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Trends and Challenges in Pharmaceutical Manufacturing

PMMI Business Intelligence

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"Customers are looking for suppliers that can provide a higher level of service from an engineering standpoint. There aren't as many pharmaceutical companies with large manufacturing engineering groups anymore, so they rely more on suppliers for system design support. There's also a generational shift happening in the industry, with younger engineers wanting information instantly online."

CEO, *OEM*

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WHO WE ARE AND WHAT WE DO

PMMI is a global resource for the packaging and processing industry, uniting the industry across the manufacturing supply chain. Our 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 connects consumer goods companies with our members' manufacturing solutions through the world-class 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.

Year-round, PMMI Media Group keeps manufacturers informed about the latest solutions, trends, and innovations in packaging and processing through a wide range of print and digital platforms, such as Packaging World, Healthcare Packaging, Contract Packaging, ProFood World, Mundo PMMI, and OEM.

ABOUT THIS WHITEPAPER

The Trends and Challenges in Pharmaceutical Manufacturing whitepaper was researched, compiled, and produced by DDR/REACH in cooperation and support of PMMI. DDR/REACH is a specialized research and business development house delivering a broad range of industry reports and white papers for over a decade. We are subject matter experts across many topics in B2B manufacturing and are adept at synthesizing in-depth VOC interviews, broad-reaching survey data, and voluminous secondary research into digestible and actionable intelligence.

INTRODUCTION

Opportunities Abound

The pharmaceutical industry is in a period of sustained growth, experiencing mid-single-digit compound annual growth rates (CAGR) for the past several years that are projected to continue through 2030.[1] Breakthrough new drugs such as specialized oncology treatments and new applications for existing drugs – such as the explosion of GLP-1 prescriptions for weight management – are leading the charge on industry growth.

Even with steady growth, pharmaceutical manufacturers face a host of challenges, from regulatory burdens to throughput demands. A couple of major industry changes are also shaking up the market:

- The expiration of drug patents over the next several years that cover over $300B in annual sales[2]
- A roughly 35% increase in research and development (R&D) activity for new drugs[3]
- A continued push toward digitization/digitalization as the final Drug Supply Chain Security Act (DSCSA) deadlines approach

Pharmaceutical manufacturers have an excellent opening to take advantage of a growing market with new opportunities in generics and the R&D pipeline, but they will need the help of OEMs and suppliers to overcome sticky operational challenges and chart a course to growth.

This whitepaper will take a closer look at the challenges and trends in pharmaceutical manufacturing, examining the opinions and perceptions of both End Users and OEMs to paint a holistic picture of packaging and format trends, operational challenges, regulatory concerns, and End User machine and service needs. By intimately understanding the limitations, challenges, and goals of End Users, OEMs and suppliers can better support their customers with machines and services that speak directly to pressing industry needs.

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Participant Definitions

OEM: Original equipment manufacturer

End User (also referred to as "manufacturer[s]"): Users of equipment to produce and/or package pharmaceutical goods

EXECUTIVE SUMMARY

Packaging Trends

Future pharmaceutical packaging will incorporate more connectivity features and more ways for consumers to interact with a product and brand.

27% of End Users will be adding more RFID tags

25% of End Users plan to incorporate wireless packaging sensors

23% of End Users are including more augmented reality features

Balancing packaging sustainability against operational and regulatory needs remains a challenge. Despite this tension, only 22% of manufacturers report they have not incorporated any sustainability features into their packaging. For those pursuing more sustainable packaging, future material changes were the most common strategy.

27% are looking to reduce material usage with lightweighting

24% are pursuing compostable materials

24% plan to use more recycled materials (post-consumer recycled material)

20% will incorporate biodegradable materials into their packaging

OEMs and End Users agree that pre-filled injectable formats will see the most growth, with 42% of End Users and 38% of OEMs selecting this format:

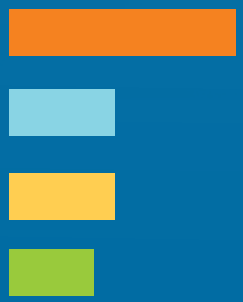
Other top growth formats include:

Blister packs (End Users) / Ampoules (OEMs)

Bottles without a secondary carton (End Users) / Blister packs (OEMs)

E-commerce

Some pharmaceutical manufacturers (31%) are already engaged in e-commerce business, with a few intending to enter the channel in the future. Those engaged in e-commerce require significant operational changes to meet demand:



57% completely changed packaging formats to a new design

36% expanded machine automation to increase throughput

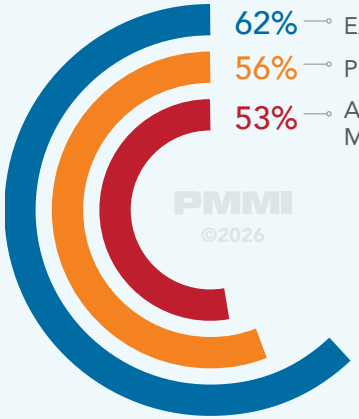
36% hired additional employees

29% engaged co-packers and co-manufacturers

For manufacturers considering entry into e-commerce, these experiences highlight the need to evaluate packaging formats, automation levels, labor requirements, and outsourcing strategies early in the planning process.

Regulations

Reporting and documentation remain a challenge, with 71% of End Users noting it is their top issue with regulations. To address regulatory requirements, End Users report making a number of changes:



OEM services to support regulatory compliance are largely in line with End User needs, but OEMs and suppliers could consider offering additional assistance around reporting requirements, such as building out digital infrastructures to digitize the reporting process.

End User Needs

End Users face a variety of challenges with pharmaceutical manufacturing and packaging. The top six selected challenges were:

44% Keeping up with regulatory changes

42% Expanding automation and reducing manual processes

42% Space constraints and footprint limitations

27% Aggregation and serialization

24% Machine monitoring (including remote monitoring)

24% Managing supply chains (including cold chain)

End Users look for machinery that emphasizes speed, automation, and convenience. Top machine features End Users look for include:

- Increase speed and throughput
- Automation and robotics programming
- Sanitary and easy-to-clean designs

The research suggests that connectivity and data will become increasingly important in pharmaceutical equipment. OEMs plan to add many features to their machinery, with the top planned inclusions being:

AI-supported processes (including machine learning)

Data gathering sensors and tools

Remote troubleshooting and upgrade capability

End Users consider many points when selecting OEM and supplier partners. Specific needs vary from operation to operation, but the most valued capabilities were:

- Availability and lead times
- Automation and robotics programming
- Packaging evaluation and packaging compliance

Purchasing

OEMs and End Users predict a strong 2026 for machine sales volumes.

Processing Machinery:

- End Users predict increases (60%) or no change (40%) in purchasing for 2026
- OEMs predict increases (20%) or no change (75%) in sales for 2026

Packaging Machinery:

- End Users predict increases (57%) or no change (43%) in purchasing for 2026
- OEMs predict growth (43%) or no change (54%) in sales for 2026.

In more concrete terms, 56% of End Users said they definitely intend to make a machine purchase in 2026.

1

PHARMACEUTICAL PACKAGING TRENDS

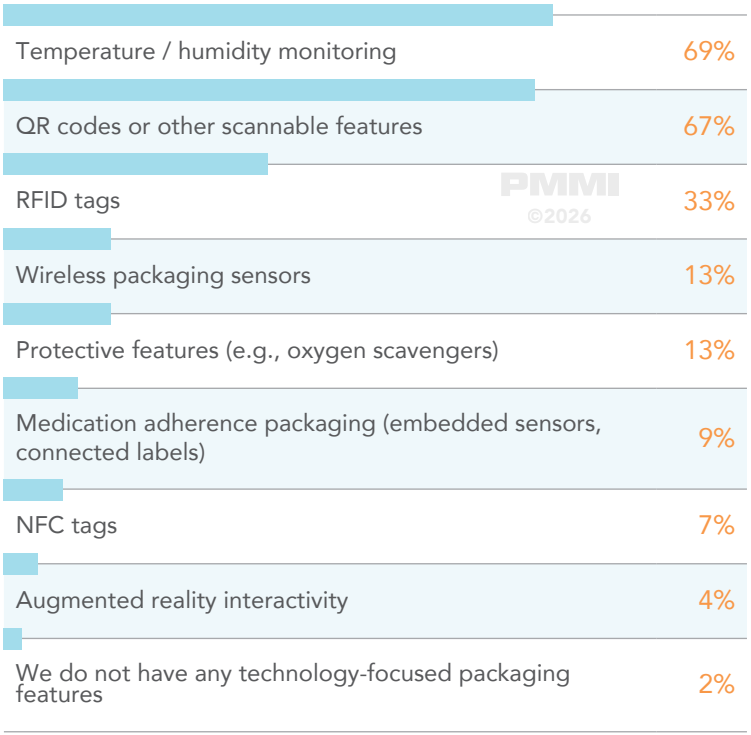
TECHNOLOGY • SUSTAINABILITY • SECURITY

“RFID technology is emerging as a major requirement. Major store brands are requiring RFID tags be embedded in products, and pharma is adopting this for inventory management. We’ve been asked to work on embedding RFID tags in shrink sleeves. We've been testing with film manufacturers who embed tags in each label. We haven't sold equipment for this yet, but expect it to become huge soon.”

VP, *Product Development, OEM*

MONITORING AND SCANNABLE CODES LEAD PACKAGING FEATURES

End User: Are you currently utilizing any of the following technology-focused features in your pharmaceutical packaging formats? (Choose all that apply)



Totals over 100% due to multiple answers

Pharmaceutical packaging continues to evolve as technology-focused packaging features gain traction, enhancing customer experiences and connecting manufacturers, care providers, and patients through a network of digital data.

In many cases, these features achieve numerous goals at once. Consider QR codes, for instance: these scannable codes allow manufacturers to better track product movement both internally and in the supply chain, ensuring quality and authenticity. Distributors can also scan the codes to double check origin, destination, product type, and authenticity. On the consumer side, customers can scan the code to verify their products, receive instructions for dosage and compliance, and connect with the manufacturer directly.

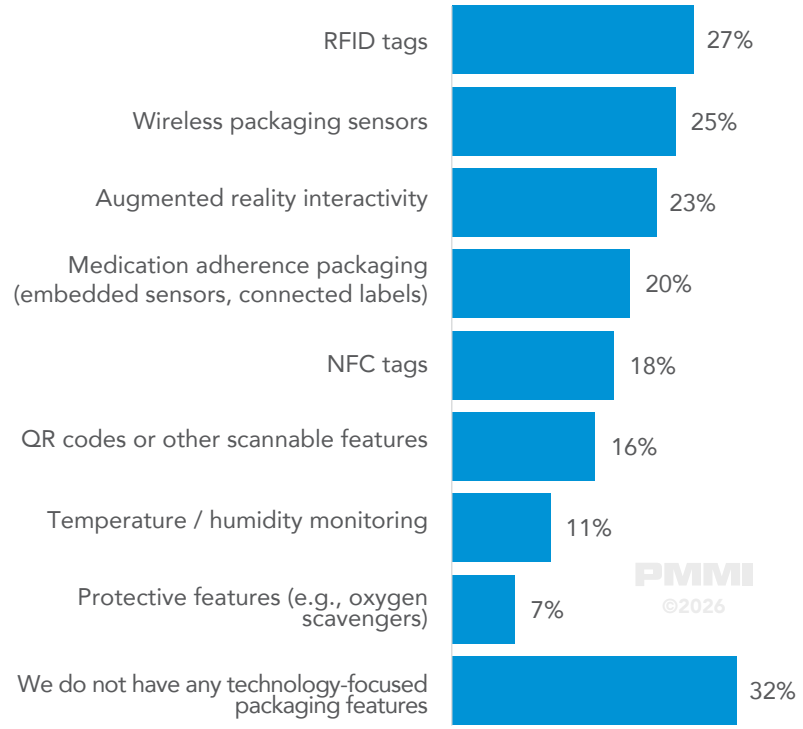
As digital infrastructures grow and consumer technological sophistication continues to expand, technology-oriented packaging features will play a key role in protecting manufacturers, products, and consumers in the pharmaceutical supply chain.

> "RFID for tracking shipments from point-to-point is crucial. Camera-enabled shippers that show what was packed and when it's opened help resolve disputes when customers claim non-receipt. Temperature monitoring with newer data loggers that track real-time and allow remote cloud-based data downloads without relying on recipients to send data are of great interest to us."

Supply Chain Manager, *End User*

FUTURE PACKAGING FEATURES WILL INCLUDE CONNECTIVITY AND CONSUMER INTERACTION

End User: Which technology-focused packaging features are you not using now, but plan to add in the future? (Choose all that apply)



Totals over 100% due to multiple answers

"Near-field and RFID capabilities are becoming more attractive because they can embed more information than a standard label code, enhancing traceability from factory to End User."

Director of Automation, *OEM*

With a majority of manufacturers already utilizing passive monitoring tools like temperature and humidity indicators, the future of technology-focused packaging will likely be in connectivity.

From verifying products in the supply chain to monitoring patient compliance and tracking clinical trials, digital connectivity in pharmaceutical packaging is the next frontier of efficiency. These features hold enormous promise for all stakeholders, allowing manufacturers to more carefully control their internal processes, efficiently monitor their products in the supply chain, and curate better customer experiences through interactive features and direct connection with the brand. Connectivity features also support personalization/customization efforts at manufacturers, a trend that 92% of industry leaders acknowledged is an important opportunity, and 84% have already begun to plan into their production strategies.[4]

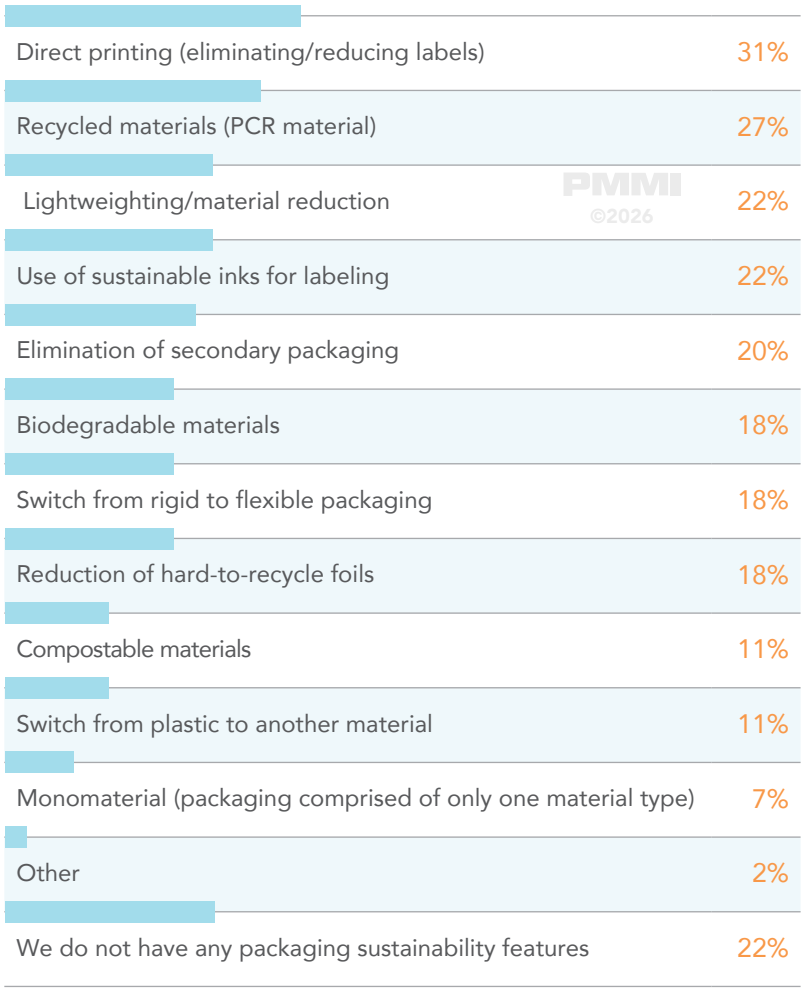
Whether a manufacturer pursues printed augmented reality labels or physical sensors embedded in the packaging, OEMs and suppliers will need to be ready for connectivity features. Equipment must be able to handle these additions without damage or interference, and manufacturers may require assistance designing, testing, and deploying new formats that incorporate technology-focused features.

"Counterfeiting and fraud are driving serialization and wireless packaging solutions. Customers have developed more sophisticated approaches, including encrypted 2D codes that display as symbols when scanned, and secure near-field technology for authentication."

Director of Automation, *OEM*

END USERS TAKE A VARIETY OF APPROACHES TO PACKAGING SUSTAINABILITY

End User: Have you incorporated any of the following sustainability strategies or features into your pharmaceutical packaging designs? (Choose all that apply)



Totals over 100% due to multiple answers

Sustainability has long been a challenge in pharmaceutical packaging, with regulations and product safety typically taking precedence over sustainability goals. End Users have adopted a number of strategies to improve packaging sustainability while still meeting regulatory and safety needs, including direct printing, the use of PCR material, and lightweighting.

Material and barrier properties are particularly challenging for manufacturers. Since pharmaceutical products are often sensitive to environmental factors such as temperature and humidity, any sustainable material choices must first meet the required barrier needs. This often limits the range of materials and formats manufacturers can pursue, making sustainability goals more challenging to meet.

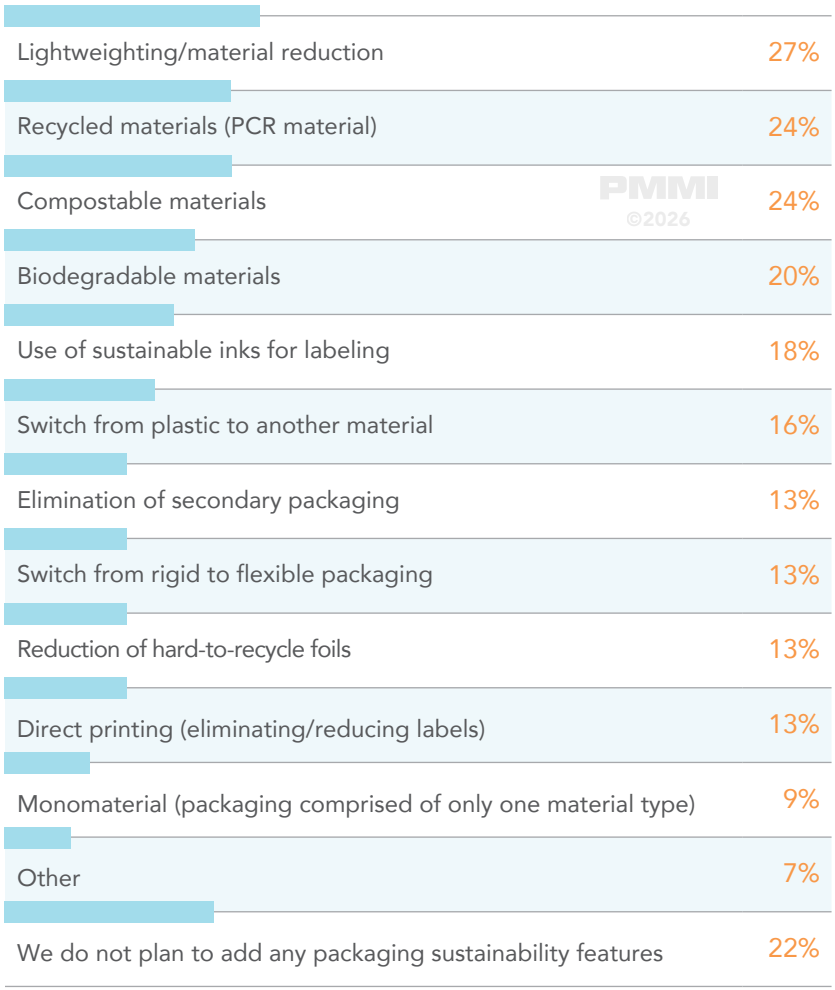
Some manufacturers have yet to adopt any packaging sustainability strategies. With 22% of End Users reporting no packaging sustainability features at all, opportunity remains for OEMs and suppliers to support End Users with crafting and meeting sustainability goals. This will be an ongoing challenge for the pharmaceutical industry that will require creativity and collaboration between manufacturers and OEMs to achieve best results.

Sustainability Gaining Traction

The pharmaceutical industry faces unique sustainability challenges due to the sensitivity of their products to environmental factors and the numerous industry regulations governing packaging. Despite this, the number of life sciences companies signed on to the Science-Based Targets Initiative (SBTi) for sustainability has increased from 7 in 2019 to 104 in 2022.[5] Sustainability can also be viewed as a future-proofing strategy, especially considering 77% of U.S. pharmaceutical industry leaders expect regulations around sustainability to ramp up in the coming years. [6]

END USERS PLAN TO ALTER PACKAGING MATERIALS TO IMPROVE SUSTAINABILITY

End User: Which sustainability strategies or features have you not incorporated in your packaging, but plan to in the future? (Choose all that apply)



Totals over 100% due to multiple answers

Looking ahead, End Users most commonly plan to modify material formats to improve packaging sustainability.

This is an important consideration for OEMs and suppliers, since material changes like using more PCR material and lightweighting often mean greater variability in material tolerances and quality. As more companies adjust materials to improve sustainability, packaging machinery will need to be flexible and adaptable across a wider range of material types.

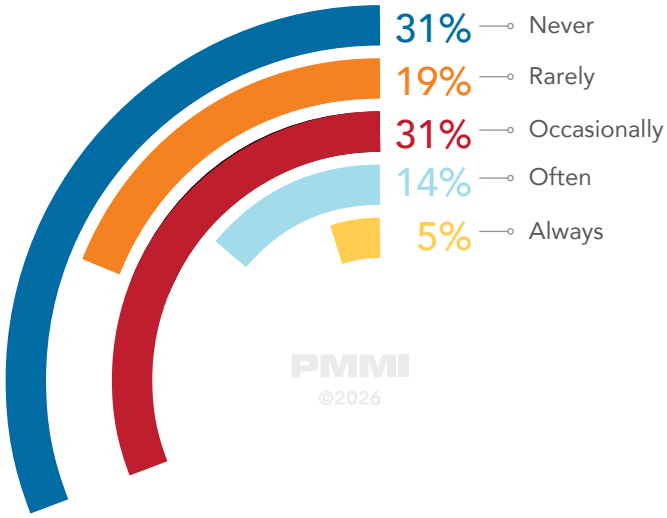
End Users may also require OEM assistance in designing, testing, and implementing more sustainable materials and formats to ensure equipment can accommodate these changes. This presents an excellent opportunity for OEMs and suppliers to deepen their understanding of End User operations and strengthen relationships.

> Raw materials are the main issue. Supplier quality has declined, requiring searches for alternative suppliers. Tariffs create additional challenges. We struggle to get consistent product at decent rates from chemical suppliers and injection molding companies that provide bottles and components."
>
> **EE and IE Manager,** *CP/CM*

> We're not actively seeking, but are willing to meet with suppliers who approach us. We've had meetings with companies presenting sustainable options, but implementation faces multiple organizational and external hurdles."
>
> **Technical Services,** *CP/CM*

SOME END USERS SEEK HELP FROM OEMS WITH SUSTAINABLE PACKAGING

OEM: How often do pharmaceutical customers request help with accommodating sustainable packaging formats?



OEMs have an important role to play in End User packaging sustainability goals, especially when it comes to incorporating new designs or materials into production. From flexible machinery to format tests, many End Users will need OEM support to incorporate sustainable packaging.

With less than one-third of OEMs reporting they are never approached by End Users for help with packaging sustainability, accommodating new sustainable formats is likely to remain a key area of collaboration between End Users and OEMs.

Paper-based Packaging Alternatives

Paper-based materials have become a popular secondary and tertiary packaging option for pharmaceutical manufacturers looking to improve their sustainability. With recycling playing a key role in sustainability calculations, material choices make a meaningful difference. In the U.S., plastics are recycled at abysmally low rates of well under 10%, meaning even fully recyclable packaging is rarely recycled correctly, obliterating potential sustainability gains.[7] With a recycling rate of approximately 81%, paper-based packaging yields more practical and repeatable sustainability results through significantly higher recycling adherence.[8]

> The main challenge is providing equipment that clearly codes onto sustainable materials. Pharmaceuticals prefer permanent codes (often using lasers) because if the only way to remove the code is by damaging the product, it prevents counterfeiting. However, when customers switch to different sustainable materials, the laser technology may no longer work if the substrate is non-reactive, requiring different coding solutions."

Director of Automation, *OEM*

PHYSICAL BARRIERS ANCHOR PACKAGING SECURITY

End User: Which security features are you currently using on your packaging to prevent counterfeiting and fraud? (Choose all that apply)

External seals, wraps, or tapes	60%
Tamper-evident secondary cartons (cannot be resealed once open)	58%
QR codes and other scannable features	47%
Internal foil seals	36%
Watermarks or hidden graphics	13%
NFC / RFID tags for tracking	9%
Wireless sensors (to indicate opening)	4%
Augmented reality features for verification	2%
Other	2%
We do not have any packaging security features	2%

Totals over 100% due to multiple answers

> Expensive drugs require more visibility to prevent them from going bad, being stolen, or falling into the hands of counterfeiters, which also protects brand reputation."

Supply Chain Manager, *End User*

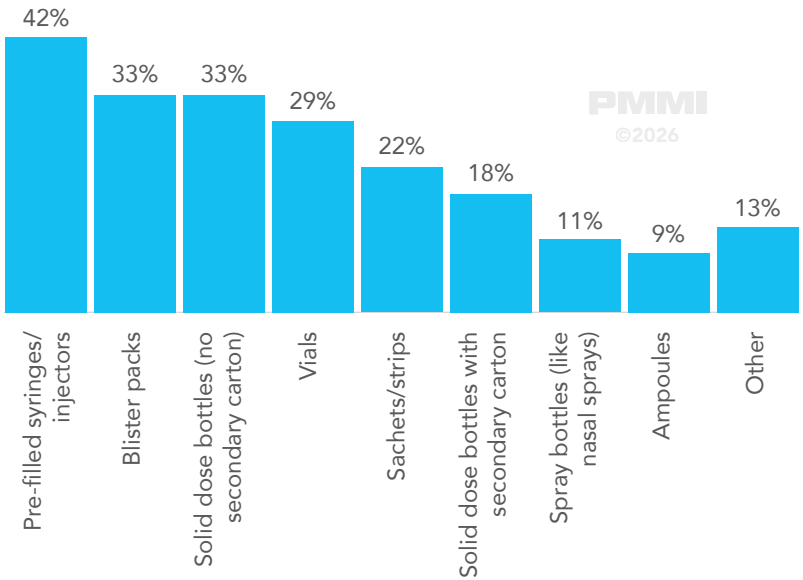
Product safety and authenticity are of the utmost importance in the pharmaceutical industry, especially considering the global counterfeit drug market is estimated to exceed $400 billion, with incidents of counterfeit products increasing 38% from 2016 to 2020.[9]

To protect against fraud and tampering, End Users primarily rely on physical barriers like tapes, foil seals, or cartons to safeguard their products.

Nearly half (47%) of End Users also indicate using scannable features like QR codes that allow stakeholders to quickly determine authenticity. With End Users adopting more connectivity features in the future, technology-focused strategies like wireless tracking are likely to play a greater role in product safety. OEMs will need to ensure their equipment is capable of handling these features without causing damage or disruption.

STRONGEST GROWTH PREDICTED IN PRE-FILLED INJECTABLES, BLISTERS, AMPOULES, AND BOTTLES

End User: Which top three pharmaceutical packaging formats do you expect to see the most volume growth over the next three years? (Choose up to three)



Totals over 100% due to multiple answers

Blisters and Compliance

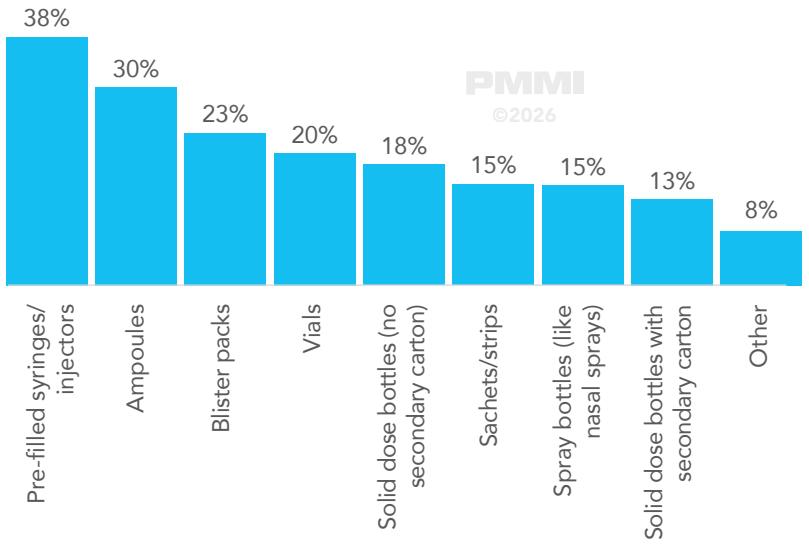
Blister packs can also play an important role in medication compliance. In one study, patients issued blister packs achieved compliance rates of 90%, compared with 56% among patients receiving traditional pill bottles.[10] A superior sustainability profile, improved adherence outcomes, and greater ease of customization are just a few reasons why blister packs are expected to see continued growth.

Looking ahead to the next three years, both OEMs and End Users expect pre-filled injectable formats to see the most growth, fueled by continued expansion in the biologics market. Products such as GLP-1 drugs have exploded onto the scene, with 12% of adults saying they have used GLP-1 drugs, and 6% currently taking them.[11]The sales of GLP-1 drugs alone could reach $126 billion by 2029.[12] These high-value biologics are expected to be central to growth in pre-filled injectables and to a lesser extent, ampoules.

Blister packs are another area of agreement for growth. Blisters have been gaining ground due to their lighter weight, reduced material usage, and ease of customization to enhance consumer experience. They also offer sustainability benefits, as switching from bottle formats to blisters can reduce plastic usage by up to 75%.[13]

With pre-filled formats and blisters predicted to grow, OEMs will need to evaluate their machinery portfolios to ensure they can accommodate increasing demand for these formats.

OEM: Which top three pharmaceutical packaging formats do you believe will experience the most volume growth over the next three years? (Choose up to three)



Totals over 100% due to multiple answers

2

E-COMMERCE CHANNELS

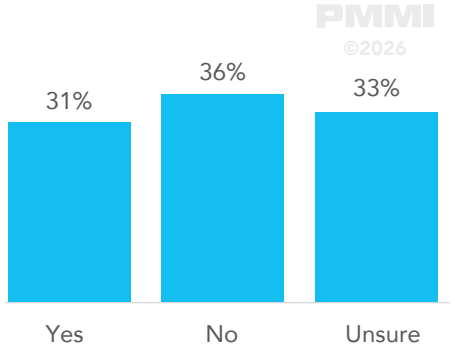
PREVALENCE • GROWTH • OPPORTUNITIES

"E-commerce requires standardizing packaging sizes for efficient stacking and transport. Customers are moving toward having just a few standardized box sizes rather than custom packaging for each product."

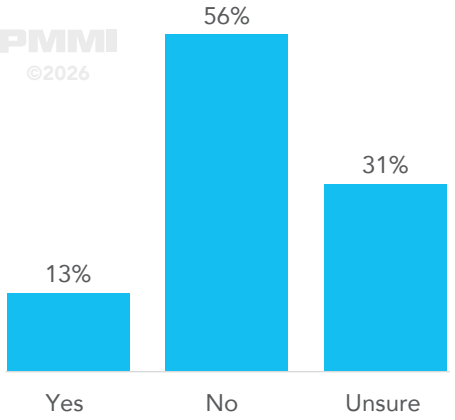
Technical Trainer, *OEM*

SOME END USERS SELL THROUGH E-COMMERCE CHANNELS AND A FEW PLAN TO IN THE FUTURE

End User: Do you currently sell pharmaceutical products through e-commerce channels?



End User: Do you plan to sell pharmaceutical products through e-commerce channels within the next three years? (Among those who don't do e-commerce currently)



E-commerce has been a hot topic in the pharmaceutical industry, with even the most conservative estimates showcasing a market worth tens of billions of dollars and poised for future growth.[14]

However, pharmaceutical manufacturers face numerous regulatory and safety hurdles when looking to expand to online selling. From packaging and labeling compliance to theft and counterfeiting, online pharmaceutical sales often require more monitoring and preventative measures than traditional channels to ensure consistent product quality and authenticity.

OEMs have an important role to play in helping their customers evaluate whether an e-commerce model is right for their business. With fewer than one-third of respondents currently selling online and only 13% of those not selling online planning to do so, individual companies will need help evaluating the feasibility of online sales.

E-commerce Early Adopters

Pharmaceutical e-commerce is still in its early stages, but there is significant potential for early entrants. While still only a fraction of the overall pharmaceutical market, e-commerce sales are widely predicted to see low-to-mid double-digit CAGR expansion over the next decade.[15] As consumer preferences continue to shift toward convenient online buying, a larger share of pharmaceutical sales are expected to move online. Major industry players are already making early investments in online sales space. Those companies gaining an early foothold in this channel will have a head start over those that delay or eschew entering it.[16]

"To accommodate e-commerce, we're upgrading equipment, hiring more automation engineers and IT personnel, and ensuring they rotate through different shifts to provide coverage for all operations."

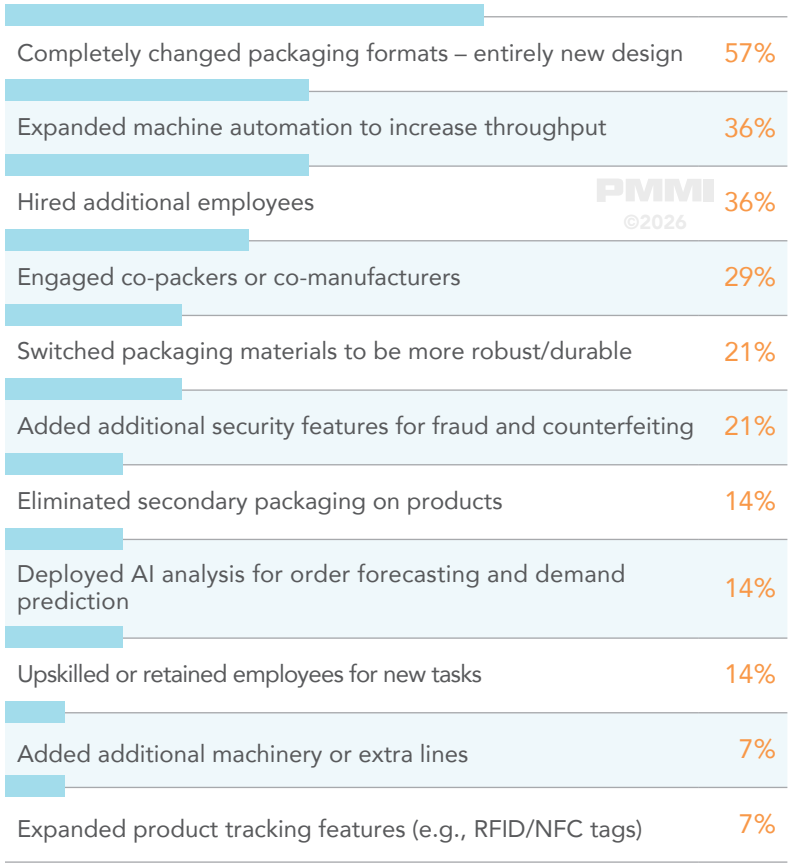
Director of Pharmaceutical Engineering, *End User*

"For e-commerce, manufacturers are looking to streamline operations by developing machinery that can handle randomization, allowing them to consolidate multiple production lines into one adaptive line."

Technical Trainer, *OEM*

END USERS HAVE MADE SIGNIFICANT CHANGES TO ACCOMMODATE E-COMMERCE

End User: What changes have you made to specifically accommodate e-commerce channel distribution? (Choose all that apply)



Totals over 100% due to multiple answers

While not all operations will pursue an e-commerce model, those that already have report numerous changes to support the initiative. With more frequent and rougher handling, and more opportunity for theft and fraud, products in the e-commerce channel require additional considerations like new packaging formats and more security features to ensure quality and safety.

The extra volume generated by e-commerce orders can also require additional manufacturing capacity. Companies report a variety of strategies to meet e-commerce demand, including increasing automation and engaging contractors. OEMs have significant opportunity to assist customers expanding into the e-commerce space and can deepen relationships by providing machines and services to support e-commerce strategies.

Contractor Growth

The use of pharmaceutical Contract Development and Manufacturing Organizations (CDMOs) has steadily increased over the years, with spend on CDMOs growing about 12% annually, compared to a baseline increase of about 7% for general R&D spending. By 2029, overall spending on CDMO services is expected to double from the 2014 total.[17] With manufacturers relying more on CDMOs, OEMs and suppliers may have additional opportunities at CDMOs as they work to build out capacities and absorb production overflow.

> Industry changes, particularly the e-commerce boom in the last five years and especially since COVID, have driven machine purchases. New distribution centers need new equipment, and as companies expand their e-commerce delivery capabilities, they require the same equipment in each new facility."
>
> **Technical Trainer,** *OEM*

3

REGULATIONS

COMPLEXITY • CHALLENGES • STRATEGIES

“We do offer some regulation training and guidance, but not everything. We certify our distributors on our equipment so they can advise end customers on how our machinery helps meet local compliance requirements. We also provide specific training upon request to help customers meet their compliance needs, such as when regulations require a certain number of training hours per year.”

Technical Trainer, *OEM*

OVERVIEW OF GLOBAL PHARMACEUTICAL REGULATIONS

U.S. Regulations

Drug Supply Chain Security Act (DSCSA)

The Drug Supply Chain Security Act (DSCSA) outlines steps to achieve an interoperable and electronic way to identify and trace certain prescription drugs at the package level as they move through the supply chain. This system is designed to prevent harmful drugs from entering the U.S. drug supply chain, detect them if they do, and enable rapid removal to protect patients. Product serialization and aggregation requirements are central to these efforts. Most DSCSA deadlines have already passed, with two final compliance dates for dispensers based on size in November 2025 and November 2026.

FDA Good Manufacturing Practices (GMP)

The FDA ensures the quality of drug products by carefully monitoring manufacturers' compliance with its Current Good Manufacturing Practice (CGMP) regulations. These regulations establish minimum requirements for the methods, facilities, and controls used in manufacturing, processing, and packing of drug products. They are designed to ensure products are safe for use, and contain the ingredients and the strength stated on their labels.

State-level Regulations

Some states also require state-approved licensing, certifications, and oversight for the manufacturing of all or certain drug types.

Product-specific Regulations

Some pharmaceutical products are also more tightly regulated than others, as governed by regulations such as the Controlled Substances Act, which designates certain drugs as Schedule I-V with varying requirements based on classification.

European Union Regulations

European Union Good Manufacturing Practices (GMP)

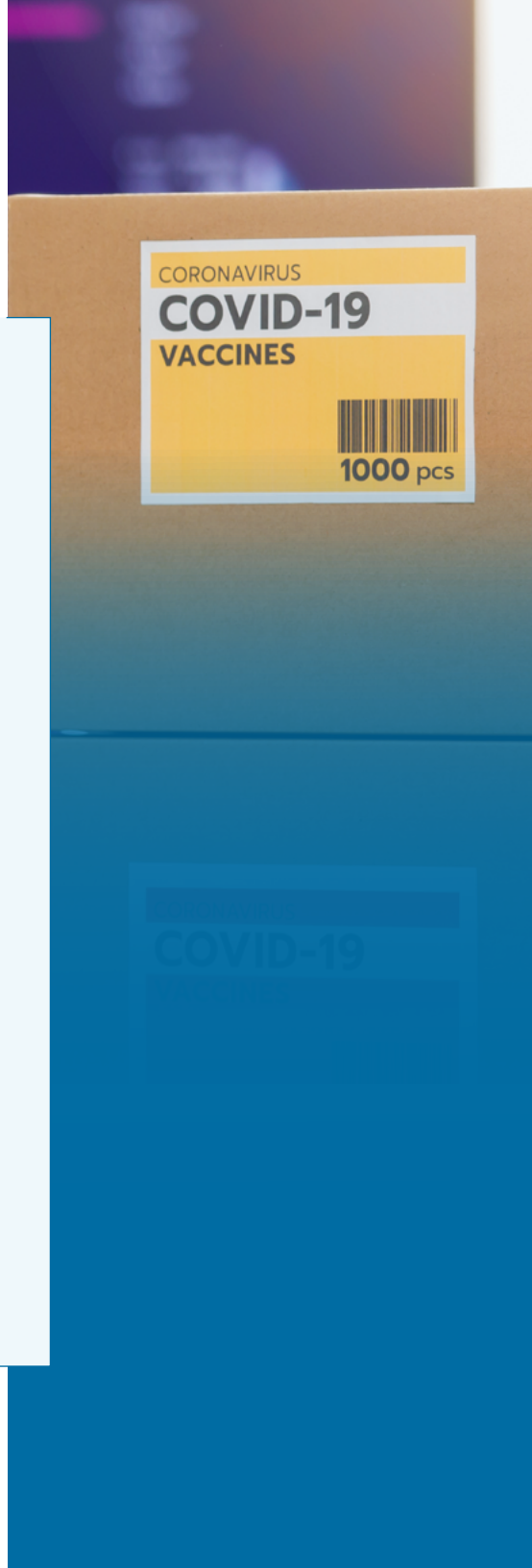
Any manufacturer of medicines intended for the European Union market must comply with European Union Good Manufacturing Practice (GMP), regardless of where they are located.

GMP requires that medicines:

- Are of consistent high quality;
- Are appropriate for their intended use;
- Meet the requirements of the marketing authorization or clinical trial authorization.

European Union "Pharma Package" Regulations

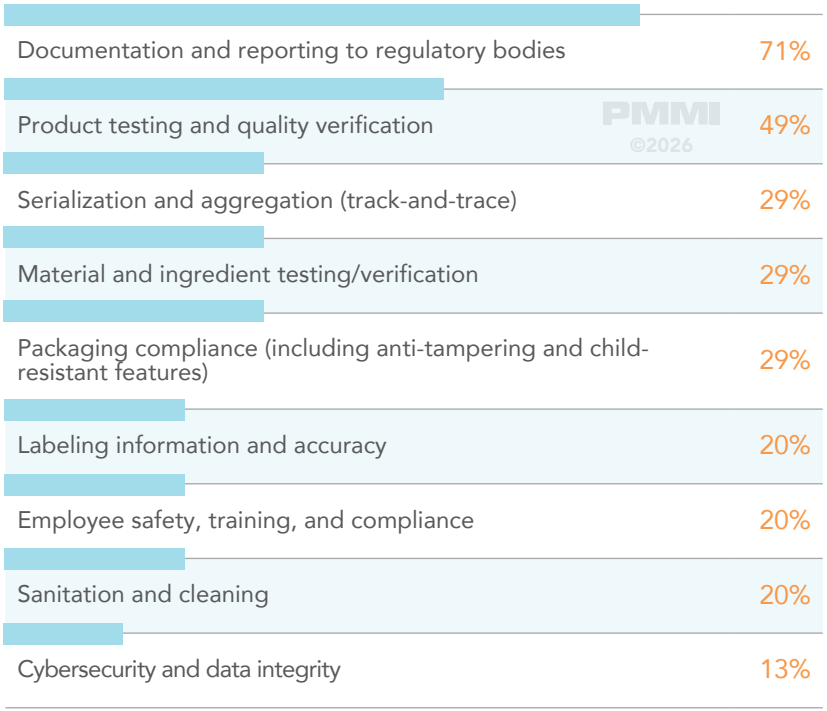
The pharma package is the first major revision of European Union pharmaceutical laws since 2004. Its goals are to better meet patient needs, boost Europe's competitiveness and support innovation. The package introduces new rules for all medicines, including those for rare diseases ('orphan medicines') and for children. It also includes recommendations to strengthen efforts to combat antimicrobial resistance (AMR).



Sources: U.S. Food and Drug Administration; European Medicines Agency; European Council of the European Union

END USERS REPORT ONGOING REGULATORY CHALLENGES WITH REPORTING AND TESTING

End User: What top three aspects of regulatory compliance are the most difficult or time-consuming for your organization to meet? (Choose up to three)



Totals over 100% due to multiple answers

"I'm hoping for automation to really drive progress. Manual operations have limitations with packaging, aggregation, and serialization. I hope to resolve hard points with more automation and new technology in that space."

Sr. Bioprocess Engineer, *End User*

Regulations are an essential part of the pharmaceutical manufacturing process, protecting consumer safety and product quality. However, adhering to these regulations can be challenging for pharmaceutical manufacturers.

While companies have made progress in meeting requirements such as DSCSA serialization, a majority still indicate difficulty with the documentation and reporting processes, and to a lesser extent with serialization and aggregation in general.

This signals an ongoing opportunity for OEMs and suppliers to support pharmaceutical manufacturers in meeting regulatory reporting requirements. Whether through building digital infrastructure or training employees on new data management processes, OEM and supplier support will remain critical to successful digital reporting strategies.

Digital Documentation

Digital documentation is an important part of efficiently meeting DSCSA reporting requirements and has accelerated broader digitization efforts across the pharmaceutical industry. A separate survey found that levels of digital documentation varied significantly from organization to organization:

- 19% | Reported fully digital documentation
- 46% | Indicated a nearly even mix of digital and manual documentation
- 32% | Noted some digital documentation, but primarily still rely on manual documentation
- 3% | Stated they had no digital documentation at all

End Users will need continued OEM and supplier support to achieve their full digital documentation goals, especially considering 74% of pharmaceutical businesses report digitization efforts are a major part of their ongoing business activities.[18]

OEMS REPORT MOST FREQUENTLY HELPING END USERS WITH PRODUCT TESTING, PACKAGING COMPLIANCE, AND SANITATION

OEM: What top three regulatory requirements do End Users most often ask you to help them address through equipment or services? (Choose up to three)

Product testing and quality verification	40%
Packaging compliance (including anti-tampering and child-resistant features)	33%
Sanitation and cleaning	33%
Employee safety, training, and compliance	31%
Labeling information and accuracy	24%
Documentation and reporting to regulatory bodies	21%
Serialization and aggregation (track-and-trace)	19%
Material and ingredient testing/verification	10%
Cybersecurity and data integrity	5%
Other	2%

Totals over 100% due to multiple answers

OEMs report their customers most frequently request help with the physical product and packaging requirements of pharmaceutical regulations, as well as operational needs like training and sanitation.

A strong majority (71%) of End Users report difficulty with documentation and reporting, yet only 21% of OEMs say customers ask for help in this area. OEMs and suppliers with experience in building digital infrastructures and transitioning operations from manual to digital processes may be well positioned to support manufacturers struggling with regulatory reporting.

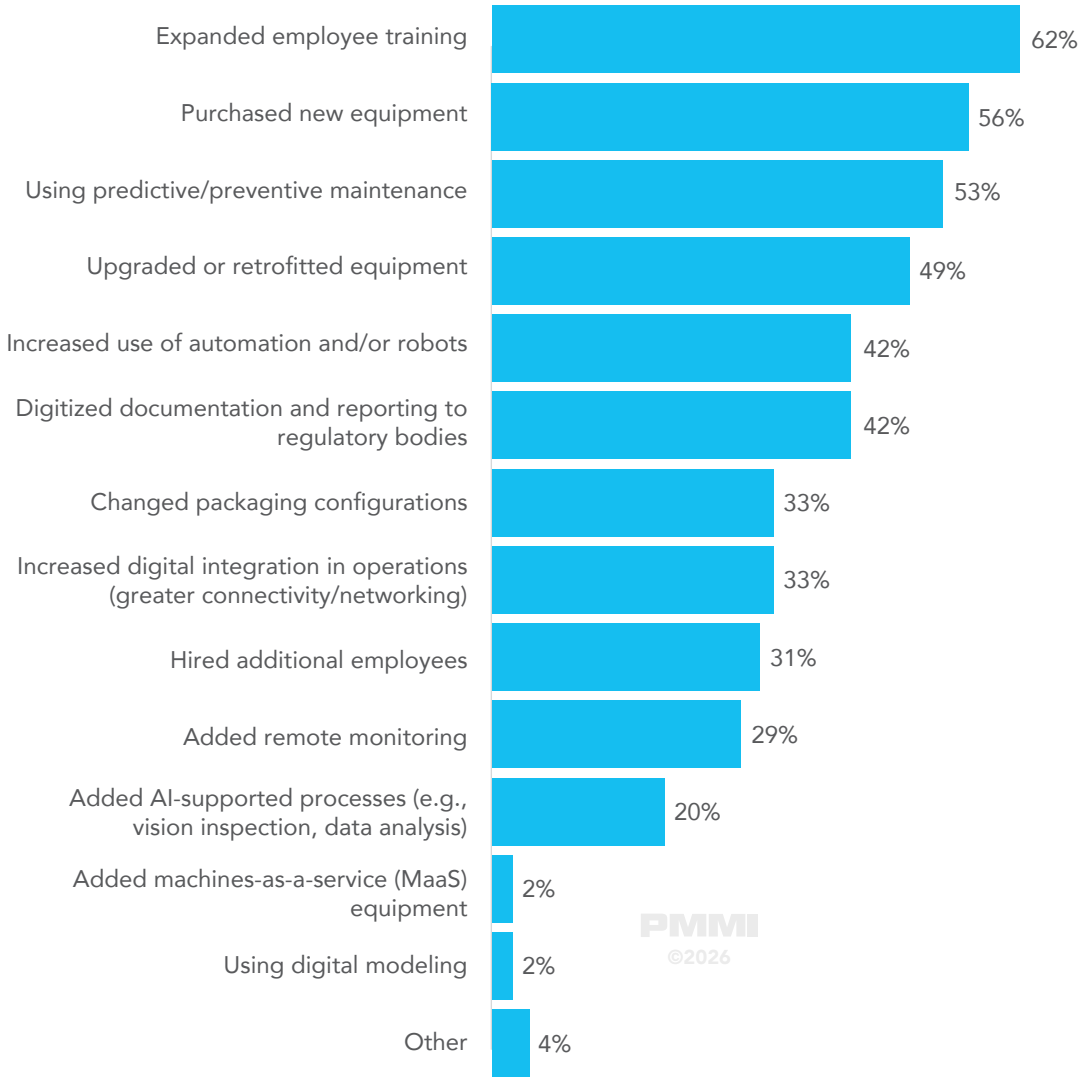
With a seeming disconnect between End User needs and their requests of OEM partners on documentation struggles, OEMs and suppliers may want to consider emphasizing their digital integration and reporting infrastructure capabilities.

Sanitation: Beyond Pharmaceuticals

Machine cleaning and sanitation is an important process in pharmaceutical manufacturing, but it is also vital to other manufacturing sectors. Sanitation in food and beverage manufacturing is essential to protect manufacturer reputation, brand image, and consumer safety. To learn more about sanitation in food and beverage manufacturing and how OEMs and suppliers can better support sanitation efforts at their customers, check out PMMI's *Food Safety and Sanitation Trends* report.

END USERS DEPLOY A VARIETY OF SOLUTIONS TO ADDRESS REGULATORY CHALLENGES

End User: What steps has your organization taken to meet regulatory requirements for pharmaceutical manufacturing? (Choose all that apply)



The strategies End Users are pursuing to address regulatory challenges present clear opportunities for OEMs and suppliers. Tools like expanded employee training, machine purchases, and equipment retrofits align closely with well-established OEM products and service offerings designed to alleviate regulatory burdens.

OEMs and suppliers also have an excellent opportunity to provide more specialized services like process integration and automation expansion. Strategies reported by End Users such as predictive/preventive maintenance schedules and automation and robotics often require skills beyond in-house expertise, increasing reliance on OEM and supplier support to achieve full value.

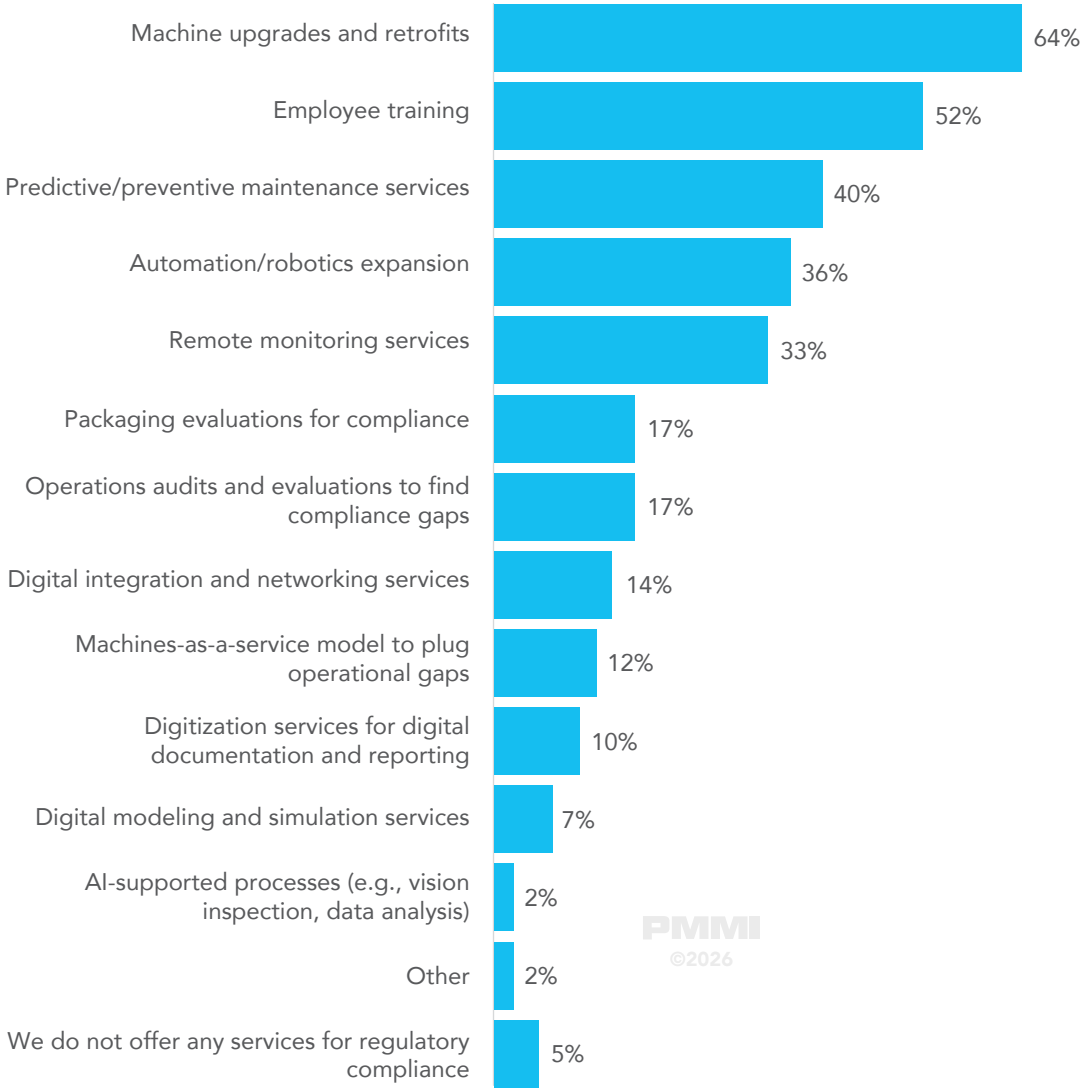
Those OEMs and suppliers able to quickly demonstrate practical solutions to regulatory challenges, such as equipment and training that can be supported with specialized skills like automation integration, could stand out to End Users.

Digital Skills in Demand

Demand for employees with specialized digital skills has been growing in pharmaceutical manufacturing. One analysis found 83% of biopharma supply chain leaders indicated a need for enhanced technological skills amongst employees. Companies are actively looking to fill this gap, with job postings for digital roles at life sciences companies like data engineers and data scientists growing 69% and 19% respectively. They are also looking to retrain employees, with 65% noting they are actively engaged in upskilling and reskilling. OEMs and suppliers can support these efforts by providing comprehensive machine and process training.[19]

OEM REGULATORY SERVICES ALIGN CLOSELY WITH END USER NEEDS

OEM: What services do you offer to End Users struggling with regulatory compliance? (Choose all that apply)



The services offered by OEMs to help End Users address regulations mostly align with the challenges End Users report, with one key exception.

A strong majority of End Users (71%) indicate challenges with documentation and reporting, and 42% note they are pursuing digitization strategies for their reporting. This is an ongoing challenge for pharmaceutical manufacturers that often requires specialized skills such as digital infrastructure construction and extensive digital process integration. In many cases, manufacturers lack these skills internally and must seek outside help.

Despite this need, only 10% of OEMs indicate they offer digitization services to support regulatory compliance, and just 14% say they provide the digital integration services necessary to achieve reporting digitization. Given that documentation remains a persistent challenge for End Users, OEMs and suppliers may need to evaluate the feasibility of expanding digital infrastructure and digitization services to better support regulatory reporting needs.

> OEMs offer machinery training but none we work with offer regulatory compliance training."
>
> **Technical Servicers,** *CP/CM*

> Suppliers provide hands-on training when we get new equipment. Regarding regulation, I'm not aware of training on that."
>
> **Warehouse & Logistics Process Expert,** *End User*

4

END USER NEEDS AND PREFERENCES

CHALLENGES • MACHINE FEATURES • SERVICES

"Integration, robotics, and automation are huge. Another is predictive and preventative maintenance. Customers don't just want to predict when a failure will come, or just how to improve their line functionality. They want us to analyze their line and tell them exactly where they can do better. This is a differentiator among suppliers."

Director of Automation, *OEM*

OEM AND SUPPLIER PARTNERS CAN HELP ALLEVIATE END USER CHALLENGES

End User: What are your top six biggest challenges in pharmaceutical manufacturing/packaging? (Choose up to six)

Keeping up with regulatory changes	44%
Expanding automation/reducing manual processes	42%
Space constraints and footprint limitations	42%
Aggregation and serialization	27%
Managing supply chains (including cold chain distribution)	24%
Machine monitoring (including remote monitoring)	24%
Reporting and documentation for regulatory bodies	22%
Accommodating new or changing packaging formats	22%
Digital integration – connecting machines, processes, and software digitally	22%
Making pharmaceutical packaging more sustainable	22%
Verification and consistency of material/ingredient quality	22%
Training and educating employees	20%
Deploying advanced technologies (e.g., AI)	20%
Lack of labor and employee turnover	18%
Achieving needed speeds and throughput	18%
Machine service and maintenance	18%
Gathering, organizing, and storing operational data	16%
Analyzing and utilizing operational data	16%
Sanitation and cleaning	13%
Accommodating e-commerce channels	11%
Incorporating tamper- and child-resistant features	7%

Totals over 100% due to multiple answers

End Users reported an array of challenges related to pharmaceutical manufacturing. The variety of challenges reflects the diversity of the pharmaceutical industry, where differences in regulatory pathways (OTC vs. Rx), packaging formats (solid dose vs. pre-filled injectables), and product types (cold remedies vs. oncology treatments) create distinct operational requirements and hurdles.

OEMs and suppliers that offer a diverse portfolio of machine options, a variety of specialized skills, digitization and automation features, and can support manufacturer processes through tools like remote monitoring, training, and education, will be well positioned to comprehensively address End User needs.

Ultimately, OEMs and suppliers must engage directly with customers to understand their specific challenges and needs. By understanding where customers are now and where they want to be in the future, suppliers can better align equipment and services, while building stronger partnerships.

Regulatory Anxiety Remains

Pharmaceutical leaders continue to express uncertainty about future regulatory burdens. In a recent survey, about one-third of respondents noted concerns about potential changes to U.S. regulations, while 37% were uncertain about the future of global regulatory frameworks.[20] OEMs and suppliers can deepen End User relationships by supporting regulatory compliance and requirements, as well as providing education on the latest regulatory changes.

OEMS REPORT HELPING END USERS WITH NUMEROUS MACHINE, REGULATORY, AND PERSONNEL CHALLENGES

OEM: What are the top six pharmaceutical manufacturing challenges End Users frequently ask you to help them address? (Choose up to six)

Machine service and maintenance	46%
Expanding automation/reducing manual processes	41%
Accommodating new or changing packaging formats	33%
Training and educating employees	31%
Achieving needed speeds and throughput	31%
Space constraints and footprint limitations	31%
Lack of labor and employee turnover	28%
Reporting and documentation for regulatory bodies	26%
Sanitation and cleaning	26%
Making pharmaceutical packaging more sustainable	26%
Machine monitoring (including remote monitoring)	23%
Aggregation and serialization	13%
Digital integration – connecting machines, processes, and software digitally	13%
Keeping up with regulatory changes	13%
Verification and consistency of material/ingredient quality	10%
Analyzing and utilizing operational data	5%
Incorporating tamper- and child-resistant features	5%
Gathering, organizing, and storing operational data	3%
Managing supply chains (including cold chain distribution)	3%
Accommodating e-commerce channels	3%
Deploying advanced technologies (e.g., AI)	3%

Totals over 100% due to multiple answers

The challenges OEMs report helping End Users with mostly align with the top challenges End Users themselves reported. One area that OEMs could consider expanding service in is education around changes to regulatory requirements.

Keeping up with regulatory changes was the top challenge reported by End Users (44%), but only 13% of OEMs say End Users frequently ask them for help in this area. As the final DSCSA deadlines come into effect in November 2026, it is vital for End Users to be up-to-date and compliant with the latest regulations. This is even more important for large international manufacturers selling in multiple markets that must contend with a host of other regulatory bodies.

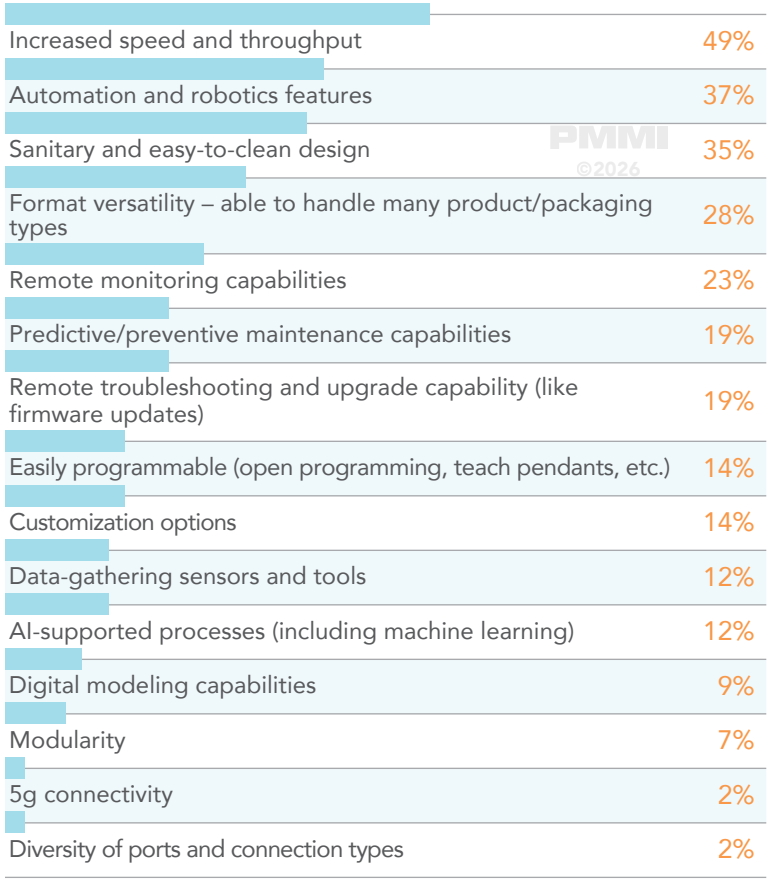
OEMs and suppliers could consider proactive outreach and education efforts to help End Users understand how regulatory changes can drive operational impacts.

> "More training on troubleshooting for operators, similar to what mechanics receive, would reduce downtime. This training should come from the supplier."
>
> **Warehouse & Logistics Process Expert,** *End User*

> "Most requests are for training on equipment operation and data interfaces - how to review and extract data in the format they want."
>
> **CEO,** *OEM*

END USERS LOOK FOR MACHINERY THAT EMPHASIZES SPEED, AUTOMATION, AND CONVENIENCE

End User: What are the top three machine features you look for when evaluating new pharmaceutical manufacturing equipment? (Choose up to three)



Totals over 100% due to multiple answers

Increased speed and throughput is the top feature End Users look for when evaluating new pharmaceutical manufacturing equipment, followed by automation and robotics and easy-to-clean designs. These top three features can all be grouped into one category: process efficiency. Each is focused on minimizing downtime, improving uptime, and increasing production output. End Users are signaling a need for faster, more efficient machinery, and emphasizing measurable efficiency gains could be a persuasive way for OEMs and suppliers to approach End Users.

End Users also indicated they value designs related to connectivity. Capabilities such as remote monitoring and predictive/preventive maintenance require a higher degree of digital connectivity, a key area of expansion for pharmaceutical manufacturers in general. Even for those operations that currently lack the necessary digital infrastructure, connectivity-ready machines can help future-proof equipment investments by ensuring systems are prepared for integration when digital infrastructures are built out.

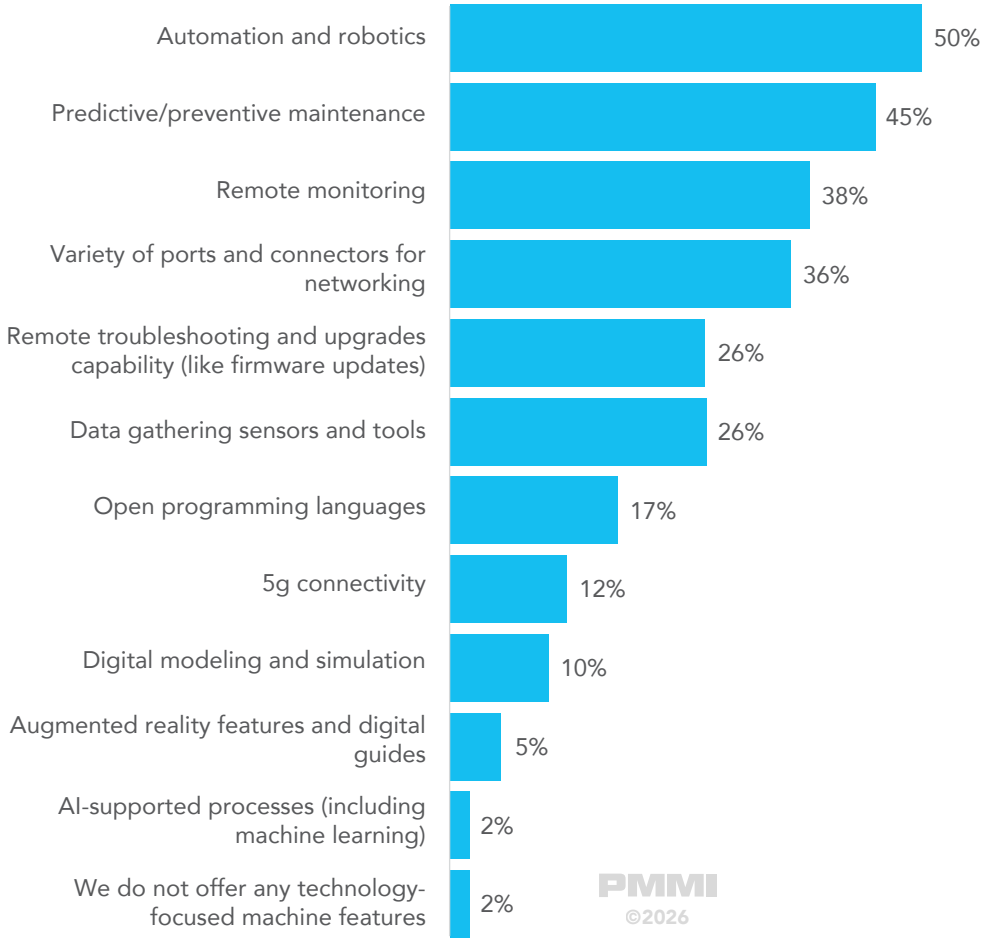
Unlocking Capacity: A Segment Example

OEMs and suppliers may be able to help some pharmaceutical End Users unlock unused capacity. One study of sterile pharmaceutical manufacturers using the McKinsey pharmaceutical operations benchmarking of solids (POBOS) database found that many manufacturers do not leverage the full capacity from their sterile lines, with utilization benchmarking at a median value of 51%. In specific case studies, OEMs and suppliers were able achieve phenomenal results by using digital data analysis to improve efficiencies. Outcomes included a vaccine CDMO that doubled their throughput capacity within a year, cut changeover times in half, and increased overall equipment effectiveness (OEE) by 50% to 60%. OEMs and suppliers with the skills needed to digest and apply digital data could help End Users unlock significantly more capacity within their existing operations.[21]

> Automation with verification systems will be most important. As compliance requirements become stricter, online verification systems like 3D cameras, sensors, and electronic counting will be essential for equipment selection."
>
> **Director of Pharmaceutical Engineering,** *End User*

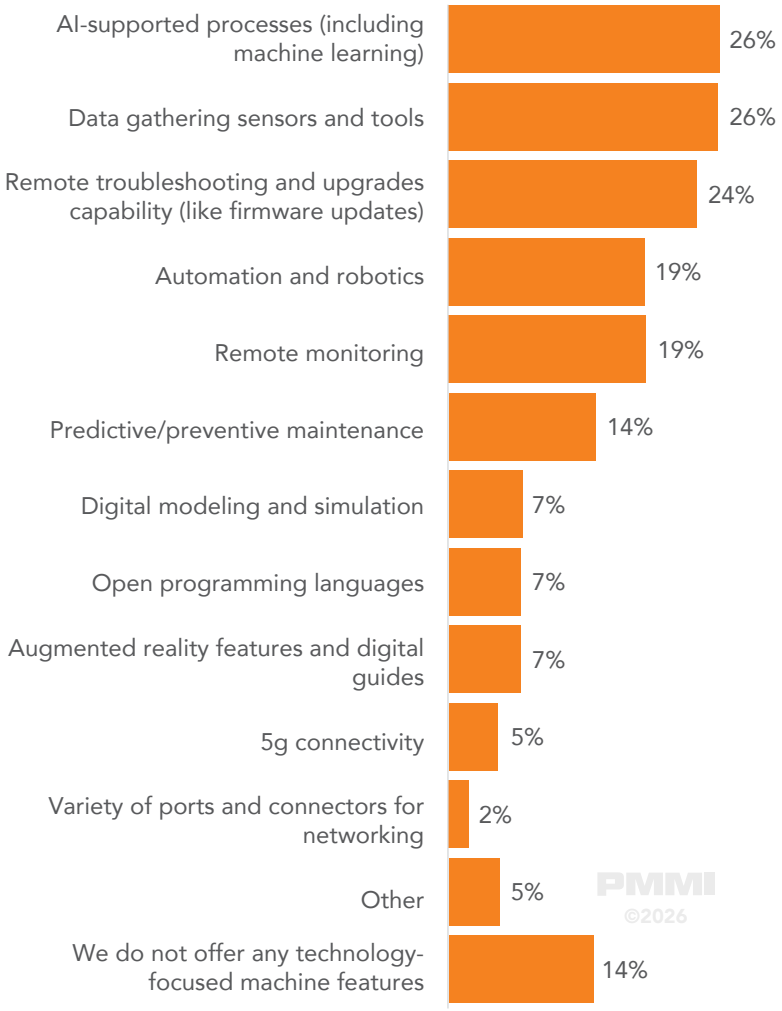
DATA AND CONNECTIVITY FEATURES WILL BE IMPORTANT FOR FUTURE PHARMACEUTICAL EQUIPMENT

OEM: Which of the following technology-focused machine features do you currently offer on your pharmaceutical equipment? (Choose all that apply)



Totals over 100% due to multiple answers

OEM: Which of the following technology-focused machine features do you not offer now, but plan to add to your pharmaceutical equipment in the future? (Choose all that apply)



Totals over 100% due to multiple answers

DATA AND CONNECTIVITY FEATURES WILL BE IMPORTANT FOR FUTURE PHARMACEUTICAL EQUIPMENT *(continued)*

Current technology features offered on OEM machinery align closely with End User needs, emphasizing throughput and connectivity. For instance, End Users cite throughput as a top challenge, while OEMs report automation and robotics as their most commonly offered technology feature. With robotics capable of increasing pharmaceutical throughput by 30% to 50% compared with manual processes, OEMs are already deploying tools that address End User needs.[22]

Looking ahead, OEMs are signaling big developments in machine sophistication. Many OEMs plan to incorporate more advanced technologies in the upcoming years, including AI-empowered processes. With many OEMs noting they already include well-established features like robotics and predictive/preventive maintenance routines, the next frontier of pharmaceutical equipment is expected to include more data and connectivity features.

AI-supported features need robust operational data to feed modeling and analytics tools. On the individual machine level, AI-powered machine learning programs also require a steady stream of high-quality data to function optimally. End Users will need help from OEMs and suppliers in building out digital infrastructures and deploying physical data-gathering sensors to bolster data volumes. OEMs appear to be responding to this need, with nearly half indicating they will be adding more sensors to their machinery.

Connectivity will also play an important role in pharmaceutical manufacturing. While slower to incorporate remote connectivity features than some other manufacturing sectors due to heightened cybersecurity concerns and regulatory requirements, the pharmaceutical industry is poised for greater adoption. As the technology matures and becomes more standard, and as cybersecurity safeguards improve in efficacy and sophistication, remote connectivity is likely to see greater use in pharmaceutical manufacturing. Those OEMs including remote connectivity capability on their machinery will be better able to meet the future networking needs of End Users.

Generative AI (Gen AI)

AI is a hot topic in manufacturing, with stakeholders across the pharmaceutical industry searching for ways to better apply this breakthrough technology. According to one independent analysis, the "Operations" portion of pharmaceutical manufacturers (which includes processing and packaging) could generate between $4 and $7 billion in additional economic value through the deployment of Gen AI tools.[23]

Two case studies highlight the revenue potential for Gen AI:

- A biopharma CDMO increased upstream throughput by 15% and downstream throughput by up to 60% with Gen AI analysis.
- A biopharma manufacturer used a comprehensive suite of Gen AI analytics tools, resulting in a 29% increase in upstream throughput.[24]

With up to 70% of digital transformations failing due to poor transition and management, it is vital for OEMs and suppliers to lend their expertise in helping End Users understand and deploy AI.[25]

> "Automation and software improvements are most important, particularly software that can integrate with different systems, merge with supply chain operations, and connect with engineering systems."
>
> Director of Pharmaceutical Engineering, *End User*

> "We're making machines more intelligent by building in technologies that can contact plant leaders or maintenance managers via text or email notifications about issues."
>
> Sr. Technical Trainer, *OEM*

END USERS EVALUATE A DIVERSE LIST OF CAPABILITIES WHEN SELECTING OEM AND SUPPLIER PARTNERS

End User: When considering which OEMs/component suppliers to work with, what top three services or capabilities are most important for your organization? (Choose up to three)

Totals over 100% due to multiple answers

"The biggest impact of labor shortages for us is increased requests for additional automation. We're looking at integrating machines with robotics to replace tasks previously done by humans due to labor shortages."

Sr. Technical Trainer, *OEM*

End Users consider several different criteria when evaluating potential partners. While equipment lead times are always a top concern for End Users, OEMs and suppliers will need to carefully consider a host of other aspects sought by End Users.

One important consideration is access to specialized skills, particularly for technology-focused features. End Users often lack in-house expertise for advanced capabilities such as robotics programming, and many also face workforce and skills gaps that affect even standard procedures like troubleshooting. OEMs and suppliers able to provide their own employee expertise for these tasks can stand out to End Users in search of a partner.

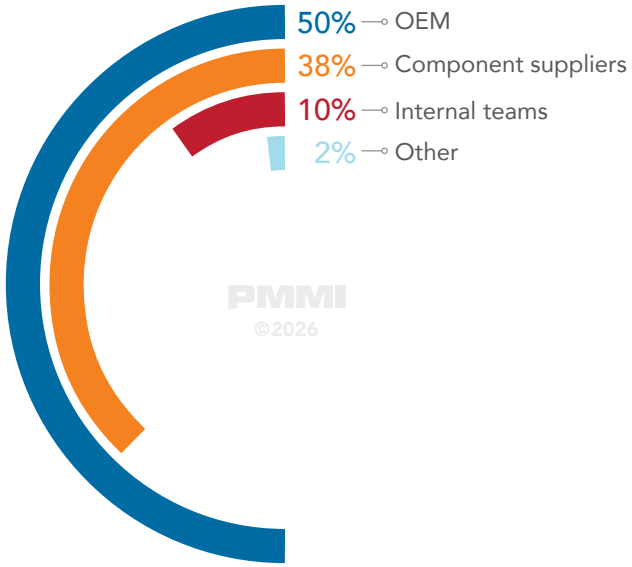
Another crucial capability is aftermarket support. With only 10% of End Users relying primarily on internal teams for aftermarket parts and services, OEMs and suppliers must be able to comprehensively meet the post-installation needs of their customers. Offerings such as maintenance packages and equipment retrofits can help distinguish suppliers, particularly when paired with comprehensive services like replacement parts and employee training that address key End User priorities.

"We'd like better automation controls that are adaptive. Currently, everything is programmed to do exactly what it's told without the ability to intelligently alter its programming based on situations. We need machinery that can adapt to different consumables and conditions without requiring specific inputs."

Technical Trainer, *OEM*

END USERS PRIMARILY RELY ON EXTERNAL HELP FOR AFTERMARKET PARTS AND SERVICES

End Users: Who does your company primarily rely on for aftermarket parts and services for your operations?



> Machinery often falls into disrepair due to improper maintenance, leading to higher failure rates and direct impacts on production. For example, a facility targeting 100 units per day might only produce 60 due to equipment breakdowns or improper operation from lack of skilled personnel."

Technical Trainer, *OEM*

As indicated by this research, End Users overwhelmingly rely on external help for their aftermarket parts and services. OEMs and suppliers must ensure they have comprehensive, responsive aftermarket parts and services teams ready to promptly address any hiccups or breakdowns. When a problem arises, End Users need confidence that their suppliers can deliver timely, effective solutions and ongoing support.

PMMI *Aftermarket Parts & Service* Report

Aftermarket parts and services are crucial not just in the pharmaceutical industry, but across manufacturing segments. To learn more about how other industries are approaching aftermarket parts and services, and how OEMs and suppliers can better support the needs of their End Users, check out PMMI's *Aftermarket Parts & Service* Report.

5

MACHINE SALES

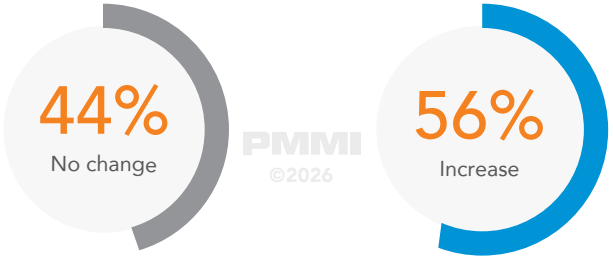
HISTORIC • FUTURE • MACHINE TYPES

> “Equipment purchases and retrofits are primarily driven by increasing demand for popular drugs.”
>
> **CEO**, *OEM*

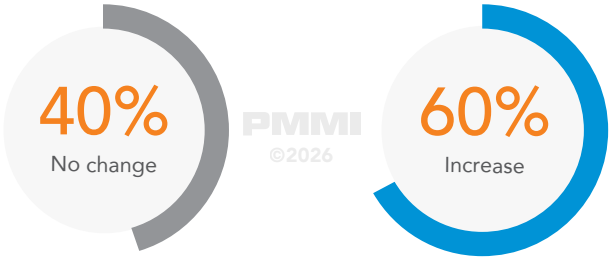
ALL END USERS PREDICT GROWTH OR STABILITY IN MACHINERY PURCHASES

Processing Machinery

End User: In the last three years, how, if at all, has your company changed its purchasing of pharmaceutical processing machinery?



End User: How do you anticipate your pharmaceutical processing machinery purchasing will change in 2026 as compared to 2025?



"We try to get as much life out of equipment as possible. New purchases are driven by efficiency, user-friendliness, and ability to support current and future volume growth."

Warehouse & Logistics Process Expert, *End User*

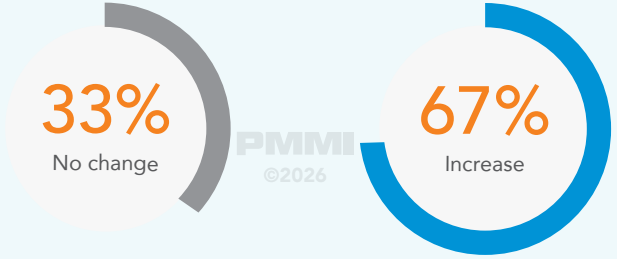
The purchasing outlook presents positive news for OEMs and suppliers. Survey results show that no End Users reported purchasing less equipment over the last three years, nor do any expect to reduce equipment purchases in the coming year.

With a majority of End Users indicating increased investment in both processing and packaging equipment in 2026, it will be vital for OEMs and suppliers to ensure their machinery is ready to meet the future needs of pharmaceutical manufacturers.

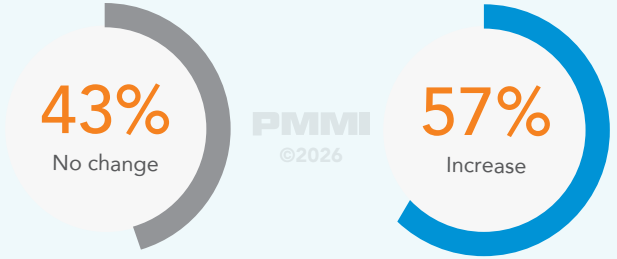
As highlighted earlier, features such as AI-empowered processes, remote connectivity, and greater digital and physical automation will be important to pharmaceutical equipment of the future. Those OEMs able to best apply these features to solving sticky challenges like throughput growth and regulatory reporting could stand out to End Users in search of solutions.

Packaging Machinery

End User: In the last three years, how, if at all, has your company changed its purchasing of pharmaceutical packaging machinery?



End User: How do you anticipate your pharmaceutical packaging machinery purchasing will change in 2026 as compared to 2025?



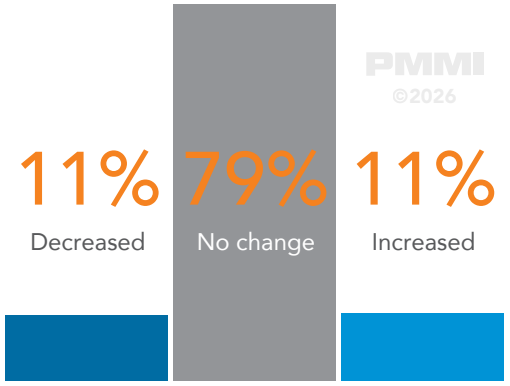
"Product growth is the primary driver. When a product performs well in the market with good growth (25-30% annually), you can justify spending a significant budget on equipment for that product line."

Director of Pharmaceutical Engineering, *End User*

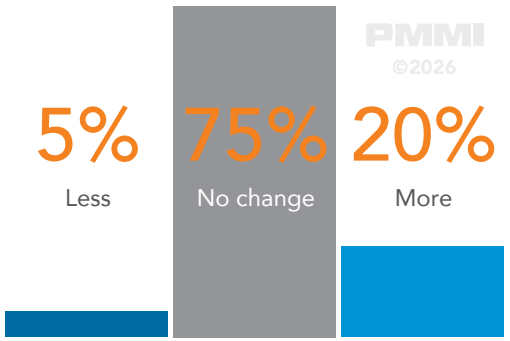
MOST OEMS PREDICT GROWTH OR STABILITY IN MACHINERY SALES

Processing Machinery

OEM: In the last three years, have you noticed any changes in the sales volume of your pharmaceutical processing equipment?



OEM: How do you anticipate your pharmaceutical processing machinery sales will change in 2026 compared to 2025?



When reflecting on past and future machine sales, OEM sentiments closely align with End User responses. With few exceptions, OEMs report that sales volume has increased or remained steady over the last three years, and nearly all anticipate stability or growth in the year ahead. On average, growth predictions are stronger for packaging equipment than for processing equipment.

The next several years could prove to be a crucial time for OEMs and suppliers as the pharmaceutical industry adopts more technology-focused features backed by connectivity and data. OEMs themselves report increasing incorporation of these capabilities into their machinery, signaling a clear industry trajectory.

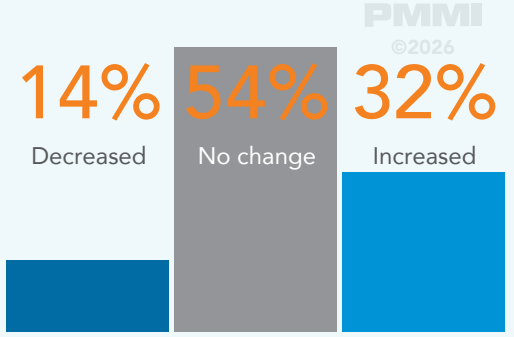
To capitalize on this favorable sales outlook, OEMs and suppliers will need to evaluate their offerings to ensure their portfolio incorporates the connectivity and data-powered tools of the future, such as AI-supported processes.

> We see two main purchasing drivers: new products requiring different equipment specifications, and security needs. Retrofits typically happen when customers need to increase speed or add more data. Obsolescence is a minor factor as many customers follow the: 'If it's not broke, don't fix it' mentality."

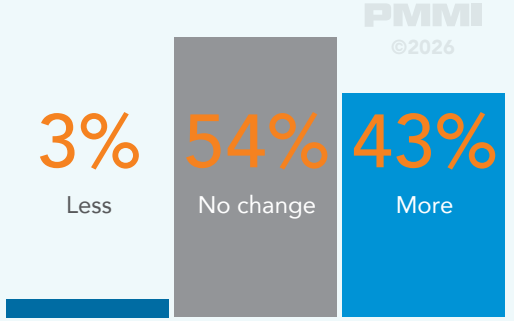
Director of Automation, *OEM*

Packaging Machinery

OEM: In the last three years, have you noticed any changes in the sales volume of your pharmaceutical packaging equipment?

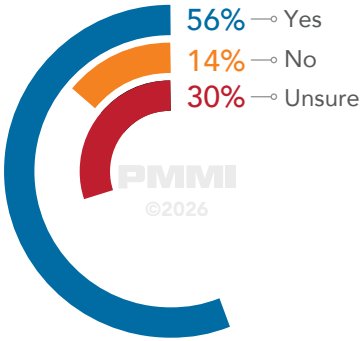


OEM: How do you anticipate your pharmaceutical packaging machinery sales will change in 2026 as compared to 2025?



A MAJORITY OF END USERS PLAN TO PURCHASE MACHINERY IN 2026

End User: Do you plan on purchasing any pharmaceutical packaging or processing machinery within the next year?



A majority of End Users report plans to purchase machinery in 2026, with only 14% definitively stating they do not plan to make a purchase. This aligns closely with both OEM and End User sentiment around continued sales stability and growth.

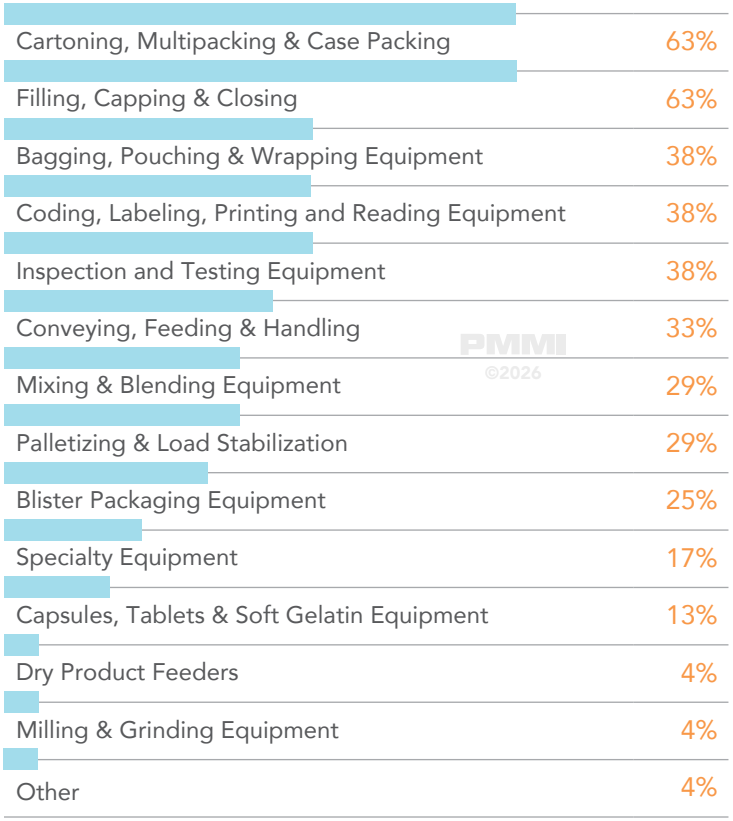
While the categories of equipment were diverse, several types of packaging machinery stand out. As End Users adapt to labeling, format, and material changes driven by factors such as regulatory variance, e-commerce, and sustainability initiatives, they may uncover additional needs for new packaging machinery.

OEMs and suppliers that can clearly articulate how their machinery addresses specific manufacturing and regulatory challenges will be well positioned to capture this anticipated End User demand.

PMMI 2025 *State of the Industry* Report

Understanding machine sales trajectories is an important indicator in manufacturing, illuminating key trends in industry segments through the lens of equipment purchasing. For additional insight into machinery investment trends from the OEM perspective, see PMMI's 2025 *State of the Industry* Report, released in August, 2025.

End User: Which types of pharmaceutical machinery do you anticipate purchasing? (Choose all that apply)



Totals over 100% due to multiple answers

"Our biggest driver for equipment purchases is new business or new products that require new equipment."

EE and IE Manager, *CP/CM*

6

KEY REPORT FINDINGS

KEY FINDINGS

Taken together, these findings suggest that pharmaceutical manufacturers are prioritizing flexibility, connectivity, and sustainability across both packaging formats and machinery investments. OEMs and suppliers that align solutions around regulatory compliance, automation, data-enabled services, and evolving e-commerce requirements will be best positioned to support end-user growth and strengthen long-term partnerships.

The next generation of pharmaceutical packaging will look to expand connectivity features and consumer interaction.

Top three packaging features that will be added in coming years:

1) RFID Tags
2) Wireless packaging sensors
3) Augmented reality interactivity

End Users are making material changes to enhance the sustainability of pharmaceutical packaging.

Top packaging sustainability changes in the future:

1) Lightweighting / material reduction
2) Recycled materials (PCR)
3) Compostable materials
4) Biodegradable materials

OEMs and End Users predict pre-filled syringes/injectors, blister packs, bottles without a carton, and ampoules will see the greatest growth in the coming years.

Top packaging format growth predictions:

1) Pre-filled syringes/injectors
2) Blister packs [End User]; Ampoules [OEM]
3) Bottles (no carton) [End User]; Blister packs [OEM]

End Users and OEMs predict healthy growth for machine sales, with a majority (56%) of End Users intending to purchase machinery in 2026.

Top machine categories End Users intend to purchase:

1) Cartoning, Multipacking & Case Packing
2) Filling, Capping & Closing
3) Bagging, Pouching & Wrapping Equipment

End Users face a host of challenges, but OEMs and suppliers have numerous opportunities to offer machines, services, and solutions to deepen partnerships.

Top End User challenges:

1) Keeping up with regulatory changes
2) Expanding automation / reducing manual processes
3) Space constraints and footprint limitations

E-commerce will continue to grow slowly, but those entering the e-commerce market make numerous operational and format changes that are opportunities for OEMs and suppliers.

Top changes made to accommodate e-commerce:

1) Entirely new packaging format
2) Expanded machine automation
3) Hired additional employees
4) Engaged co-manufacturers or co-packers

The next generation of pharmaceutical packaging machinery will include connectivity and data analytics to support technology-focused features like AI-powered processes.

Top technology features OEMs plan to add to machinery:

1) AI-supported processes (including machine learning)
2) Data gathering sensors and tools
3) Remote troubleshooting and upgrades

6

APPENDICES

A: Participant Profile and Methodology
B: Endnotes and References
C: Additional PMMI Reports and Content

PARTICIPANT PROFILE AND METHODOLOGY

To assess pharmaceutical manufacturing trends and challenges over the next several years, we combined secondary research and independent studies with insights and statistics gathered through survey responses and detailed interviews with both OEMs and End Users. Statistics, unless otherwise cited, are derived from the data gathered through survey responses.

87 pharmaceutical OEMs and End Users were asked for their thoughts on the future of pharmaceutical manufacturing, with an emphasis on important trends and challenges. 48% were OEMs, and 52% were End Users. Out of End Users, 73% were manufacturers, 22% were contract packagers/manufacturers, and 5% were retailers. In addition to soliciting survey responses, 11 interviews were conducted directly, 5 with OEMs, and 6 with End Users.

To tease out potential gaps and opportunities, this study focuses on analyzing the differences between OEM and End Users responses on a wide range of topics in pharmaceutical manufacturing. With an emphasis on End User machine and packaging needs of the future, this study aims to provide OEMs with insights and statistics to illuminate the trends and challenges in pharmaceutical manufacturing.

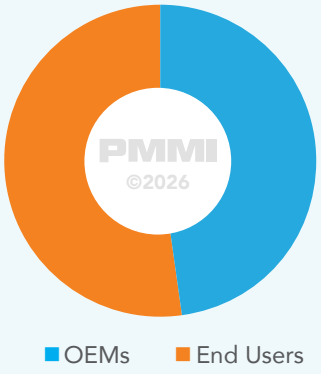
Survey questions reported in this study are identified as either "OEM" or "End User", indicating the party queried. To provide the most holistic picture, full question response tables have been included with all participant responses represented.

TOTAL

87
Surveys

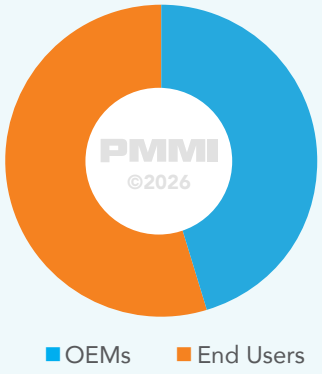
11
Interviews

Survey Participants
n = 87



Quantitative insights were compiled from survey responses from both OEMs and End Users regarding the trends and challenges in pharmaceutical manufacturing.

Interview Participants
n = 11

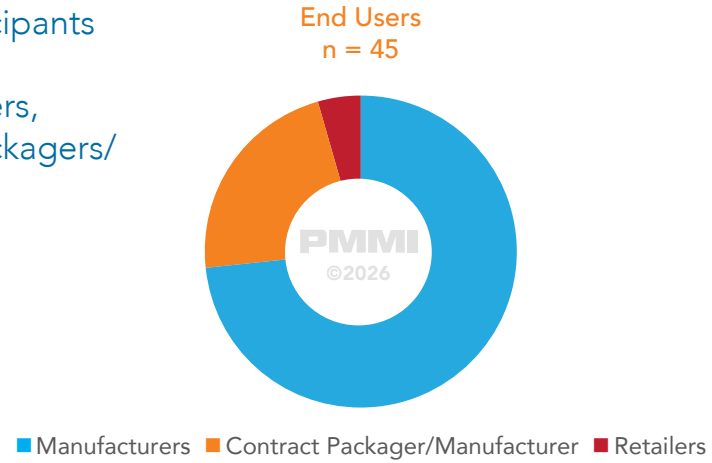


Survey respondents were asked to participate in direct interviews after completion. Interviews drilled down further into survey topics to glean additional insights and perceptions and lasted approximately 30 to 60 minutes.

QUANTITATIVE AND QUALITATIVE

OEM participants were all manufacturers of equipment.

End User participants included 33 manufacturers, 10 contract packagers/ manufacturers, and 2 retailers.



In-depth interviews were conducted with 11 survey respondents.

5

OEMs

5 original equipment manufacturers

6

End Users

4 manufacturers, 2 contract packagers/ manufacturers

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