-based training.

End users also report relying on traditional methods—manuals, classroom sessions, and peer shadowing dominate. Interviews confirm this reliance, noting that while videos, HMI prompts, and interactive platforms are promising, they are still less commonly provided or utilized.



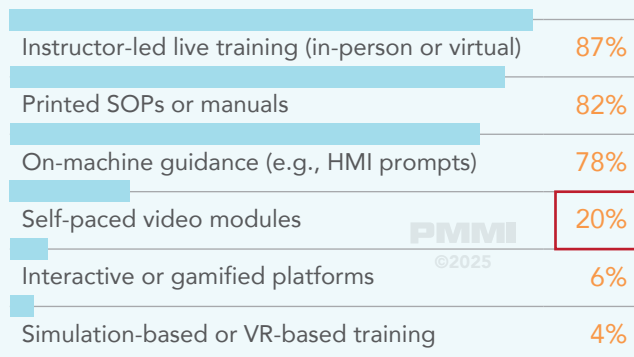
If they're coming in as an operator, they typically shadow an experienced operator for X number of days, and then they would work with support from operators to run the equipment."

Project Engineer, Food/Beverage Manufacturer

The HMI guides are extremely helpful and I'm a big fan of them. I just wish I could use them on a lot of machines. Some of ours are so old they don't even have HMIs."

Process Engineer, Life Sciences

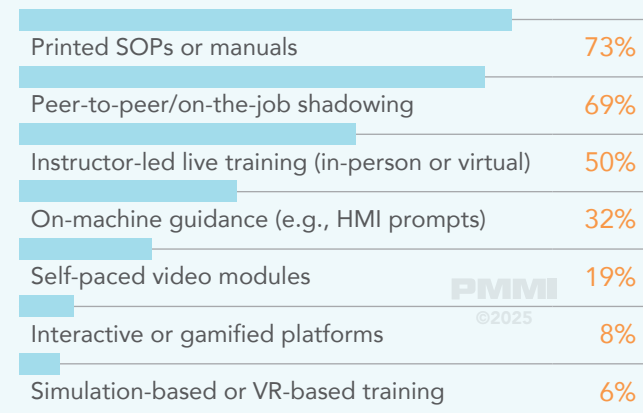
Which of the following training formats do you currently offer to your customers? (OEMs)



Totals over 100% due to multiple answers

End-user interviews reveal strong demand and interest for video content—an opportunity for OEMs to expand

What types of training formats are currently used to onboard or upskill operators? (End Users)



Totals over 100% due to multiple answers

ON-THE-JOB SHADOWING AND LIVE INSTRUCTION ARE SEEN AS MOST EFFECTIVE

When asked which formats are most effective for knowledge retention, peer-to-peer/shadowing dominates (83%), followed by instructor-led training (51%).

Earlier, 73% said they rely on printed SOPs/manuals to onboard or upskill operators, yet only 14% rank them most effective—revealing a disconnect between what’s most used and what actually drives learning.

Interviews highlight growing demand for video content. Its relatively low ranking in the survey likely reflects limited usage and experience today. Many end users view videos as a flexible, accessible format that could support operators on demand—signaling an opportunity for OEMs to expand offerings.

Operators consistently learn best by ‘doing,’ which makes shadowing and hands-on repetition the most relied-on methods. But this approach has risks: training can vary by shift, and tribal knowledge disappears when experienced staff leave. End users said scalable complements, like short training videos, HMI step-throughs, or picture-driven manuals, could help capture expertise and reduce dependence on undocumented knowledge.

To reduce risk and improve training outcomes, companies may need to pair hands-on shadowing with documented, digital formats that make knowledge more consistent and transferable across the workforce.



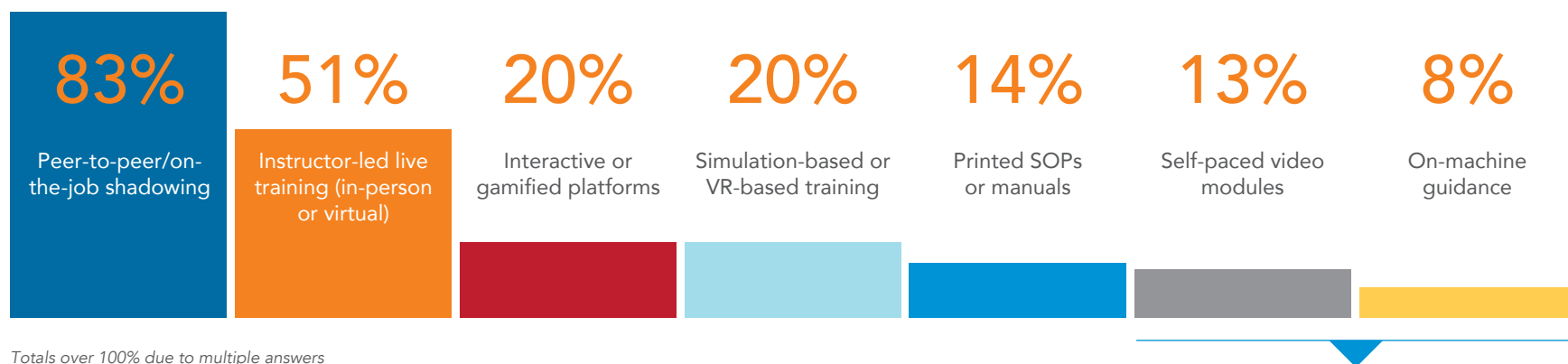
The classroom learning works the best, but not only that, we actually bring all our operators out to the line to train them. We’ll say, can you show us how to do this? Have them walk u through using the equipment. It really is the hands on, in person learning is the best way that we see success.”

Packaging Engineer, Food/Beverage Manufacturer

It’s hard to nail down today’s learner and the biggest challenge in our field today is trying to figure out what is the best way to teach. Hands on is always key, but there has to be supplementary ways to learn when you can’t be hands on.”

Managing Director, OEM

Please rank the following formats in order of their effectiveness in helping your workforce retain and apply new knowledge (End Users)

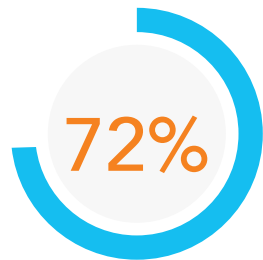


Totals over 100% due to multiple answers

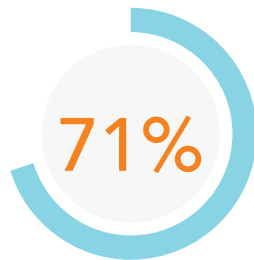
Lower rankings may reflect limited adoption, availability today, not necessarily low effectiveness.

WHEN IT COMES TO CONTENT, OPERATORS NEED TRAINING THAT'S PRACTICAL, PROCEDURAL, AND TASK-SPECIFIC

According to end users, the most helpful training content for operators address foundational equipment knowledge and day-to-day operational procedures:



Say both "introduction to the machine" and "simple low-skilled troubleshooting" are most helpful



Value training on "changeover procedures", and 68% on cleaning procedures

Additional key topics include:



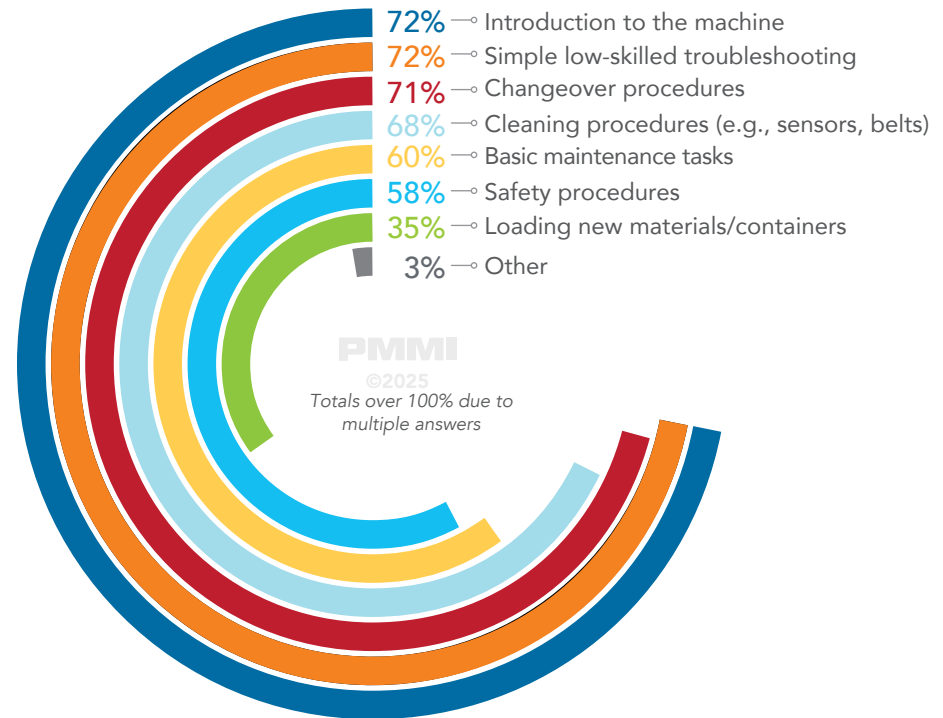
Basic Maintenance



Safety Procedures

► This supports the broader finding that effective operator training should focus on task-based learning that helps operators confidently run, adjust, and maintain equipment in real-world conditions.

Which of the following tasks are currently automated in any capacity in your operations? (End Users)

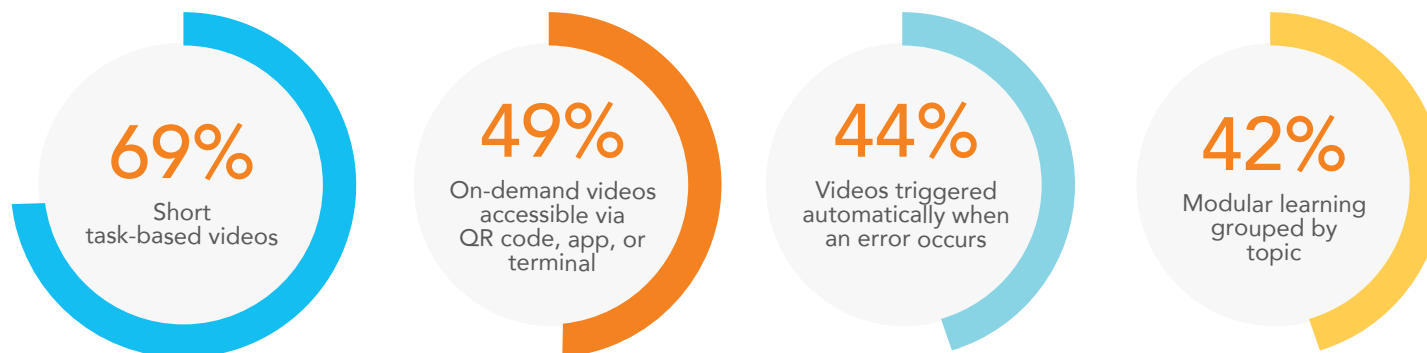


A lot of machine manufacturers offer on site training, hands on training—extremely helpful. However, once those operators who have had that training leave, they take that knowledge with them. It's not really documented."

Process Engineer, Life Sciences

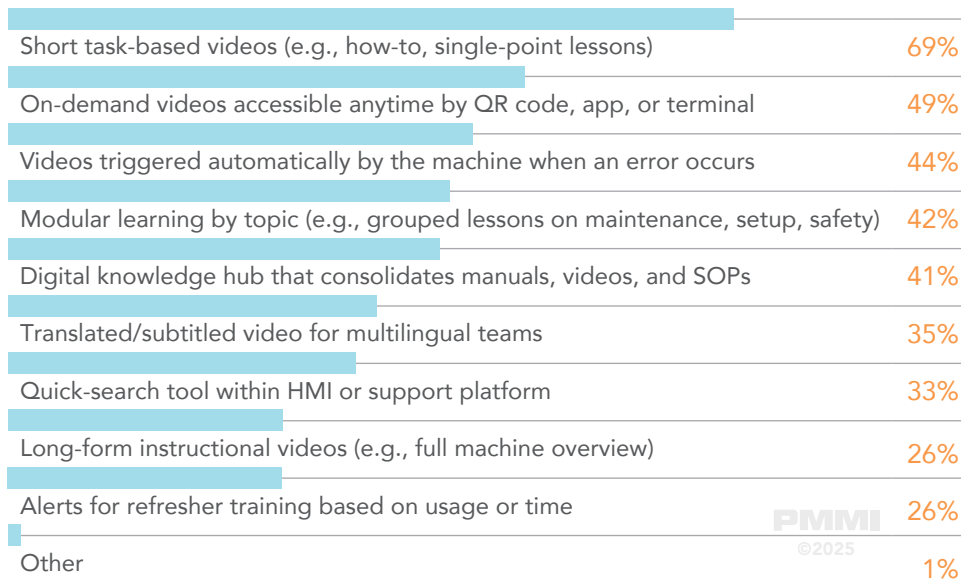
WHEN IT COMES TO TRAINING FORMATS, MANY WANT JUST-IN-TIME, VIDEO-BASED LEARNING

End users identified the formats that would be most effective in minimizing downtime, and the top responses all emphasize timely, bite-sized, and accessible support:



Interviews reinforce these preferences, with many noting that classroom lessons and thick manuals rarely stick, while operators learn best through short, visual, task-specific guidance. Several emphasized the value of quick videos or step-through HMI prompts to walk operators through troubleshooting in the moment.

In your opinion, which training or assistance formats would be most effective in helping operators/technicians minimize downtime? (End Users)



PMMI
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Our maintenance people will go find a manual and get to the right spot where if an alarm came up and a QR code showed up, you speed up the process without having to call engineering with me having to send my people out, you know, simple things like the sensors better.”

Electrical Engineering Manager,
Cosmetics/Personal Care

Audio is not valuable at all, especially on the manufacturing floor. They have to go to a conference room to listen to a video. It can't be done at the machine.”

Electrical Engineering Manager,
Cosmetics/Personal Care

Totals over 100% due to multiple answers



5

KEY TAKEAWAYS AND IMPLICATIONS

KEY TAKEAWAYS

WORKFORCE

95% struggle to find skilled operators/technicians; turnover disrupts day-to-day operations and drains productivity.

Onboarding takes months; undocumented knowledge loss magnifies the problem.

TOOLS & SUPPORT

Printed manuals and shadowing dominate; digital and embedded tools are underutilized.

OEMs report offering more than end users report seeing, potential highlighting gaps in delivery and integration.

AUTOMATION

Current adoption is limited but many end users see automation as a solution to workforce challenges and plan to target loading/unloading, inspection, and changeovers.

Barriers include ROI, space, and potential downtime.

LEARNING & TRAINING

Shadowing is seen as most effective but risky and inconsistent without proper documentation.

End users want more practical formats: short videos, HMI prompts, multilingual/picture-driven manuals to scale learning and reduce reliance on tribal knowledge.

So what does this mean for OEMs and technology providers?

Those who **modernize equipment design and training/support models** will be best positioned to help close workforce gaps and meet evolving customer expectations.

In addition, **educating end users on underutilized tools** and demonstrating ROI on training investments can drive stronger adoption.

IMPLICATIONS: WHAT OEMS CAN DO DIFFERENTLY IN **EQUIPMENT DESIGN AND SUPPORT?**

End users report that while OEMs provide sophisticated machines, they can be difficult to troubleshoot and maintain in real-world conditions. Operators often struggle with complex or customized machines, outdated manuals, and the absence of built-in guidance.

Opportunity for OEMs: Practical design features and embedded tools can reduce errors, cut downtime, and empower less experienced staff.



Visual Cues for Changeovers

Clear color-coded or labeled steps to reduce operator mistakes



Imagine you're having to change over a machine with 20 different points. If each point is color-coded with a number 1 to 20, and step-listed, it makes it much easier for people to do the right work safely and consistently."

Director of Engineering, Food/Beverage Manufacturer



Embedded Troubleshooting

Better and more intuitive HMIs that walk operators step by step through issues



HMI screens that walk you through all the changeovers, every single step you've got to click through it as you do the changeover."

Project Engineering, Food/Beverage Manufacturer



QR Codes to Machine-Specific Resources

Fast, direct access to the right documentation



[digital features] are great. the hope is that it is tied to the exact machine that you have."

Automation Engineer, Food/Beverage Manufacturer

WHAT OEMS CAN DO DIFFERENTLY IN **TRAINING AND SUPPORT TOOLS?**

End users say while OEM-provide onsite training and materials are often **limited, inconsistent, or impractical**. Manuals are usually paper-based, training videos are rare, and digital documentation is often missing or not tailored to customized equipment. Even when documentation exists, it is often too technical, inconsistent in terminology, or overly long—leading some companies to rewrite or simplify them into their own quick-start guides for operators.

Opportunity for OEMs: Provide training tools that are clear, consistent, and accessible: multilingual, picture-driven manuals, short task-based videos, and digital libraries linked to the machine. Training could also improve through skilled trainers and follow-up support after installation.



Fill Gaps in Basic Resources

Ensure manuals/digital content are delivered

“...almost half the time, the manuals always had stuff to be desired. After OEM training, I call up three months later, no one knows what’s going on with my machine, they never made the manual [that had all the customizations].”

Automation Engineer,
Food/Beverage
Manufacturer



Multilingual, Picture-Driven Manuals

Make content more accessible to diverse workforces

“We have a very multilingual workforce, so having some of the guides in multiple languages is something we’ve been working hard. And younger generation they learn differently than the older generations”

Project Engineer, Food/
Beverage Manufacturer



Plain Language and Consistent Terminology

Avoid overly technical language or multiple names for the same part

“I’ve had experience with detailed explanations and troubleshooting guides on the HMI, but the words that describe the event was complex. When a particular fault occurred, it was Italian translated into English which wasn’t logical. So, we ended up translating it into a more commonly spoken English using more common words.”

Director of Engineering, Food/
Beverage Manufacturer



Bite-Sized, Task-Based Training Videos

Short, digestible clips focused on common operator tasks, along with digital libraries

“A PowerPoint with pictures and descriptions is better, but a video is often best. The beautiful thing about a video is we can look at it whatever time day or night.”

Director of
Engineering,
Food/Beverage
Manufacturer



Improved OEM-Led Training

Trainers who can teach effectively, not just install equipment

“A lot of times, the trainers are the people who install the equipment. They are good programmers but are not often trained in how to train people.”

Engineering
Team Leader,
Food/Beverage
Manufacturer



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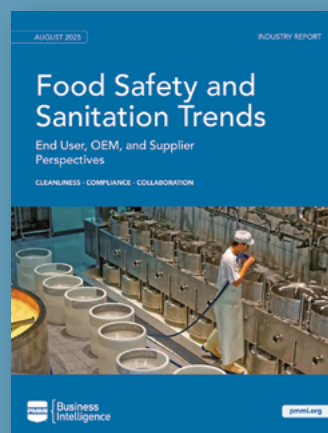
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