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3D Printing Software Survey 2024: Harnessing Software for Smart Manufacturing

Optimizing 3D Printing through Intelligent Software Solutions

Software at the Helm: Steering 3D Printing Into the Future

Charting the New Course of 3D Printing Innovation

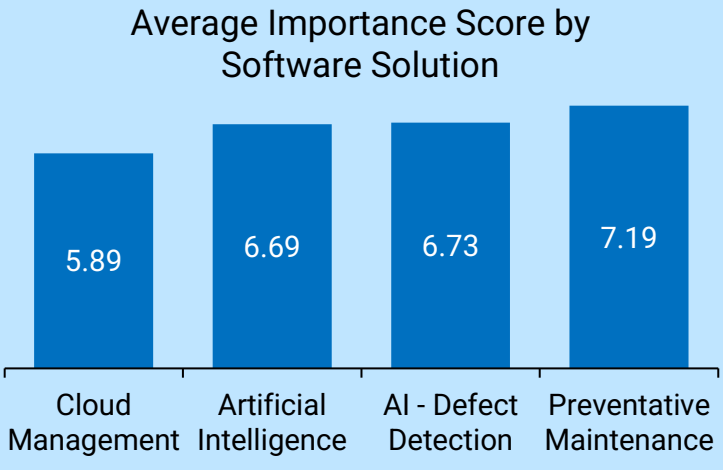
Industry leaders and technology pioneers are now acknowledging that software integration is crucial for the future of 3D printing operations. Cloud management is recognized as vital by 42% of industry professionals, and nearly half are already leveraging AI for defect detection, transitioning software from a luxury to a necessity.

The market is responding to this shift, with projections indicating a surge in the software segment of the 3D printing industry — from $5.2 billion to a staggering $43.7 billion by 2032. Such growth underscores software's expanding role in scaling operations, elevating production quality, and solidifying a leading edge in the competitive arena of manufacturing innovations.

"The evolution of additive manufacturing ("AM") has seen the integration of various software types, such as CAD design, print file preparation, MES workflow planning, and IoT process automation, which have greatly enhanced the AM process. The advent of AI tools promises to advance AM by providing predictive and automated capabilities, facilitating rapid virtual iterations, optimal option selection, and ultimately increasing process reliability."

- Rajeev Kulkarni, Chief Strategy Officer Axtra3D[1]

This insightful remark encapsulates the ongoing revolution in additive manufacturing, marking a definitive shift towards software-defined processes that promise unparalleled efficiency and reliability — the new benchmarks for an industry on the brink of transformative growth.



Software: The New Frontier of Additive Manufacturing Growth

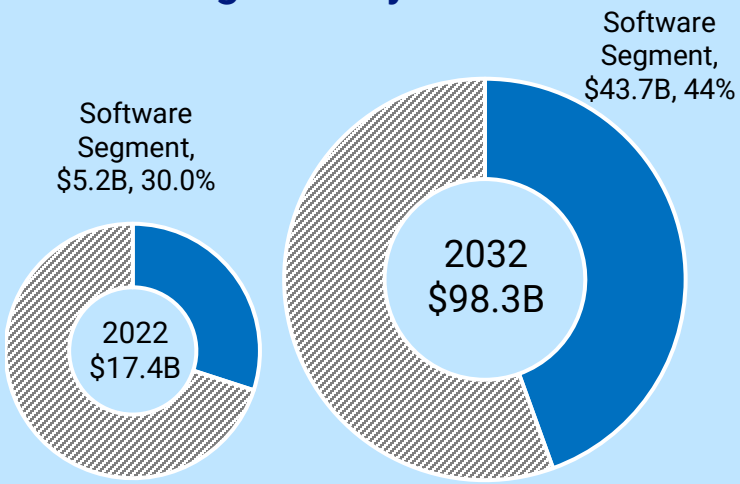
The transformative role of new software solutions in 3D printing heralds more than just operational improvements—it ushers in a shift towards smarter manufacturing. While machines continue to improve, the industry has reached a level of diminishing improvements from hardware advancements, software-driven innovation will push the next wave of machine performance.

"As we push through the adoption phase of Additive Manufacturing into full integration within Advanced Manufacturing, software leads in ensuring hardware can meet the rigorous expectations for the industrial base, as well as solve the light-to-medium production challenge. Prediction before print, geometric optimization based on machine learning, smart material selection, and fully automated, distributed (print anywhere) production become crucial enablers to this objective."

- Ron Faruqui, CEO 3DGence America, Inc.[1]

The convergence of precision engineering and advanced software is set to propel additive manufacturing into a future characterized by greater innovation and growth. Our survey reveals that the market believes software capabilities are poised to be the driving force in the next phase of AM innovation. The preceding decade's focus on hardware enhancement has set a robust foundation, now giving way to a future where sophisticated software solutions are essential for unlocking the full potential of 3D printers.

3D Printing Industry Growth[2,3]

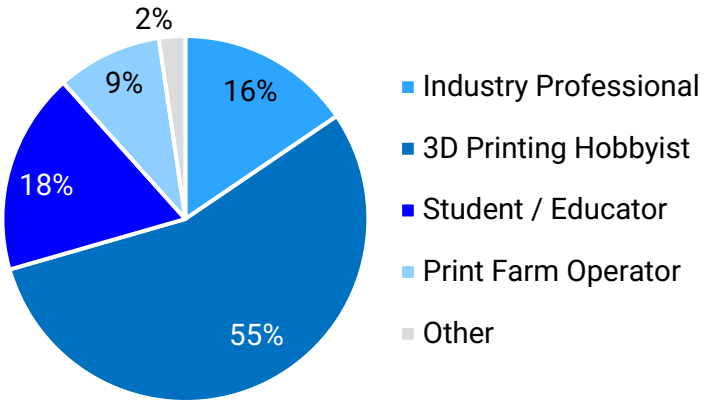


Footnote(s): 1. Quote provide to printpal.io
2. Precedence Research
3. Straits research

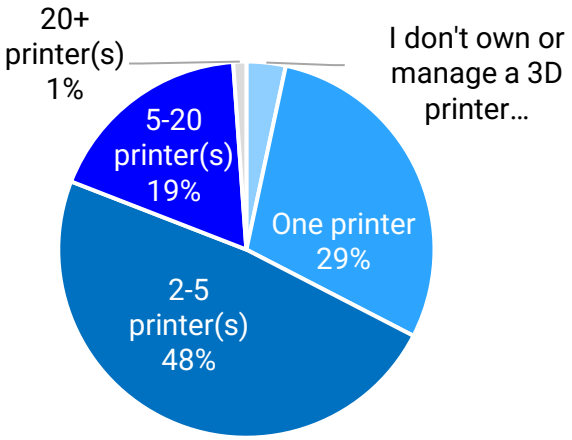
Survey Overview: Demographics & Tech Trends in 3D Printing

Diverse Respondent Demographics

Reaching a diverse range of 3D printing enthusiasts, our survey compiled insights from hobbyists (55%), industry professionals (16%), and educators (18%), as well as print farm operators (9%). Participants had the option to identify with multiple categories, offering a nuanced view of the 3D printing community's landscape.



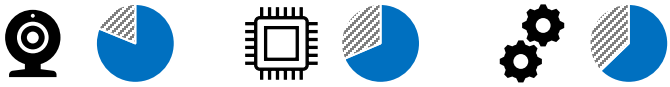
Notably, almost all respondents own or manage at least one 3D printer, with a majority managing one to two printers—indicative of engaged users likely to leverage personal printers for diverse applications. However, a small segment manages expansive fleets, suggesting professional use. These findings provide a valuable snapshot of the current state of 3D printer ownership and highlight the diverse applications of these technologies.

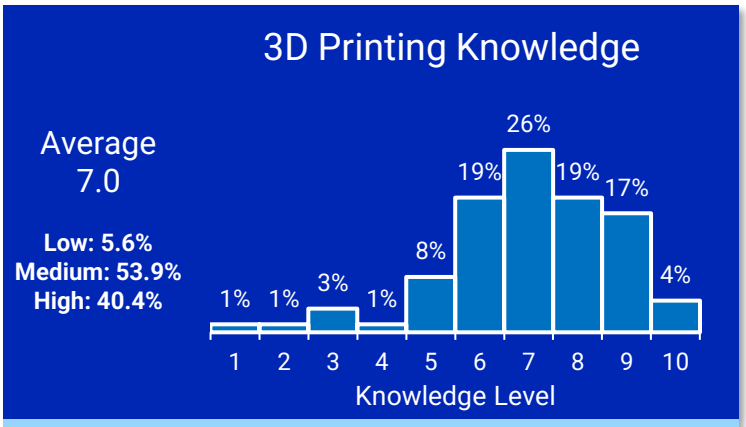


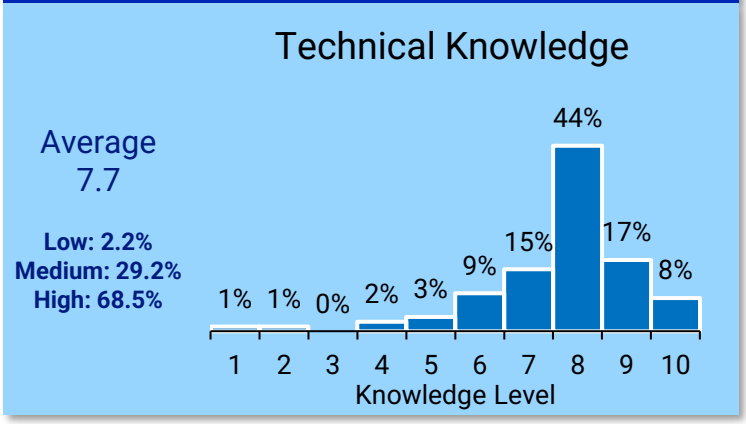
Responders by type of 3D printing

Utilization of Software Solutions(2)

Utilization of Hardware(2)







Footnote(s): 1. Includes MJF, continuous fiber reinforcement, and binder jetting
2. Included on atleast one printer
3. Can include a custom hotend, fan, motor, etc.

Intelligent Fabrication: The Advent of AI in Additive Manufacturing

AI's Growing Impact in the Evolution of Additive Manufacturing

Additive manufacturing began as a revolutionary approach to rapid prototyping, enabling designers and engineers to iterate quickly and efficiently[1]. As the technology has matured, the industry's vision has expanded beyond prototypes to include full-scale production and end-use products. Today, with advancements in machine learning and computational power, Artificial Intelligence (AI) is ushering in a new era of manufacturing.

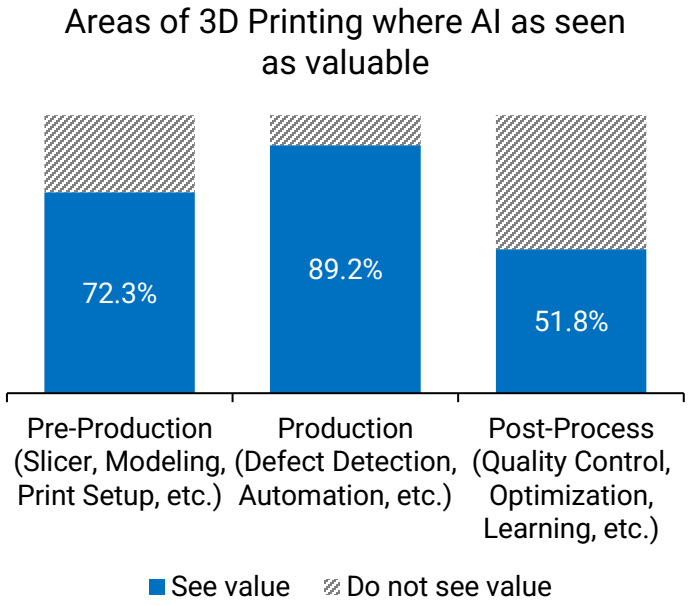
"AI is crucial for additive manufacturing, as it streamlines design and production. As AI evolves, it will unlock even greater innovations, spurring broader adoption of 3D printing technologies."

- Daniel Werner, Founder 3dpmaven[2]

AI's role in this evolution is multifaceted. It enhances precision and efficiency in production, reduces material waste, and predicts potential issues before they occur, thus streamlining the design-to-production cycle. As AI algorithms learn from each print, they develop a deeper understanding of material behavior and printing dynamics, contributing to the creation of more complex and reliable products.

The impact of AI is not limited to the printing process itself. It extends into the realms of supply chain management, predictive maintenance, and even customer service, revolutionizing how additive manufacturing companies operate and scale. With AI's predictive analytics, companies can optimize their inventory, reduce downtime, and deliver products that consistently meet customer expectations.

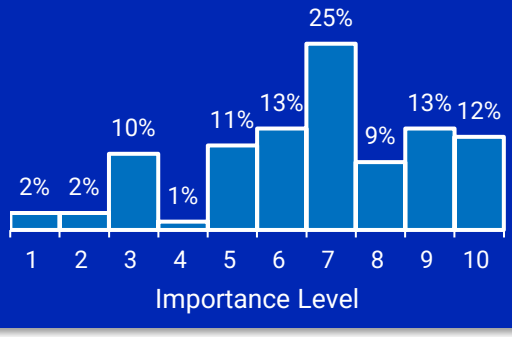
Perceived Value of AI Across the 3D Printing Process



"My prediction is that by 2030, there are going to be two kinds of AM companies, those who fully embraced and benefited from AI, and those who are out of business."

- Avi Reichental, CEO Nexa3D[3]

In embracing AI, the additive manufacturing industry is not only optimizing its current operations but also paving the way for future innovations that will redefine what is possible in manufacturing. As AI continues to evolve, its synergy with 3D printing promises to break new ground in customization, material science, and manufacturing agility.



	Industry Professional	Student & Educator	3D Printing Hobbyist	Print Farm Operator
Average Score	7.45	6.48	6.75	6.42
Increased Likelihood to:				
Score High (>7)	57.9%	(0.1%)	3.7%	(4.3%)
Score Low (<4)	(31.5%)	19.1%	(4.9%)	14.1%

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Footnote(s): 1. TWI Ltd
2. Quote provide to printpal.io
3. Nexa3D CEO at Additive Manufacturing Strategies (AMS)

AI Defect Detection: Trends in Industry Uptake

Solution Background

Defect detection in additive manufacturing has progressed significantly with the advent of AI technologies. Initially rooted in traditional manufacturing, AI-based defect detection solutions have now become prevalent in consumer-level FDM printing, backed by multiple providers. At the heart of this evolution is computer vision, a technology that captures and analyzes real-time imagery to detect and address printing anomalies. This intelligent oversight is crucial in maintaining consistent product quality and significantly reducing the need for manual intervention.

Key Components for AI Defect Detection Solutions:

- **Connectivity Module:** Devices such as the Raspberry Pi serve as a hub to facilitate communication between the software, printer, and imaging system.
- **Imaging Technology:** Employs integrated cameras to monitor the printing process continuously and capture detailed images for analysis.
- **Cloud Integration:** Utilizes advanced cloud-based AI models, which not only process data but also continuously learn and adapt to improve defect detection capabilities.

Adoption of AI Defect Detection

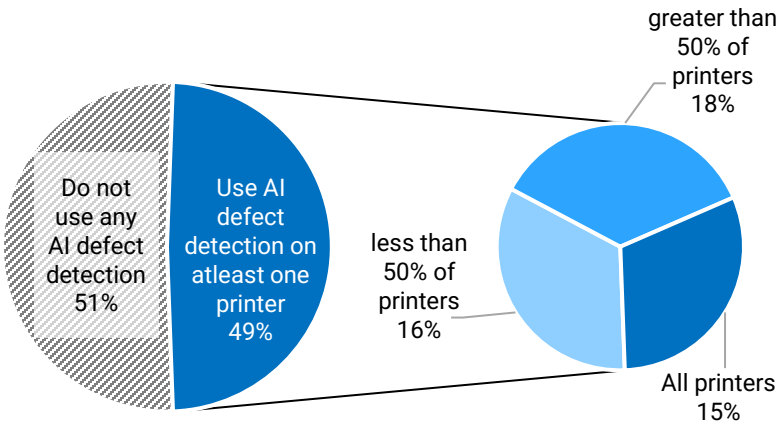
The landscape of consumer 3D printing is rapidly transforming with the advent of AI defect detection. Leading manufacturers such as Creality and BambuLab are at the forefront, embedding AI technology within their printers — a trend resonating with consumers who increasingly view AI integration as a critical purchasing criterion. This shift mirrors a wider industry pivot towards smarter, self-regulating, and more user-centric printing environments.

Recent data illustrates that nearly half of 3D printer users have embraced AI for defect detection, with many extending its use across their entire range of printers. This widespread adoption highlights a growing confidence in AI to enhance precision and ensure reliability.

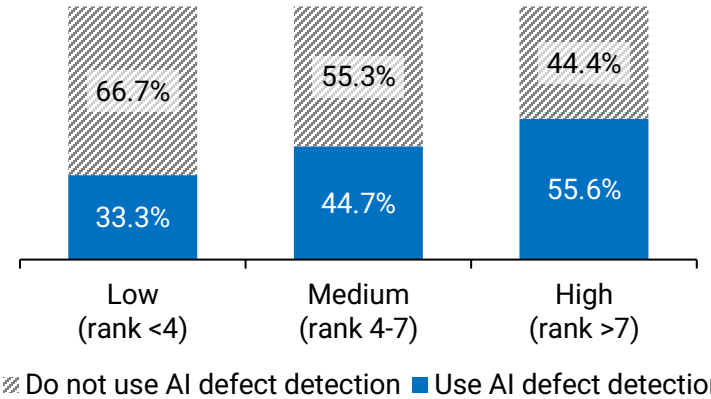
"The accelerating integration of AI within consumer 3D printers marks a paradigm shift from hands-on tweaking to intelligent, precision-driven production. As industry leaders pave the way, AI becomes not just a feature but an expectation, shaping the buying decisions of an informed consumer base. This technological leap into smart manufacturing is a harbinger of a more adaptive and intuitive era for 3D printing, powered by software innovation."

- Daniel Kuzmin, COO & Co-Founder printpal.io

Usage of AI defect detection



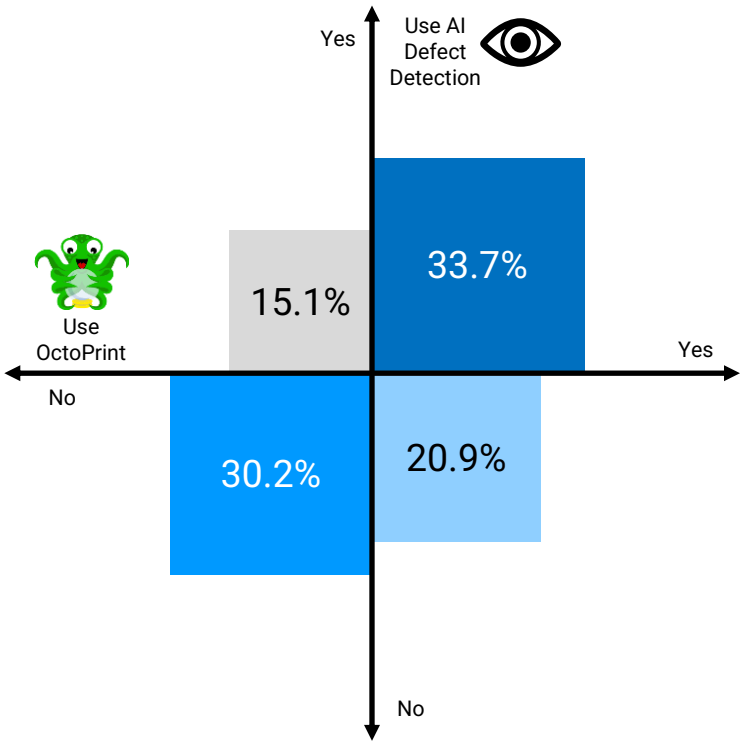
Usage of AI defect detection by level of 3D printing knowledge



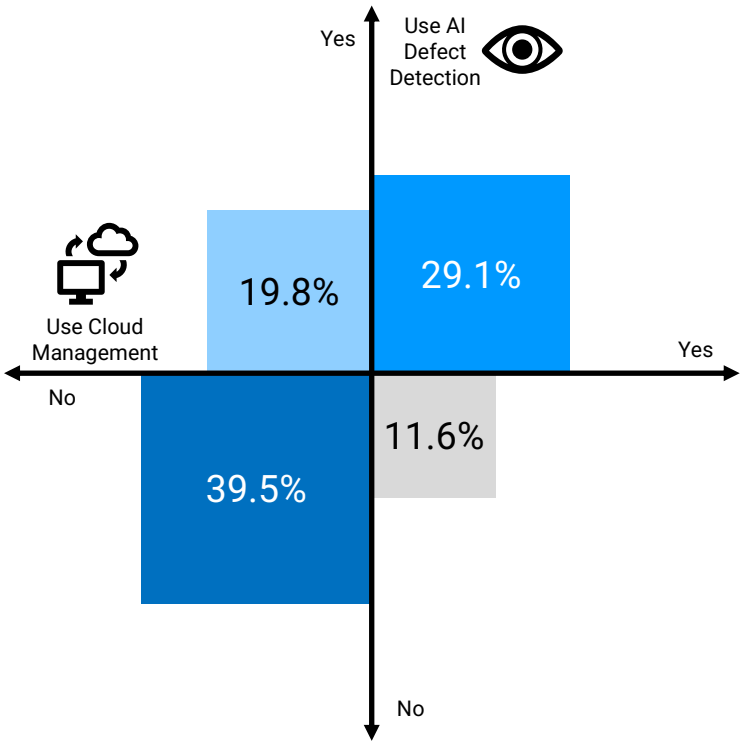
A dive into user demographics reveals that 3D printing expertise correlates with AI adoption as individuals with a 'High' level of proficiency are 67% more inclined to utilize AI than those less experienced. Moreover, as the 3D printing community matures, in skill and solution sophistication, the once-steep learning curve is being smoothed by accessible AI tools that address and preempt the traditional challenges faced by users.

Relationship Between Use of Software and Hardware Solutions & AI Defect Detection

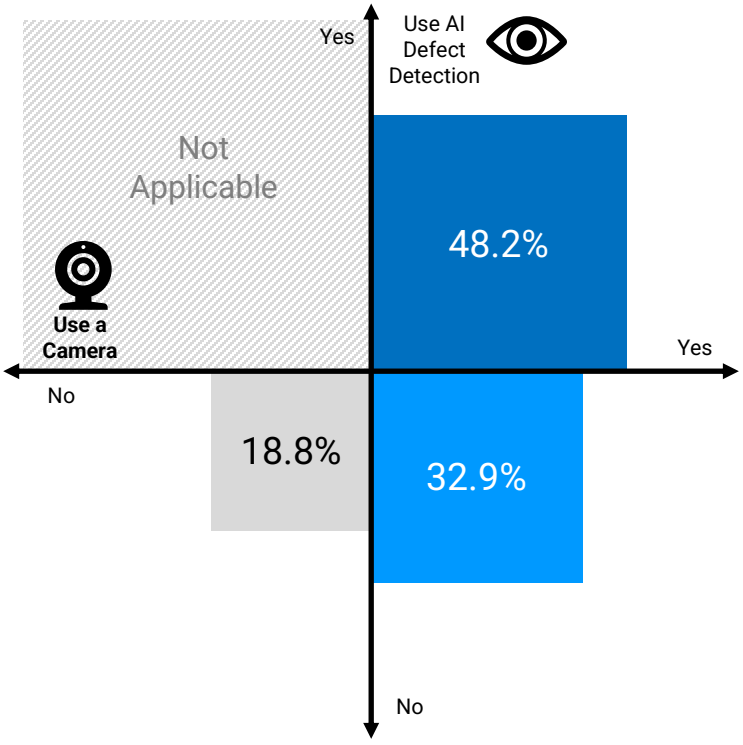
OctoPrint & AI defect detection relationship matrix



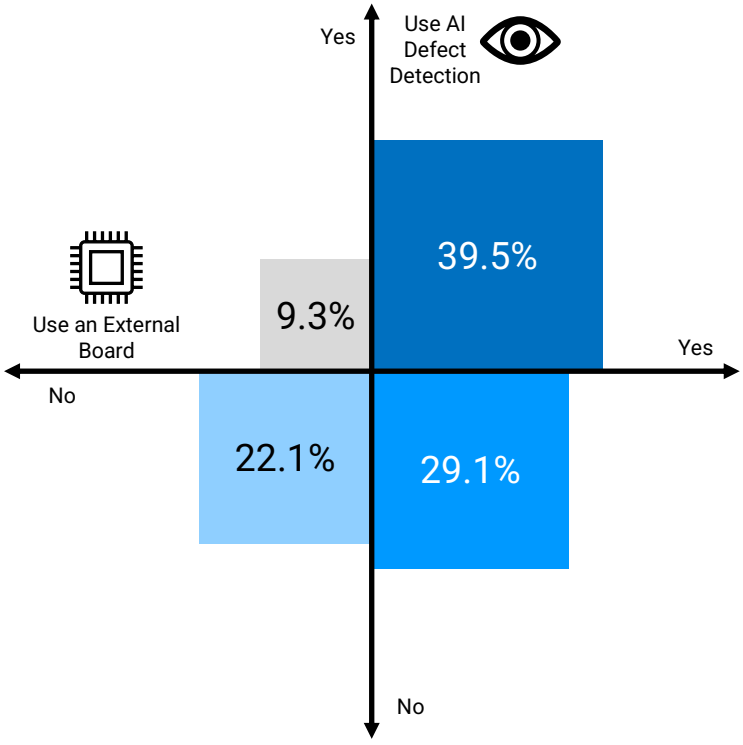
Cloud management & AI defect detection relationship matrix



Camera & AI defect detection relationship matrix

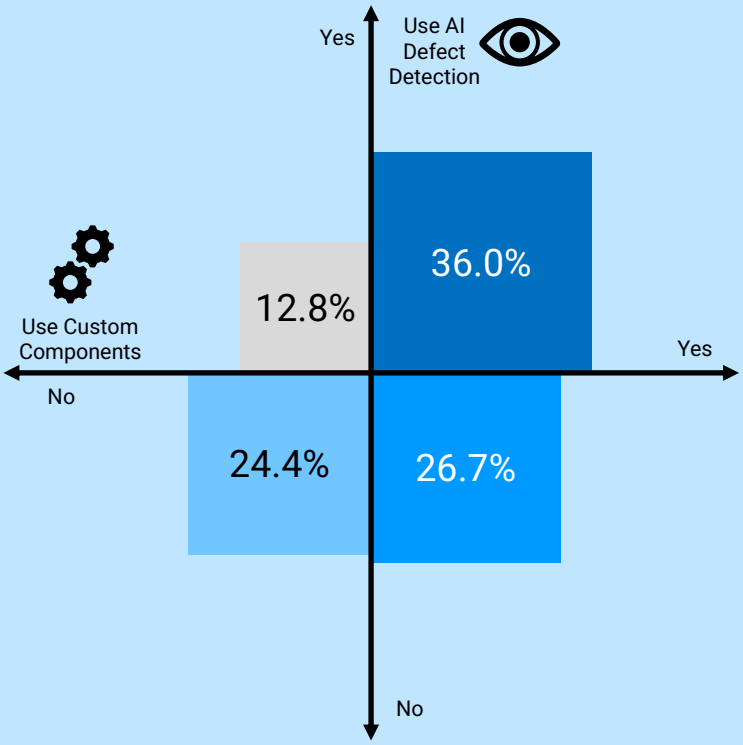


External board & AI defect detection relationship matrix



Summary of Software & Hardware Relationship to AI Defect Detection

Custom components & AI defect detection relationship matrix



This matrix explores the relationship between survey responders' usage of software and hardware solutions, and AI defect detection.

Software Solutions:

- **AI Defect Detection:** Actively scans 3D print jobs, alerting users if any irregularities arise.
- **Cloud Management:** Platform enabling remote access and management of multiple printers.
- **OctoPrint:** An open-source management tool upon which many other solutions are built.

Hardware Enhancements:

- **Camera:** An external or connected camera providing visual monitoring of the 3D printer.
- **External Board:** Typically, a single-board computer like a Raspberry Pi, which interfaces with the 3D printer for enhanced control.
- **Custom Components:** A diverse range of tailored parts, including specialized hotends, heating beds, and motors, designed to meet specific printing needs.

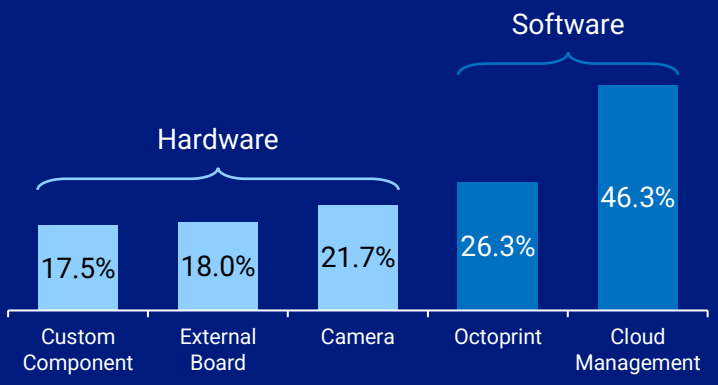
How AI defect detection relates to the use of different software and hardware

The artificial intelligence boom has become more apparent in 3D printing, particularly through the development of AI-based computer vision to detect the occurrence of printing defects. This solution has traditionally been provided outside of the OEM offering until BambuLab announced their P1P[1] and Creality announced their K1 Max[2].

AI defect detection normally requires the use of an external or embedded board and a camera. Given those requirements, it is not surprising that users that own hardware addons are 7.6% more likely to use defect detection, with camera owners being 22.9% more likely. However, an even greater indicator is the use of OctoPrint or Cloud Management, with users being 26.3% and 46.3% more likely to use this solution, respectively.

3D printing users are focused on improving their quality of life by using impactful solutions such as cloud management and defect detection.

Increased likelihood to use AI defect detection vs. total population



+7.6% Hardware

+22.9% Software

*Responders that use some kind of software offering or have additional hardware components are 22.9% and 7.6% more likely to use AI defect detection than the average population

Footnote(s): 1. BambuLab
2. Creality

Optimizing 3D Printing Through Cloud Management

Solution Background: The Rise of Cloud Management in 3D Printing

Cloud management has become a cornerstone of modern 3D printing operations, offering unmatched flexibility and control. This paradigm shift allows for remote monitoring and management of print jobs, facilitating seamless integration of workflows and scalability. The genesis of cloud-based solutions in 3D printing was driven by the need to centralize print operations and streamline the process from design to production.

"Cloud management in 3D printing is not just about connectivity; it's about unlocking the full potential of additive manufacturing. As we look ahead, cloud-managed ecosystems will be essential in the transition from prototyping to production, driving not only operational efficiency but also enabling broader use-cases for the industry."

- Albert Møller Nielsen, CEO SimplyPrint(1)

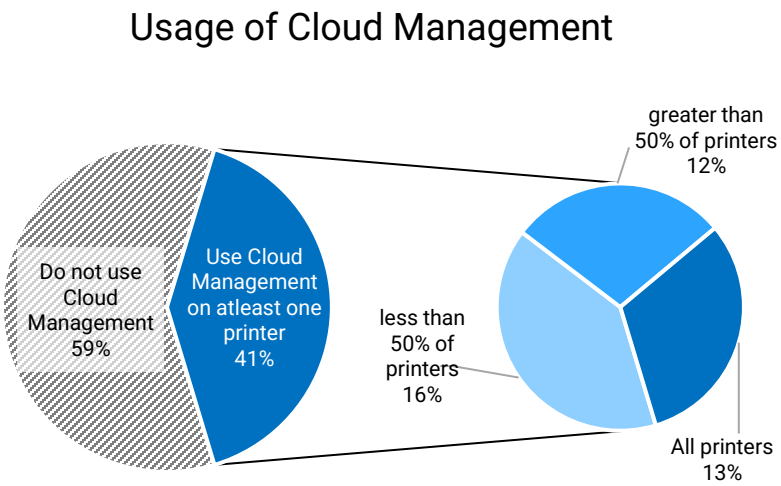
The technology has evolved to include features like real-time analytics for on-the-fly decision making, comprehensive fleet management for streamlined oversight, and collaborative platforms for shared project innovation making it an indispensable tool for industry professionals seeking to leverage the power of connectivity and automation.

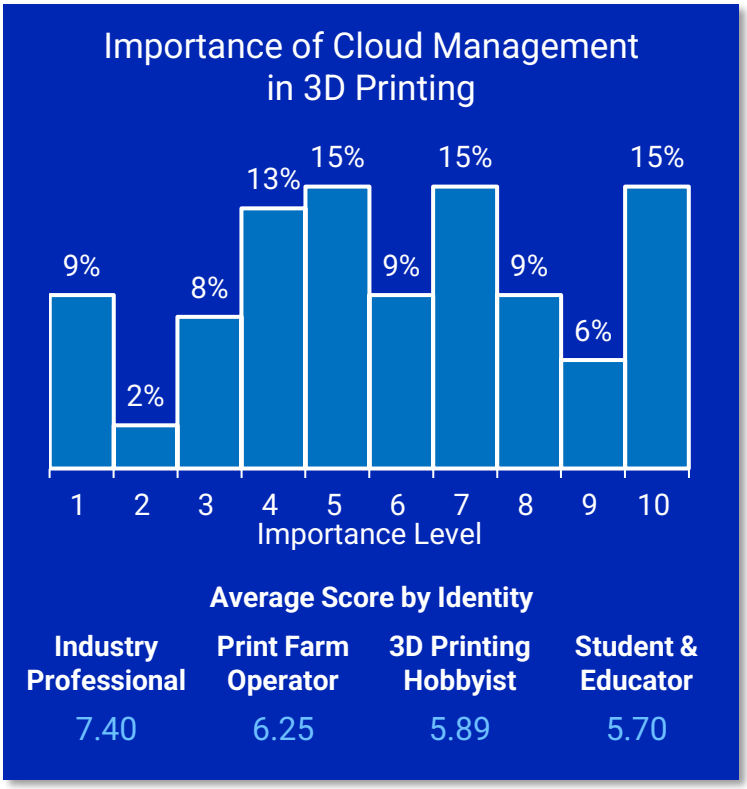
Embracing Cloud Management Across the 3D Printing Spectrum

Utilization patterns show an uptick in the adoption of cloud management. 41% of users have incorporated them into their operations, in at least one printer. This uptake signals an increasing awareness of the advantages offered by cloud capabilities, such as improved efficiency, streamlined workflows, and enhanced productivity. Among adopters, 25% are applying cloud management to over half of their printers, underscoring the critical role it plays for users overseeing larger printer fleets.

Industry professionals, with an average importance score of 7.40, underscore the value placed on cloud management, recognizing its role in enhancing operational efficiency. Print Farm operators, who scored 6.25, are also seeing the operational benefits given their larger fleets.

The potential for cloud management to streamline 3D printing operations is immense, offering a competitive edge and a means to foster growth. With the data indicating a steady rise in value and adoption, cloud management stands on the brink of becoming a standard across the industry.





Footnote(s): 1. Quote provide to printpal.io

Scaling Efficiencies: Cloud Management Across Printer Fleets

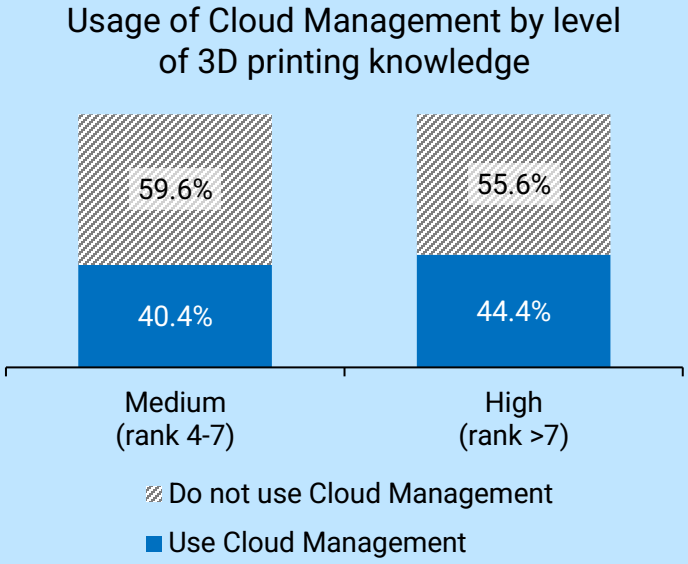
Differential Management Integration by Fleet Size

Our data reveals that as printer fleets expand, the integration of cloud management becomes more prevalent. Among users with 2-5 printers, 37.2% have adopted cloud management on at least one of their printers. The leap is more pronounced within larger fleets with 70.6% of users managing 5-20 printers leveraging the solution, indicating that larger operations recognize the benefits for managing their fleet.

The link between proficiency in 3D printing and the adoption of cloud management is also evident in our findings. As individuals' knowledge deepens, so does their utilization of cloud management tools; those with a higher level of 3D printing knowledge (ranked >7) show a 44.4% usage rate of cloud management systems. This compares to the 40.4% usage rate among those with a medium level of knowledge (rank 4-7).

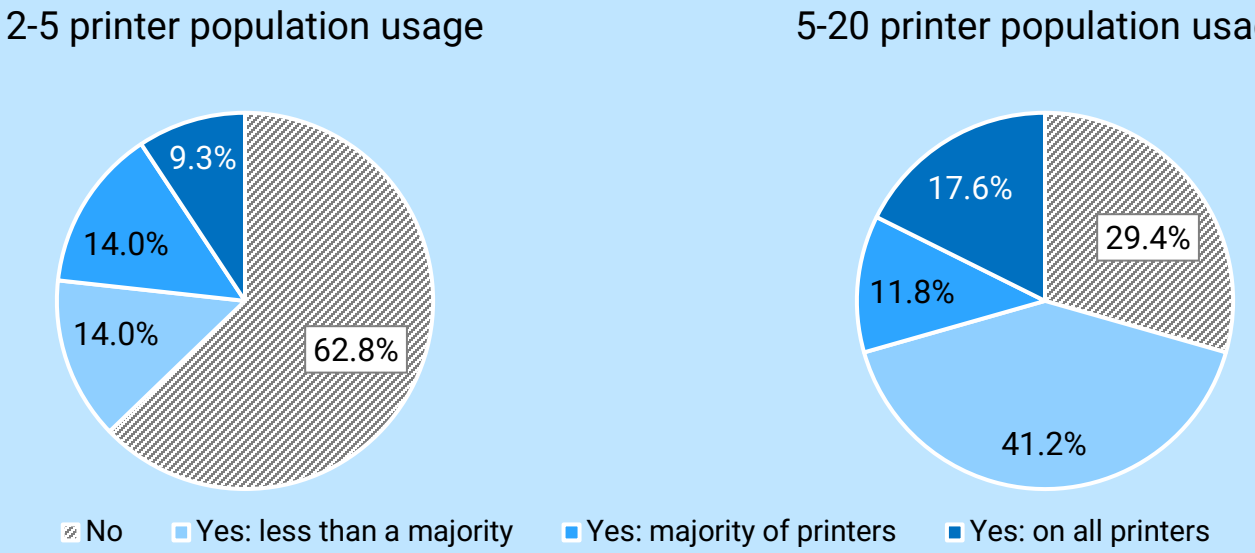
This trend not only highlights the value placed on cloud management solutions by advanced users but also suggests that as users' understanding and engagement with 3D printing grow, they increasingly recognize the transformative potential of cloud management in optimizing their workflows. With these solutions enabling remote monitoring, agile scalability, and seamless workflow integration, it's clear why those most familiar with 3D printing's intricacies are leading the charge in adopting these advanced management systems.

Necessity Drives Adoption in Extensive Operations



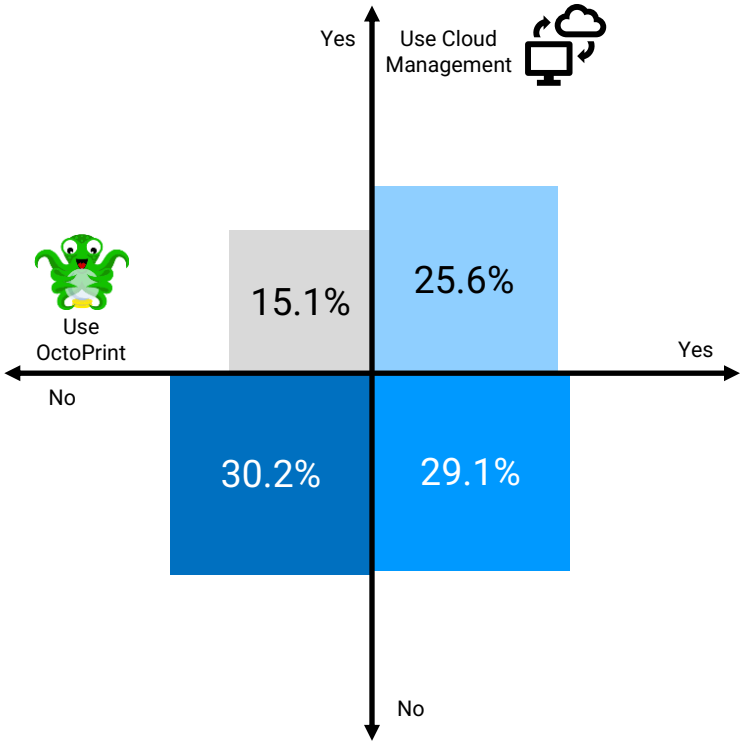
The correlation between printer fleet size and cloud management adoption underscores that as operational demands grow, so does the need for robust, centralized control systems. It's evident that for those managing substantial fleets, cloud management is not an optional luxury but a strategic imperative.

This is further exemplified by the trend that a notable 17.6% of those with larger fleets use cloud management across all printers, showcasing cloud management as a key facilitator for scalability and efficiency in high-volume printing operations.

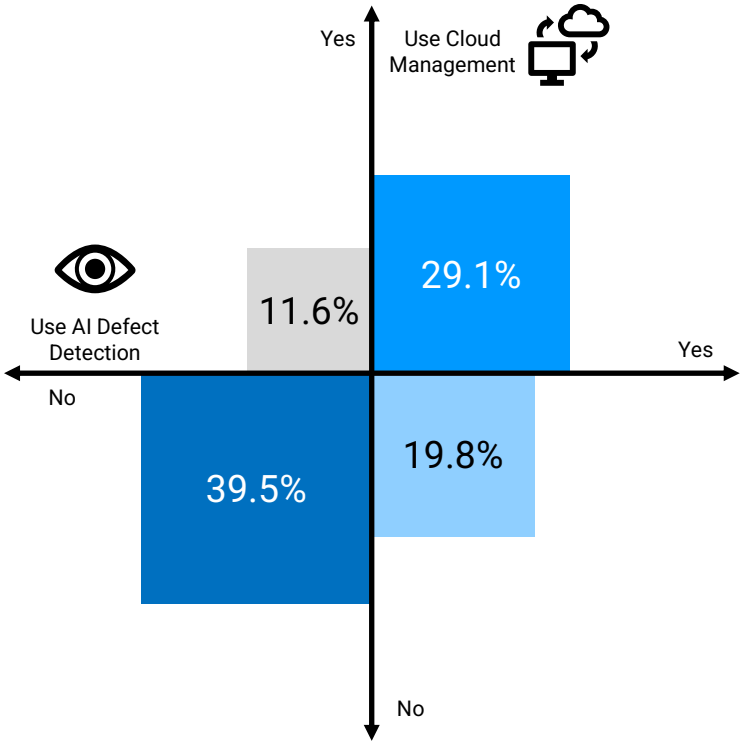


Relationship Between Use of Software and Hardware Solutions & Cloud Management

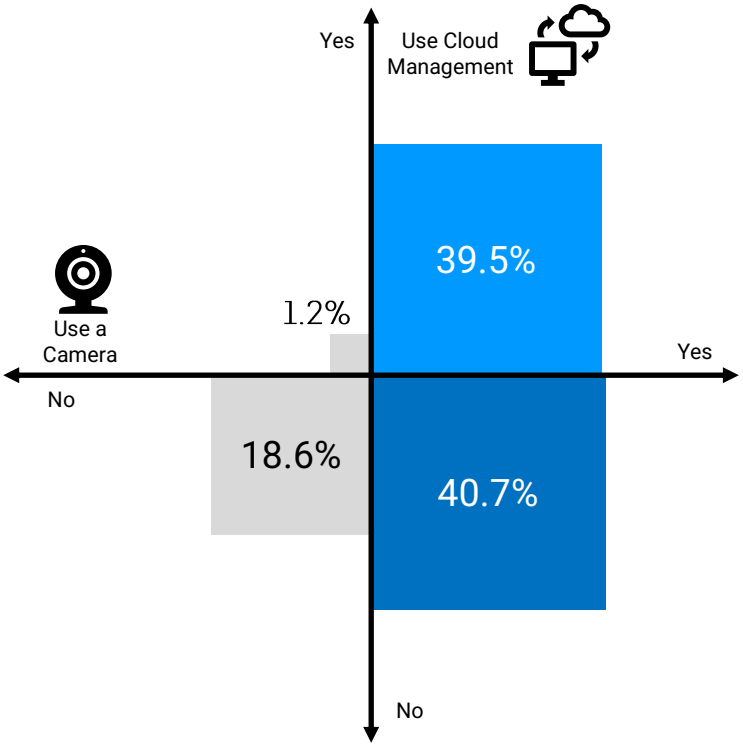
OctoPrint & Cloud management relationship matrix



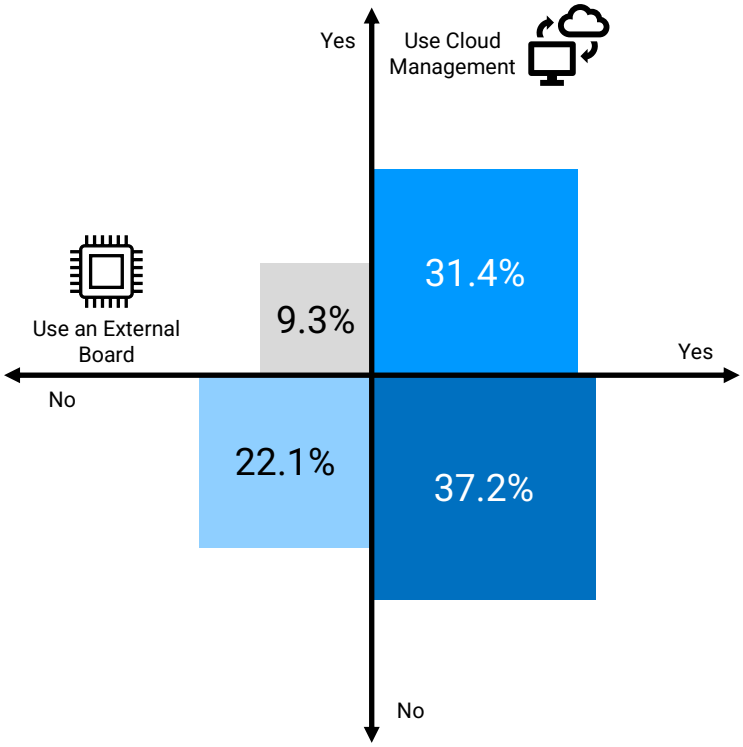
AI defect detection & Cloud management relationship matrix



Camera & Cloud management relationship matrix

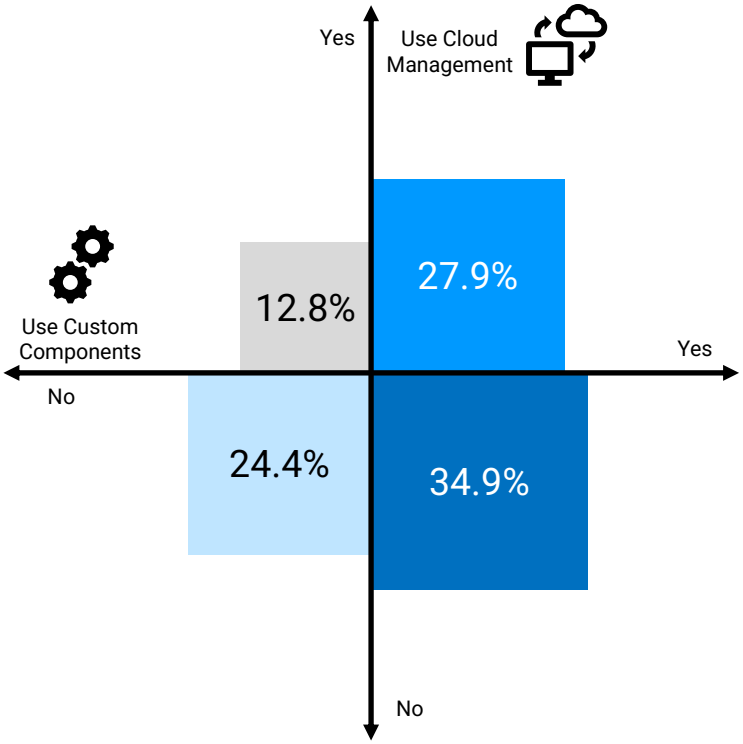


External board & Cloud management relationship matrix



Summary of Software & Hardware Relationship to Cloud Management

Custom components & Cloud management relationship matrix



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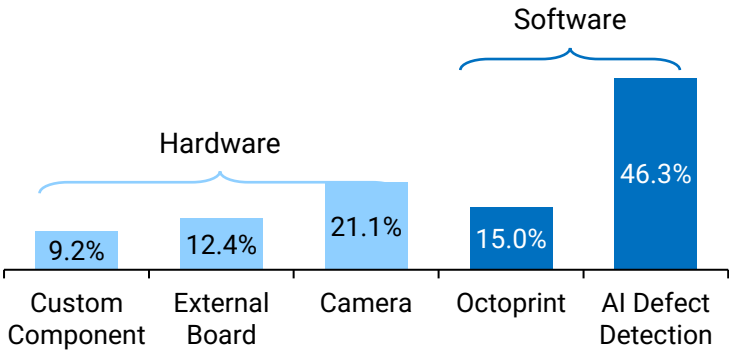
Cloud Management's Synergy with 3D Printing Technologies

Our data illustrates a pivotal synergy; users leveraging cloud management are more likely to integrate software solutions such as AI defect detection. For instance, 60% of users who have adopted cloud management also utilize AI defect detection, reflecting the preference for a streamlined, automated workflow that capitalizes on the efficiency of AI.

These relationships suggest a clear trajectory toward integrated solutions, where cloud management stands as a central hub, not only fostering efficiency and remote operability but also encouraging the adoption of advanced printing techniques. As cloud platforms continue to evolve, they are expected to become the standard, tying together the threads of innovation across the 3D printing landscape and propelling the industry into a new era of connected, intelligent production.

Increased likelihood to use Cloud management vs. total population



+7.1% Hardware

+43.3% Software

*Responders that use some kind of software offering or have additional hardware components are 43.3% and 7.1% more likely to use AI defect detection than the average population

Future-Proofing 3D Printing: The Critical Role of Preventative Maintenance

Recognizing the Importance of Maintenance in 3D Printing

Prevailing wisdom in the 3D printing sector recognizes the significance of proactive steps to mitigate printing issues before they escalate. The compiled data illustrates a consensus towards the high value of preventative maintenance, with responses heavily skewing towards the upper end of the importance scale. This concentration of responses between 6 and 8 underscores an industry-wide endorsement of preemptive measures as a critical component of successful 3D printing operations.

These insights not only reflect the current acknowledgment but also suggest an increasing trend towards prioritizing maintenance to enhance efficiency, minimize downtime, and reduce long-term costs.

As operations scale within 3D printing, the necessity of preventative maintenance becomes increasingly pronounced. The survey indicates that entities with larger fleets of printers, particularly those managing 5 to 20 machines, report a higher valuation of preventative strategies.

This trend suggests that as the complexity and stakes of production rise, so does the reliance on sophisticated maintenance protocols. Larger fleets encounter amplified operational challenges, where the impact of downtime is magnified, making software solutions for preemptive maintenance not just a convenience, but a critical business strategy for continuity and scalability.

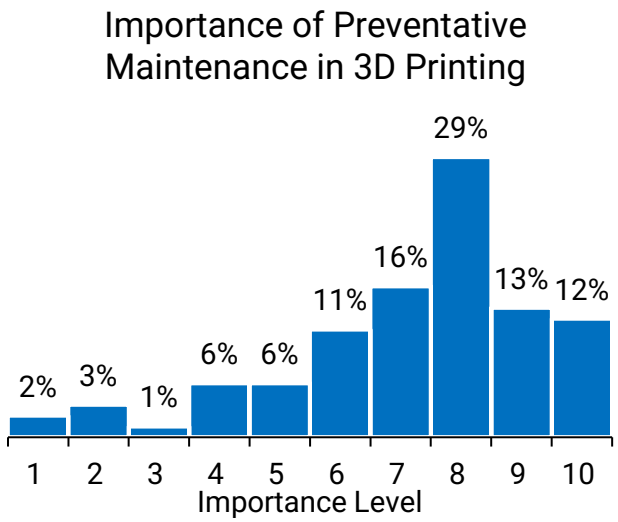
Preventative Maintenance: A Scaling Need for 3D Printer Fleets

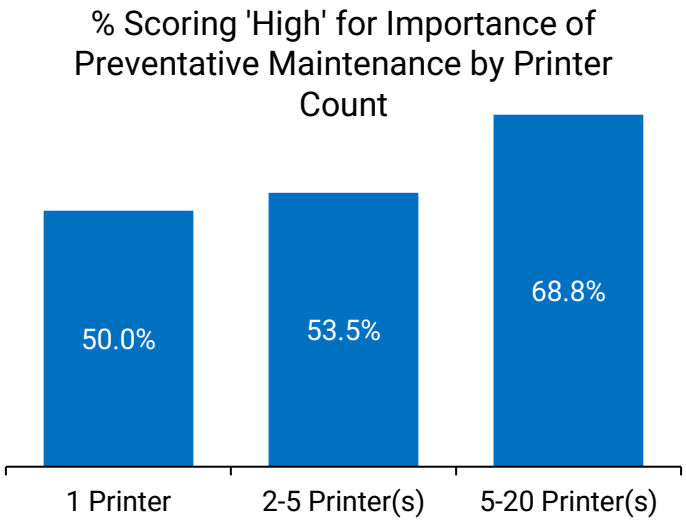
The adoption and integration of preventative maintenance, is rapidly becoming necessary for 3D printing businesses aiming to optimize operations. This trend is particularly noticeable as enterprises scale up, with those operating larger fleets of printers significantly emphasizing the importance of preemptive maintenance measures.

Small-scale operators may perceive preventative maintenance software as a luxurious addition rather than a necessity. However, the data suggests that even those with a single printer recognize the value, albeit to a lesser degree than larger operators. For large-scale operations, the intricate ballet of managing multiple prints escalates the risks and costs associated with potential downtimes. Herein lies the impetus for the industry-wide pivot towards software solutions that can predict, prevent, and troubleshoot issues before they compound.

The investment in preventative maintenance software transcends mere operational smoothness; it embodies a strategic foresight that can result in a significant return on investment.

Early adopters of such software can avert costly failures, reduce waste, and optimize printer uptime, thereby gaining a competitive edge in the market. The long-term financial benefits, coupled with the bolstering of reputation as a reliable manufacturer, make a compelling case for early integration of maintenance software.





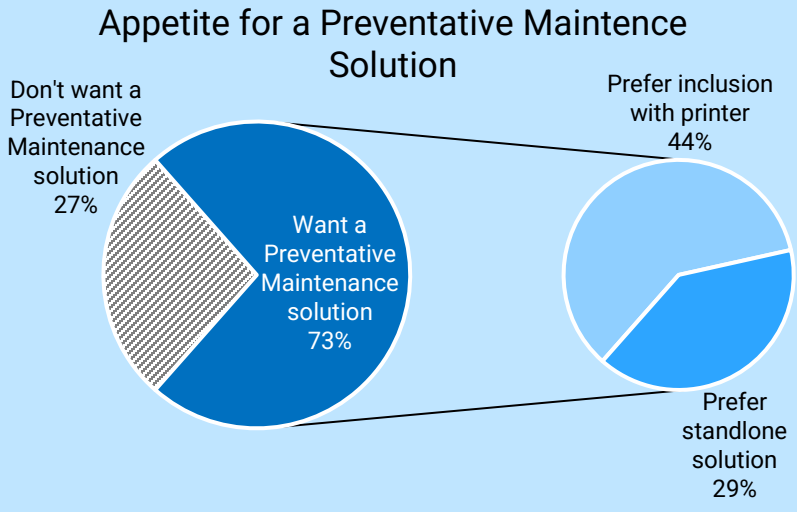
Proactive Overhaul: Embracing Preventative Maintenance in 3D Printing

Market Demand for Preventative Maintenance Solutions

Market trends in 3D printing reveal that preventative maintenance is not merely a feature but a necessity, with 73% of survey participants advocating for it. This demand spotlights the transition from piecemeal maintenance to integrated, system-wide solutions. 44% of users prefer these maintenance capabilities to be an inbuilt aspect of their printers, signaling a shift towards holistic solutions from purchase.

As the landscape of 3D printing evolves, the push for preemptive maintenance underlines a wider recognition of its intrinsic value. It's a reflection of an industry maturing beyond the infancy of innovation to a stage where reliability and uptime become the pillars of productivity. This discerning demand suggests an era where seamless operation and maintenance are not merely advantageous but foundational.

The industry's pivot to proactive maintenance is also a reflection of a maturing market that increasingly prizes uptime and smooth operation. As businesses scale and the complexity of their 3D printing operations increases, the integration of preventative maintenance is proving to be a significant enabler of growth and a delineator of competitive advantage. This acknowledgement of the pivotal role of maintenance can be seen in the consensus among industry professionals that efficiency and reliability are becoming synonymous with additive manufacturing.



Operational Efficiency & Error Mitigation

The imperative for preventative maintenance is underscored by the current inefficiencies and error prevalence in 3D printing operations. Despite significant advancements in machine efficiency over the past decade, additive manufacturing continues to chase the benchmark set by more traditional manufacturing processes.

For industry professionals, who score the importance of preventative maintenance in 3D printing at a notable 7.75, the focus has shifted from mere error correction to proactive avoidance and systemized maintenance. These strategic measures enable not only more reliable outputs but also improved resource allocation and heightened operational efficiency. As the technology and applications of 3D printing mature, so too does the critical need for robust preventative measures, poised to set new standards within the industry.

Average Score by Identity			
Industry Professional	Print Farm Operator	3D Printing Hobbyist	Student & Educator
7.75	6.75	7.26	6.74
% Scoring High Importance (>7)			
70%	50%	57%	44%

Prevailing errors and operational hiccups are key hindrances to the broader uptake and scalability of 3D printing. Confronting these issues squarely, preventative maintenance stands out as a strategic imperative for industry frontrunners. It transcends its traditional role to become a versatile toolkit—curtailing material waste, circumventing equipment wear, and amplifying the productivity of print jobs.

Looking ahead, industry visionaries unanimously agree: investment in preventative maintenance transcends immediate returns; it is a commitment to the future of 3D printing. A future envisaged to be defined by unparalleled precision, enduring reliability, and the apex of operational excellence.

Reporting Identity: 3D Printing Hobbyist

In the diverse ecosystem of additive manufacturing, many professionals also embrace the role of 3D printing hobbyists. This segment, rich with engineering enthusiasts and DIY aficionados, brings a classic, hands-on perspective to an industry that melds tradition with innovation.

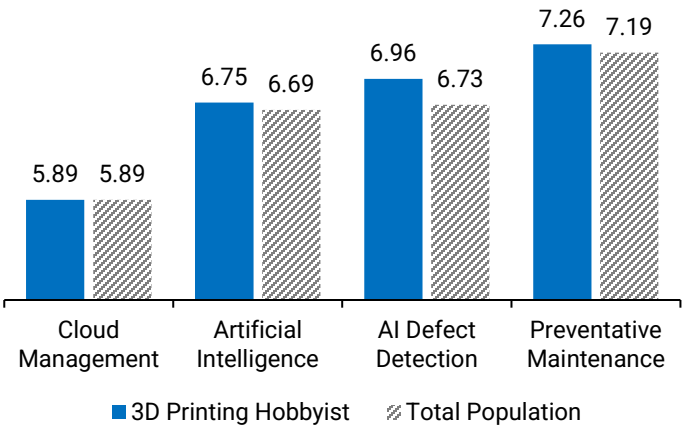
Hobbyist Profile: A Snapshot

3D printing hobbyists, renowned for their hands-on, experimental approach to additive manufacturing, are often the harbingers of industry trends. Merging a common passion with industry professionals, these enthusiasts cultivate unique technology adoption patterns, typically favoring FDM techniques over SLA/SLS printing and showing a marked interest in the integration of advanced solutions such as AI defect detection and cloud management.

Leading the charge in the embrace of new technologies within the 3D printing domain, hobbyists frequently eclipse the broader industry's pace in adopting innovative tools. Their predilection for AI in defect detection highlights their deep-rooted involvement in the printing process and underscores a committed approach to quality control. An impressive 90% of hobbyists are keen to incorporate AI defect detection within their printers, indicating a shift in the market where AI's contribution is integral to the evolution of 3D printing methodologies, far beyond being a novelty.

Their significant frustration with print failures is further emblematic of a widespread demand for advanced preventative maintenance. This sentiment is indicative of an overarching market trend leaning towards software solutions that are not only about maintenance but also about elevating the standards and capabilities of 3D printing practices.

Importance of Various Software Solutions vs. Average



+14%

More likely for Hobbyists to manage 1 printer than the average population. They are also less likely to use resin (SLA/SLS) printing and more likely to use Extrusion (FDM/FFF) printing.

Minimal reporting difference

Hobbyists report using some kind of software solution (*OctoPrint, cloud management, AI defect detection*) in line with the total population[1]. However, use of AI defect detection was 7% more likely.

Minimal reporting difference

Hobbyists report having additional hardware (*camera, external board, custom component*) in line with the total population[1]. However, use of an external board was 9% more likely for this group.

6.94
3D Printing Knowledge
(1%) var. to avg.

7.67
Technical Knowledge
No var. to avg.

Hobbyists are reporting in line to 3D printing and technical knowledge levels representative of the total population.

They are more likely to fall in the Medium and less likely to fall in the High 3D printing knowledge level

Slightly more inclined towards the High and less likely to score in the Low technical knowledge level.

Less print failures but higher failure frustration

Hobbyists are 4% more likely to report never or rarely experiencing failures but are 5% more likely to report print failure frustration as Medium or High.

With higher frustration comes greater perceived value in AI defect detection, as Hobbyists are 8% more likely to score High importance for the solution.

72%
Want a Preventative Maintenance Solution

56% of the Hobbyists that want the solution want it included with the purchase of the printer.

44% of those that want preventative maintenance prefer it as a standalone service.

90%
Want an AI Defect Detection Solution

34% of the users that want AI defect detection want it included with the purchase of the printer.

34% want it included with a cloud management solution.

32% prefer a standalone solution.

Footnote(s): 1. Under 5.0% difference in reporting

Reporting Identity: Industry Professional

Comprising forward-thinkers and innovators, industry professionals are driving additive forward. With their finger on the pulse of emergent technologies, they're not just adapting to new industry standards — they're setting them, ensuring their businesses thrive in a nascent industry.

Innovation Pioneers: Profiling the 3D Industry Professional

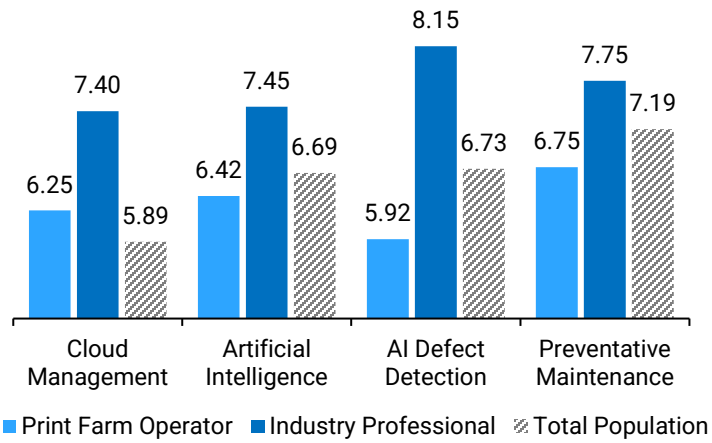
Industry professionals are the catalysts of industry advancement, consistently at the helm of adopting transformative technologies. These visionaries, spanning roles from executives to print farm operators, bring a forward-thinking perspective to their work, integrating solutions like AI for defect detection into their workflows.

While AI plays a crucial role, with 97% of professionals favoring its integration, it's part of a broader strategy that employs smart, software systems to optimize manufacturing processes. A substantial 39% prefer that their printers come equipped with AI capabilities, reflecting a trend toward seamless, integrated operations that enhance productivity and innovation.

Beyond AI, these professionals exhibit a mastery of the additive manufacturing field, applying their expertise to propel industries such as aerospace, automotive, healthcare, and consumer goods toward the future. They are pivotal in steering the industry's progress, cultivating a collaborative environment that nurtures breakthroughs and ensures that the sphere of 3D printing continues to expand its influence globally.

Their contribution is defining not only the current landscape but also setting the groundwork for the next wave of innovation, with AI defect detection, cloud management, and preventative maintenance being pieces of the complex puzzle.

Importance of Various Software Solutions vs. Average



+195%

More likely to manage 5+ printer than the average population. They are also less likely to use FDM/FFF printing but are much more likely to use resin (+24%), metal (+185%), and other[1] (+20%) printing.

+26%

Industry professionals and farm operators are significantly more likely to use a software solution. 54%, 22%, and 20% more likely to use cloud management, AI defect detection, and OctoPrint, respectively.

+11%

Industry professionals and farm operators are more likely to use additional hardware. 34%, 18%, and 9% more likely to use custom components, an external board, and a camera, respectively.

8.22
3D Printing Knowledge
+17.0% var. to avg.

This group has the highest reported 3D printing and technical knowledge levels. 85% more likely to report high 3D printing knowledge and 19% more likely to report a high technical knowledge level.

8.16
Technical Knowledge
+6.4% var. to avg.

Print farm operators' self reported a higher level of 3D printing knowledge, but lower technical knowledge level compared to the industry professional group.

Higher fail frequency and highest print failure frustration

Industry professionals are more likely to report never experiencing failures, yet only 6% report never experiencing a failure. They are also 11% more likely to report frequently experiencing failures.

This population reported the highest print failure frustration level of 6.50 and was 44% more likely to report a High level.

78%
Want a Preventative Maintenance Solution

64% of the industry professionals that want the solution want it included with the purchase of the printer.

36% of those that want preventative maintenance prefer it as a standalone service.

97%
Want an AI Defect Detection Solution

39% of the responders that want AI defect detection want it included with the purchase of the printer.

39% want it included with a cloud management solution.

22% prefer a standalone solution.

Footnote(s): 1. Includes MJF, continuous fiber reinforcement, and binder jetting
2. Under 5.0% difference in reporting

Reporting Identity: Student & Educator

Students and educators in the realm of 3D printing bring a unique blend of curiosity and academia to additive manufacturing. With a focus on learning and innovation, they contribute fresh perspectives that can shape future applications of technology.

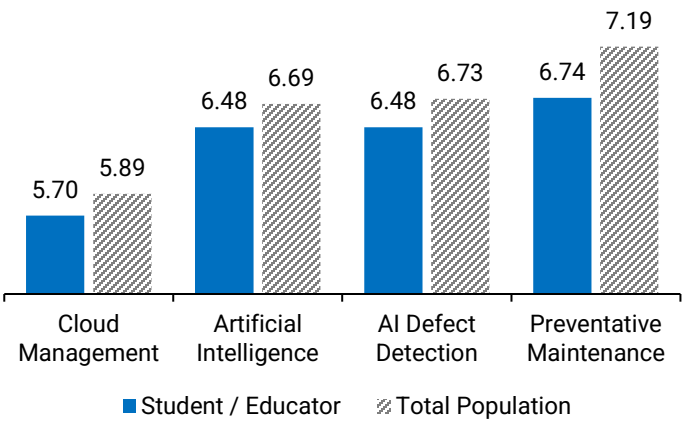
Shaping the Future: The Academic Perspective on 3D Printing

Spanning the spectrum from K-12 to higher education, the Student & Educator demographic is integrating 3D printing into the learning environment. Far more than a mere instructional tool, it's a subject of study, igniting curiosity and innovation. Students and educators delve into specialized and emerging 3D printing technologies, paving the way for transformative advances in manufacturing and design.

The implementation of 3D printing in academia is as varied as the disciplines it serves, providing students with immersive, hands-on learning experiences that bring abstract concepts to life. Although AI defect detection may not be their primary focus, students and educators are keenly interested in the expansive possibilities of 3D printing as a multidisciplinary tool that opens doors to future innovations and career opportunities.

This group's approach to software mirrors their educational goals, favoring functionalities that bolster learning outcomes. From cloud management that fosters collaborative learning environments to AI applications that demystify complex industry processes, their selection of tools underscores an emphasis on learning that is both foundational and forward-looking. In this way, students and educators are not just passive recipients of knowledge but active participants, transitioning from theoretical learning to practical application in the wider world of industry.

Importance of Various Software Solutions vs. Average



+19%

More likely for Students & Educators to manage 1 printer. However, they were the most likely to use 'Other' forms of 3D printing such as MJF, continuous fiber reinforcement, and binder jetting.

(24%)

Students & Educators are significantly less likely to use a software solution with their printer (*OctoPrint, cloud management, AI defect detection*). However, they are more likely to use a solution on all hardware.

(16%)

Students & Educators are less likely to have additional hardware (*camera, external board, custom component*). However, like a software solution, they are more likely to use added hardware on all their machines.

6.57
3D Printing Knowledge
(7%) var. to avg.

Students & Educators reported a lower 3D printing and technical knowledge level compared to the reporting average, and particularly compared to their industry professional, and hobbyist counterparts.

7.09
Technical Knowledge
(8%) var. to avg.

For both reporting on 3D printing and technical knowledge, this population was significantly more likely to score a 'Low' level of knowledge (Score <4).

Frequent print failures but low failure frustration

Students & Educators are 33% more likely to report frequent failures but are 53% more likely to report print failure frustration as Low.

As a group that isn't utilizing 3D printing technology for personal or business need, but for educational purposes, print failures become much more acceptable.

87%
Want a Preventative Maintenance Solution

65% of the Hobbyists that want the solution want it included with the purchase of the printer.

35% of those that want preventative maintenance prefer it as a standalone service.

87%
Want an AI Defect Detection Solution

55% of the users that want AI defect detection want it included with the purchase of the printer.

20% want it included with a cloud management solution.

25% prefer a standalone solution.

Contact, Citations & Methodology

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1. Quote provided directly to printpal.io

Survey Methodology

Objective: The study aimed to dissect the prevailing attitudes and expectations towards software solutions in the 3D printing sector. Our endeavor was to distill insights from across the spectrum of industry engagement levels, shedding light on how different stakeholders perceive the impact of these technologies.

Survey Structure: A series of 21 carefully curated questions were presented to capture a comprehensive picture of the industry landscape. These inquiries ranged from profiling participants to delving deep into their perspectives on various software solutions shaping the field. A thoughtful blend of Likert scales, multiple-choice queries, and open-ended questions were employed to embrace the diverse viewpoints and experiences of respondents. Participation was further encouraged through an optional raffle entry for a chance to win a gift card.

Demographic Spread: We reached out to a broad demographic within the 3D printing community, ensuring a rich tapestry of insights by encompassing views from industry veterans to novices, from dedicated hobbyists to academic leaders. The outreach was crafted to be as inclusive as possible, channeling the survey through a multitude of platforms from January to March 2024. The survey resulted in eighty-nine unique responses. Key touchpoints included industry-focused newsletters, diverse social media channels, and specialized professional forums to ensure a balanced respondent pool.

Analysis Process: The data was sifted through by the analytics team at printpal.io. Quantitative responses were statistically analyzed for trends and patterns, while the qualitative feedback was thematically assessed to uncover deeper underlying themes and sentiments.

Ethical Assurance and Limitations: Every participant was thoroughly briefed on the intent of the study and assured absolute anonymity, with a clear option to consent to the use of their data. The findings in this report are openly available, democratizing the knowledge derived from this study. Despite the breadth of data, the survey's scope was naturally bounded by certain constraints, such as the potential for self-selection bias and the lack of a longitudinal dimension to monitor trends over time.

Emerging Trends: Initial findings suggest an increasing inclination towards integrating cloud management and leveraging AI defect detection, especially among participants demonstrating a profound understanding of 3D printing intricacies.