

# SING for GREEN

## Interviews

### Report



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## Introduction

[SINGforGREEN](#) is a project whose main purpose is to develop specific course curriculum contents in the fields of sustainable design for a green transition, supported by additive manufacturing technologies.

One of the initial activities of the project was to conduct a series of interviews with organizations (Industry and Higher Education organizations) that can provide their insights on these topics, as well as on the underlying limitations, barriers, needs, and opportunities. The information gathered in this process will be crucial input for identifying needs to be addressed in subsequent stages of the project, where a curriculum will be defined, and new training contents will be developed and tested.

These interviews lasted approximately 1 hour and consisted of a guided interview (conducted in person, over the phone, or via any remote meeting tool) covering topics such as additive manufacturing, design, and sustainability.

Two series of interview questions were created during Work Package 2 process. Series of interview questions were addressed to two types of entities:

1. People from higher education institutions
2. AM experts from industry

There were conducted interviews with **17** AM Experts from industry and **18** people from Higher Education Institutions.

## Interview questions for people from higher education institutions

There were **11** main interview questions, covering **5** topics, addressed to people from higher education institutions:

1. AM: Can you summarize the AM technologies and the related capabilities in which your organization is providing or can provide training activities?
2. Design: Does your organization provide training courses or materials related to design activities?
3. Design for AM: Does your organization provide specific courses or materials in the field of DfAM (Design for Additive Manufacturing)?
4. Design for AM: If the answer to question 3 is yes, can you summarize your training curriculum/programmes/courses/seminars, etc. offer?
5. Sustainability: Have you received any formal education or training on integrating sustainability principles into DfAM processes? Which?
6. Sustainability and AM: Does your organization have previous experience on implementing some specific methods, techniques, practices, or software for making AM related activities more sustainable (or more sustainable than other manufacturing options)?
7. Sustainability and AM: Do you see sustainability as a training topic? Is it currently integrated in your AM training offer? An in the context of other manufacturing technologies? If the answer is yes, how?
8. Sustainability and AM: What do you see as the most important sustainability issues designers face nowadays?
9. Sustainability and AM: What specific knowledge and skills do you think are essential for designers to effectively implement sustainable design principles and practices in their work?
10. Sustainability and AM: Do you think that your organization could improve its current level of skills and knowledge regarding AM-design-sustainability? If the answer is yes, in what areas?
11. Sustainability and AM: What types of training methods and platforms do you believe would be most effective in equipping designers with the necessary knowledge and skills for sustainable design?

There were also 2 additional questions in conclusion:

- Are you interested in a free training of employees in your organisation focused on sustainability context of AM technologies in design activities?

- What would be your preferred topics for the training?

### **AM: Can you summarize the AM technologies and the related capabilities in which your organization is providing or can provide training activities?**

The overall results indicate a wide range of technologies and training capabilities, with a predominance of plastic 3D printing technologies. Three-quarters of the participants frequently mentioned Fused Filament Fabrication (FFF) or plastic material extrusion. Photopolymerization technologies also have a significant presence, though at about half the rate of FFF. Powder Bed Fusion (PBF) technologies are considerably less common.

For metallic 3D printing, implementation is much lower, with around a quarter of respondents using these technologies. There were mentions of PBF, Directed Energy Deposition (DED), and metal filament printing technologies, but their presence is more sporadic.

### **Design: Does your organization provide training courses or materials related to design activities?**

We gathered 18 responses: 13 answered Yes, 4 answered No, and 1 was Not Applicable. These training courses are primarily part of master's programs like MSc in Engineering for Product Design, MSc in Engineering for Direct Digital Manufacturing, and MSc in Mechanical Engineering. Topics covered include Ecodesign, Grasshopper (generative design), Life Cycle Assessments (LCAs) with SimaPro, architecture software from "Desktop," material properties characterization, testing with Additive Manufacturing (AM), and mechanics in design.

Other subjects are the development of "ProTOp" for topology optimization, digital technologies for product development, principles of additive manufacturing, material and mechanical design, French Certification in Design for Additive Manufacturing (DfAM), design considerations (defects, supports, geometry), and manufacturing/production processes for additive manufacturing.

One participant emphasized that AM design is critical for successful product design and production. Overall, these courses integrate training with products and equipment, combining manufacturing and post-processing technologies.

### Design for AM: Does your organization provide specific courses or materials in the field of DfAM (Design for Additive Manufacturing)?

A total of 8 participants reported that their organization provided specific courses in Design for Additive Manufacturing (DfAM), while 5 participants stated that their organization did not offer such courses, and 2 participants were unsure. Examples of the courses mentioned include an MSc in Engineering for Direct Digital Manufacturing and a third-year Mechanical Engineering course on Advanced Manufacturing Technologies. Some organizations offered courses on Generative Design using software such as Fusion 360, Apex Generative Design, NX Siemens, and nTopology. Additionally, Industrial Design courses allowed students to gain hands-on experience with 3D printing, although these were not specifically focused on DfAM. The responses indicated a varied approach, with some organizations offering specifically tailored DfAM courses, while others did not.

### Design for AM: If the answer to question 3 is yes, can you summarize your training curriculum/programmes/courses/seminars, etc. offer?

Some examples of the training curriculum include teaching the basic principles of Additive Manufacturing (AM), its processes, applications, and Design for Additive Manufacturing (DfAM). Students are asked to design parts by reducing mass and stress concentrations in preparation for AM. Industrial Design courses involve 3D modeling and printing for validation, although DfAM is not included. The curriculum also covers the technology and theoretical aspects of AM, with PhD students focusing on DfAM, design rules, function integration, part consolidation, and the use of lattice and gyroid structures. Additionally, it includes the fabrication process, such as slicing, orientation, supporting, nesting, printing parameters, and simulation of the AM process, as well as using industry case studies.

### Sustainability: Have you received any formal education or training on integrating sustainability principles into DfAM processes? Which?

We gathered a total of 18 responses. Out of these, 2 respondents answered Yes, and 16 answered No. Only 2 interviewees recognized that they had received formal education or training on integrating sustainability principles into DfAM processes. However, of the 16 respondents who answered No, 31% (5 individuals) indicated that they had engaged in non-formal education, such as self-research or independent learning, although this was not formally recognized.

The 2 interviewees who answered Yes provided specific examples of their training:

- "Mapping of product functions and design principles for additive manufacturing" (dental medicine)
- "Computational design in AM" and "Eco design for AM related to Life Cycle Assessment" (requested by aeronautics)

### **Sustainability and AM: Does your organization have previous experience on implementing some specific methods, techniques, practices, or software for making AM related activities more sustainable (or more sustainable than other manufacturing options)?**

Out of the 18 responses analyzed, 5 were excluded due to either not answering the question or lacking specific answers.

Among the 13 valid responses, the most popular answer involved the use of specific software packages. Six respondents indicated they are using software such as LCA (Life Cycle Analysis) to assess environmental impact, generative design tools, and topology optimization software to minimize material use while maintaining performance.

Three respondents mentioned engaging in topology optimization activities beyond software, including teaching or research. Another three respondents highlighted practical sustainability measures, such as turning off AM machines when not in use and recycling materials for reuse in 3D printing.

Additionally, one respondent noted that they optimize printing processes primarily for financial reasons.

### **Sustainability and AM: Do you see sustainability as a training topic? Is it currently integrated in your AM training offer? An in the context of other manufacturing technologies? If the answer is yes, how?**

18 interviewees answered this question. Three of them did not provide any answer. Eight of them have training on the topic, while seven of them do not offer any courses on sustainable design.

When we look at the distribution of the answers to the different topics, most of the responses indicate that "Elements of Sustainability" are delivered or suggested to be delivered as a training course for designers to integrate sustainability into AM design. The other answers for the suggested topics are distributed equally; there are two responses for each of the following topics:



- Life Cycle Assessment (LCA)
- Generative Design and Topology Optimization
- Material Recycling and Resource Efficiency
- Energy Conservation
- Sustainable Materials and Processes
- Economic and Marketing Benefits of Sustainability

Finally, one participant stated that "Environmental Impact Assessment" can be considered as a course on sustainability for AM designers.

### Sustainability and AM: **What do you see as the most important sustainability issues designers face nowadays?**

Some important sustainability issues designers face include Product end-of-life overlooked in design, neglecting Eco-design principles. Sustainability improvements face economic challenges as they may alter the overall cost. Many compares using AM with traditional methods, ignoring the unique sustainability benefits and challenges of AM, such as material recyclability and process costs. Misunderstanding about AM's potential, material perception, and lack of specialized courses. Designers need to consider the entire product lifecycle for true sustainability. More awareness and education needed. Difficult to achieve overall vision of how the entire process changes when including sustainability. Cost of expensive software, lack of understanding post-processing steps.

### Sustainability and AM: **What specific knowledge and skills do you think are essential for designers to effectively implement sustainable design principles and practices in their work?**

This question is crucial among the interview set as it directly addresses the necessary skills for AM designers to achieve sustainable design.

Among the eighteen respondents, the majority, with eleven responses, emphasized that AM designers should possess 'material knowledge' for sustainable designs. Nine respondents stated that a basic understanding of AM technologies and processes is essential and should be taught to AM designers. 'Design for AM principles' was mentioned by six respondents, while 'life cycle assessment' was highlighted by five. Additionally, respondents suggested incorporating 'generative design and topology optimization' into the training. Finally, integrating 'sustainability principles and awareness' along with practical applications such as case studies or best practices is recommended for educating designers about sustainable design.

**Sustainability and AM: Do you think that your organization could improve its current level of skills and knowledge regarding AM-design-sustainability? If the answer is yes, in what areas?**

Out of eighteen responses, seventeen affirmed that their organization could provide and would benefit from these areas:

- Cost estimation methods to determine the payback on AM tools
- LCA evaluation on the recycling of AM products
- Development/Circularity of new AM materials from recycled materials
- Use of build simulation tools to prevent bad decisions
- Optimization of energy consumption
- Optimization of various technologies (both AM and non-AM)
- Prototyping and industrial design
- Construction and design in general
- Basic knowledge on design, technologies, and materials
- Investment in repositories and platforms in native languages
- Standardization
- Environmental footprint of a product, process, or material
- Matching the requirements
- Azure manufacturing
- Types of technologies, design, and post-processing of 3D printed parts
- Parameters optimization to minimize waste and energy consumption
- Topology optimization, generative design, and lattice structures
- Materials recycling
- Good practices in industry

Additionally, one interview was unclear (YES or NO) and highlighted the difficulty in finding an audience for this niche topic, as people typically seek information on either sustainability or AM. This becomes especially important when the audience is from the industry.

**Sustainability and AM: What types of training methods and platforms do you believe would be most effective in equipping designers with the necessary knowledge and skills for sustainable design?**

The question aims to understand higher education stakeholders' opinions on training AM designers in sustainable design topics. Interestingly, none of the interviewees preferred purely online learning. Most respondents, six in total, favoured a "blended learning" approach, where online learning is used for the introduction, but approximately

70% of the course is conducted face-to-face and in proximity to the AM equipment. Four respondents preferred exclusively face-to-face training. Two suggested practical exercises, such as case studies, and regular workshops were also highlighted by participants. Additionally, one respondent mentioned that hands-on training could be provided through digital twins of the AM equipment or VR technologies.

### Are you interested in a free training of employees in your organisation focused on sustainability context of AM technologies in design activities?

All respondents are interested in free training.

### What would be your preferred topics for the training?

The topics preferred by the respondents, listed by frequency, are as follows:

- **Additive Manufacturing (AM) Technologies:** Respondents emphasized the need to understand the different AM technologies, their distinctions, and how to optimize the AM production process.
- **Design and Modeling:** Many respondents highlighted the importance of training in design and modeling for additive manufacturing, including topology optimization, generative design, and design constraints specific to AM.
- **Sustainability:** Several responses stressed the importance of sustainability training within the context of AM. This includes understanding sustainability in general, designing for sustainability, and comparing the sustainability of different AM technologies.
- **AM Materials:** Some respondents indicated the importance of understanding the various materials used in AM, such as polymers, composites, and metals.
- **Best Practices:** Several responses emphasized the importance of learning industry best practices and insights from other organizations with training in this area.
- **Others:** Topics such as post-processing, software tools, and regulations were also mentioned.

## Interview questions for AM experts from industry

There were twelve main interview questions, covering five topics, addressed to AM experts from industry:

1. AM: **Can you summarize the AM technologies/capabilities that are available in your organization as well as the available manufacturing materials?**
2. Design: **Does your organization carry out the design tasks for all the additive manufacturing works? If the answer is yes, could you please explain what is your typical design process for AM?**
3. Design for AM: **What design and slicing tools does your organization use?**
4. Design for AM: **Do you know about the term DfAM (Design for Additive Manufacturing)? Do you associate it with some specific methods, techniques, practices, or software? Which ones?**
5. Sustainability: **How does your organisation understand and implement sustainability in its industrial activity? Can you provide a successful example/case study?**
6. Sustainability and AM: **What kind of formal education or training on integrating sustainability principles into designing for AM processes have you received so far?**
7. Sustainability and AM: **Does your organization implement some specific methods, techniques, practices, or software for making AM related activities more sustainable (or more sustainable than other manufacturing options)?**
8. Sustainability and AM: **What existing sustainability initiatives or practices would you like to implement in the future?**
9. Sustainability and AM: **What barriers or limitations do you encounter when implementing sustainable practices?**
10. Sustainability and AM: **What specific knowledge and skills do you think are essential for designers to effectively implement sustainable design principles and practices in their work?**
11. Sustainability and AM: **What types of training methods or platforms do you believe would be most effective in equipping designers with the necessary knowledge and skills for sustainable design?**
12. **Is there anything you want to add?**

There were also two additional questions in conclusion:

- **Are you interested in a free training of employees in your organisation focused on sustainability context of AM technologies in design activities?**
- **What would be your preferred topics for the training?**

**AM: Can you summarize the AM technologies/capabilities that are available in your organization as well as the available manufacturing materials?**

In general, the results show that Fused Filament Fabrication (FFF)/plastic material extrusion is the most widely adopted technology, mentioned by almost three-quarters of the participants. In metal 3D printing, metallic technologies are less common, with nearly half of the respondents having used them, predominantly Powder Bed Fusion (PBF) technologies.

Both metal and polymer 3D printing involve other technologies as well. In plastic fabrication, photopolymerization technologies for resins are frequently mentioned, with occasional use of Binder Jetting and PBF-polymer. In metal fabrication, PBF remains dominant, but there are instances of Directed Energy Deposition (DED) and Laminated Object Manufacturing (LOM)

Regarding materials, commonly used plastics include PLA, ABS, and PETG (FFF), with occasional use of reinforced fibers (FFF) and resins (VAT photopolymerization). Among metals, frequently used materials include various aluminium, titanium, and steel alloys.

**Design: Does your organization carry out the design tasks for all the additive manufacturing works? If the answer is yes, could you please explain what is your typical design process for AM?**

Sixteen out of the seventeen interviewees are involved in designing parts for 3D printing at some level.

Most interviewees focus on optimizing parts already created by customers using conventional designing techniques. In implementing design optimizations, they primarily aim to minimize part weight and reduce 3D printing time. Additionally, by altering designs to reduce the need for support structures, they effectively minimize waste.

When developing new part designs for 3D printing, they rely mainly on general knowledge of specific 3D printing technologies' capabilities and design constraints, along with in-house experience and proven design solutions. Only two interviewees incorporate modern, innovative design methods like Topology Optimization and Generative Design to improve the weight-to-strength ratio of components.

The interviewees primarily use 3D printing for prototype production to verify the accuracy of component shapes and the correct functioning of mechanisms. They also use 3D printing for producing final, functional components and mechanisms, including:



- Functional components for engineering and automotive sectors
- Sheet metal bending tools
- Components for production lines and automation
- Measuring, assembly, and welding jigs

### Design for AM: **What design and slicing tools does your organization use?**

Most Commonly Used Design Software (CAD Software):

- SolidWorks
- CATIA V5/3DEXperience
- Autodesk Inventor
- Creo
- Autodesk Fusion 360

Most Commonly Used Slicing Software:

- PrusaSlicer
- Materialise Magics
- Bambu Studio/Lab
- Cura

### Design for AM: **Do you know about the term DfAM (Design for Additive Manufacturing)? Do you associate it with some specific methods, techniques, practices, or software? Which ones?**

Most respondents demonstrate a clear understanding of DfAM, recognizing it as a methodology focused on optimizing designs specifically for additive manufacturing (AM) technologies. They emphasize the importance of leveraging AM capabilities to create parts with complex geometries that are difficult or impossible to produce using traditional manufacturing methods.

Some respondents stress the need for a different approach to design and production for each AM technology due to their specific characteristics and limitations → design constrains. This includes understanding material properties, deposition methods, and the specific requirements of each AM technology.

The respondents mentioned several specific design methods they use in the context of Design for Additive Manufacturing (DfAM):

- Topology Optimization
- Lattice Structures
- Generative Design
- Part Consolidation
- Multimaterial Design

The respondents mentioned several CAD software they know or use in the context of DfAM:

- nTopology
- Fusion 360
- 3DEXperience
- Altair
- Ansys

### **Sustainability: How does your organisation understand and implement sustainability in its industrial activity? Can you provide a successful example/case study?**

The most common response to this question (6 out of 7) is that companies aim to minimize energy consumption, for example, by turning off machines or lights that are not in use. Six out of seventeen also mentioned recycling their waste internally or externally. Three respondents indicated that they use some form of mass reduction design, such as lattice structures. Five respondents noted that AM is inherently sustainable because it uses only the necessary material, and any excess can be reused without additional steps, unlike traditional manufacturing methods. Two respondents mentioned printing spare parts, while one stated that they redesign and print "burner" parts (parts that can only be used once) to make them reusable. Three respondents are part of a larger group or standard of institutions that collectively address sustainability and ecology. One interviewee mentioned having an internal sustainability policy that aids in better resource planning.

### **Sustainability and AM: What kind of formal education or training on integrating sustainability principles into designing for AM processes have you received so far?**

The majority of respondents mentioned that they have not received any formal education or training specifically related to integrating sustainability principles into designing for AM processes.

Some interviewees acknowledged participating in various training programs related to AM technologies, such as deep dive trainings and courses on specific AM processes or tools. However, they expressed a lack of formal education or training specifically focused on sustainability principles in AM.

Several interviewees mentioned that their knowledge in AM and related practices, including sustainability considerations, was primarily gained through self-teaching and hands-on experience.

In conclusion, the responses reflect a general lack of formal education or training specifically focused on integrating sustainability principles into designing for AM processes.

### **Sustainability and AM: Does your organization implement some specific methods, techniques, practices, or software for making AM related activities more sustainable (or more sustainable than other manufacturing options)?**

The most common response to this question (5 out of 17) was that interviewees employ material reduction techniques, such as lattice structures, to reduce mass, thereby saving time and energy. These responses also highlighted the importance of good preparation for printing, like minimizing support material through shape or mass manipulation. Additionally, one interviewee noted that AM is inherently sustainable because it only uses the required amount of material. Another mentioned that metal printers are more sustainable as they don't use emulsions like CNC machines and extract N<sub>2</sub> from the air, eliminating the need for extra gas. Furthermore, AM allows for the reuse of sieved powder, with one interviewee specifically using a 3D metal printing vacuum for this purpose.

Three respondents stated that they outsource recycling by selling scraps to waste management companies or returning empty spools or powder canisters for refilling. One interviewee mentioned that they have started ordering larger bottles of material. A casting company reported that they locally recast scraps.

Six respondents indicated that they believe they use some sustainable practices, although not clearly defined or tangible, and one interviewee stated that they do not use any sustainable practices at all.

### **Sustainability and AM: What existing sustainability initiatives or practices would you like to implement in the future?**

The most common response to this question (4 out of 17) was a desire to use more topology optimization, generative design, and lattice structures. An equal number of interviewees (4 out of 17) stated that they do not plan to implement any changes. Two respondents mentioned they would like to conduct Life Cycle Assessments (LCA) to identify areas for improvement, and one interviewee expressed plans to follow some ESG

practices. Another interviewee wants to assess and display the carbon footprint of each product.

Two respondents indicated a desire to better educate their employees, with one also wanting to include the local population in this education. One interviewee aims to install photovoltaics within their facility, while another company plans to implement the EN14001 Environmental Management System. One company is interested in experimenting with plant-based materials like PA11. Additionally, two respondents expressed a desire to make changes to their machines to optimize them, such as incorporating multi-material and multi-axis capabilities. Finally, two interviewees mentioned that they would like to collect more data on this subject.

### **Sustainability and AM: What barriers or limitations do you encounter when implementing sustainable practices?**

The most common issue, mentioned by a significant majority (12 out of 17), is the cost of materials, software, and overall sustainability practices. The second most frequent problems are material limitations (properties not meeting requirements) and a lack of education on sustainable practices, each cited by four out of seventeen respondents. This is followed by the lack of material availability, mentioned by two respondents. Additionally, two interviewees noted that many recycling and sustainability practices are still in development. One interviewee highlighted government incompetence in improving and enforcing sustainable practices, while another stated that they do not encounter any problems at all.

### **Sustainability and AM: What specific knowledge and skills do you think are essential for designers to effectively implement sustainable design principles and practices in their work?**

The most common response to this question (7 out of 17) is the need for designers to understand how specific technologies work. Equally important (7 out of 17) is knowledge of materials, including their properties and uses. Five respondents emphasized the importance of understanding the product lifecycle and being aware of how certain technologies, materials, and processes impact the environment. One interviewee mentioned the principles of recycling and the circular economy.

Two respondents highlighted the need for knowledge in product post-processing, and another two stressed the importance of understanding topology optimization, design constraints, DfAM principles, and basic mechanics. One interviewee mentioned that adaptability is crucial, while another emphasized the ability to think

outside the box. One respondent pointed out the need to modernize the educational system, while another said that designers should know not only how to produce a part but also how to repair it to extend its lifecycle.

### Sustainability and AM: **What types of training methods or platforms do you believe would be most effective in equipping designers with the necessary knowledge and skills for sustainable design?**

Key observations and conclusions are:

- **Diverse Training Methods:** The responses suggest a preference for a diverse range of training methods, including traditional in-person training, online courses, workshops, and practical hands-on experiences.
- **Practical Implementation:** A recurring theme across several responses is the importance of practical implementation of taught skills and knowledge. Designers seem to value opportunities to apply sustainable design principles in real-world scenarios, whether through hands-on projects, design challenges, or practical sessions.
- **Individualized and Small Group Learning:** There's an emphasis on individualized learning experiences and small group settings, where attendees can engage in open discussions, ask questions, and receive personalized attention.
- **Combining Theory with Application:** Effective training methods should strike a balance between theoretical knowledge and practical application. While theoretical understanding is essential, it's equally crucial for designers to learn how to apply sustainable design principles in their work and understand the practical implications of their decisions.

In conclusion, effective training methods for equipping designers with knowledge and skills for sustainable design should be diverse, practical, and engaging, incorporating a balance of theory and application. Individualized learning experiences, small group settings, and opportunities for interaction and collaboration are essential to achieve meaningful learning outcomes.

### **Is there anything you want to add?**

The question responses highlight several key points regarding additive manufacturing (AM):

- Recycling strategies are essential for the long-term sustainability of AM.
- It's important to make AM more appealing to young people and educate them about its potential from an early age, starting in elementary school.



- Practical experience in AM is invaluable, requiring many failures to achieve success.
- The "Sing for Green" project, despite being a great idea, lacks sufficient awareness and momentum beyond academic circles.
- People need to understand the differences between consumer-grade and industrial 3D printers, and the industry should recognize that AM can often be more efficient than traditional manufacturing methods like CNC.
- More online workshops and seminars are needed to increase awareness.
- The sustainability of AM requires thorough study through Life Cycle Assessment to provide the industry with concrete data for substantial change, as current information is insufficient for a significant impact.

### Are you interested in a free training of employees in your organisation focused on sustainability context of AM technologies in design activities?

All respondents are interested in free training.

### What would be your preferred topics for the training?

The topics preferred by the respondents, listed by their frequency, are as follows:

- **Materials and Technologies:** There is a significant emphasis on understanding the various materials used in Additive Manufacturing (AM), particularly metal printing technologies.
- **Design and Optimization:** Training needs include topology optimization, generative design, and understanding component design constraints for AM.
- **Software Tools and Methods:** Respondents expressed a need for training in various AM software tools and post-processing techniques.
- **Broader Context and Applications:** Understanding the wider applications and context of AM technologies was also highlighted.
- **Sustainability:** Topics include understanding the environmental impact of AM, such as life cycle assessment (LCA) and carbon footprint analysis.
- **Health and Safety:** There are concerns related to metal materials and the importance of safe post-processing methods.

## Conclusion

The [SINGforGREEN](#) project aims to enhance the education and training in sustainable design through additive manufacturing (AM) technologies. This report highlights the findings from a series of interviews conducted with industry experts and higher education professionals to understand the current landscape, needs, and opportunities in the field of sustainable design and AM.

Key insights from the interviews reveal a broad adoption of plastic 3D printing technologies, with a notable presence of Fused Filament Fabrication (FFF) and photopolymerization techniques. However, the implementation of metallic 3D printing remains limited. The findings indicate that most organizations are actively engaged in design tasks for AM, leveraging both traditional and innovative design methods like Topology Optimization and Generative Design.

Despite the recognition of AM's potential for sustainable manufacturing, the integration of sustainability principles into AM processes is still in its infancy. Only a small fraction of respondents have received formal education on sustainability in AM, and most rely on self-research and practical experience. There is a significant interest in enhancing sustainability practices, such as material recycling, energy conservation, and the use of sustainable materials, but cost and lack of education are major barriers.

The responses suggest a strong interest in training programs focused on sustainability in AM. Preferred training topics include understanding different AM technologies and designing for AM, sustainable design principles, and best practices in the industry. Effective training methods should combine theoretical knowledge with practical application, emphasizing hands-on experience and individualized learning.

In conclusion, the interviews underscore the need for a comprehensive educational framework that integrates sustainability into AM training. By addressing the identified gaps and barriers, [SINGforGREEN](#) can play a pivotal role in equipping designers with the necessary knowledge and skills to implement sustainable design practices effectively. The findings from these interviews will guide the development of targeted training curricula, ultimately contributing to a more sustainable future in manufacturing.



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