

Annual Additive Post-Processing Survey: Trends Report 2022

ANNUAL EDITION 2022

POSTPROCESS

INTRODUCTION

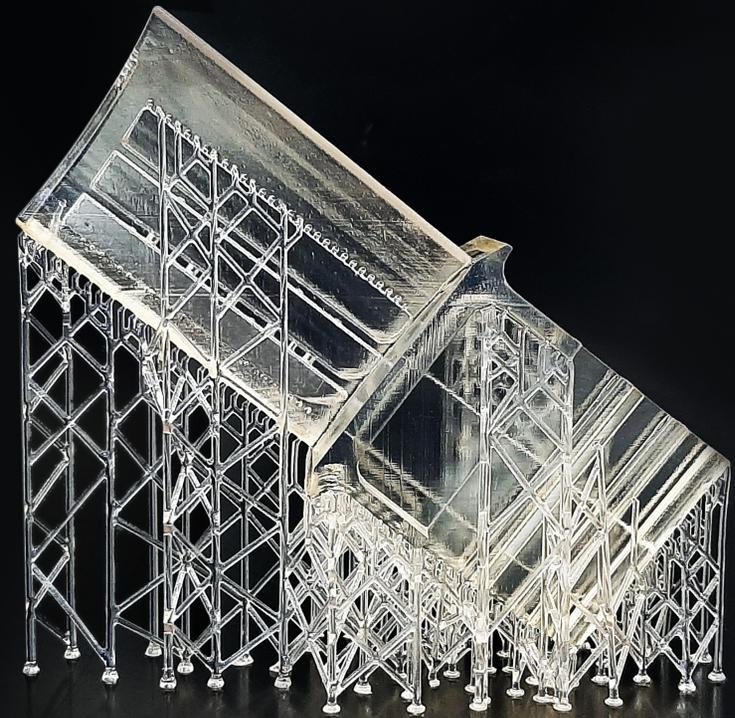
Welcome to the fourth Annual Additive Manufacturing Post-Processing Survey: Trends Report 2022. In this report of end-user survey data, we explore the often under-reported third step in Additive Manufacturing after the design and 3D printing steps - post-processing. This critical step includes several processes that are instrumental to getting to the final customer-ready 3D printed part.

Our goal in surveying the market and assembling this data is to help make clear the path towards a successful future for Additive Manufacturing (AM) by recognizing the downfalls, considerations, and opportunities when it comes to all aspects of post-processing.

Whether new to 3D printing or many years in, we hope that readers will find helpful takeaways that they can utilize for their own business planning.

This year's report provides new insights and angles but also confirms some of the most insightful learnings from the last three editions. The verification of these key points when looking at the data year over year is further confirmation of the validity of the report.

Thank you to everyone who took the time to share their valuable insights and opinions to compile this one-of-a-kind transcript.



3D PRINT TECHNOLOGY TRENDS

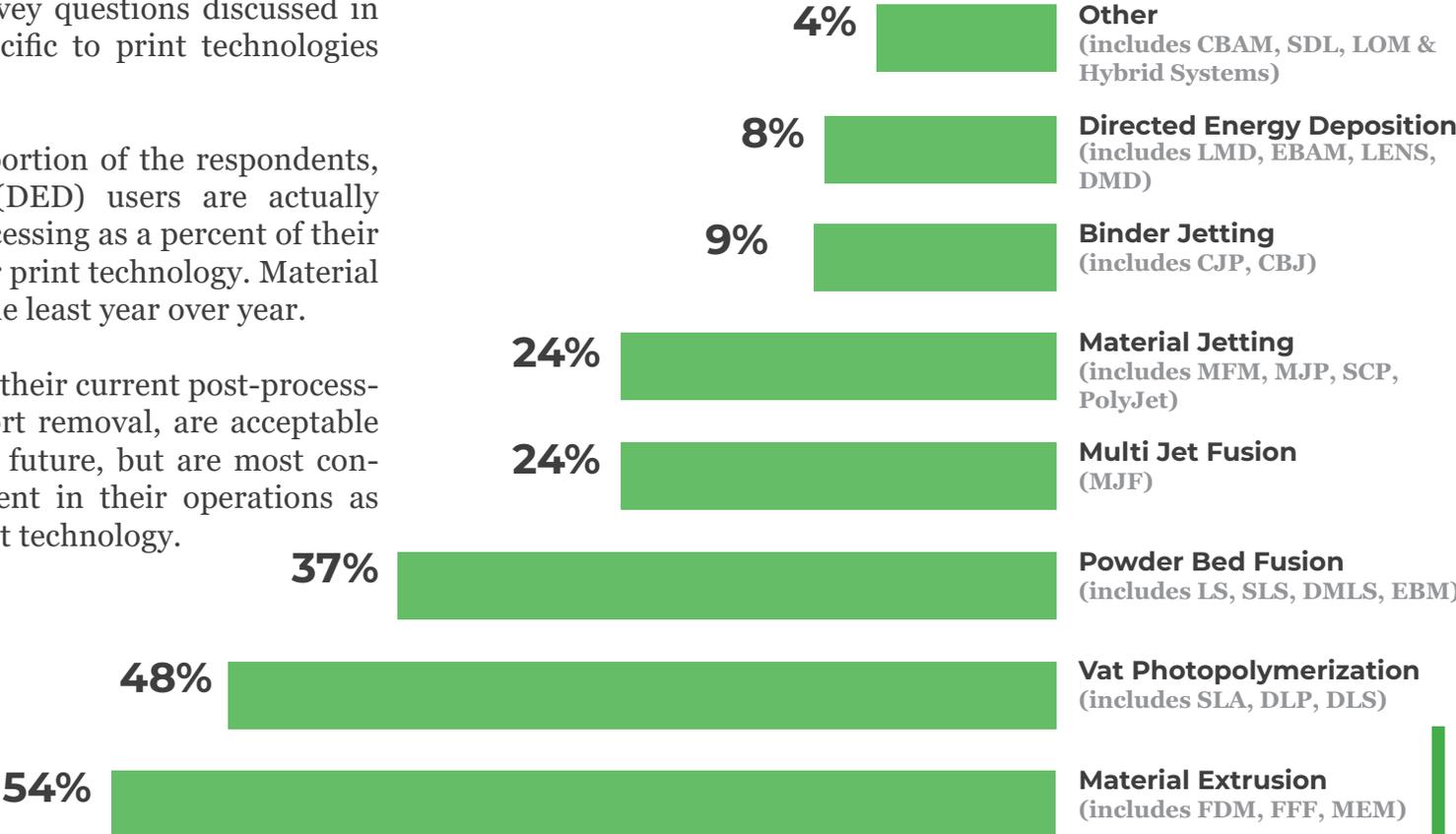
Our respondents' 3D print technology trends are consistent year over year, with Material Extrusion, Vat Photopolymerization, and Powder Bed Fusion in the 1, 2, and 3 positions, respectively for the third year in a row.

Respondents are also using a variety of print technologies. This year, over half of respondents are printing with two or more print technologies, which is more than reported last year. However, the top 3 print technologies still account for 65% of all responses.

As a preview to additional survey questions discussed in forthcoming pages, trends specific to print technologies reveal:

While representing a smaller portion of the respondents, Directed Energy Deposition (DED) users are actually spending the most on post-processing as a percent of their overall AM budget vs. any other print technology. Material Extrusion users are spending the least year over year.

Material Jetting users find that their current post-processing methods, mainly for support removal, are acceptable today and into the foreseeable future, but are most concerned about waste management in their operations as compared to users of other print technology.

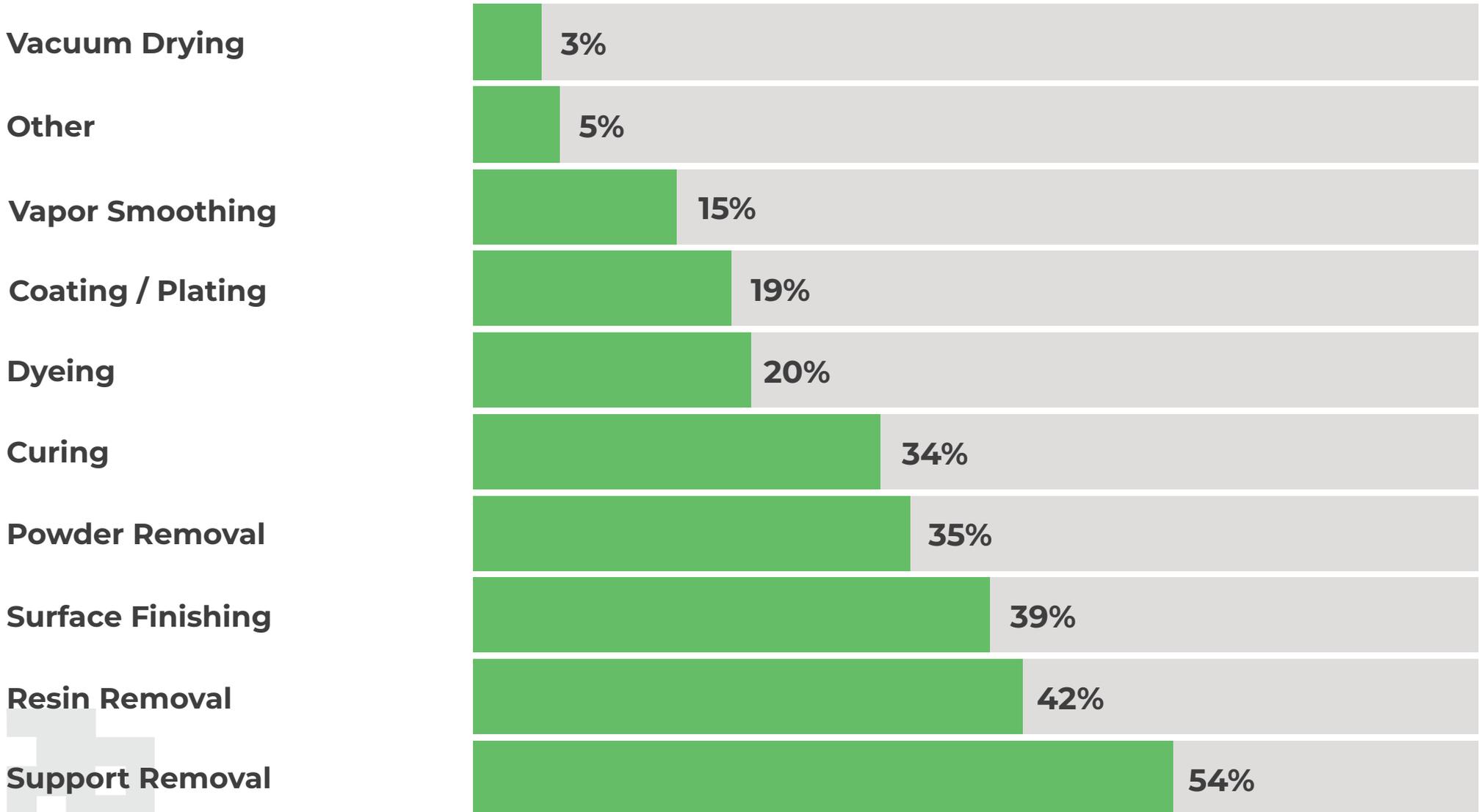


POST-PROCESSING METHOD TRENDS

In line with the most utilized print technologies shown on the prior chart, support, resin, and powder removal processes are still reported by respondents as the most common operations.

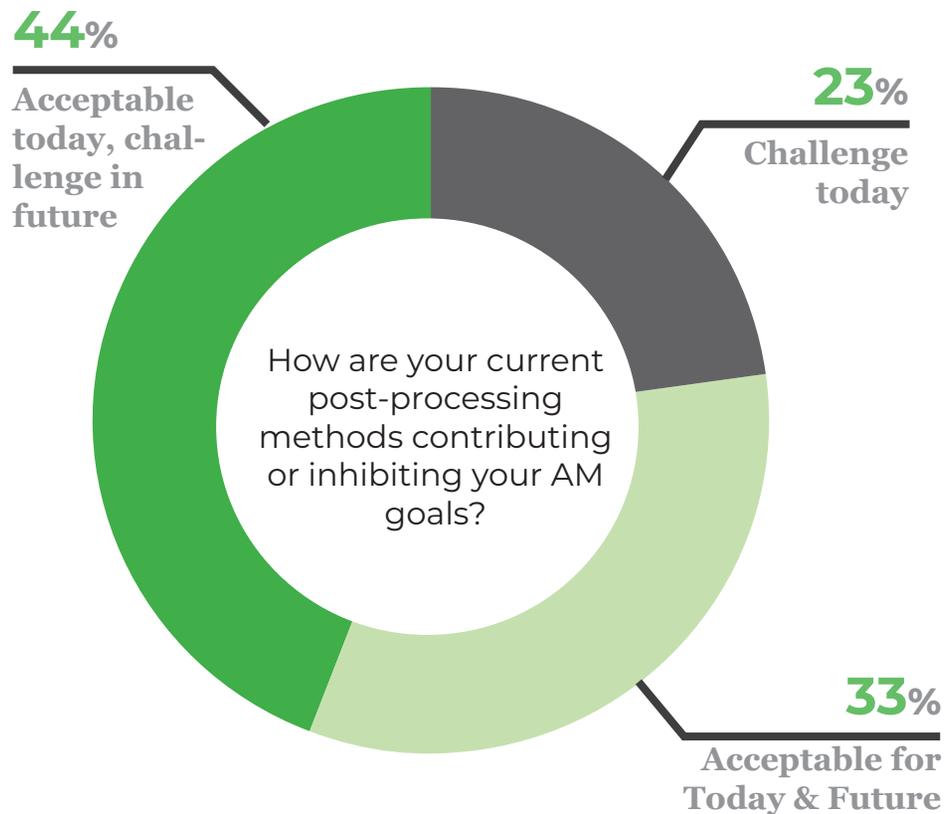
When it comes to percentage of time spent on different post-processing methods, Material Extrusion and Material Jetting users spend more than half of their time on support removal.

Binder Jetting, Directed Energy Deposition, and Hybrid System users spend the majority of their post-processing time on surface finishing. While Vat Photopolymerization users are focused on resin removal and support removal, Multi Jet Fusion and Powder Bed Fusion users are mostly spending time on powder removal activities versus dyeing, painting, or vapor smoothing.



POST-PROCESSING METHOD TRENDS

When asked how current post-processing methods are contributing or inhibiting the respondents additive manufacturing goals, the overall response is that only one third of respondents state that their methods are acceptable both today and into the foreseeable future. 44% feel that the methods are acceptable for today, but anticipate that they will become a challenge in the future, likely when they want to scale up their operations.



Interesting data is gleaned when breaking this information out by each individual print technology.

Vat Photopolymerization shows that post-processing methods are sufficient for now but foresee it becoming a challenge in the future at a higher percentage than any other print technology. The resin removal step of 3D printed SLA, DLP, and CLIP technologies is notoriously messy and cumbersome, so it is valid that aspect could be what respondents see as the biggest hindrance to scaling up productions.

Powder Bed Fusion respondents stated they have the most challenges today with their post-processing out of all of the other print technologies, and they see it continuing to be an issue in the future. More than half of these users also state they are looking to improve the Health, Safety, and Environment conditions of their operations, specifically with their current issues with powder mitigation and potential safety hazards that occur with exposing operators to loose powder.

Both **Material Jetting** and **Material Extrusion** users seem to have the easiest time right now with their post-processing methods with the majority stating that their methods are acceptable today and into the future, but about 40% of these users also fear issues such as the consistency and length of time to finish parts may inhibit their AM goals in the future.

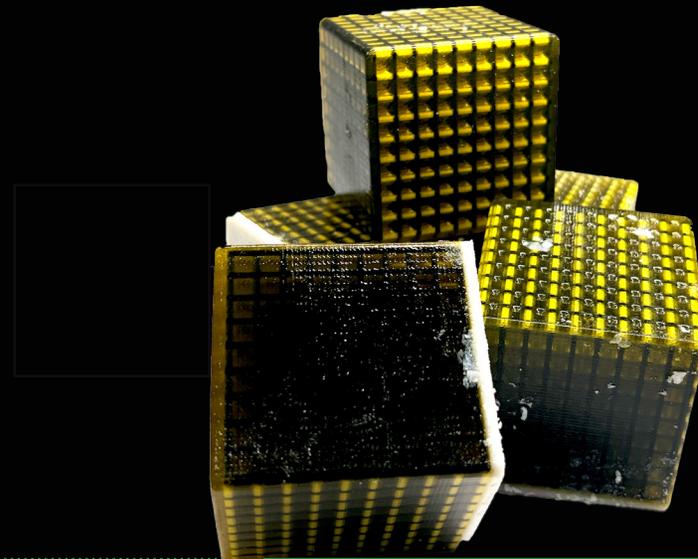
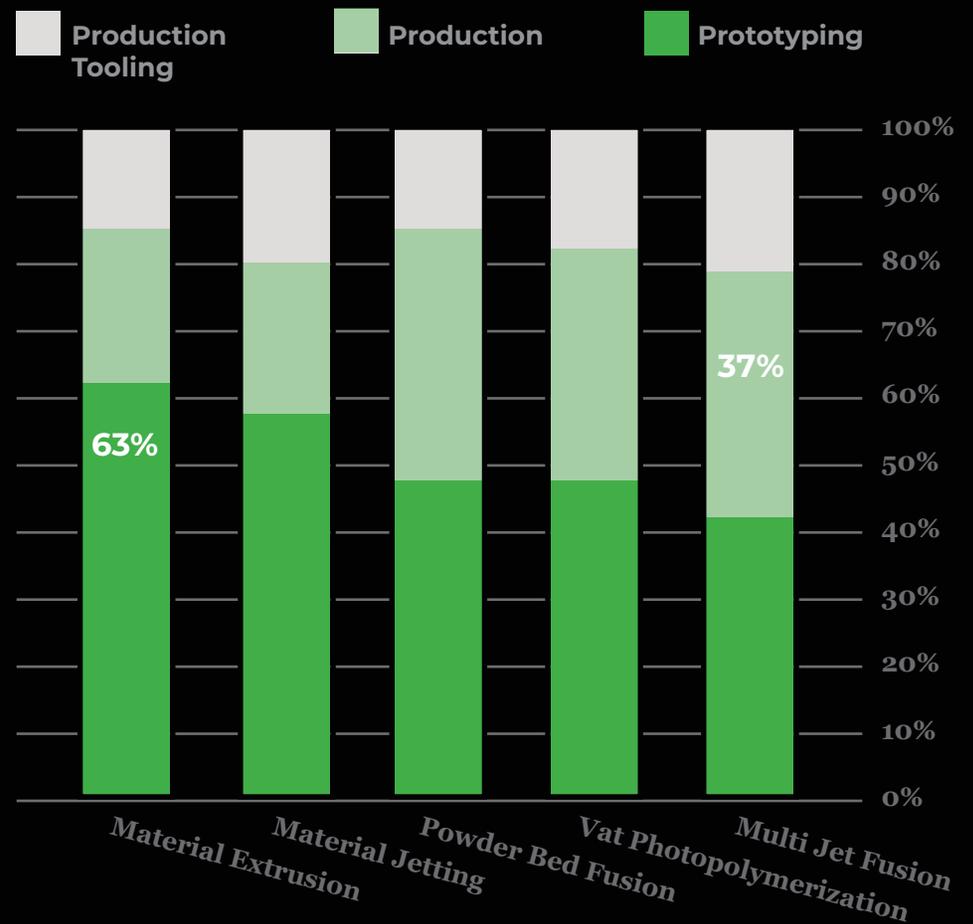
PRODUCTION VS. PROTOTYPING TRENDS

Focusing in on the top five print technologies in the chart to the right, which make up more than 80% of total respondents:

Multi Jet Fusion (MJF) users report the highest percentage of their operations using AM for production at 37%, which increased by 6% since last year. However, post-processing methods are of concern for the ability to continue to scale. 41% of MJF users say their current post-processing methods, mainly powder removal, are acceptable for today but will become a challenge in the future.

Powder Bed Fusion users come in close second for production operations at 36%, but have the highest percentage out of all print technologies stating that current post-processing methods are a challenge today.

Material Extrusion users are leading the prototyping usage category. Material Extrusion users are one of the top reporting Length of Time to Finish Parts as its biggest pain point. The ability for the market to continue to grow into Rapid Prototyping applications will require addressing this obstacle.

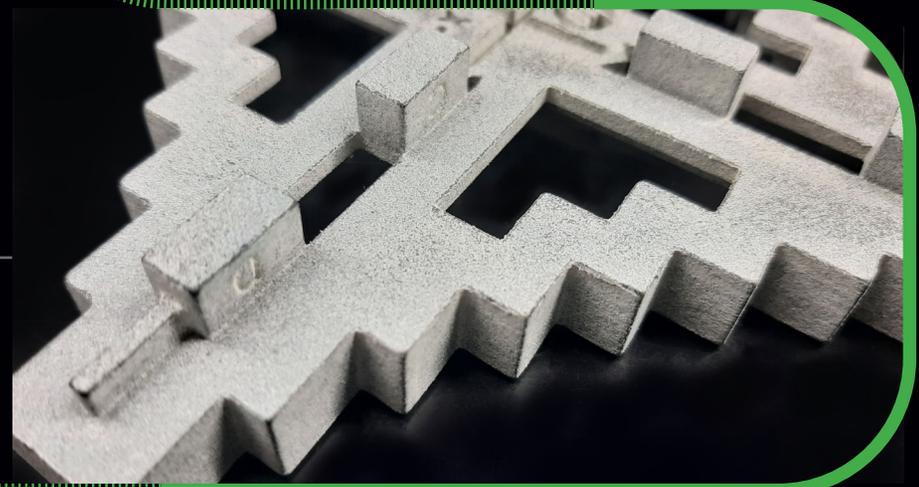
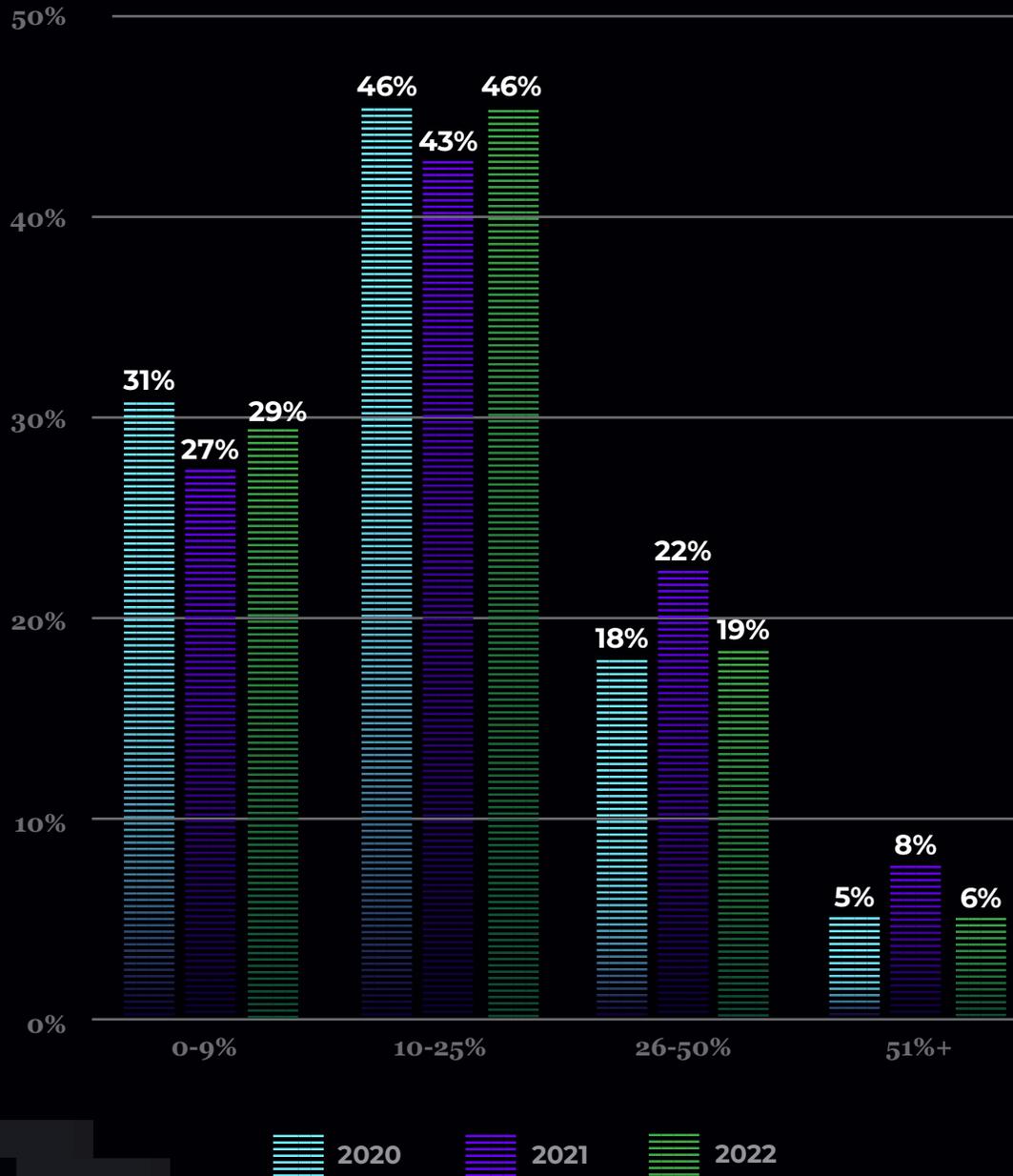


POST-PROCESSING EXPENDITURES

Post-processing as a portion of additive manufacturing operational expenditure (equipment, labor, consumables, etc.) has stayed fairly consistent year over year. The majority of respondents allocated 25% or less of their additive manufacturing budget to post-processing activities.

The data becomes more interesting when looking at it by vertical market segment. Consistent with last year, respondents in the Automotive market reported post-processing expenditures highest of the top 5 markets, spending 26% or more of their budget on post-processing. Users in the Industrial Machinery industry, however, have the highest percent of those allocating over 51%+ of their AM budget to post-processing.

Respondents who must perform Powder Removal processes (DED, Powder Bed, MJF) collectively are allocating the most money on post-processing as a percent of their overall AM budget.



POST-PROCESSING PAIN POINTS

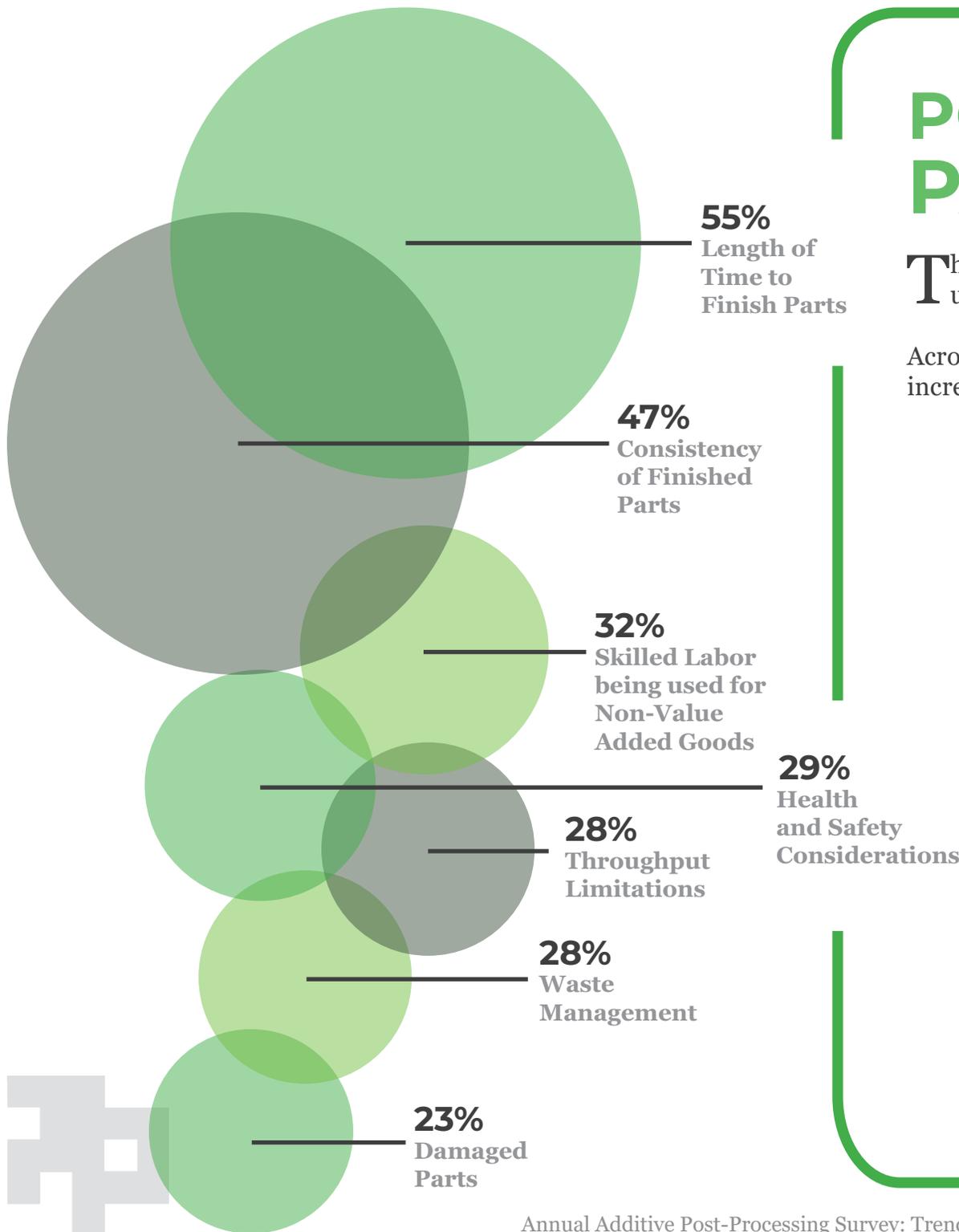
The top 2 post-processing pain points reported by AM users were consistent year over year.

Across all remaining categories, percentages reported increased, most significantly for the Skilled Labor choice.

Out of all print technologies and challenges, the highest percentage pain point is Material Extrusion with Length of Time to Finish Parts.

As reported previously, not only do users performing Power Removal most indicate that their methods today are an inhibitor and their spending the most on post-processing as a percent of their overall budget, they also represent the highest percentage of pain points reported in the top 3 categories.

Users in Resin Removal reported the most concern for the Health and Safety Considerations. When it comes to Waste Management, Material Jetting lists this as their highest pain point overall, and has the highest percentage in this category out of all other print technologies.



KEY TAKEAWAYS: TOP 3 PRINT TECHNOLOGIES

Let's explore highlights for respondents who said one of these technologies was their top printing method used...

Material Extrusion



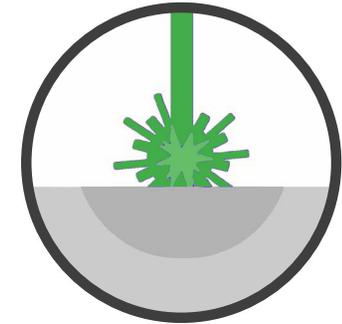
- Length of Time to Finish Parts
- Consistency
- Damaged Parts

VAT Photopolymerization



- Health, Safety, Environmental
- Skilled Labor Being Used
- Length of Time to Finish Parts

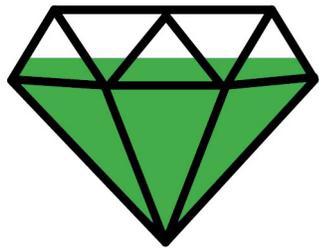
Powder Bed Fusion



- Consistency
- Length of Time to Finish Parts
- Skilled Labor Being Used

POST-PROCESSING INVESTMENTS

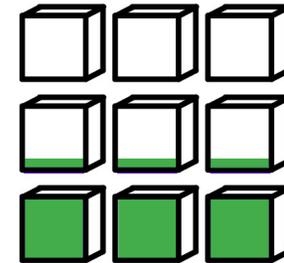
The top 3 areas where AM users would like to invest in to improve their post-processing operations were consistent year over year. The choices centered on investment for the purposes of increasing throughput and redirection of labor to higher value activities increased the most over last year by 9% and 14%, respectively. This sentiment is likely correlated to the tight labor market experienced in 2022.



76%
Improving
End Part
Quality



49%
Reducing
Cycle Time



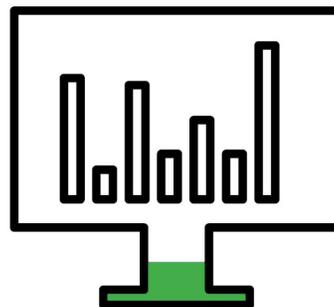
48%
Increasing
Throughput



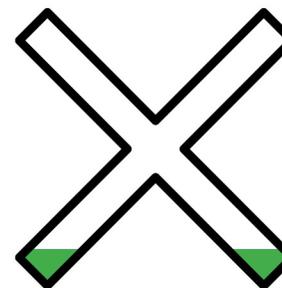
47%
Redirecting
Labor to Higher
Value Activities



38%
Increasing
Health, Safety
& Sustainability
Operations



12%
Ensuring a
Connected
/ Software
Enabled
Factory



8%
Have No Plans
to Invest in
Post-Processing
Operations



Health, Safety & Sustainability

57% of respondents said they are looking to improve the health, safety, and sustainability of their post-processing operations, consistent with the responses since 2020.

Direct Energy Deposition users lead the pack with 100% of respondents who use DED as their primary print technology being the most concerned with Environment, Health, and Safety (EH&S), followed by Vat Photopolymerization and Powder Bed Fusion.



Respondents in the Medical industry report the highest concern with EH&S, with Aircraft/Aerospace coming in a close second.

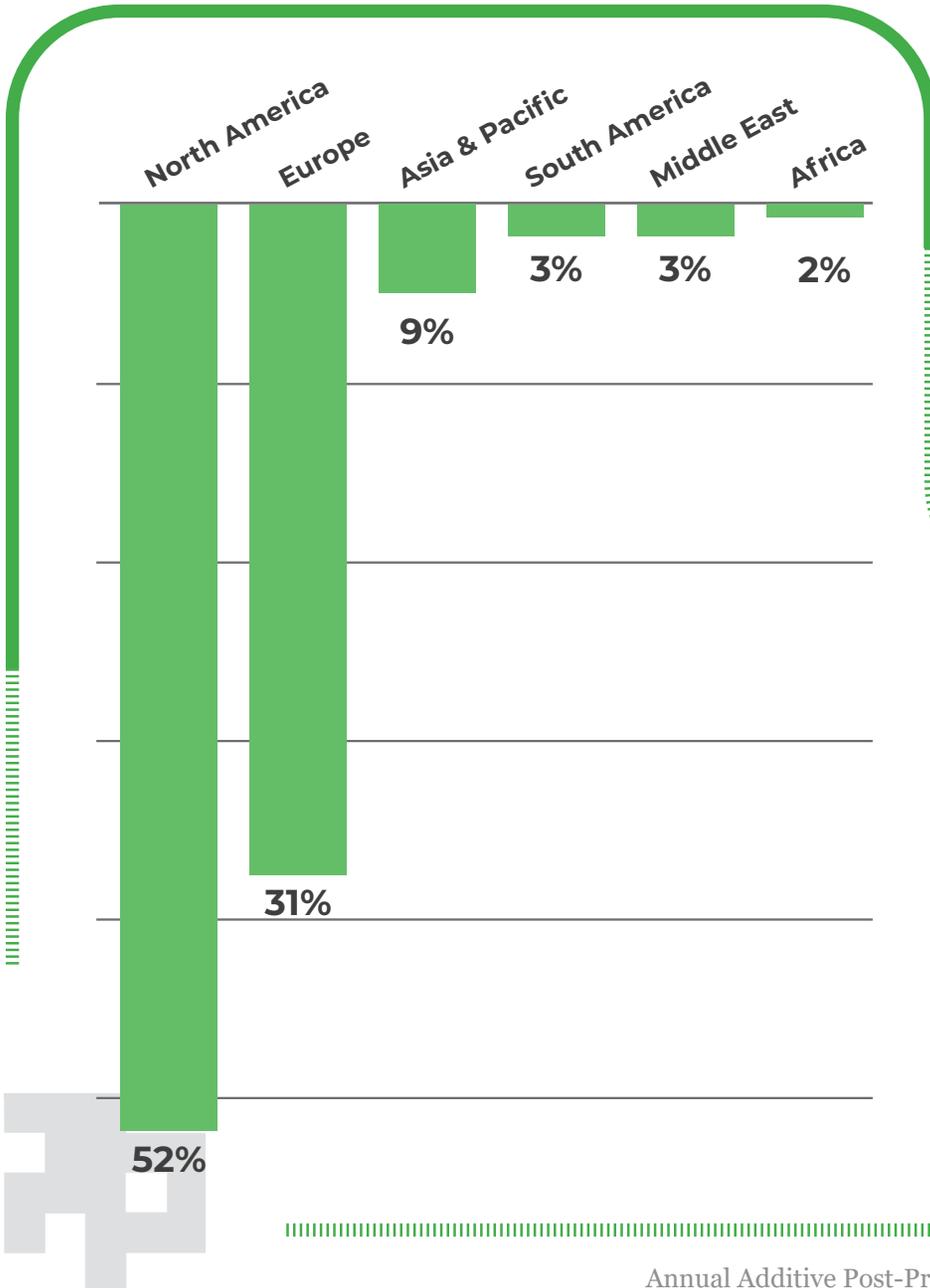
Users located in Europe have the highest percentage of concern for health, safety, and sustainability over other regions.



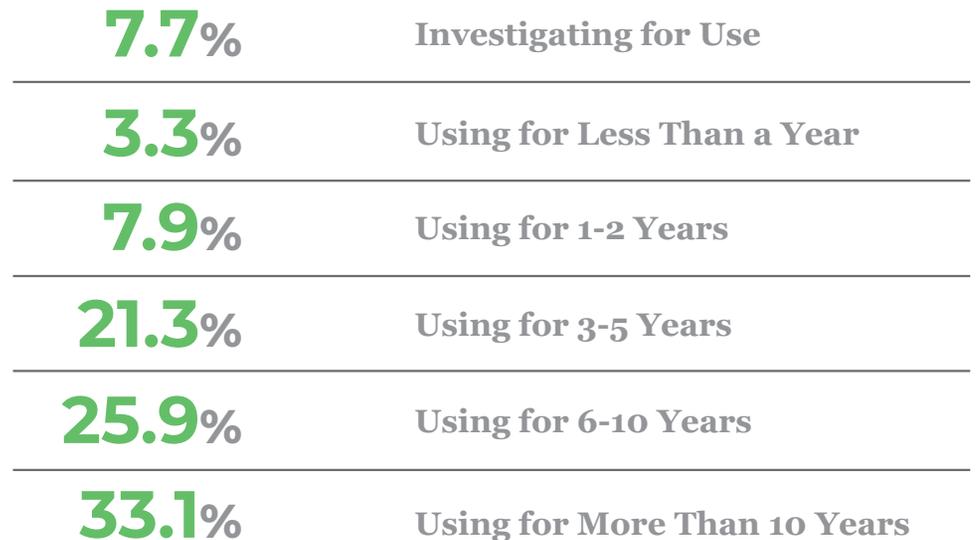
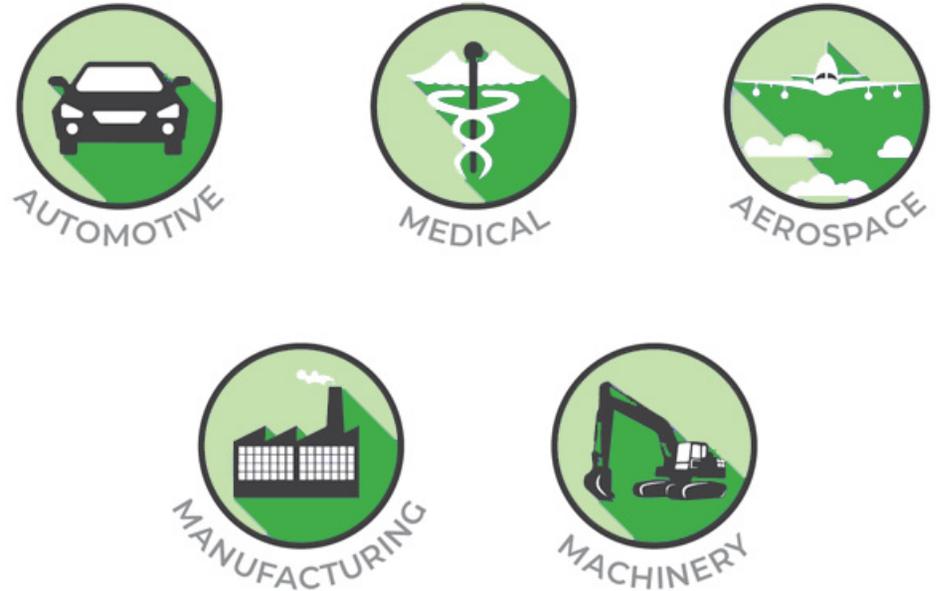
APPENDIX: MEET OUR RESPONDENTS



DEMOGRAPHICS: COMPANIES

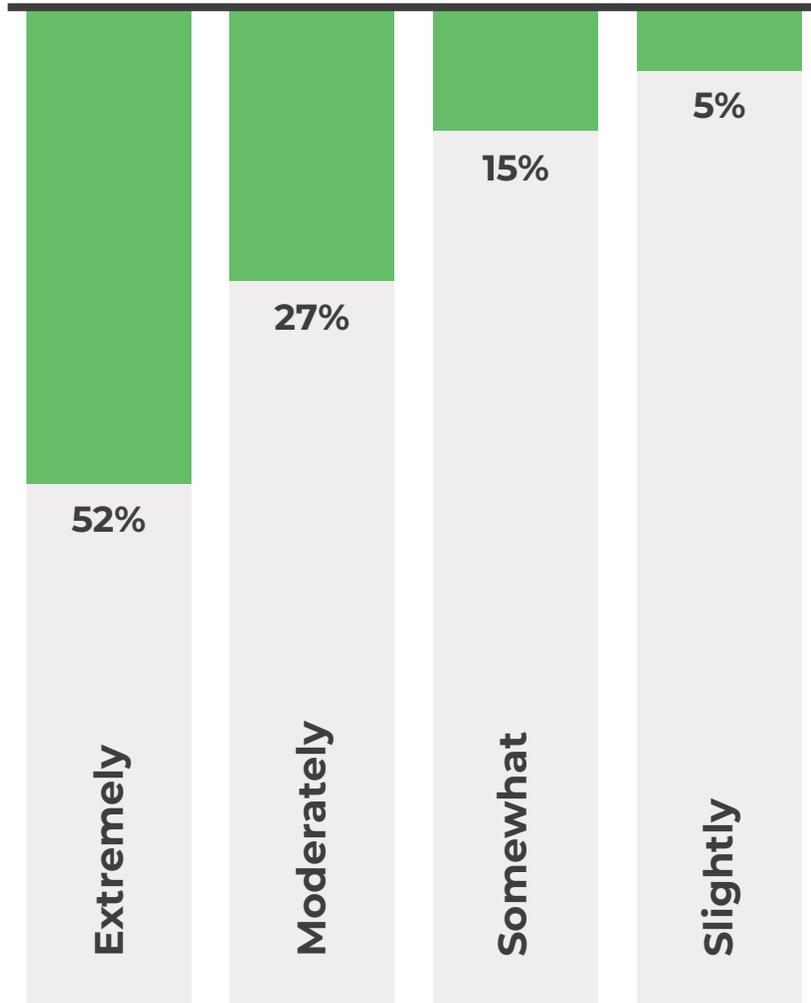


Top 5 Industries of our Respondents:

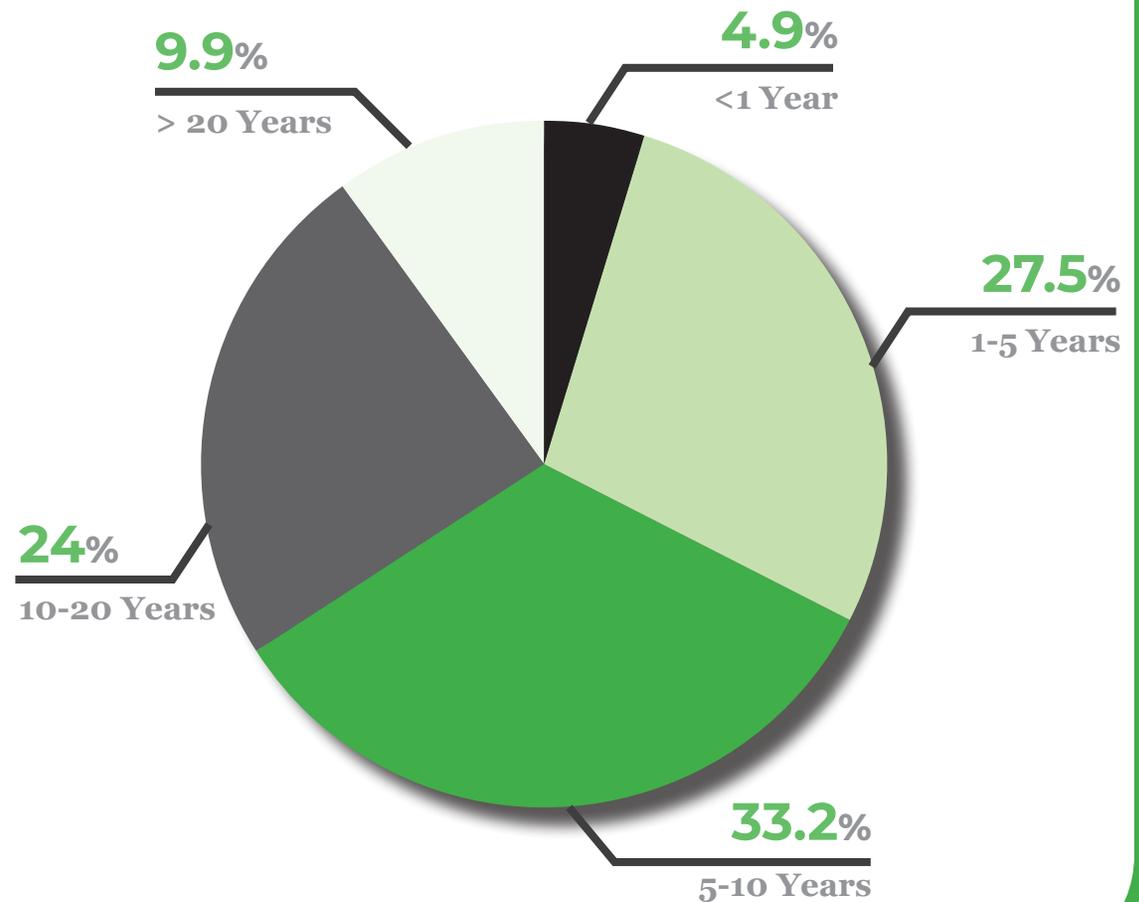


DEMOGRAPHICS: INDIVIDUALS

How familiar are you with your company's additive manufacturing post-printing methods?



Approximately how many years have you been working with Additive Manufacturing?





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