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WHITE PAPER

The Formulation Effect: Impacts on Food & Beverage Production, Equipment and Investment





PMMI The Association for Packaging and Processing Technologies

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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 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.

ABOUT THIS REPORT

PMMI conducted this research in collaboration with Advantage Research, Inc. to provide PMMI member companies and the broader industry with an in-depth understanding of how emerging food and beverage formulation trends are influencing processing and packaging operations, equipment requirements, and machinery investment.

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METHODOLOGY

ONLINE QUANTITATIVE RESEARCH

Data collection: May 29 – June 27, 2026 | 8- to 10-minute online survey with End Users and OEMs in the food and beverage industry

TOTAL RESPONDENTS	149
End Users (CPGs and Co-Packagers/Co-Manufacturers)	95
OEMs (OEMs and Component Suppliers)	54

VIRTUAL QUALITATIVE IN-DEPTH INTERVIEW RESEARCH

Interviews: June 9 – August 3, 2026

30- to 40-minute length of interview with End Users and OEMs in the food and beverage industry

TOTAL NUMBER OF INTERVIEWS	15
End Users (CPGs and Co-Packagers/Co-Manufacturers)	8
OEMs (OEMs and Component Suppliers)	7

Individual percentages may not sum exactly to the aggregate total due to rounding.



INTRODUCTION

Enhanced nutritional and functional formulations are becoming a more prominent part of food and beverage production, driven by growing demand for products with added protein, fiber, probiotics, reduced sugar, weight-management benefits, and other nutritional attributes.

As these formulations become more diverse, manufacturers are navigating new challenges related to ingredient behavior, processing requirements, sanitation, product quality, packaging, and production flexibility. More SKUs, shorter runs, and frequent reformulations can further increase complexity and place new demands on existing equipment and production systems.

This research explores how these formulation trends are affecting food and beverage manufacturers and the equipment suppliers that support them. Specifically, the report examines how formulation changes are influencing day-to-day operations, equipment requirements, production flexibility, and capital investment—and where they may create new opportunities for OEMs and suppliers.

This research aims to:

- **Identify** the nutritional and functional formulation trends shaping food and beverage product development
- **Understand** how changing product and ingredient characteristics affect manufacturing complexity
- **Assess** the impact on ingredient handling, processing, sanitation, packaging, and quality control
- **Evaluate** how these formulation trends are influencing equipment requirements, production flexibility, and line design
- **Identify** product formats creating the greatest processing, packaging, and equipment challenges
- **Examine** how these trends are influencing equipment modifications, innovation priorities, and capital investment



EXECUTIVE SUMMARY

ENHANCED FORMULATIONS ARE CREATING NEW OPPORTUNITIES AND NEW DEMANDS ACROSS FOOD AND BEVERAGE MANUFACTURING

1

Enhanced formulations are becoming mainstream

High-protein products and fiber, low sugar, probiotics, and GLP-1-adjacent nutrition are leading growth. Nearly half of End Users say these products now account for more than 10% of production, and 61% report at least a moderate impact on operations.

47% report >10% of production **61%** report at least a moderate impact

2

The greatest impact is in core processing operations

Changes in texture, moisture sensitivity, stability, flow, and ingredient compatibility create added complexity in:

- Mixing/blending
- Dosing/metering
- Cooking/thermal processing
- Cleaning/sanitation
- Powder handling

3

End Users manage complexity before investing in equipment

End Users often manage complexity through process adjustments before turning to equipment changes. This may help explain why End Users report more operational impact while OEMs see a more limited effect on equipment needs.

4

Greater product variety is increasing the need for flexibility

More SKUs, shorter runs, pilot activity, reformulations, and frequent changeovers are pushing companies toward systems that can adapt more quickly to changing products and formats.

More SKUs	More Pilot Activity
Shorter Runs	Frequent Changeovers

5

Investment is on the horizon

While End Users do not immediately turn to equipment changes, over the next three years, more than half expect investment in processing equipment to increase, and 51% expect related processing or packaging investment to reach at least \$500,000.

56%

Expect processing equipment investment to increase (next 3 years)

51%

Expect \$500,000 or more in related processing or packaging investment

6

Equipment investment is already underway

Half of End Users have added or plan to add new processing equipment, while 47% report the same for packaging equipment and 36% have replaced or plan to replace equipment. Investment also extends to controls and automation, line configuration, QA/inspection capabilities, and filling/dosing modifications.

50%

Have added or plan to add new processing equipment

47%

Have added or plan to add new packaging equipment

36%

Have replaced or plan to replace equipment

7

Equipment must adapt to a wider range of products and formulations

End Users are increasingly seeking equipment that can accommodate multiple products and formulations as SKU complexity and production variability grow. For OEMs, this is creating opportunities around multi-format capability, AI/process optimization, real-time monitoring, and automation/data integration—while food safety, sanitation, and performance remain essential.



Multi-format capability



AI/process optimization



Real-time monitoring



Automation/data integration

A collection of SPORTS bars and various nuts on a wooden surface. The bars are in various colors (blue, green, brown) and some are unwrapped, showing the granular texture of the bars. Nuts like almonds and cashews are scattered around. A sprig of fresh basil is also present. The background is a wooden cutting board.

1

EMERGING FORMULATION TRENDS

Enhanced nutritional and functional formulations are moving into the mainstream, led by protein and supported by growth in fiber, low-sugar, probiotic, and GLP-1-adjacent formulations. These products are most commonly offered in convenient and portable formats, while growing product variety (SKU proliferation) is creating new demands for production flexibility.

ENHANCED FORMULATIONS ARE BECOMING MAINSTREAM

Enhanced nutritional and functional formulations are becoming an increasingly common part of food and beverage production. Nearly all End Users surveyed say that some portion of their production involves these products, and nearly half (47%) say they account for more than 10% of their current production volume.

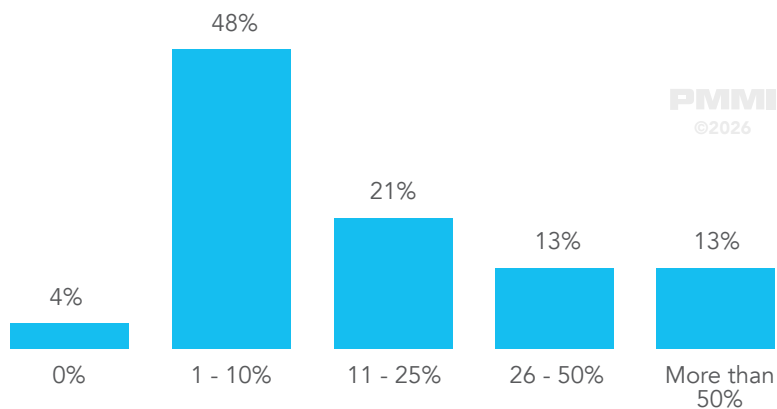


The functional beverage space is booming... regardless of what industry you're in, the 'functional everything' is taking a front seat right now."

Vice President, *End User*

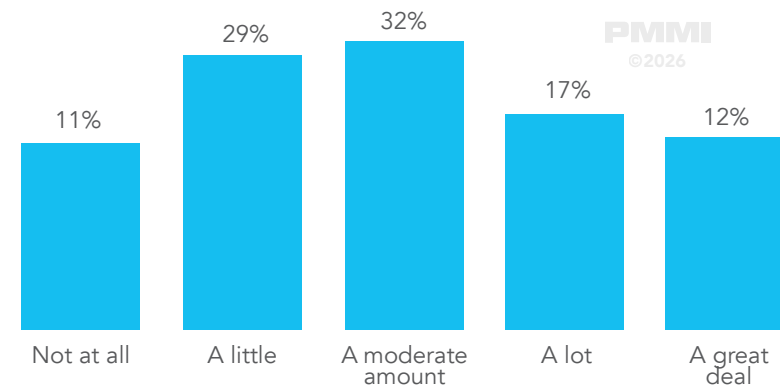
END USER PERSPECTIVE

What approximate share of your organization's production volume involves enhanced nutritional or functional formulations today?



This prevalence is also translating into meaningful operational impacts. Six in ten End Users (61%) say enhanced formulations have had at least a moderate impact on their operations, including 29% who report a lot or a great deal of impact. Only 11% say these products have had no impact at all.

To date, how much of an impact have these product formulations had on your operations?



One of the biggest trends is added protein across all these different beverages. The second is lower sugar in everything."

Senior Manager of Packaging, *End User*

The effect on equipment needs appears more limited. Among OEMs, 37% say enhanced formulations have had at least a moderate impact on their customers' equipment needs, while 63% report little or no impact.

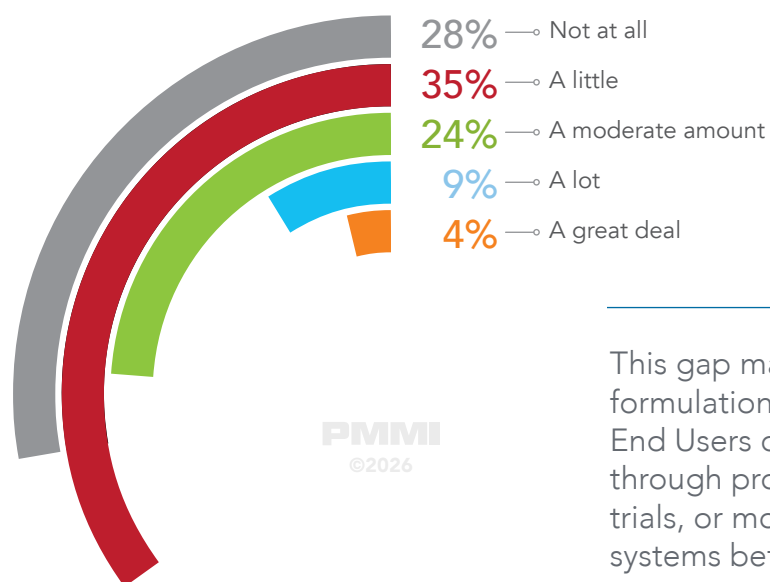


We know they're doing it, but none of our customers are coming back saying, 'We need something changed. It's not working. Conveyors are behaving differently.'"

Director of Engineering, OEM

OEM PERSPECTIVE:

To date, how much of an impact have enhanced nutritional or functional food and beverage formulations (such as added protein, fiber, bioactives, vitamins/minerals, electrolytes, probiotics, or other functional ingredients) had on your customers' equipment needs?



This gap may partly reflect where formulation complexity occurs. End Users often address changes through process adjustments, trials, or modifications to existing systems before turning to OEMs for equipment changes or new systems.



PROTEIN DOMINATES FORMULATION TRENDS, WITH GROWTH EXTENDING ACROSS OTHER NUTRITIONAL AND FUNCTIONAL AREAS

High-protein formulations are leading growth in enhanced food and beverage development. More than six in ten End Users (62%) identify high protein as one of the fastest-growing formulation areas, while more than three-quarters of OEMs (78%) expect it to have a major impact on product development over the next three years.

Growth extends beyond protein. End Users point to high fiber/prebiotic fiber (42%), low/no-sugar formulations (37%), probiotics/postbiotics (36%), and GLP-1-adjacent nutrition/weight-management support (35%) as other areas of growth. OEMs also anticipate strong influence from GLP-1-adjacent nutrition (43%), low/no-sugar products (41%) and probiotics/postbiotics (37%).



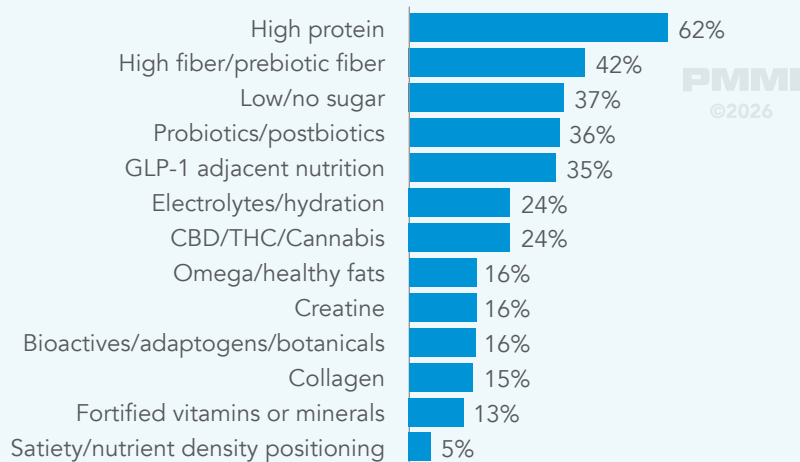
Fiber is another one that you're starting to see being fortified into an application or a seasoning after the fact and trying to achieve gut health claims."

President, End User

Future product development is expected to combine traditional nutrition priorities, such as protein enrichment or sugar reduction, with more specialized benefits related to digestive health, satiety and weight management. This growing diversity in formulations is likely to increase the range of ingredient properties and production requirements that systems must accommodate.

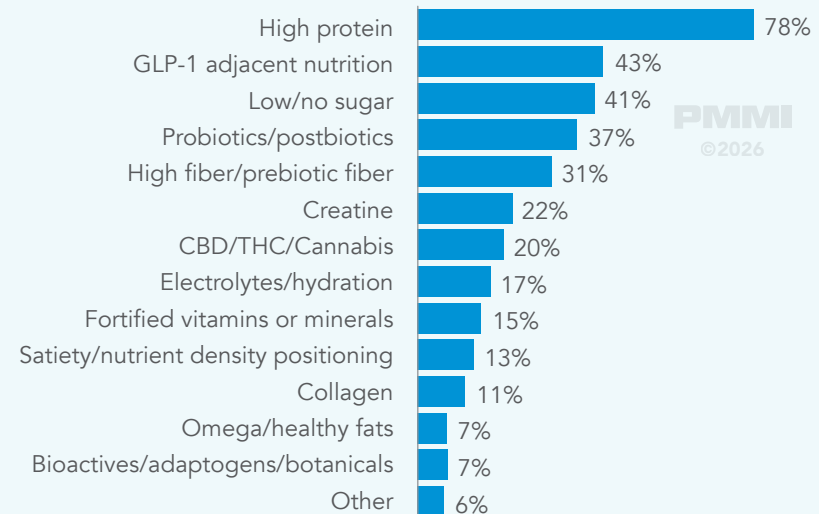
END USER PERSPECTIVE:

Which enhanced nutritional or functional formulation areas are experiencing the fastest growth in product development? (choose up to five)



OEM PERSPECTIVE:

Over the next three years, which formulation strategies do you expect to have the greatest impact on food, beverage, and nutraceutical product development? (choose up to five)



ENHANCED FORMULATIONS ARE COMMONLY DELIVERED IN CONVENIENT, PORTABLE FORMATS

Enhanced nutritional and functional benefits are most commonly delivered through formats that tend to be convenient, portable, and easy to portion. Ready-to-drink beverages and powders/stick packs/sachets lead, each cited by three-quarters of End Users (75%). Bars (60%), capsules/tablets (47%), and gummies/chews (46%) are also commonly cited. One-quarter of End Users cite shots/concentrates (25%), while nearly one in four (24%) cite dairy products as a format for delivering enhanced nutritional benefits.

Enhanced formulations are less commonly delivered through bakery/snacks, frozen or refrigerated meals, confectionery, sauces/dressings, and meat/seafood alternatives.

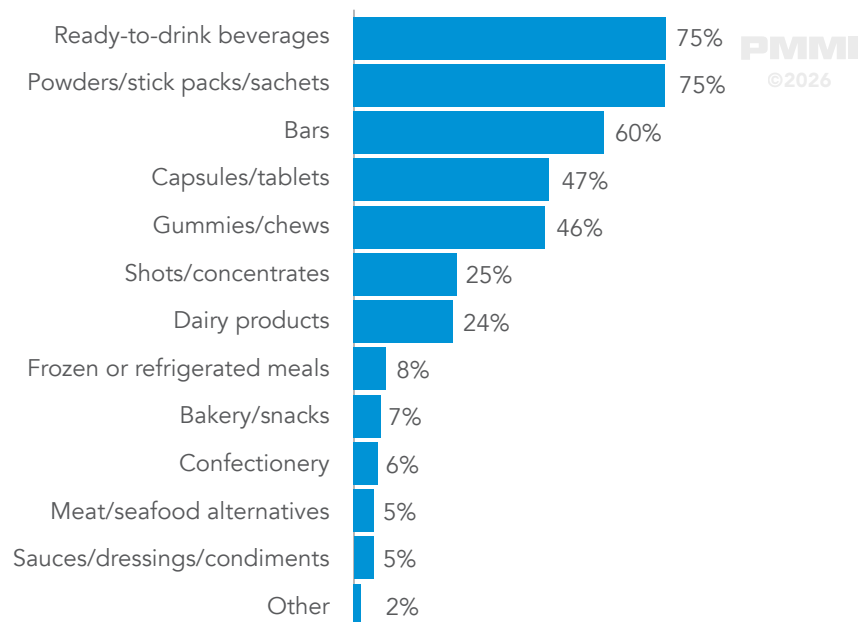


We have a customer that's looking to do stick packs in the probiotic space. We do a significant quantity of stick packs."

Vice President of Operations, End User

END USER PERSPECTIVE:

Which product formats are most commonly used to deliver enhanced nutritional benefits today? (choose up to five)



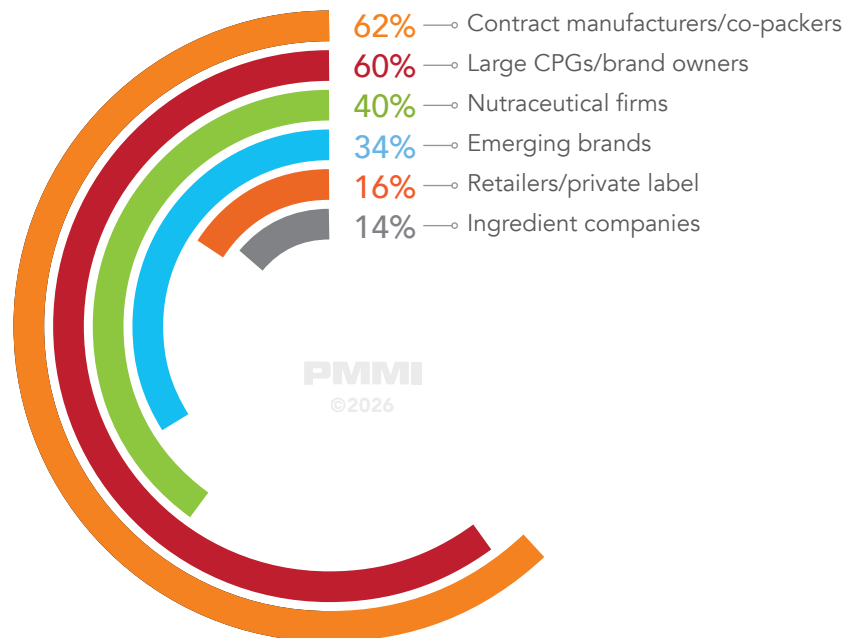
CO-PACKERS AND LARGE CPGs LEAD EQUIPMENT DEMAND

OEMs report that demand for equipment capable of handling enhanced formulations extends across multiple customer types. Contract manufacturers/co-packers are the most frequently cited source of demand (62%), closely followed by large CPGs/brand owners (60%). This indicates that both brand owners and their outsourced production partners are seeking equipment that can support more complex formulations.

Nutraceutical firms are also a notable source of demand (40%), while emerging brands account for 34%. Retailers/private-label manufacturers (16%) and ingredient companies (14%) are less frequently cited as sources of demand.

OEM PERSPECTIVE:

Which customer segments are generating the most demand for equipment supporting enhanced formulations? (choose all that apply)



We have seen a lot of trends...A lot more co-packers. We see big brands asking co-packers to take care of it. And for us, it translates into having more flexible equipment, equipment that can pass different packages, different bottle size, different bottle shapes. But maybe after a year or two they will need to make something for another big brand."

Managing Director, OEM

When you talk about a line that has to change over two to three to maybe even four times per shift, then it becomes more of a pit stop style changeover...They literally need to change over in minutes and change from one product to another or one package to another."

Vice President, OEM



2

PRODUCT AND INGREDIENT IMPACT

Enhanced formulations can alter texture, moisture sensitivity, stability, flow, and ingredient compatibility, creating particular challenges when working with dairy proteins, multi-ingredient blends, beverages and powders. These challenges can extend from formulation through processing and packaging.

ENHANCED FORMULATIONS MOST STRONGLY AFFECT TEXTURE, FOLLOWED BY MOISTURE SENSITIVITY, STABILITY, AND PARTICULATE SUSPENSION

Overall, enhanced formulations do not create a single, isolated production issue; rather, they affect multiple product characteristics and behaviors that can have downstream implications for processing, handling, filling, packaging, and quality control. Texture/mouthfeel is the most commonly reported characteristic affected “a lot” or “a great deal,” cited by 59% of End Users.



If I think back to when we started making it, it was a much thicker product and we destroyed a lot of equipment because it was so much thicker and getting it out of the tank and into the cup required significantly different pressures.”

Director of Engineering and Innovation, *End User*

Moisture sensitivity is also a concern, with 44% of End Users reporting a lot or a great deal of impact. Stability/separation and particulate suspension are close behind at 42% each, while 37% report a lot or a great deal of impact on viscosity/flowability. Shelf life, heat sensitivity, and foaming are affected to a lesser extent.



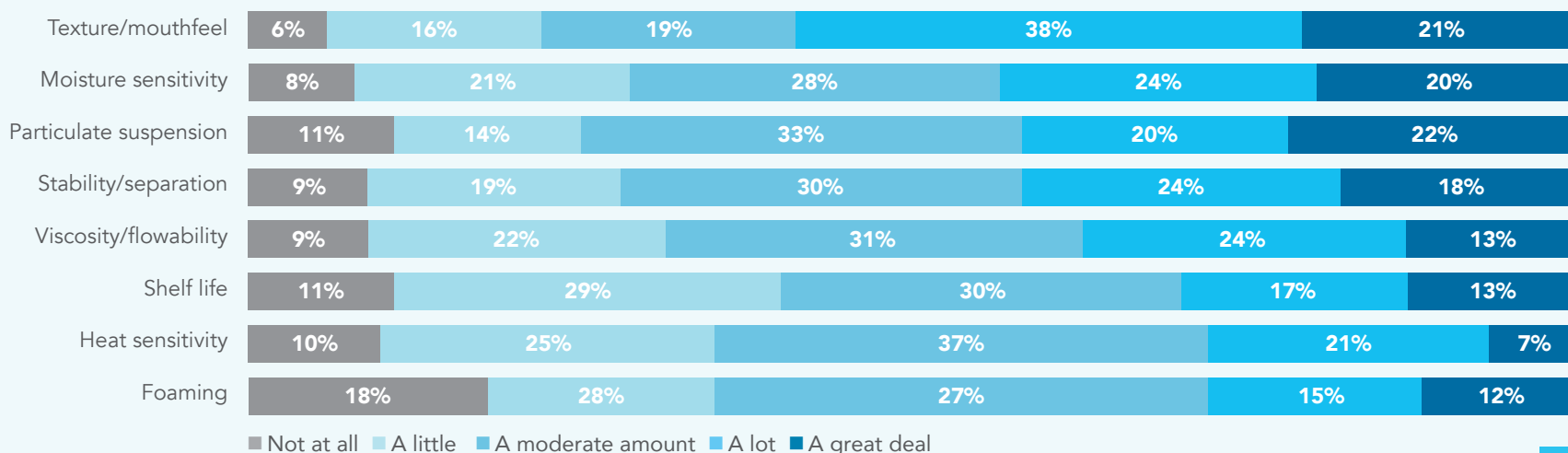
Powders can be sensitive to moisture and that moisture level can affect how a product is sealed or how a product is stored or even the integrity of a pouch.”

Vice President of Operations, *End User*

What I’ve seen so far is some of the ingredients for stability or blending purposes, how do they stay? Does it separate out? Does it stay in suspension?”

Engineering Manager, *End User*

END USER PERSPECTIVE: How much do enhanced nutritional formulations affect each of the following product characteristics?



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CLUMPING, DUSTING, AND MOISTURE SENSITIVITY ARE THE LEADING SOURCES OF MANUFACTURING COMPLEXITY

End Users identify a broad range of ingredient properties that can complicate production, with clumping and dust generation the most commonly cited challenges. Nearly half (46%) say clumping/dust generation creates manufacturing complexity. Moisture sensitivity follows at 39%, reinforcing the difficulty of keeping ingredients stable, free-flowing, and consistent during storage and processing.

Roughly one in three End Users cite ingredient interaction/incompatibility (34%), poor solubility and stickiness (33% each), the need for precise dosing (32%), and microbiological sensitivity (31%) as characteristics that create manufacturing complexity. Fine or inconsistent particle size and heat sensitivity are less frequently cited but still affect around one-quarter of End Users.



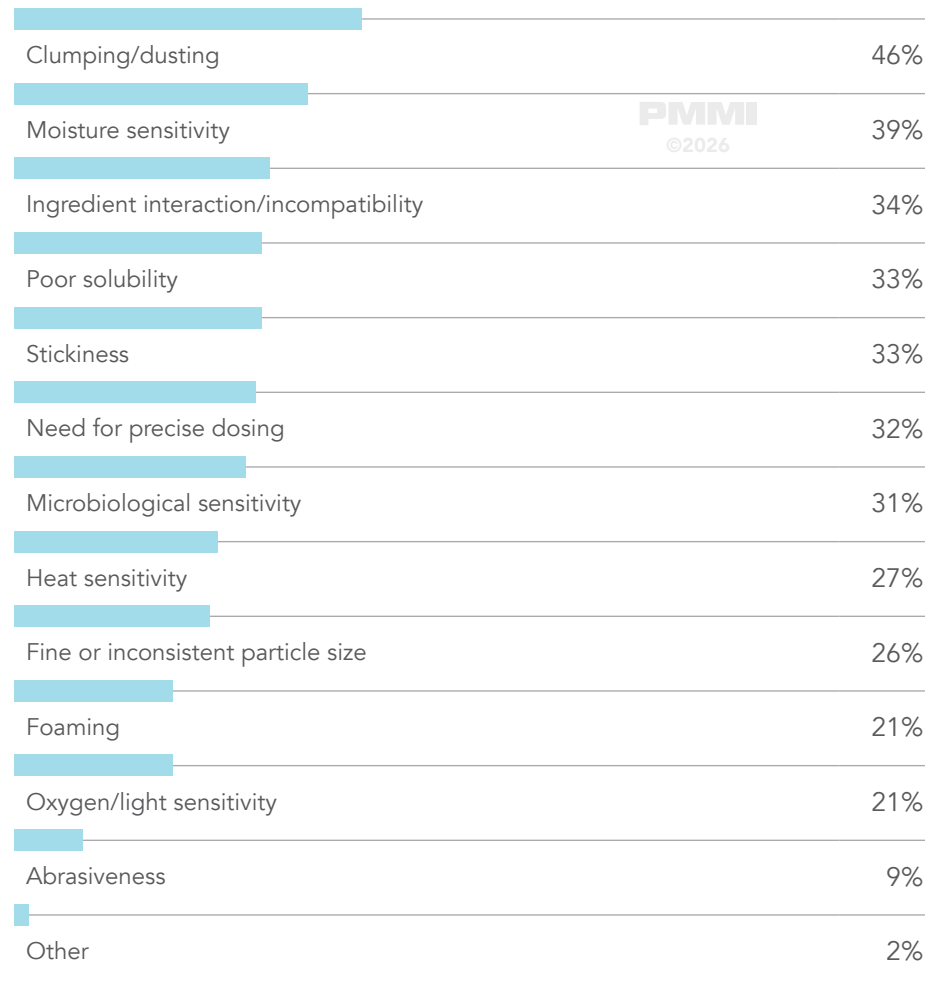
Certain probiotics which might have lesser flow characteristics or not flow as freely as a sugar-based product may clump up. It still runs, but it may clump up and create additional sanitation work or where product may be caught in the machine.”

Vice President of Operations, *End User*

Manufacturing complexity stems from both how ingredients physically behave (clumping, sticking or poor solubility) and other characteristics that require careful management, including dosing requirements, microbiological sensitivity, and compatibility with other ingredients. These challenges can affect ingredient handling, mixing, product consistency, sanitation, and line efficiency.

END USER PERSPECTIVE:

Which ingredient characteristics create the greatest manufacturing complexity? (choose all that apply)



DAIRY PROTEINS LEAD PRODUCTION CHALLENGES; COMPLEX BLENDS ADD COMPLEXITY

Production complexity is driven both by individual ingredients with challenging properties and by formulations that combine multiple functional components into a single product.

Whey/dairy proteins stand out as the most commonly cited challenging ingredient category, identified by 51% of End Users. This may reflect difficulties related to solubility, foaming, heat sensitivity, viscosity, and equipment cleaning.



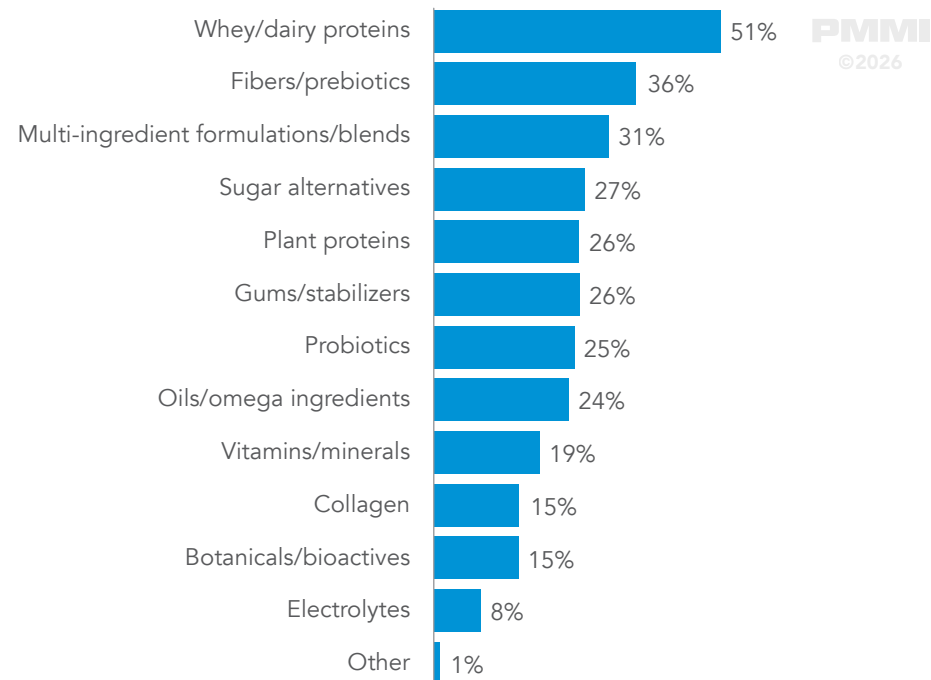
There's specific heating requirements, pasteurizing requirements. Once it's pasteurized, it needs to be cooled and then packaged, filled and packaged. And that can create some challenges for the specific packaging chosen."

Project Engineer, End User

Fibers/prebiotics rank second, identified by 36% of End Users, followed by multi-ingredient formulation/blends at 31%. Combining ingredients can introduce competing processing requirements, interactions, or incompatibilities that add complexity beyond handling individual ingredients. Other ingredients cited as creating production challenges include sugar alternatives (27%), plant proteins and gums/stabilizers (26% each), and probiotics (25%).

END USER PERSPECTIVE:

Which ingredients or formulation categories present the greatest production challenges? (choose all that apply)



So what if I put those diced peaches in the yogurt? Well, that would be great. That would be cool. But that size piece probably doesn't fit through the nozzle in the yogurt filler and it may tend to plug or it might be hard to clean."

Director of Engineering and Innovation, End User

BEVERAGES CHALLENGE PRODUCTION; POWDERS LEAD EQUIPMENT MODIFICATIONS

End Users most often identify ready-to-drink beverages (42%) and powders/stick packs/sachets (41%) as creating the greatest processing/packaging challenges. Among OEMs, powders/stick packs/sachets (47%) are most frequently cited as creating the greatest equipment modification challenges, followed by frozen or refrigerated meals (40%) and dairy products (33%).

The formats creating the greatest processing and packaging challenges for End Users are not necessarily the same as those creating the greatest equipment modification challenges for OEMs. Powders/stick packs/sachets stand out across both measures, ranking near the top for both processing/packaging challenges and equipment modification challenges.



Ready-to-drink beverages will be the hardest, I would say... For RTDs, you are going through a pasteurization process. Whatever process you're going through, pasteurization, packaging, et cetera, all of this would need to be completely revamped."

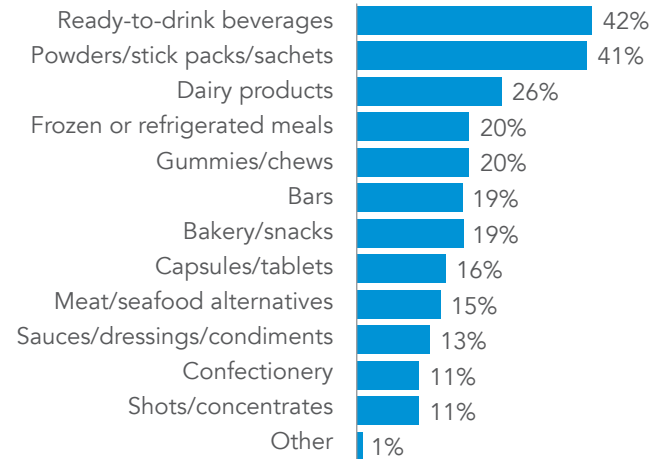
Regional QA Manager, End User

Powder stick packs can be challenging to package and have good seals. It is effective and a good source of revenue, but the machinery used takes a long time to clean. Bulk packaging is best but for retail sticks it is much more complicated, and you need experienced machine operators."

Regional QA Manager, End User

END USER PERSPECTIVE:

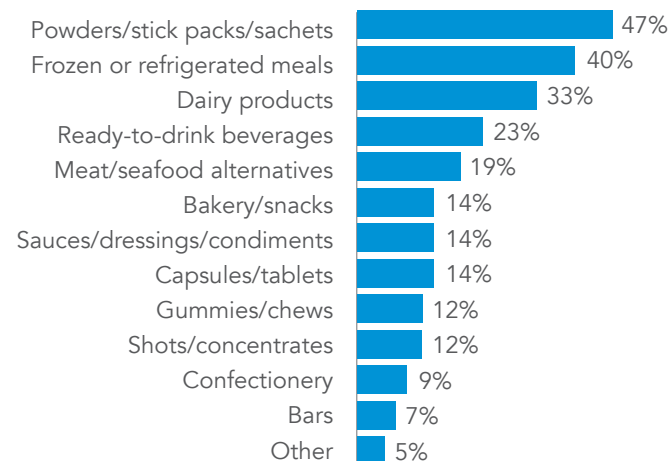
Which product formats create the greatest processing or packaging challenges? (choose up to five)



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OEM PERSPECTIVE:

Which product formats create the greatest equipment modification challenges? (choose up to five)



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3

MANUFACTURING IMPLICATIONS

Enhanced formulations affect the full production line, but the greatest pressure falls on core processing activities, led by mixing/blending, followed by dosing and thermal processing. End Users often respond first through process adjustments before pursuing equipment changes. Greater SKU variety, smaller runs, and more frequent changeovers are increasing the need for flexibility.

FORMULATION COMPLEXITY SPANS PRODUCTION, WITH MIXING AND DOSING MOST AFFECTED

The impact of enhanced formulations extends across the production line but is concentrated in core processing activities. Nearly two-thirds of End Users (63%) say mixing/blending is affected, making it the most commonly cited process. Dosing/metering (41%) and cooking/thermal processing (39%) follow. Cleaning/sanitation/CIP is also affected for roughly one-third of End Users (34%), while powder handling and line changeovers are each cited by 32%.

The impact extends beyond these core processing activities. Ingredient handling/storage (29%), inspection/quality control (26%), and depositing/filling (25%) are also affected, indicating that formulation changes can influence multiple stages of production.

Packaging material selection (14%) and sealing (12%) are less frequently cited, suggesting that formulation changes have a more pronounced impact on core processing activities than on these packaging-related processes.



Starting with the cleaning, heat treatment, actual heat treatment in the product as well... and then finished product packaging... Storage properties, actual cleaning of the equipment, and then processing parameters all needs to be modified."

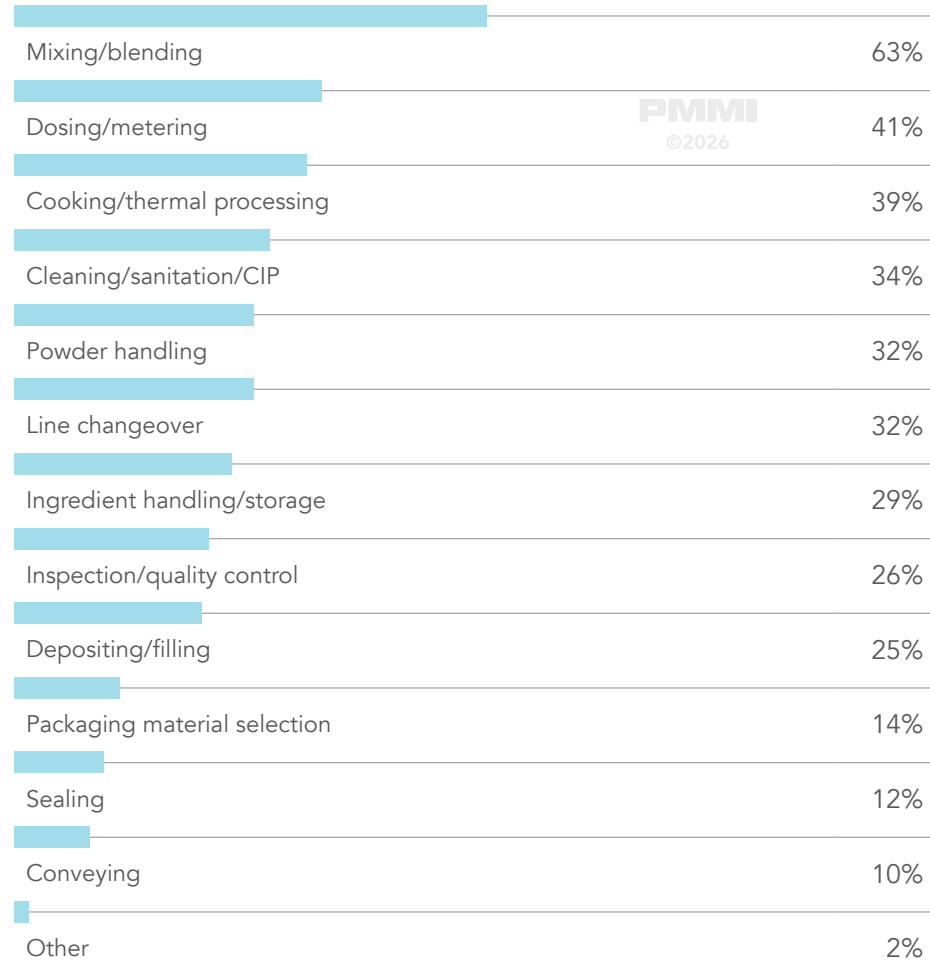
Regional QA Manager, End User

Shelf life and water activity goes hand in hand... Heat treatment when the protein is sensitive to heat, any protein, whether it's dairy, non-dairy, soy, wheat, milk, all of that will have some heat sensitivity."

Regional QA Manager, End User

END USER PERSPECTIVE:

What production processes are most affected by enhanced formulations? (choose all that apply)



MANUFACTURING PROCESS ADJUSTMENTS OFTEN COME BEFORE EQUIPMENT CHANGES

Nearly all End Users (97%) report making manufacturing process adjustments at least sometimes when producing products with enhanced formulations. More than half of End Users (52%) say adjustments are needed often or always, while another 45% say they are needed sometimes. OEMs report a different pattern for equipment changes: 43% say customers sometimes require equipment modifications or new capabilities because of enhanced formulations, while only 4% say this occurs often. More than half say these requests occur rarely (37%) or never (16%).

Together, the findings suggest that formulation-related changes are more commonly managed through manufacturing process adjustments than through equipment modifications or new capabilities. End Users may first address formulation challenges through adjustments to existing processes and procedures before pursuing equipment changes, which may help explain why End Users report stronger operational impacts than OEMs report equipment-related impacts.



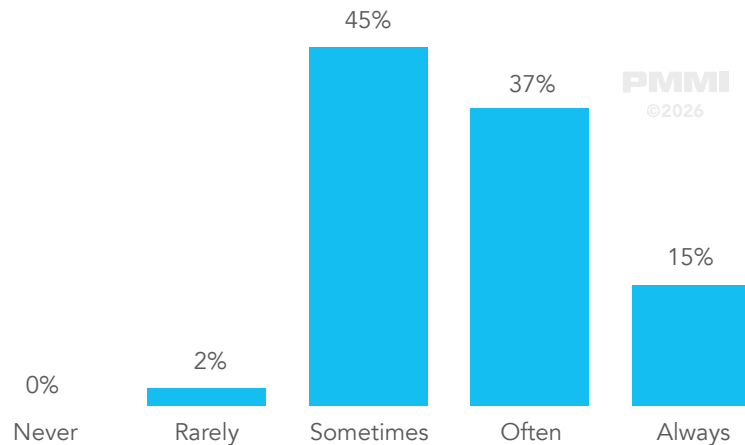
First and foremost, instead of buying new equipment, we see if we can modify—change the cleaning parameters, the time or temperature, chemical concentrations...The second step would be to buy a modification or something that will overcome those challenges...Buying new equipment would be the last resort because it's an investment."

Regional QA Manager, End User

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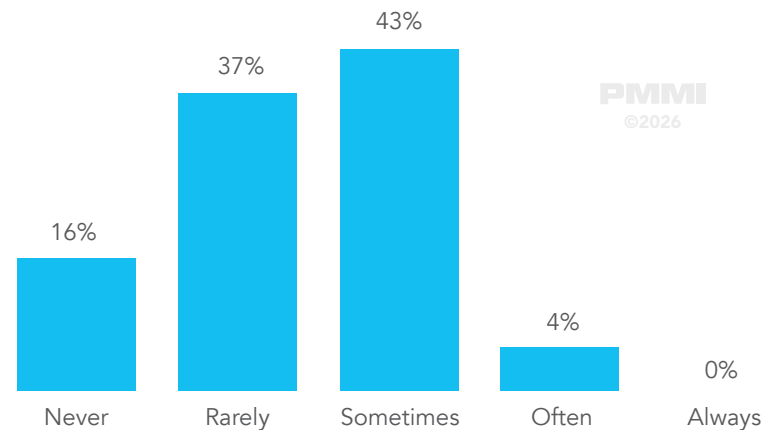
END USER PERSPECTIVE:

When producing enhanced formulations, how often are manufacturing process adjustments required?



OEM PERSPECTIVE:

How often do customers require equipment modifications or new capabilities specifically because of enhanced nutritional formulations?



ENHANCED FORMULATIONS ARE DRIVING GREATER PRODUCTION FLEXIBILITY

Enhanced formulation trends are contributing to greater product variety, shorter runs, and more frequent product changes. Nearly half of End Users report smaller production runs (47%) and increased SKU complexity (47%), while 43% report more pilot/testing runs. More customized packaging formats (41%) and more frequent product reformulations (38%) are also frequently cited.

OEMs see the effects somewhat differently among their customers. More frequent changeovers and a greater need for flexible equipment are the most commonly cited impacts, each reported by 44% of OEMs.

The largest differences between End Users and OEMs appear in increased SKU complexity (47% vs. 26%), more pilot/testing runs (43% vs. 20%), and more frequent reformulations (38% vs. 26%). The findings suggest that End Users more often report impacts related to product variety, testing, and reformulation, while OEMs most often observe customer needs for more frequent changeovers and flexible equipment.

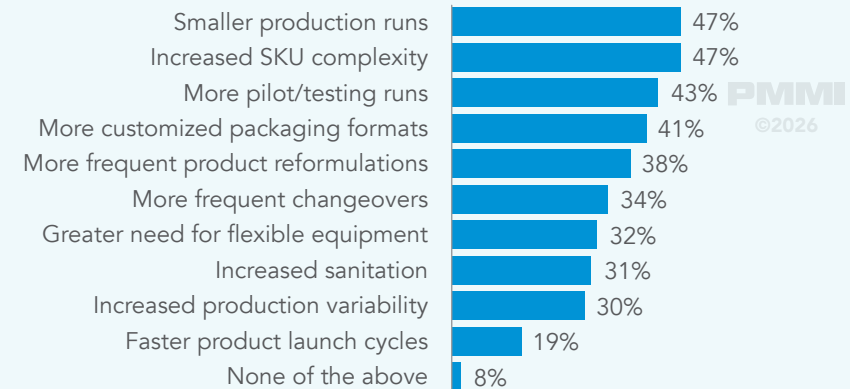


Partially because of doing a lot of different formulation changes, they're (customers are) doing a lot more like pilot runs, a lot more changeovers and a lot more trying to be flexible in what they produce."

Senior Product Manager, OEM

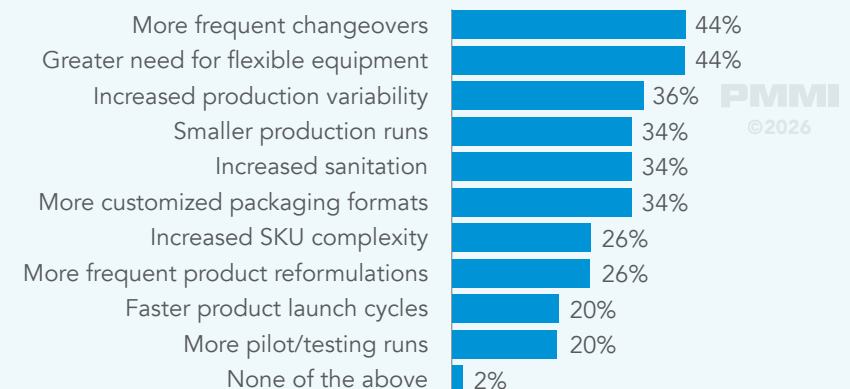
END USER PERSPECTIVE:

How are enhanced nutritional or functional product trends affecting your operations? (choose all that apply)



OEM PERSPECTIVE:

Based on what you see among customers, how are enhanced nutritional or functional product trends affecting processing and packaging operations? (choose all that apply)





4

OPERATIONAL CHALLENGES

Enhanced formulations create their greatest challenges in day-to-day production, increasing demands on mixing, ingredient flow, sanitation, quality control, and line efficiency. Equipment changes are less common but remain important where existing systems lack the flexibility to support new products, shorter runs, and frequent changeovers without significant modification.

ENHANCED FORMULATIONS CHALLENGE PRODUCTION PERFORMANCE AND CREATE OPPORTUNITIES FOR EQUIPMENT IMPROVEMENTS

The most common challenge for End Users is mixing, blending, or handling challenging ingredients (57%) such as powders, particulates, and high-viscosity products. This is the most commonly reported challenge by a wide margin, reinforcing that enhanced formulations place significant demands on core production processes.

Other challenges show how formulation complexity can ripple through day-to-day operations. Increased cleaning and sanitation requirements are cited by 38% of End Users, while 36% report greater quality control, validation, or process monitoring requirements. Clogging, bridging, or ingredient flow issues and reduced line speed or throughput are each cited by 30%, highlighting challenges related to both product flow and production efficiency.

Product waste or yield loss (24%), ingredient dusting or loss during processing (21%), and inaccurate dosing or metering (18%) are less frequently cited. Together, these findings suggest that enhanced formulations can require more operational oversight and tighter process control to maintain consistency, productivity, and product quality.

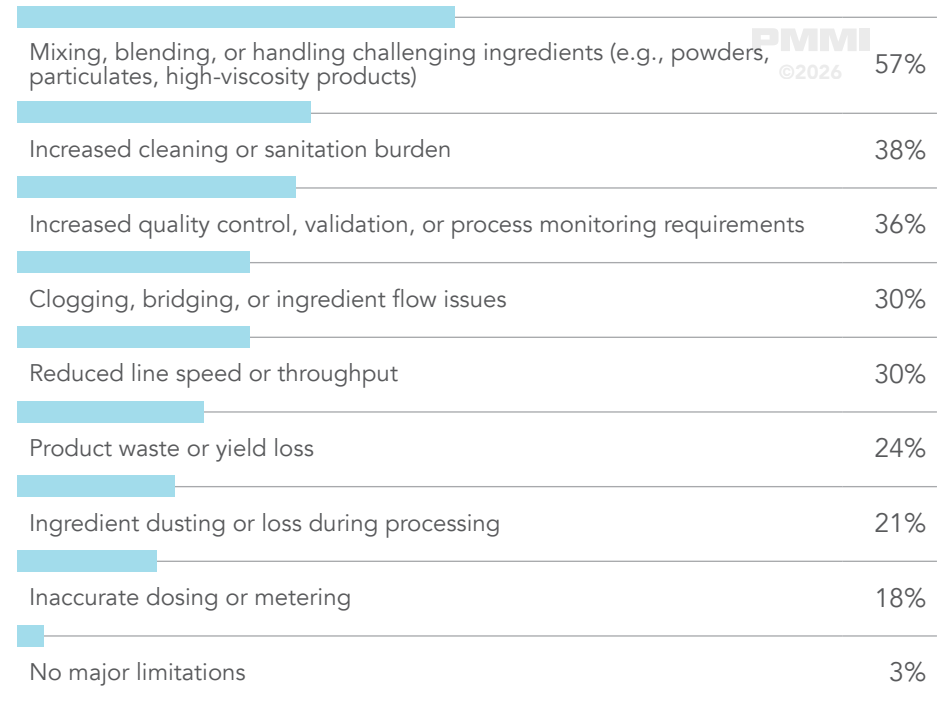


Getting a sticky, fairly large piece size into a small bottle opening—I joke that literally the bottleneck is the bottleneck, quite literally. We actually have to string them out in order to basically get them to go into the bottle one at a time, but still do that at a high rate of speed.”

Vice President, OEM

END USER PERSPECTIVE:

What operational or equipment-related challenges, if any, do you encounter with current equipment when manufacturing products with enhanced nutritional or functional formulations? (choose all that apply)



EQUIPMENT FLEXIBILITY CAN STRENGTHEN THE CASE FOR EQUIPMENT UPGRADES

Existing equipment presents challenges for some End Users as production requirements become more varied. More than one-third of End Users (36%) report increased quality control, validation, or process monitoring requirements. Nearly one-quarter (24%) cite limited ability to accommodate new products or packaging formats without equipment modifications, while 23% report longer downtime for product or format changeovers.

These findings point to flexibility and changeover efficiency as notable equipment limitations, particularly as End Users manage greater product variety and changing formats.

These limitations also suggest potential opportunities for equipment investment. As product variety, shorter runs, and more frequent changeovers place greater demands on existing systems, constraints in flexibility and changeover efficiency may strengthen the case for equipment modifications, upgrades, or new equipment.

END USER PERSPECTIVE:

What operational or equipment-related challenges, if any, do you encounter with current equipment when manufacturing products with enhanced nutritional or functional formulations? (choose all that apply)

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Increased quality control, validation, or process monitoring requirements	36%
Limited ability to accommodate new products or packaging formats without equipment modifications	24%
Current equipment requires longer downtime for product or format changeovers	23%
No major limitations	3%



[End Users] want to have more variety...reacting faster; having better, more consistent quality; improving traceability; being safer; being more flexible and being able to be cleaned more."

Senior Product Manager, OEM



When we buy a new piece of capital equipment it needs to be flexible enough and easy enough to change over and operate that we can supply products to many different customers without large capital investments."

Open Ended Survey Response, End User



It's just a number of different powders and densities and flow characteristics that have been developed. And everybody wants to run that through one filling machine."

Vice President, OEM



5

EQUIPMENT AND INVESTMENT RESPONSE

As formulation complexity grows, End Users are responding with equipment purchases, automation, and targeted line modifications to improve safety, performance, and flexibility. Investment is currently concentrated in processing, while future equipment is expected to emphasize automation, real-time monitoring, data integration, and multi-format flexibility.

FOOD SAFETY AND HYGIENE LEAD END USER PRIORITIES, WHILE OEMS PRIORITIZE THROUGHPUT AND FLEXIBILITY



End Users place the greatest importance on food safety and regulatory compliance (93%) and hygienic/sanitary design (88%), followed by precise dosing/metering (84%) and throughput and production efficiency (80%). OEMs share the emphasis on food safety and hygienic design, but their priorities shift toward operational performance. Throughput and production efficiency (92%) ranks first overall, followed by rapid changeovers and flexible manufacturing (91%), while seal integrity/package compatibility (88%) also ranks among leading needs.

Overall, End Users place greater emphasis on protecting and controlling the product and process, while OEMs place more emphasis on keeping equipment productive and adaptable across changing production requirements.



There's the flexibility, the changeability, the throughput changes and the cleanliness and sterilization. All of those are just the recurring, repeated asks."

Senior Product Manager, OEM

Cleanability is a big one for us. And a lot of times it's not at the forefront for the equipment OEM. It's usually, 'Hey, we made this equipment and it makes the product and then now how do we clean it?' versus let's put the thinking upfront and design the equipment so that you are able to clean it. And this isn't the case for every OEM, but for a lot of the OEMs, this is a challenge."

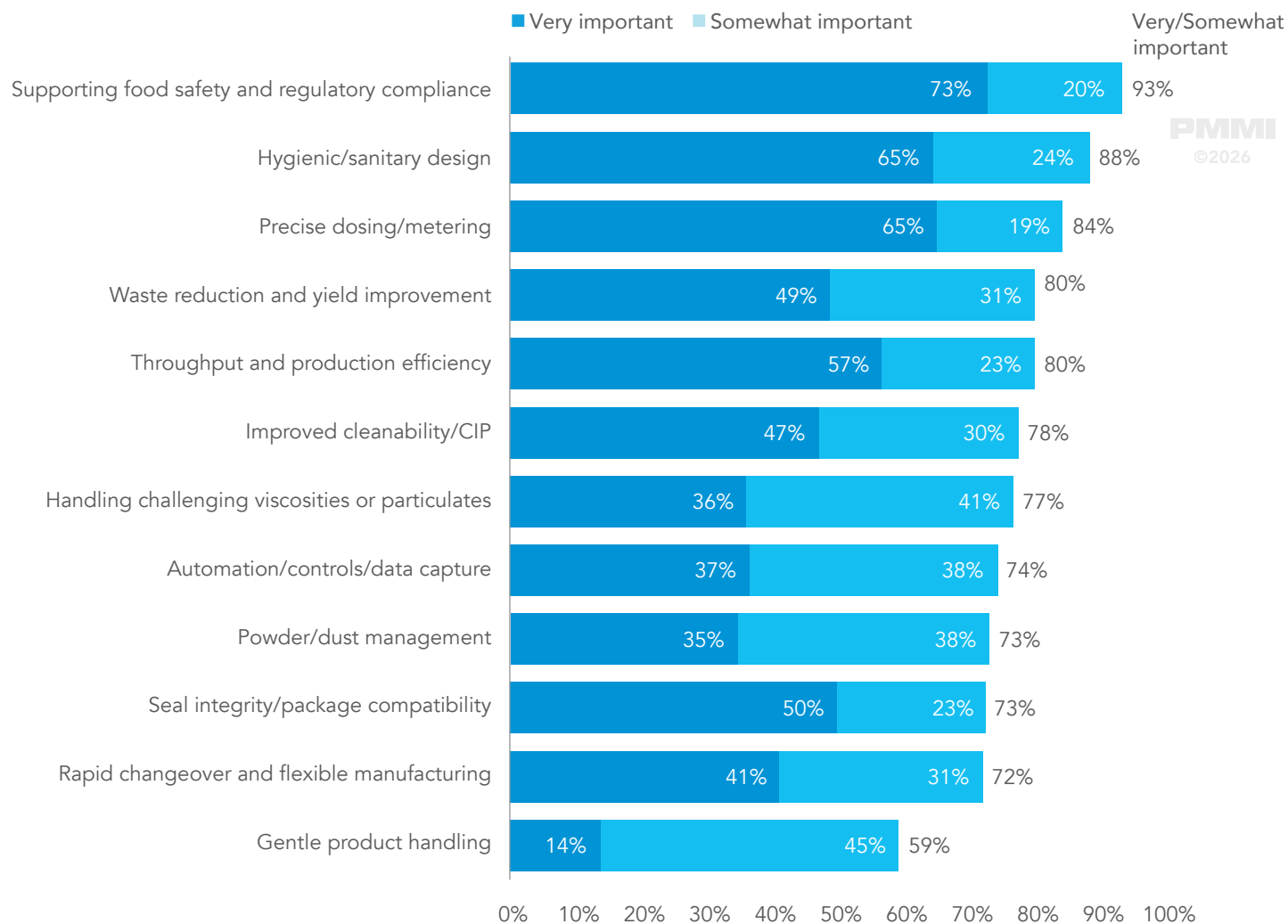
Project Engineer, End User

From a sanitation standpoint, more rigorous cleanings. So the CIPs were definitely modified for a higher soil load."

Vice President, End User

END USER

How important are the following equipment capabilities or performance requirements when manufacturing products with enhanced nutritional formulations?

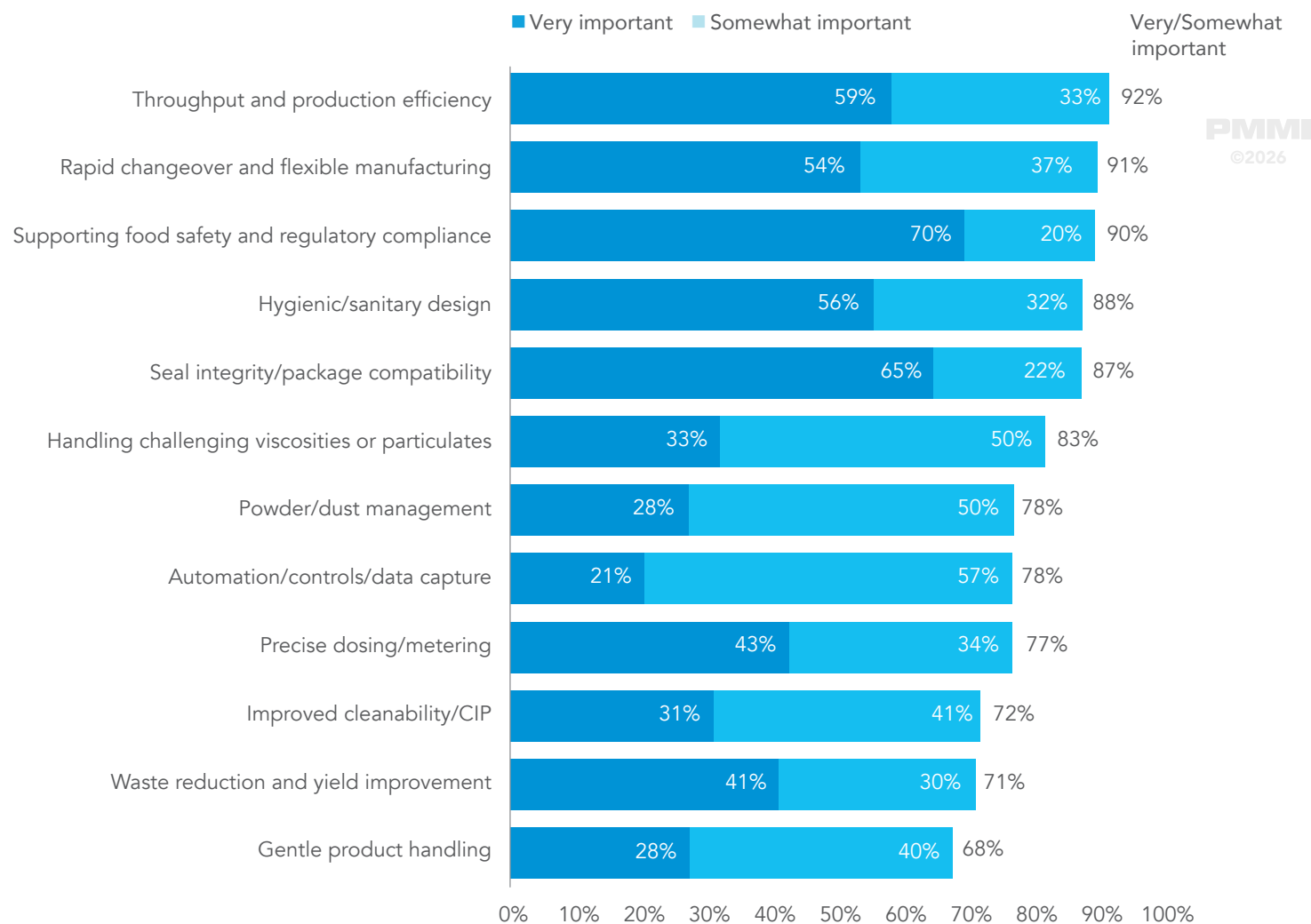


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*Refer to additional data (pg 38)

OEM

How important are the following equipment capabilities and performance requirements when supporting products with enhanced nutritional formulations?



*Refer to additional data (pg 39)

FLEXIBILITY IS THE LEADING EMERGING EQUIPMENT NEED

Equipment flexibility is the leading requirement OEMs see customers increasingly requesting, cited by two-thirds (67%) of respondents. The emphasis is on equipment that can accommodate multiple products and formulations.

Reduced changeover time ranks second (39%), reflecting the need to move efficiently among smaller runs, more SKUs, and frequently reformulated products. Hygienic/ sanitary design (37%) and improved controls/automation/data capture (35%) are also becoming more common customer requirements.

These evolving requirements may strengthen the case for equipment investment, where existing systems cannot provide the flexibility, changeover efficiency, sanitation capabilities, or controls needed to accommodate changing production demands. For OEMs, flexibility stands out as a key opportunity for equipment upgrades and new system development.



As they come up with new formulations and people keep buying all these different types of pre-workout, recovery, gainer-type products, they do really just need a line that is super flexible and can change over very, very quickly."

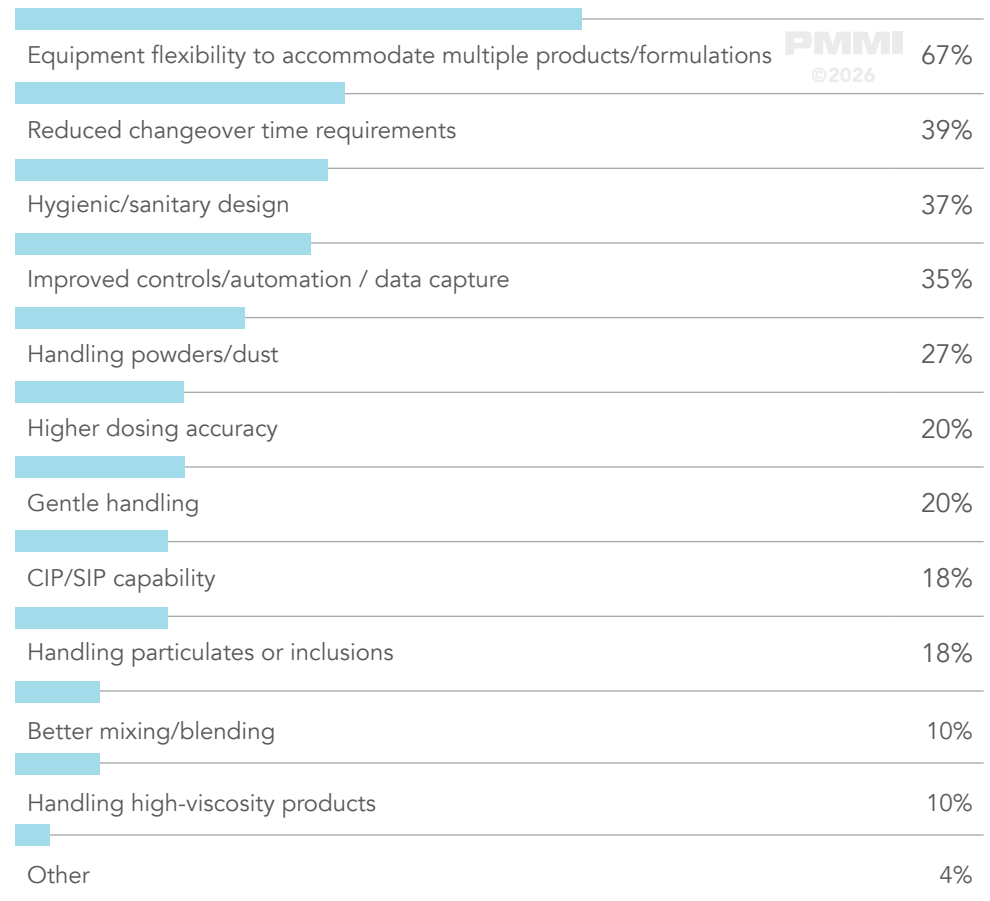
Vice President, OEM

Need for flexibility to be able to run different ingredients or products on the equipment/ production line."

Open Ended Survey Response, End User

OEM PERSPECTIVE:

Which equipment or system requirements are customers increasingly requesting because of enhanced formulations? (choose up to five)



ENHANCED FORMULATIONS ARE DRIVING EQUIPMENT INVESTMENT

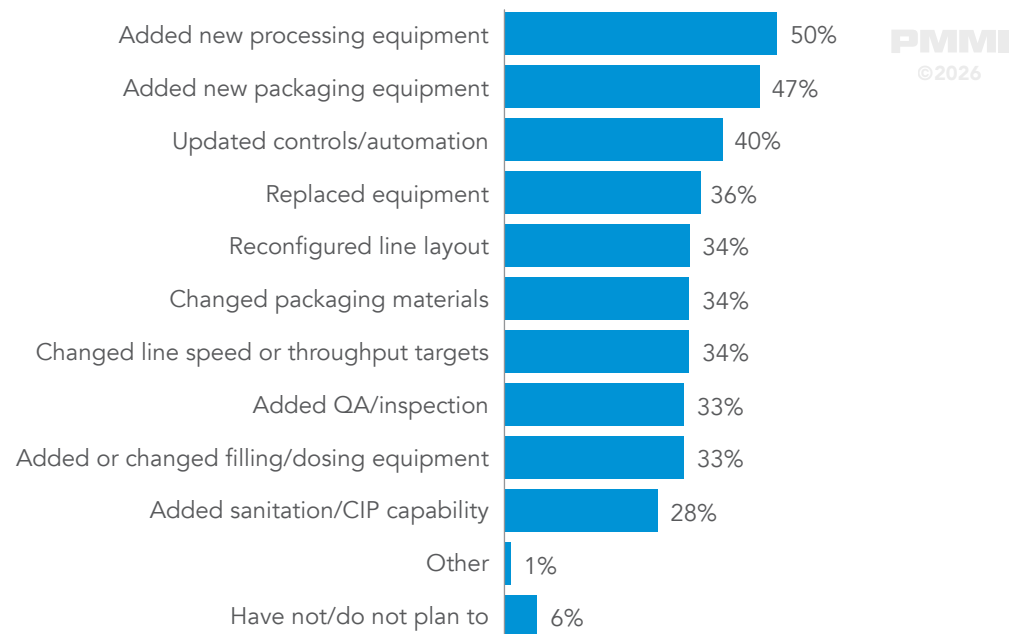
Enhanced formulations are prompting changes across both processing and packaging operations. Half of End Users have added or plan to add new processing equipment, while nearly as many (47%) report adding new packaging equipment. More than one-third (36%) have replaced or plan to replace equipment.

End Users are also adapting existing operations through automation and targeted line modifications. Four in ten (40%) have updated or plan to update controls/automation. Roughly one-third have made or plan to make other changes, including reconfiguring line layouts (34%), changing packaging materials (34%), adjusting line speed or throughput targets (34%), adding QA/inspection capabilities (33%), and adding/modifying filling and dosing equipment (33%).

Together, these findings point to meaningful equipment investment alongside modifications to existing operations. End Users are using a mix of new equipment, automation, layout changes, and targeted line modifications to accommodate changing production needs. Only 6% say they have not made and do not plan to make any of the listed changes.

END USER PERSPECTIVE:

Which of the following modifications have you made in the past 24 months or plan to make in the next 24 months? (choose all that apply)



I think it's more on the upfront side on the processing side and the primary packaging side where these people are going to see much more changes."

COO, OEM



We've actually invested in the sonication and everything else, so we can emulsify pretty much anything at this point within reason...[OEMs] really played the biggest role in getting us the right equipment, the right sized equipment, the training on the equipment, and the right price really."

Vice President, End User

ENHANCED FORMULATIONS ARE HAVING A GREATER EFFECT ON PROCESSING INVESTMENT THAN PACKAGING INVESTMENT

Enhanced formulation trends are influencing capital decisions across both processing and packaging, with a stronger impact on processing equipment. More than half of End Users (56%) say these trends are increasing processing equipment investment over the next three years, including 22% who expect a significant increase. By comparison, 47% expect packaging equipment investment to increase, including 13% who anticipate a significant increase.

Even when enhanced formulations are not increasing total investment, they are influencing investment priorities. About one-third of End Users report changes in investment priorities for processing equipment (35%) and packaging equipment (34%).

Overall, 90% of End Users report that enhanced formulations are either influencing investment priorities or increasing investment in processing equipment, while 81% say the same for packaging equipment. These findings suggest that formulation trends are influencing both the level of investment and investment priorities, with the stronger effect on processing equipment.



The investment was on creating the right raw material out of the raw material, so the emulsification. That was a pretty hefty investment, but it did give us the infrastructure to do a lot more."

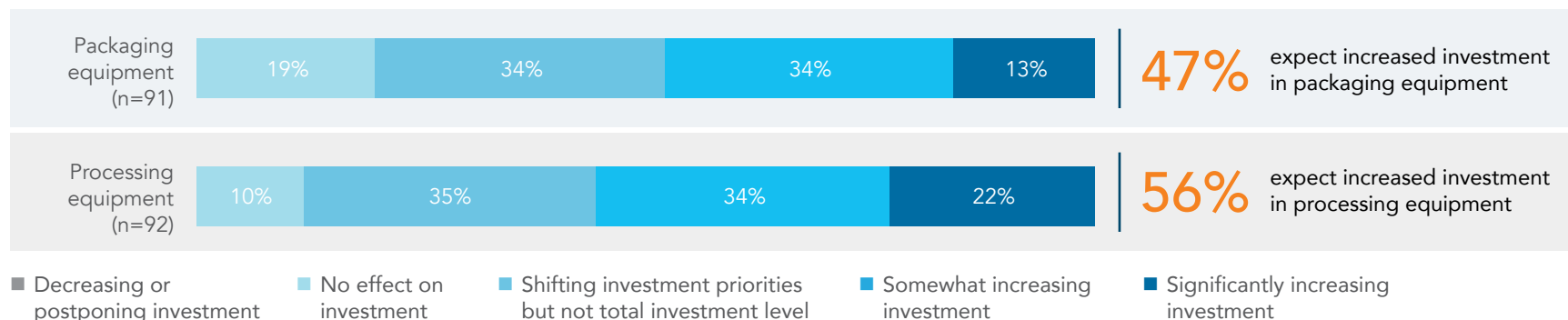
Vice President, *End User*

Some of them just try to make it work with existing machines, and then they finally get to the point where they're frustrated and they need to talk about something new."

Vice President, *OEM*

END USER PERSPECTIVE:

How are enhanced formulation trends influencing your organization's capital investment in packaging and/or processing equipment over the next three years?



JUST OVER HALF OF END USERS EXPECT FORMULATION-RELATED EQUIPMENT INVESTMENT TO REACH AT LEAST \$500,000

Expected capital investment related to enhanced formulations varies across End Users, with just over half (51%) expecting to invest at least \$500,000 in related processing or packaging equipment over the next three years. One-third (33%) anticipate investments of \$1 million or more. At the other end of the spectrum, 49% expect to invest less than \$500,000, including 15% who anticipate investing less than \$100,000.

Combined with the range of equipment and line changes reported by End Users, these investment levels point to opportunities ranging from targeted modifications and upgrades to major equipment purchases.



If an entire line is designed around a slower speed, then when they have a higher demand, the entire line has to change...Now they have to update more equipment on the line in order to meet the higher demands."

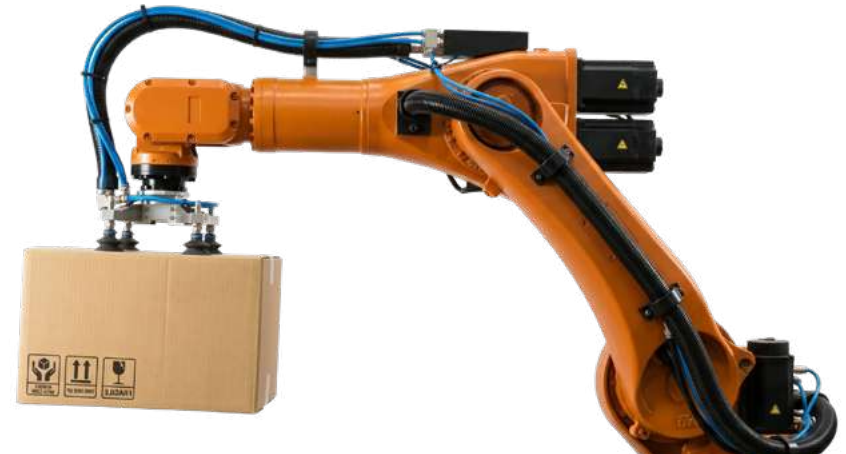
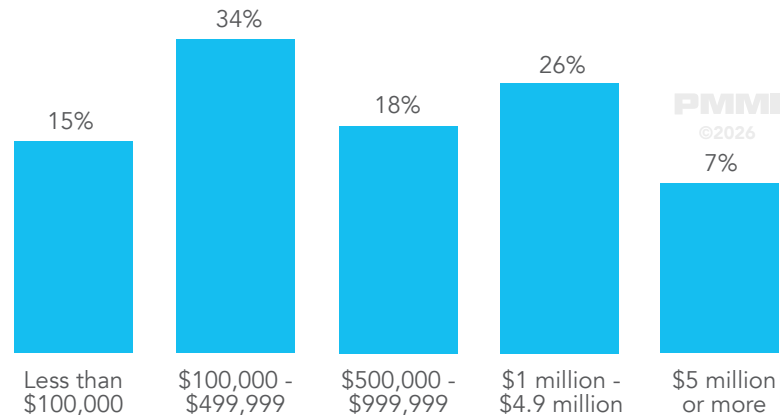
Vice President, OEM

If I have 10 machines doing the same thing and we want to run this on 10 machines, that can be a significant disruption and cost, or we're just going to modify one or two machines and start and see how it goes."

Director of Engineering and Innovation, End User

END USER PERSPECTIVE:

What is your expected capital investment range for processing/packaging equipment related to these products over the next three years?



OEMS SEE THE GREATEST INNOVATION OPPORTUNITIES IN INTELLIGENT, MULTI-FORMAT EQUIPMENT

OEMs see the greatest equipment innovation opportunities in systems that offer greater intelligence, adaptability, and visibility into production. AI/process optimization leads the list, cited by nearly half of OEMs (48%), followed closely by multi-format packaging capability (46%).

Real-time monitoring (39%) and automation/data integration (37%) also rank highly, highlighting opportunities for equipment that provides greater visibility, connectivity, and control over production. Hygienic design (35%), sustainable packaging compatibility (33%), and small-batch flexibility (30%) round out the leading opportunities.

Together, these priorities point to opportunities for OEMs to differentiate future equipment and upgrades by helping End Users manage greater product variety and production complexity with more flexibility, intelligence, and control.



I don't want to have to go through and retouch up my robot programming every single time any piece of equipment upstream or downstream changes. I want it to be able to just react in real time."

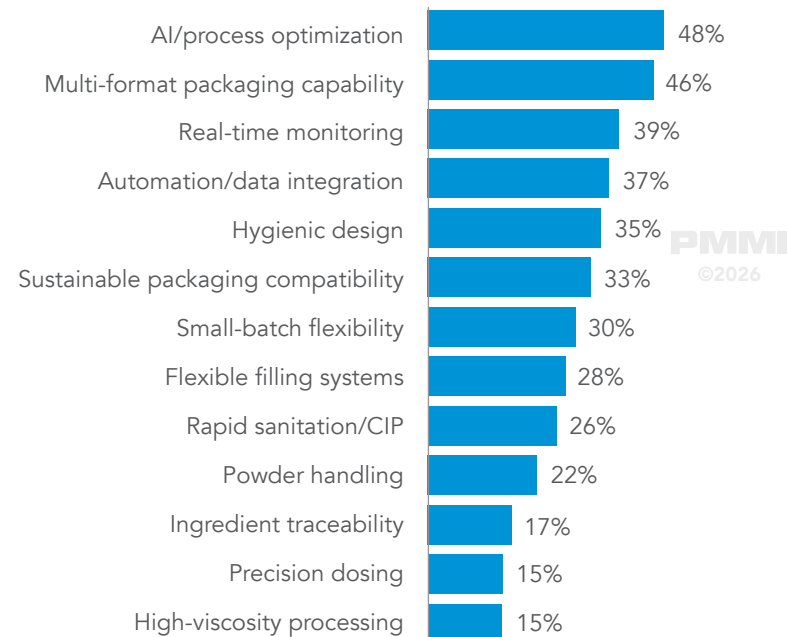
Senior Product Manager, OEM

When training AI models and creating associated logic, time is required. When businesses do not have the expertise or bandwidth, paid site visits are usually required."

Open Ended Survey Response, OEM

OEM PERSPECTIVE:

Which areas represent the greatest opportunity for equipment innovation over the next 3-5 years? (choose all that apply)



People keep innovating and customers seem to keep buying all sorts of different package sizes, product types, and it's the driver for people to invest in new equipment, but it's also the driver for us to try to keep pace with that."

Vice President, OEM



6

KEY IMPLICATIONS



KEY IMPLICATIONS



Design for greater production flexibility. More SKUs, shorter runs, reformulations, and frequent changeovers are increasing the value of equipment that can accommodate multiple products and formats with faster, more efficient changeovers.



Provide viable retrofit and upgrade paths. End Users often adapt existing processes before pursuing major equipment changes, creating opportunities for modular upgrades, automation, controls, and targeted modifications that extend existing equipment capabilities.



Help customers build the business case for equipment investment. Cleaning, downtime, reduced throughput, waste, and added quality control requirements can increase the operational burden of enhanced formulations. OEMs and suppliers can help customers evaluate when targeted modifications, upgrades, or new equipment may provide a more effective solution.



Prioritize solutions for processing-related challenges. Formulation complexity is most evident in mixing, dosing, ingredient handling, sanitation, and process control, and End Users expect a stronger investment impact on processing than packaging equipment.



Recognize the growing equipment opportunity. Half of End Users are adding or planning new processing equipment and nearly half are investing in packaging equipment. OEMs that address flexibility, changeovers, hygienic design, and formulation-specific processing challenges will be better positioned to support future customer investment.



Prepare for more intelligent and data-enabled production. OEMs see AI/process optimization, multi-format, real-time monitoring, and automation/data integration as leading innovation opportunities, pointing to growing demand for systems that provide greater flexibility, visibility, and control.

7

APPENDIX



END USER

How important are the following equipment capabilities or performance requirements when manufacturing products with enhanced nutritional formulations?

	Precise dosing/ metering	Gentle product handling	Hygienic/ sanitary design	Rapid changeovers and flexible manufacturing	Improved cleanability /CIP	Powder /dust management	Handling challenging viscosities or particulates	Seal integrity/ package compatibility	Automation controls/ data capture	Throughput and production efficiency	Waste reduction and yield improvement	Supporting food safety and regulatory compliance
Not at all important	2%	2%	2%	1%	2%	5%	3%	3%	2%	2%	1%	1%
Somewhat unimportant	6%	8%	2%	8%	2%	5%	2%	3%	8%	4%	4%	2%
Neither important nor unimportant	8%	30%	7%	19%	18%	17%	17%	20%	16%	13%	14%	3%
Somewhat important	19%	45%	24%	31%	30%	38%	41%	23%	38%	23%	31%	20%
Very important	65%	14%	65%	41%	47%	35%	36%	50%	37%	57%	49%	73%

OEM

How important are the following equipment capabilities and performance requirements when supporting products with enhanced nutritional formulations?

	Precise dosing/ metering	Gentle product handling	Hygienic/ sanitary design	Rapid changeovers and flexible manufacturing	Improved cleanability /CIP	Powder /dust management	Handling challenging viscosities or particulates	Seal integrity/ package compatibility	Automation controls/ data capture	Throughput and production efficiency	Waste reduction and yield improvement	Supporting food safety and regulatory compliance
Not at all important	2%	0%	0%	0%	2%	3%	3%	2%	2%	2%	2%	–
Somewhat unimportant	5%	4%	–	–	–	3%	3%	–	2%	–	2%	2%
Neither important nor unimportant	16%	28%	12%	10%	25%	18%	13%	10%	19%	6%	24%	8%
Somewhat important	34%	40%	32%	37%	41%	50%	50%	22%	57%	33%	30%	20%
Very important	43%	28%	56%	54%	31%	28%	33%	65%	21%	59%	41%	70%

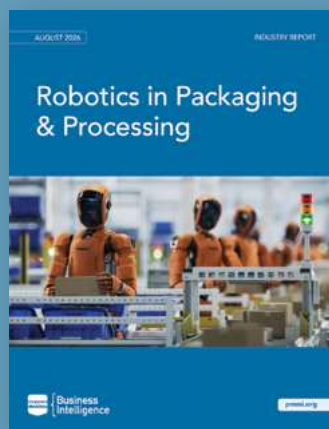


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