sculpteo

# THE STATE OF 3D PRINTING

The data you need to understand the 3D printing world and build your 3D printing strategy

APRIL 2015



# TABLE OF CONTENTS

## INTRODUCTION



## TRENDS 2015



## GEOGRAPHICAL INSIGHTS



## EXECUTING A 3D PRINTING STRATEGY



## SECTORIAL INSIGHTS

# FOREWORD

I am extremely pleased to be able to present to you the first edition of our report '*The State of 3D Printing*.' The results herein come from a quantitative study of users of 3D printing who were surveyed in regards to their practice, perceived challenges, and priorities for the year 2015 and beyond.

More than 1,100 people responded to our survey, making it the largest statistical study ever conducted on the state of our industry. Across all continents, from every business sector, we gathered details on people's daily work and listened to their feedback, which was always useful, almost always positive, and for many respondents, 3D printing was more than just a hobby—it was a passion! I would like to thank each and every one of them for their time and I invite you to participate in our survey at www.sculpteo.com/en/state-of-3D-printing if you would like to see how you stack up against the rest of the community.

Of course we are aware of the shortcomings and drawbacks present in this first report, and for example we're not under any illusions that it compares to the annual *Wohlers Report*, which is indispensable for people in our industry. However whereas the *Wohlers Report* collects expert data we have opened up a direct line to the crowd of users themselves. We will leave it up to the specialists among you to study the differences between the two.

We designed the study and the final report to be practical: we want to make sure that fledgling 3D printing entrepreneurs are asking the right questions and show them what best practice looks like in their industry. What changes can they implement to their business to help them catch up. What can they do to become leaders in their field? Various 3D printing 'power users' (regardless of whether they happen to be Sculpteo clients) have shared their best practices in this report. We hope you have as much fun reading it as we did putting it together.

The report has 4 main components:

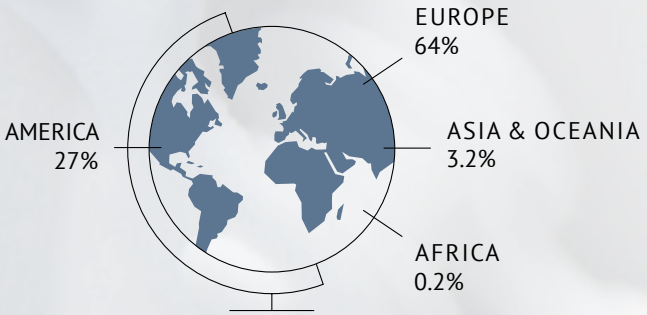
- *Trends for 2015* have been gathered from every respondent and comprise the majority of the study
- The *geographical insights* section compares and contrasts the habits of users on both sides of the Atlantic.
- *Executing a 3D printing strategy* takes a detailed, practical look at the habits of 'power users'
- The *sectorial insights* allows you to compare yourself to others within your industry

According to our panel, 2015 will be a year of growth for 3D printing. Don't get left behind—3D printing is a key tool for innovation and production!

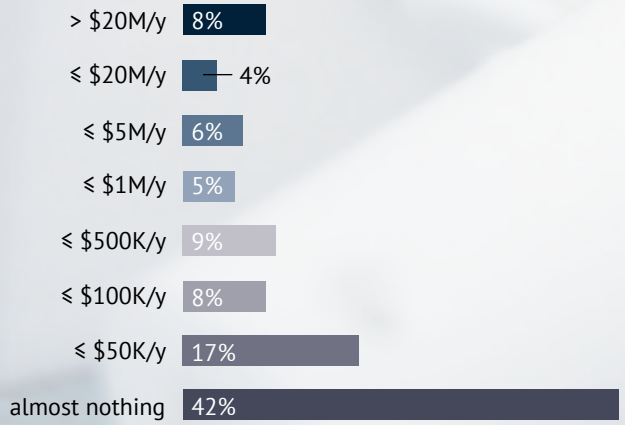
**CLÉMENT MOREAU**
CEO & FOUNDER

# SAMPLE COMPOSITION

## 1,118 RESPONDENTS




## COMPANY SIZE BY ANNUAL REVENUE




## VERTICAL MARKETS

- CONSUMER GOODS 26%
- HIGH TECH 15%
- INDUSTRIAL GOODS 14%
- ELECTRONIC & ELECTRIC 8%
- SERVICES 7.5%
- HIGHER EDUCATION 6%
- MECHANICS & METAL 5%
- HEALTHCARE 5%
- AERONAUTIC & AEROSPACE 3%
- RETAIL 3%
- AUTOMOTIVE 2.5%
- ENERGY 2%
- MARITIME 1%
- FOOD PROCESSING 1%
- TEXTILE & ARMAMENT 0.6%
- CHEMISTRY 0.3%

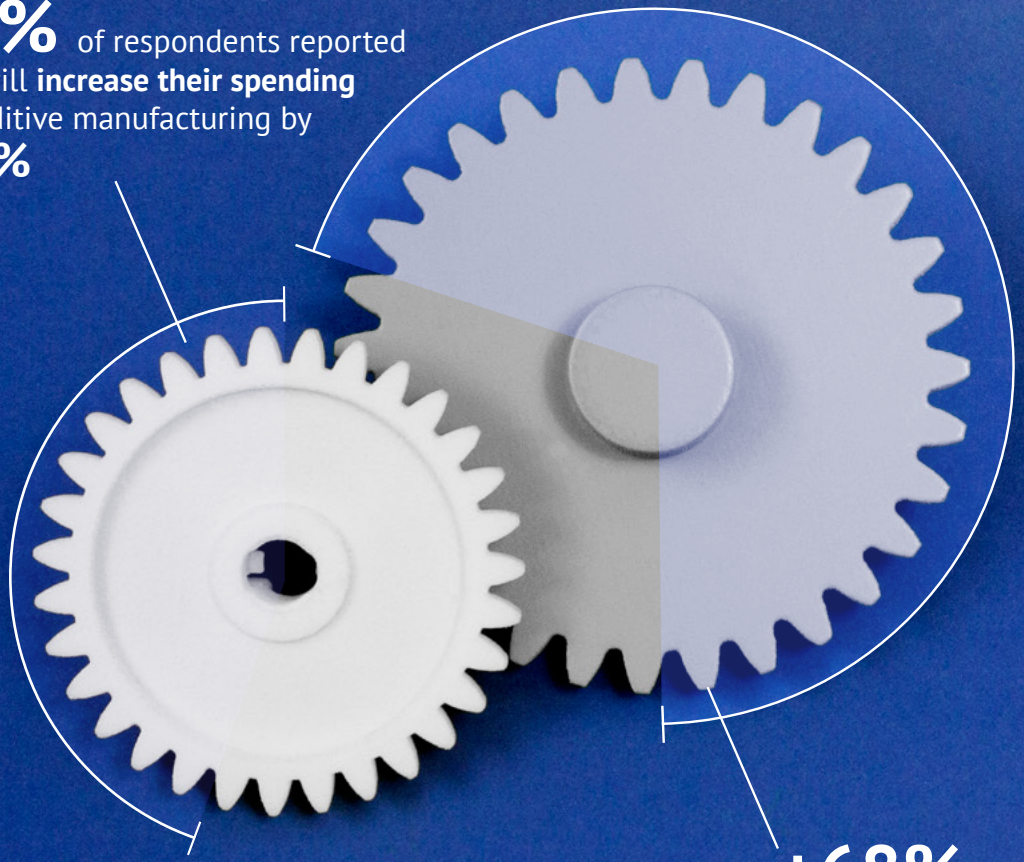
The goal of our '*State of 3D printing*' report is simple. We wanted to group together the biggest possible set of data on users of 3D printing. With more than a thousand engineers, CEOs, designers, educators, marketers, buyers and hobbyists who responded, we managed to put together a sample that we think is representative of behavior in the world of additive manufacturing.

In total, our sample consists of 1,118 respondents. Geographically, our sample is highly concentrated in Europe and America, which account for 91% of respondents. If we take a broader view, this sample summarizes the behavior of companies and individuals in 50 countries working in 16 different industries.

This report shows that the 3D printing revolution doesn't just belong to individuals. In this respect, 58% of professional respondents reported annual incomes over $50K and 23% belong to a bracket earning more than a million dollars annually.

# SPENDING IN 3D PRINTING IS INCREASING RAPIDLY

**44%** of respondents reported they will **increase their spending** on additive manufacturing by **+50%**



**+68%** of respondents reported they will **increase their spending** on additive manufacturing in 2015

An entire sector of the economy can't be summed up with just one number. But if we had to choose one, it would be this: 68% of respondents reported they will increase their spending on additive manufacturing in 2015.

Whether this is owing to newcomers in the industry or economic players with prior experience, the numbers are clear, spending is soaring. This is also why we've created this first edition of our report on 3D printing: in articulating both the quantitative and qualitative data, we can offer you an unprecedented analysis on the state of our industry.

In order to provide a snapshot of the rapidly evolving future of our industry, we have committed ourselves to giving a voice to those who participated in this report.

This section is dedicated to understanding the 'weak signals' that also pushed 71% of the participants to increase their spending for 2014.

This attitude suggests that not only is investment in additive manufacturing growing across all sectors, but also it seems to be a source of growth unto itself, as the growth in investment has been consistent from one year to the next.

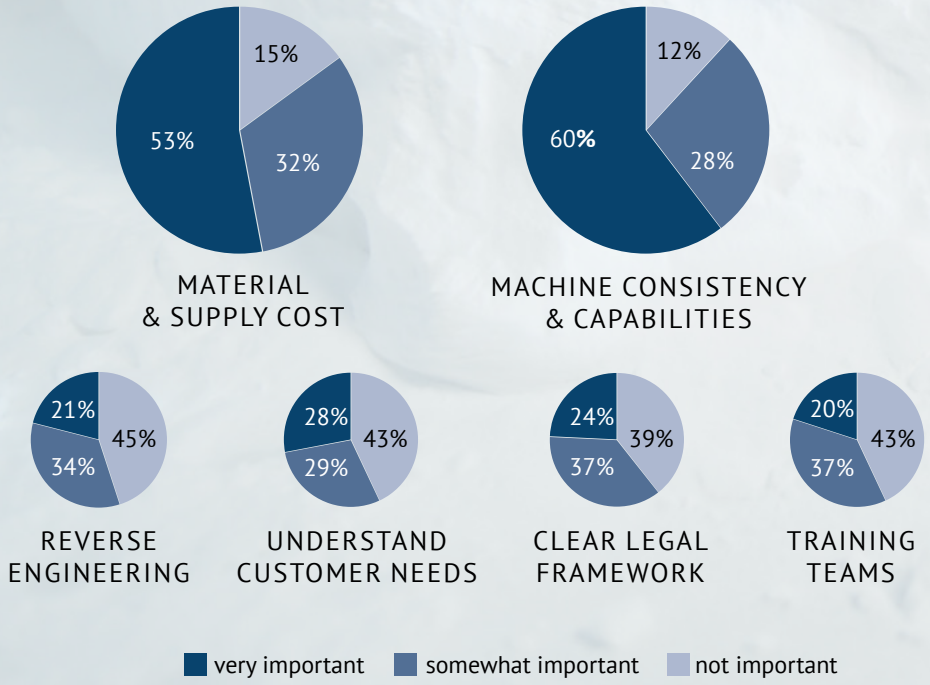
# RESPONDENTS ARE LOOKING AT MACHINE CAPABILITIES AND MATERIALS TO ACCELERATE PRODUCT DEVELOPMENT

In spite of the diversity of sectors that responded to the '*State of 3D Printing*' survey, a set of rigid criteria nonetheless clearly emerges when addressing the factors responsible for the adoption of additive manufacturing technologies.

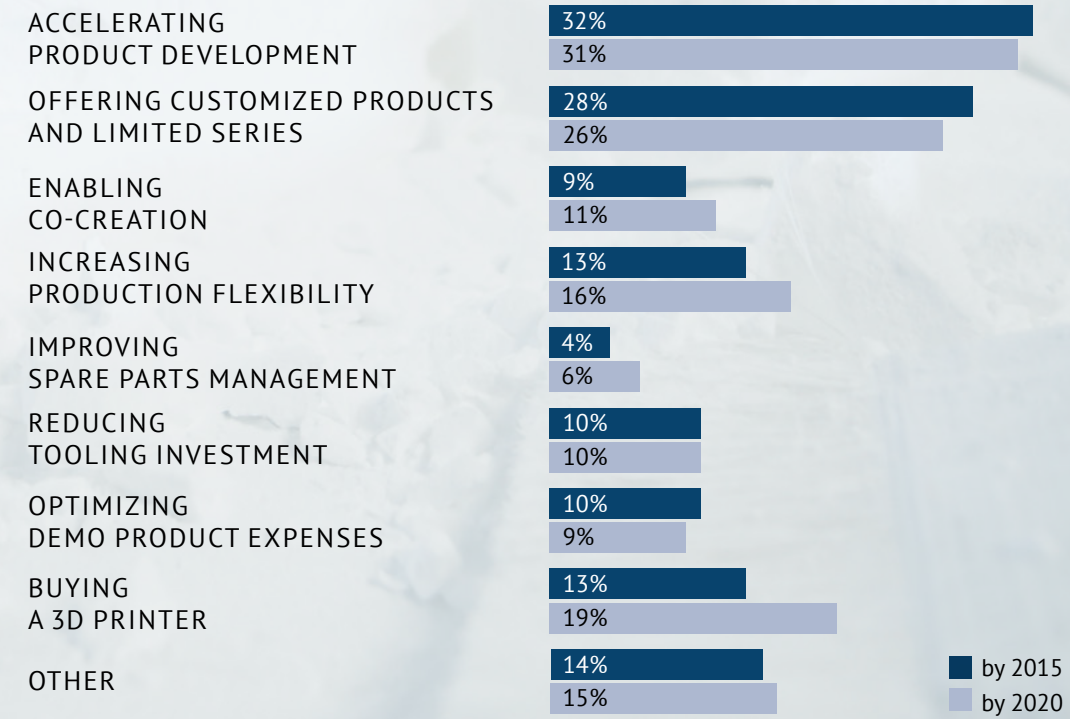
Undeniably, the material elements that have a direct bearing on 3D printing technologies are key. Decision-making hinges on machine performance and accessibility to production materials. Over 50% of respondents consider the price of supplies and machine capacity to be very important factors in the use of additive manufacturing.

Further behind are factors relating to training, consumer needs, legal framework and reverse engineering, with less than 30% of respondents considering them very important. Regarding the question of today's priorities and what they'll be five years from now, two uses for 3D printing stand out among the pack: accelerating the development of new products and the ability to offer customized or limited-run products.

## DETERMINING FACTORS IN THE ADOPTION OF 3D PRINTING




## TOP PRIORITIES RELATED TO 3D PRINTING

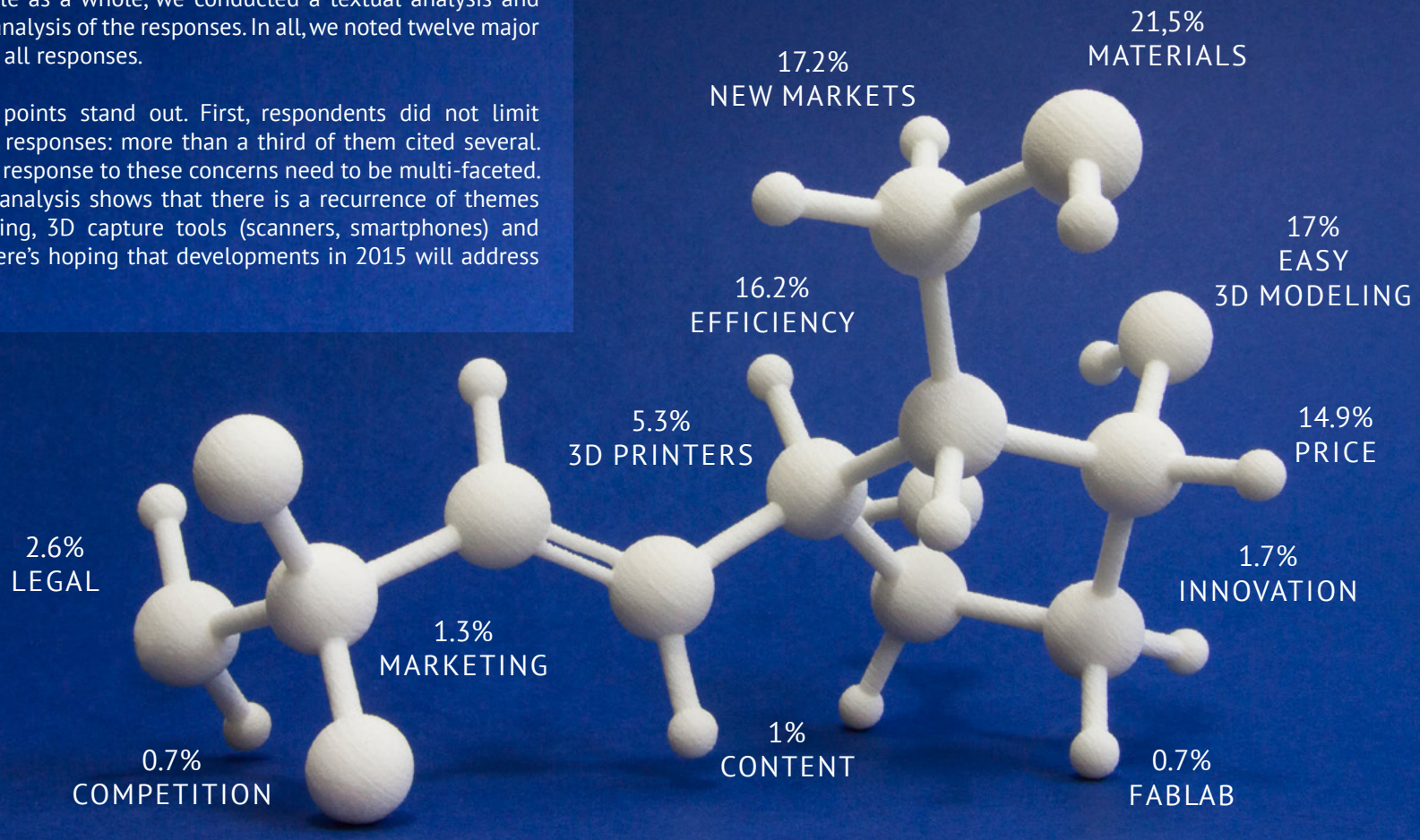


# NEW MATERIAL IS THE GRAAL OF 3D PRINTING

The question *'Are there any trends that you anticipate having a major impact on 3D printing?'* concludes the study and asks respondents to take a carefully considered view of their industry.

To make the results readable as a whole, we conducted a textual analysis and multi-categorical semantic analysis of the responses. In all, we noted twelve major themes that recurred across all responses.

More specifically, two key points stand out. First, respondents did not limit themselves to single-factor responses: more than a third of them cited several. As such, any efforts made in response to these concerns need to be multi-faceted. Second, narrower semantic analysis shows that there is a recurrence of themes relating to 3D metal printing, 3D capture tools (scanners, smartphones) and higher-precision printers. Here's hoping that developments in 2015 will address these concerns.



# ON THE LOOKOUT FOR NEW GROWTH FACTORS

+300 respondents shared their thoughts on the topic:

***Are there any trends that you anticipate having a major impact on 3D printing?***

## 91% of the answers describe GROWTH FACTORS

The respondents are convinced the 3D printing market will increase over the next few years. These factors can be seen as a general confidence in the promise of the technology rather than hesitation from the unknown.

Among the minority of those expressing a risk factor, primary among them were:

- Copyright issues
- Fire arms

## THE MOST CITED FACTORS

### 58% 3D PRINTING TECHNOLOGIES

- New materials
- Increased efficiency and accuracy
- Price drops

### 42% EXTERNAL FACTORS

- New markets
- Easier 3D modeling tools
- New regulations

***"The move into consumer use is interesting, but I'm not seeing it as more than a 'fun toy/fad' unless software becomes much more friendly."*** Survey respondent

***"Almost everything has already thought of. It's about improving on ideas (innovating). Something different will come up and have an impact on 3D printing. I still feel metal printing needs to be more mainstream."*** Survey respondent

# GEOGRAPHICAL INSIGHTS

As over 91% of respondents to the study are situated on the American and European continents, the '*State of 3D Printing*' report unsurprisingly offers a mostly American-European viewpoint of the behavior of industry members. While logically one would expect to find many similarities, there are nonetheless some marked differences that are worth noting.

While the two are similar in regards to spending habits and types of materials used,Americans and Europeans differ in their respective visions of 3D printing. We noted fairly significant differences in regards to four criteria:

- the role of 3D printing in businesses
- the uses made of 3D printing
- the most important factors relating to the development of 3D printing in the respondents' areas of activity
- current priorities and what they will be five years from now

More than just a simple opposition, perhaps we should see these differences as a way for each continent to tailor 3D printing to their own strengths, rather than as diametrically opposed visions of the same technology. It was in this spirit that we assembled the contents of this section, which combines both a statistical analysis from our 3D printing report and an interpretive framework inspired by conversations with Sculpteo customers worldwide. The latter did much to enrich the qualitative aspects of this part of the study.

Therefore in this chapter we'd like to propose the hypothesis that there are 2 schools of thought in regards to 3D printing. On the one hand, a European vision wherein 3D printing is the clearly defined domain of trained specialists. On the other, a particularly American vision wherein 3D printing can be used for everything and is accessible to everyone within the company.

In future editions of the study, we will look to see if these differences persist and it will be interesting to see how innovations on either side of the Atlantic confirm or refute this hypothesis.

**+91%** of the respondents are situated on the American and European continents

## 2 SCHOOLS OF THOUGHT

EUROPE

*3D printing can be seen as the defined domain of trained specialists.*

AMERICA

*3D printing can be used for everything and is accessible to everyone within the company.*

# EUROPEAN ORGANISATIONS ARE LESS PERMEABLE TO 3D PRINTING

With 10 different points of contention among the responses, the question of the receptiveness of businesses to 3D printing technologies is symptomatic of the differing mentalities between the two continents.

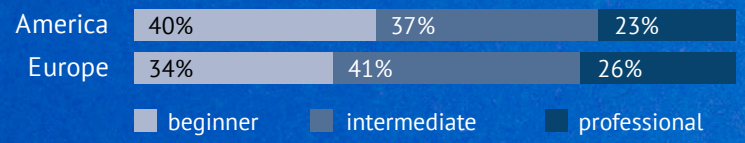
On the one hand, Americans see 3D printing as a reliable mean of manufacturing for when they need a consistent solution to a clear-cut problem. In fact, within organizations themselves, disparities between departments that use 3D printing and those who do not are less notable.

On the other hand, Europeans remain attached to the view in which 3D printing requires a special expertise.

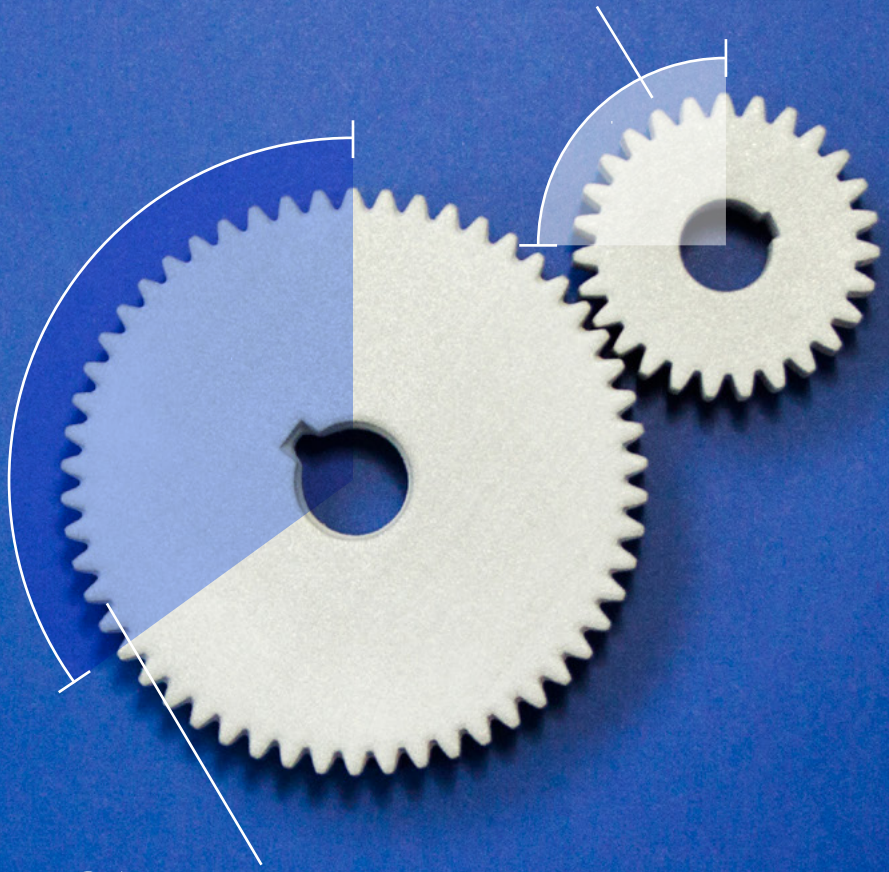
This vision of 3D printing seems even more paradoxical when we consider that Americans admit to being less qualified than Europeans. Our European respondents more readily label themselves as 'professionals' or 'intermediate' users than their American counterparts.

Similarly, Europeans are less inclined to see themselves as novice or uninitiated. This data supports the idea that 3D printing is less accessible in Europe, where people without experience in 3D printing would feel less inclined to think of it as a possible solution, or even less enfranchised to use it. Instead, Americans, trained or not, have less difficulty seeing it as a viable manufacturing method that responds to their needs, which is also not without some correspondence to the higher number of uses (see next page) reported among Americans.

*However, American 3D printing users admit to being less qualified than Europeans*




**25%** of the american respondents declare that **3D printing is quite separate** from their other activities



**35%** of the european respondents declare that **3D printing is quite separate** from their other activities

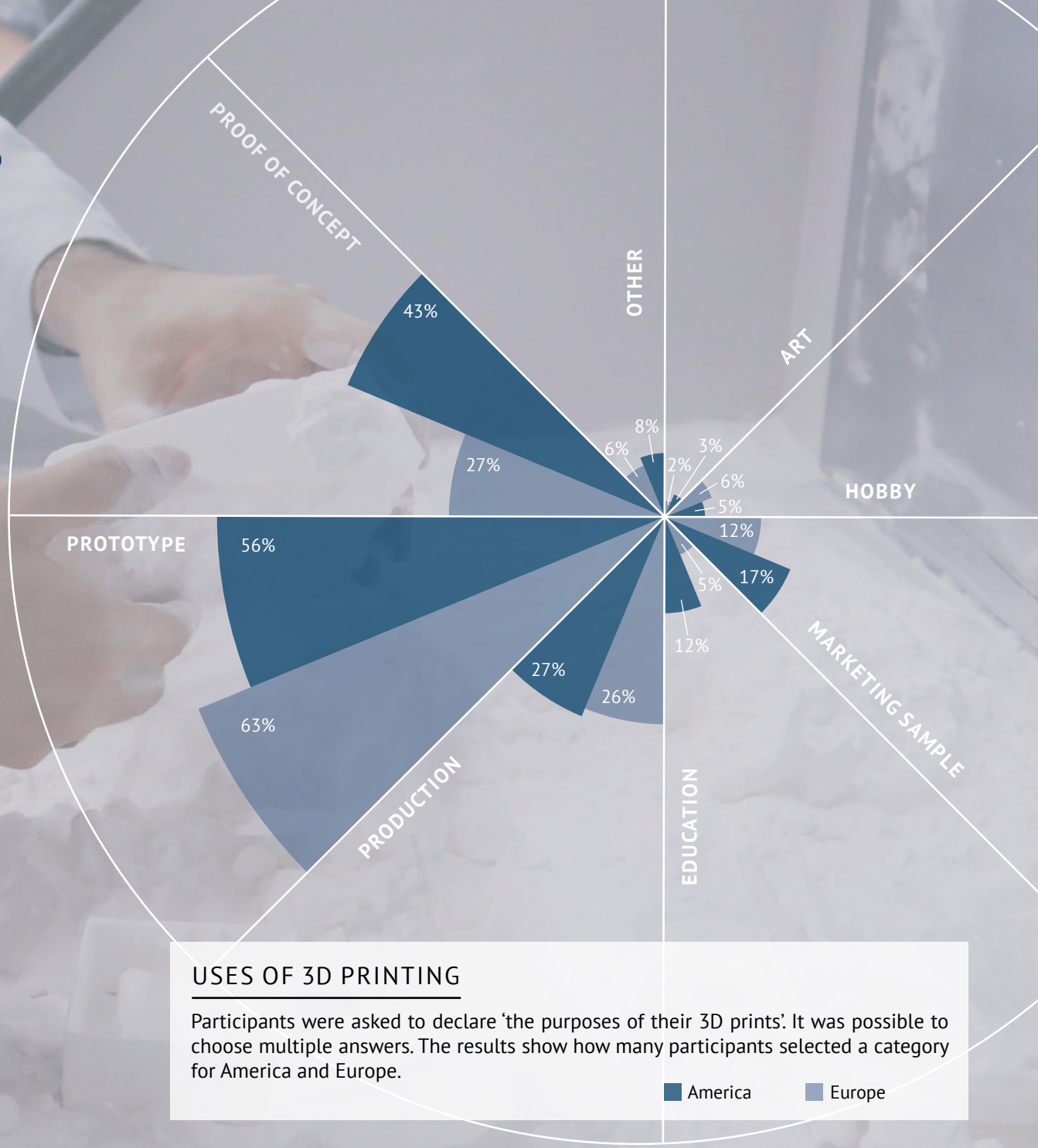
# PROTOTYPE IS KING AND PRODUCTION IS CATCHING UP

The reported uses of 3D printing among Europeans and Americans respond to mindsets that differ a little. This corroborates the idea of two schools, with Americans being more pragmatic and Europeans being more concerned with qualifications and barriers to entry.

American respondents cite more uses for 3D printing than their European counterparts. Notably, the usage of 3D printing in 'Marketing' and 'Education' sectors are reported more frequently in America than in Europe.

Despite their differing perceptions in regards to the technology, it remains true that 'Prototype' and 'Proof of concept' uses are what first come to mind when discussing 3D printing on both sides of the Atlantic.
It is interesting to see, however, that production issues are being addressed more and more, with 27% of US respondents and 26% of European respondents reporting fruitful uses for 3D printing. This places it, at least in the case of Europe, almost on par with 'Proof of concept' usage.

The number of reported uses indicates several things. First, the use of additive manufacturing technology is no longer limited only to the world of prototyping. The production world has become porous to the point where 3D printing has been able to enter in and provide concrete solutions. And from this other uses emerge. They reflect the adoption of these new manufacturing technologies by worlds that were hitherto barely touched by 3D printing. This includes all economic sectors and departments within organizations that use 3D printing as a means of disruption.




## USES OF 3D PRINTING

Participants were asked to declare 'the purposes of their 3D prints'. It was possible to choose multiple answers. The results show how many participants selected a category for America and Europe.

America Europe

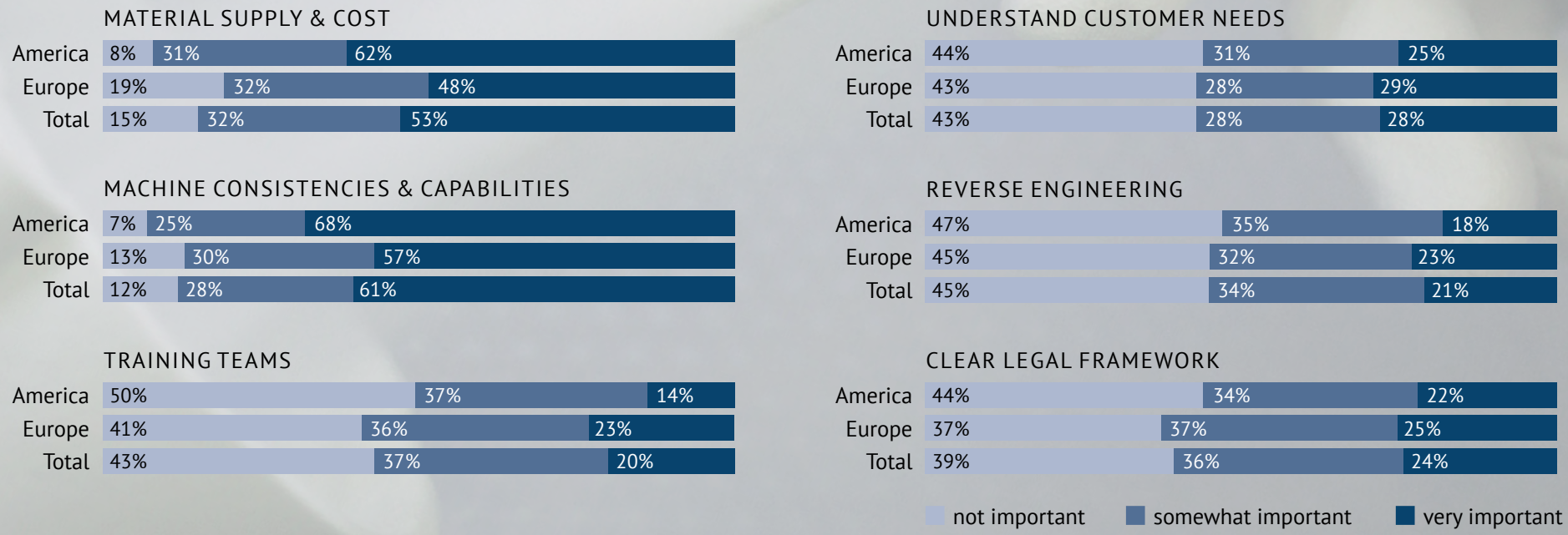
# AMERICA FOCUSES ON TECHNOLOGY WHEN EUROPE CONCERNS ABOUT EXTERNAL FACTORS

If at first glance Americans and Europeans seem to have a common influence in the different factors that motivate them to use 3D printing, it is perhaps necessary to separate the influential factors into two categories.

On one hand, there are factors relating to the technology itself, that is, machines and materials. On the other, there are external and organizational factors specific to the legal framework, in addition to factors relating to training, reverse engineering, and consumer understanding .

Once they have been classified in this manner, they reveal that 68% of Americans consider that factors relating to machinery are 'very important', 11 points higher than Europeans. Similarly, there is a 14-point difference between Americans and Europeans in regards to the importance given to factors relating to materials.

The attention paid by Americans to factors closely related to technology supports their rather pragmatic view of the matter. Americans want an additive manufacturing method that is efficient, inexpensive and versatile.
Conversely, external factors are more valued by Europeans. The use of technology is perhaps less limited by the technology itself than it is by its place in European society. As such, the training of users and legal issues are considered important by 59% and 63% of Europeans respectively, in contrast to only 50% and 56% of Americans.



# PRODUCT DEVELOPMENT AND CUSTOMIZATION ARE THE FIRST PRIORITIES EVERYWHERE

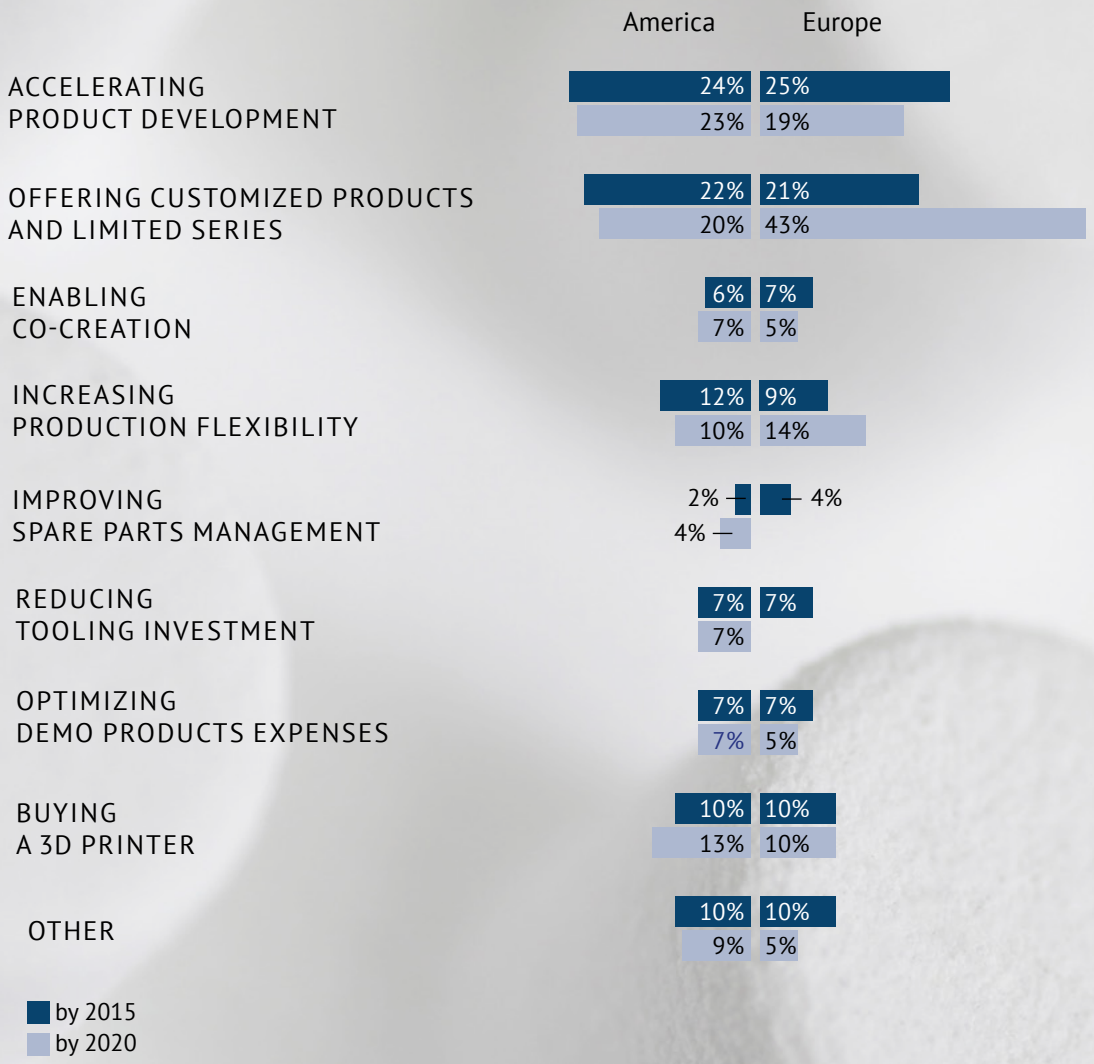
The last point of comparison between the US and Europe comes from solutions that are primarily sought through 3D printing. This time, to differentiate our point a little bit, the goal is to see that if differences do exist, whether or not the US and Europe nonetheless share the same priorities.

Unlike the other three criteria, in which it was possible to see marked differences, the question of current priorities and what those might resemble five years from now is less clearly defined.

The acceleration of product development time and the ability to offer customized products will remain key priorities, as important 5 years from now as they are today. Europe, however, appears to be very interested in the possibility of offering highly customized products.

On the American side, the only priorities that see an increase over a 5-year period include the improvement of co-creation possibilities and purchasing a 3D printer. Co-creation is notably a point frequently raised by many open-source projects that use 3D printing as a production technique in order to overcome the constraints linked to plastic injection. Each user is invited to offer his or her version of the product by modifying the 3D model.
Buying a 3D printer also climbed to third place in the list of challenges to overcome over the next 5 years for Americans.

On the European side, the two priorities that are projected to increase over the next five years mainly concern issues related to production via 3D printing. Custom products, limited editions and production flexibility will be among the most overwhelming concerns in 2020. In Europe, interest in buying a 3D printer will stay the same over the next five years.



# EXECUTING A 3D PRINTING STRATEGY

The disparities in the understanding and adoption of additive manufacturing technologies mentioned above show that there are different behaviors at play in regards to 3D printing. Far from being trivial, these differences may explain the great successes achieved by certain players in the field, and the reluctance of others to invest in 3D printing, which has significant implications.

The goal of this chapter is, through analyzing the behavior of 'power users' among the respondents, to provide the most effective way to achieve good 3D printing practices.

At Sculpteo we dream of a world where 3D printing is used by everyone, every day, as a full-fledged manufacturing method in its own right. There are still a few years before we achieve that dream, and 2015 will be a year of welcoming many first-timers.

This chapter should be taken as our welcome message to all newcomers and to all those companies who are wondering how to take advantage of 3D printing.

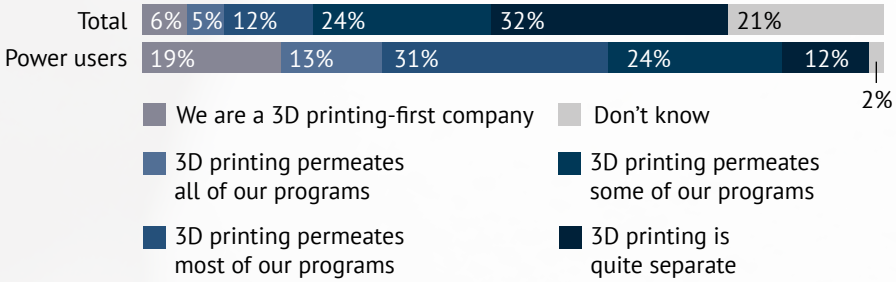
Specifically, this chapter provides practical guidance to those who are (1) struggling to strike the right balance between 3D printing and other manufacturing methods, (2) peeking around corners to see what unexpected challenges might be coming their way, (3) trying to identify the highest return projects, and (4) thinking about the best way to innovate in their organization. If you are wrestling with any of these questions, there's a good chance you'll find your answer in this chapter.

Among Sculpteo's different customers, there are some who are rather advanced users of 3D printing. In the study, we were surprised to find a uniform group of respondents that make heavy use of 3D printing and exploit its many possibilities. We call them 'power users'. We're presenting this chapter as a series of operational questions so that you'll be able to see how your process aligns with theirs.

# 4 KEY QUESTIONS FOR PLANNING YOUR STRATEGY

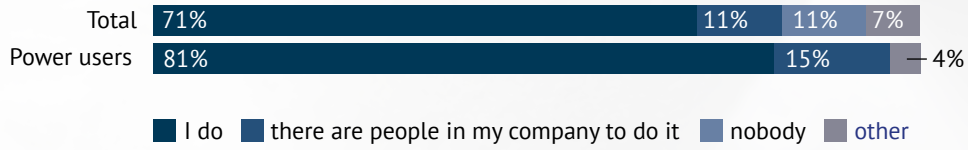
*How should I think about the 3D printing/traditional manufacturing balance?*

Evaluate methodically all your programs that could benefit from 3D printing. More than 50% of power users have integrated 3D printing into the majority of their programs.



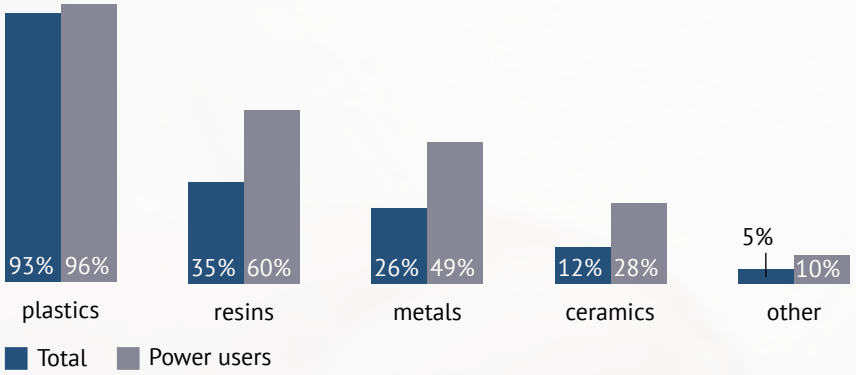

*Who should create my 3D files?*

Don't count on being able to outsource this task to someone else or finding files on the Internet. Instead, learn to work in 3D yourself or recruit someone to create, edit and manage your 3D assets.



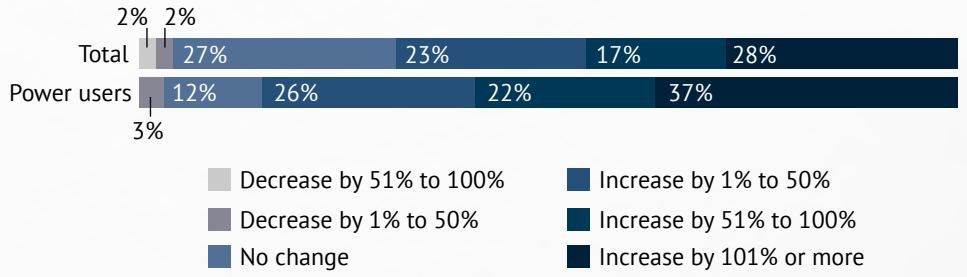

*What materials should I use?*

Start with plastic, but make looking into other materials—resin and metals—a priority.




*Where should I spend my time and budget?*

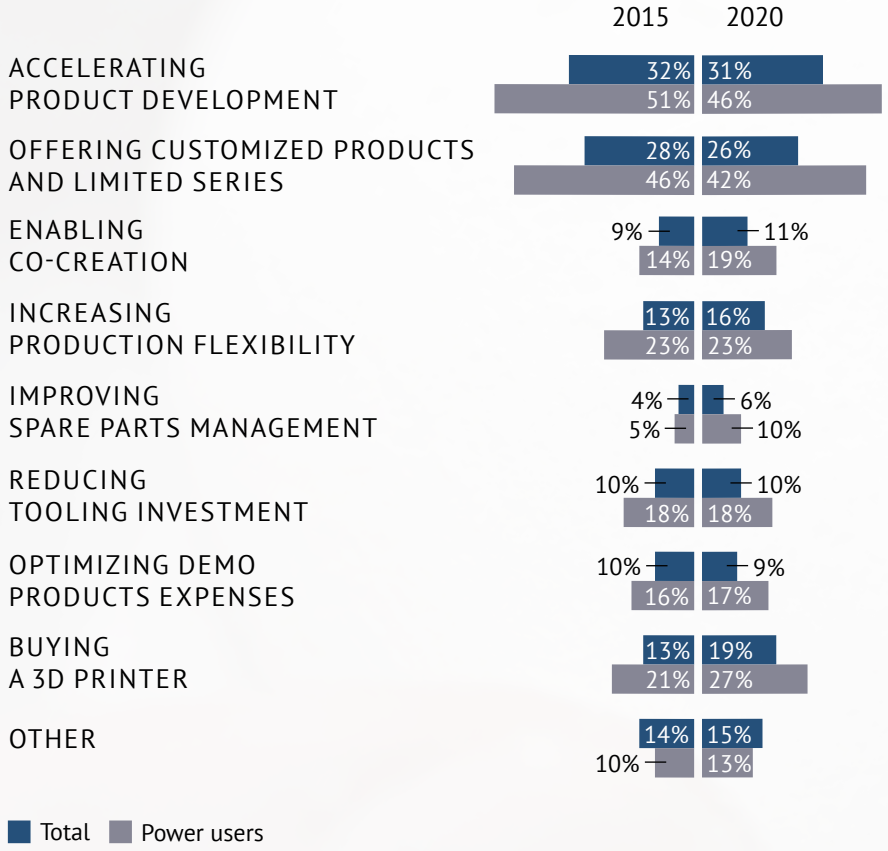
When dealing with a rapidly expanding budget, the return on investment is important. 85% of power-users plan to increase spending in 2015 (compared to 68% of all users).



# PREPARING THE FUTURE OF YOUR MANUFACTURING PROCESS

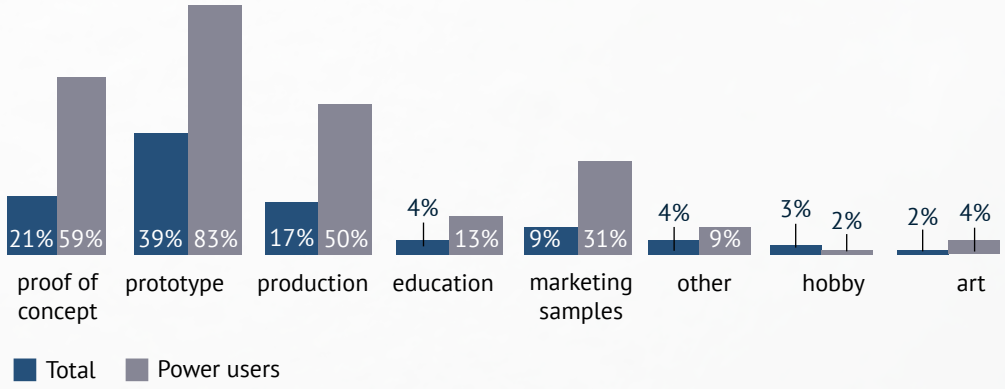
*What challenges should I anticipate?*

Start by developing your product, but don't overlook the benefits associated with production—these are the areas where power users intend to take the lead over their competitors. For 1/5 of them, increased flexibility and lower tool costs are priorities.




*What projects promise the greatest return?*

Start by looking into the prototype and proof-of-concept production. The majority of users cite both uses. To get ahead in the game, do what power users do. They have integrated 3D printing into their production, marketing and training tools in a big way. For 50% of them, 3D printing is a means of production.



# SECTORIAL INSIGHTS

Respondents to the '*State of 3D Printing*' survey were promised one thing: the ability to compare their own practices with that of others in their domain. With that in mind, this last part is dedicated to a robust sectorial analysis. Consider it as a magnifying glass, a closer look at what has already been mentioned elsewhere in the report in regards to sectors that are particularly dynamic in their use of 3D printing—sectors in which Sculpteo has a broad expertise.

As with the geographical overview, this section provides a sector-by-sector overview of key differentiating points such as the level of expenditure, the materials used, the uses made of 3D printing, the priorities and openness of organizations involved with additive manufacturing technologies.

Always with the goal of allowing everyone to compare themselves more effectively to others, we took care to include another sort of measuring stick to this section: the behavior of 'power users' in regards to each of these different points.

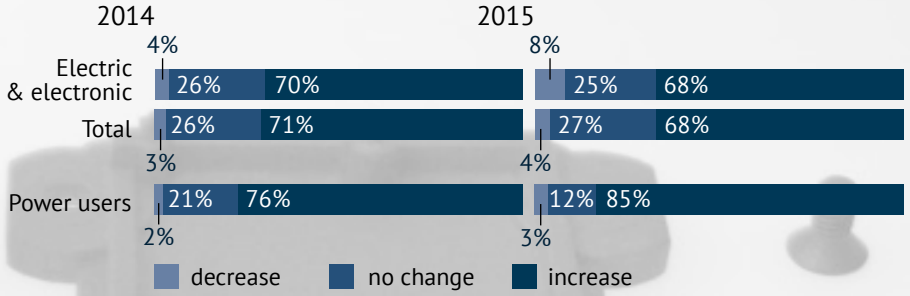
Thus, for each sector, you will find a point-by-point comparison of the overall total discussed in the first chapter on trends, the behavior of 'power users' mentioned in the previous chapter and respondents grouped according to their given sector.

To reinforce our data further, we asked some respondents (who also happen to be clients of Sculpteo) to briefly summarize the benefits they derived from additive manufacturing technologies.

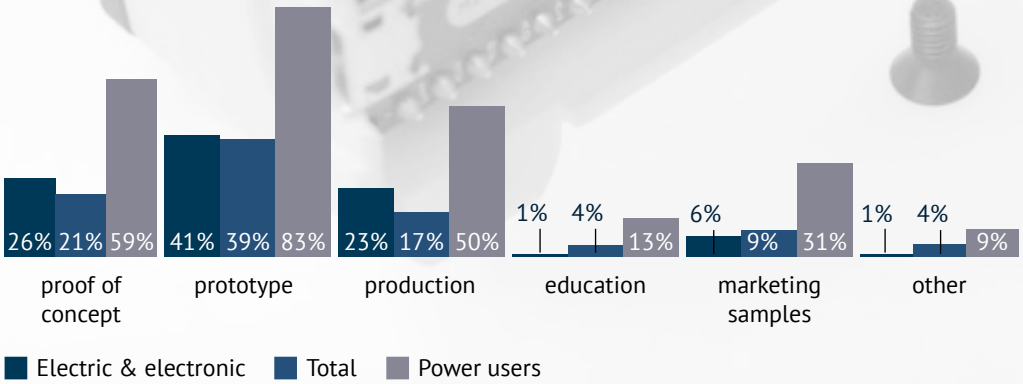
# ELECTRIC & ELECTRONIC

## WHO WORKS ON 3D MODELING IN YOUR COMPANY?

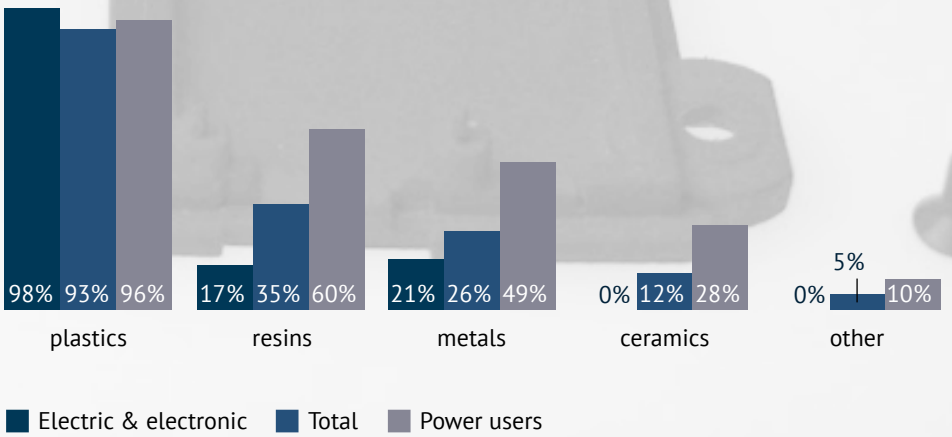

## EXPENSES




## FUNCTIONS

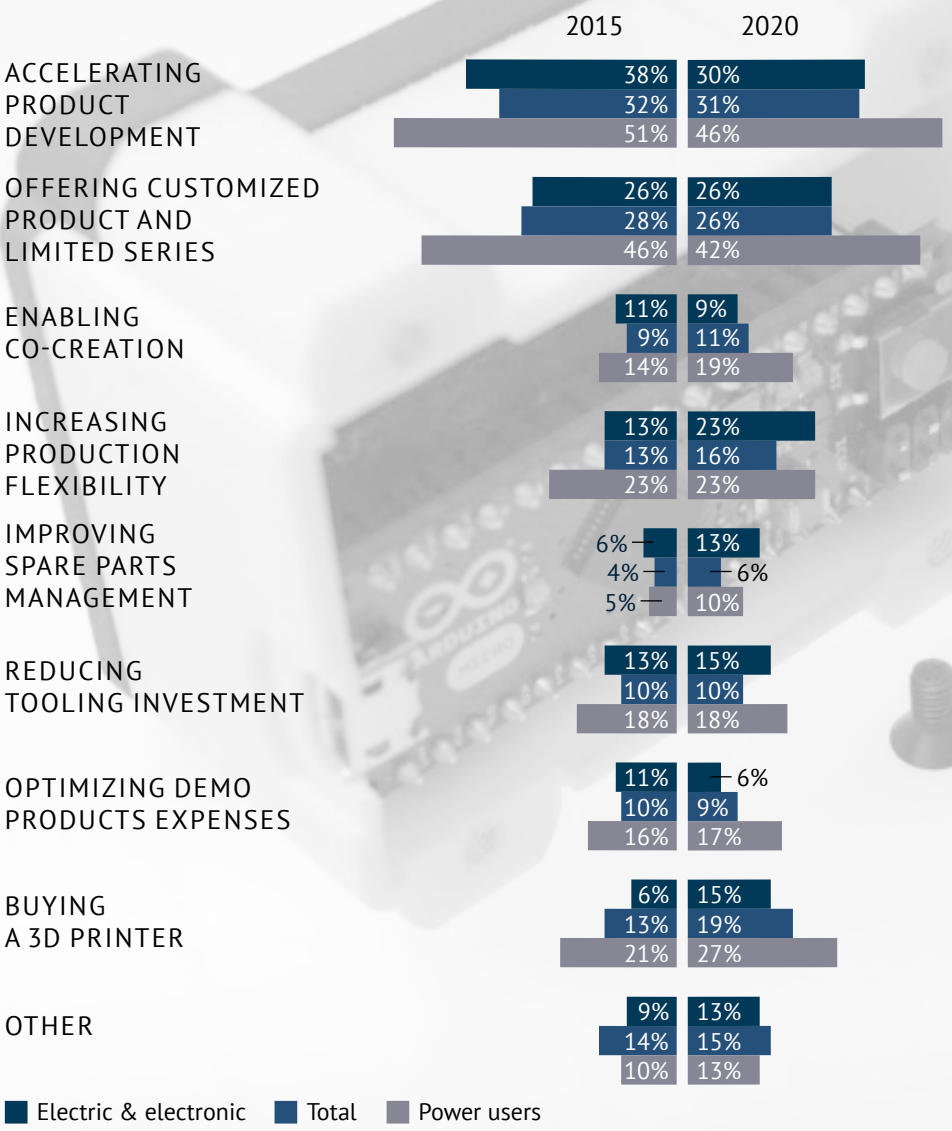



## MATERIALS

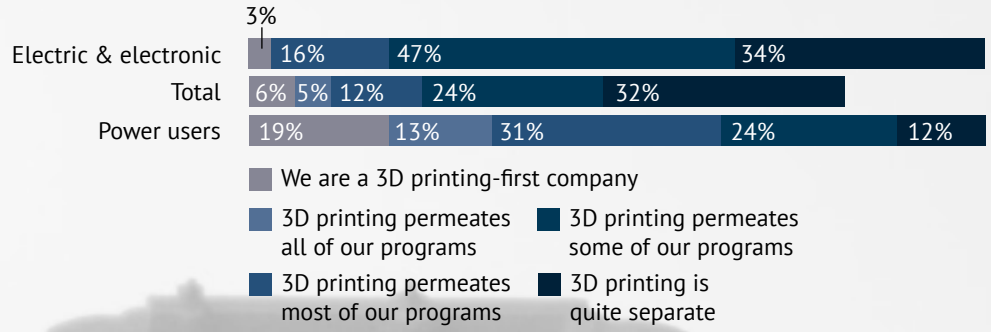


# ELECTRIC & ELECTRONIC

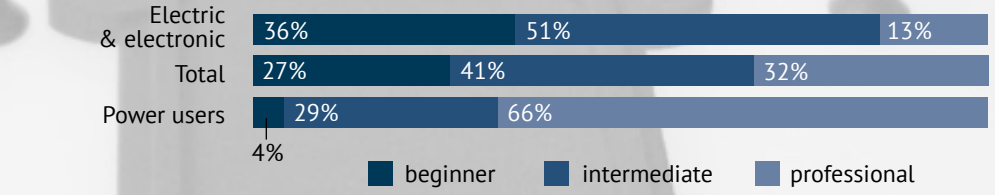
## TOP PRIORITIES




## INTEGRATION




## EXPERTISE



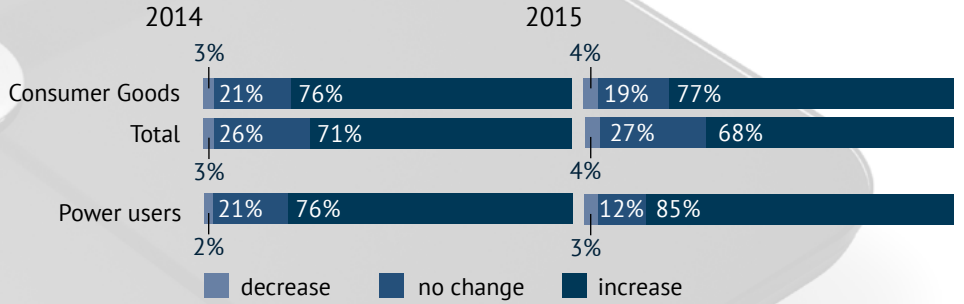

***"As an open-source project involving many team members, openQCM was facing a major issue: how will we be able to offer flexibilty in the design of our product? 3D printing imposed itself as the most satisfying solution to keep costs down during the prototyping phase as well as during production. With an object that fits in the palm of the hand, 3D printing allowed us to produced high-quality casing for a very cost efficient price when compared with injection molding. It also gave us the chance to tweak the design as much as we want and as much as others want to."***

Glenda Torres Guizado
Industrial Designer for OpenQCM

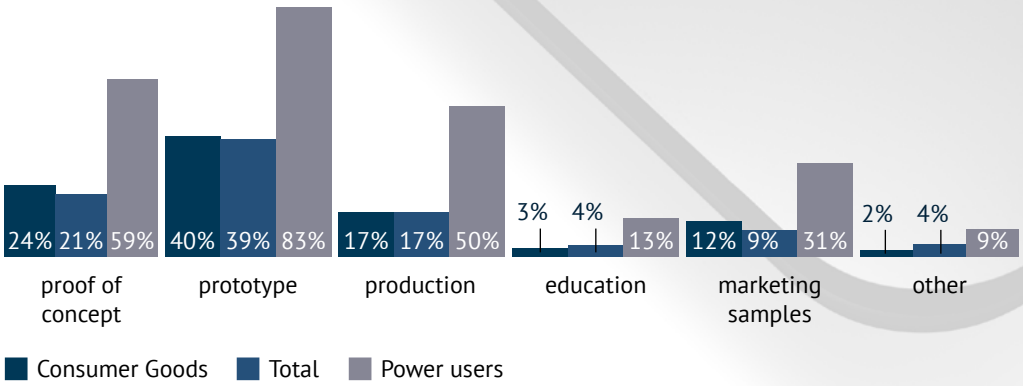
# CONSUMER GOODS

## WHO WORKS ON 3D MODELING IN YOUR COMPANY?

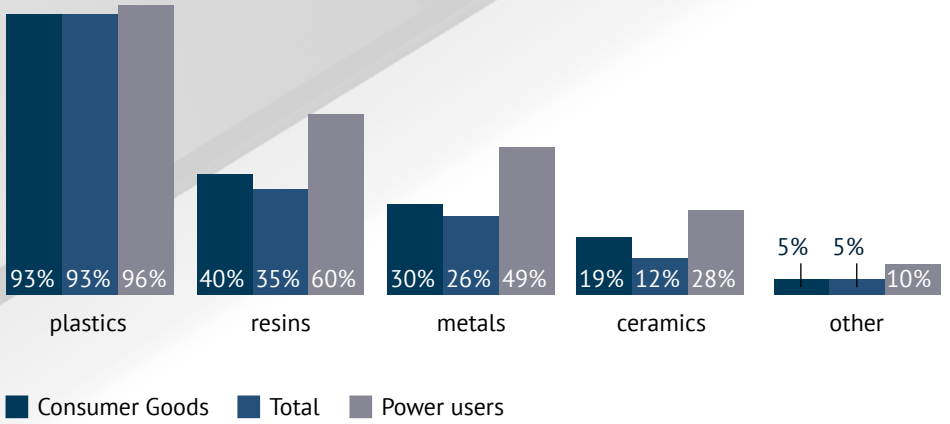

## EXPENSES




## FUNCTIONS

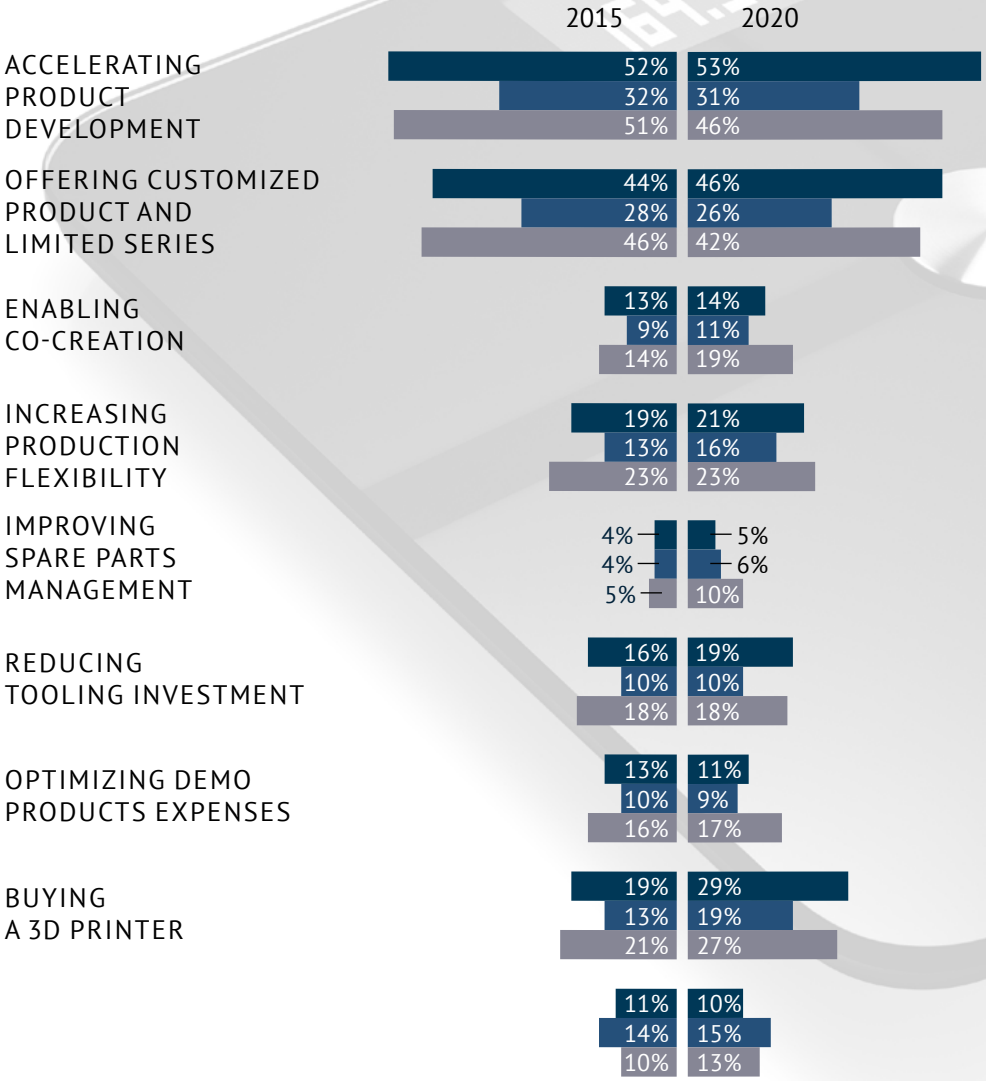



## MATERIALS

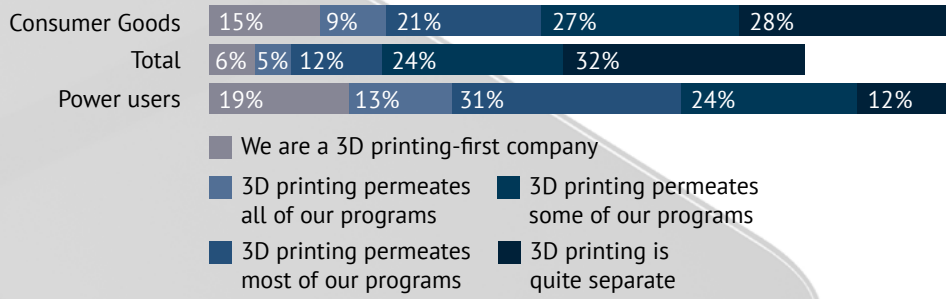


# CONSUMER GOODS

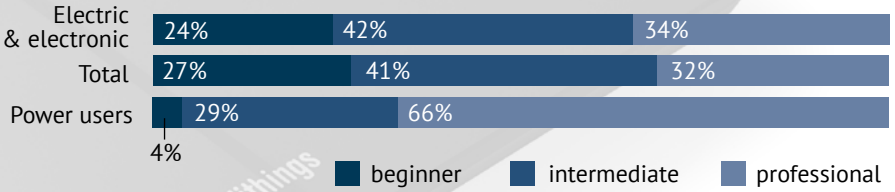
## TOP PRIORITIES




## INTEGRATION




## EXPERTISE




***"Encountering the object is essential. Being able to produce prototypes quickly in order to validate structure, concepts, product architecture and its functionality is a real added value.***
***With the wide variety of materials and finishes available via additive manufacturing, we can now accurately simulate the characteristics of the final product that we're aiming to evaluate.***
***During the design phase, it is essential to have different prototypes on hand in order to be able to choose one proposal over another. The handling of physical pieces is also an opportunity to anticipate and confirm production-related problems and thus improve the design."***

Bastien Rechke
R&D Mechanical Engineer at Withings

# INDUSTRIAL GOODS

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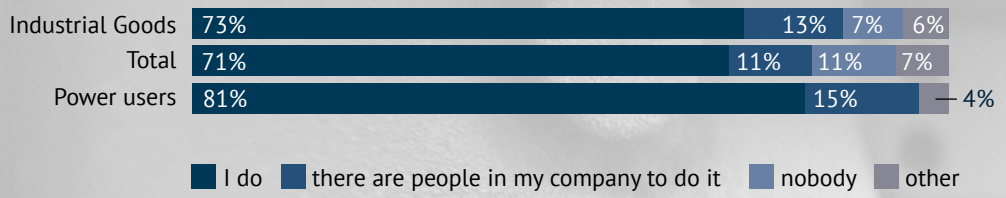


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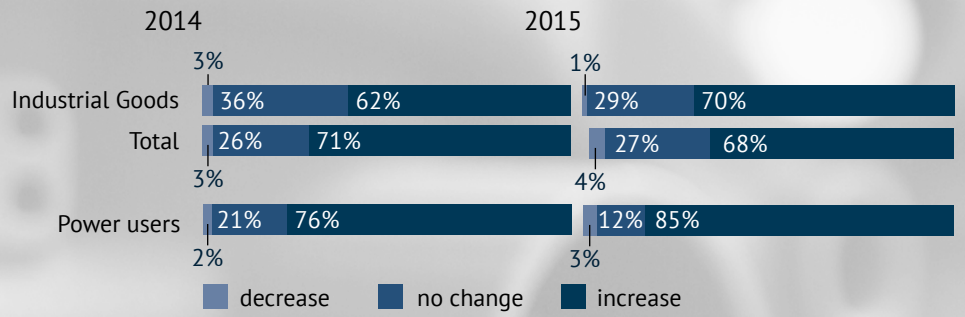


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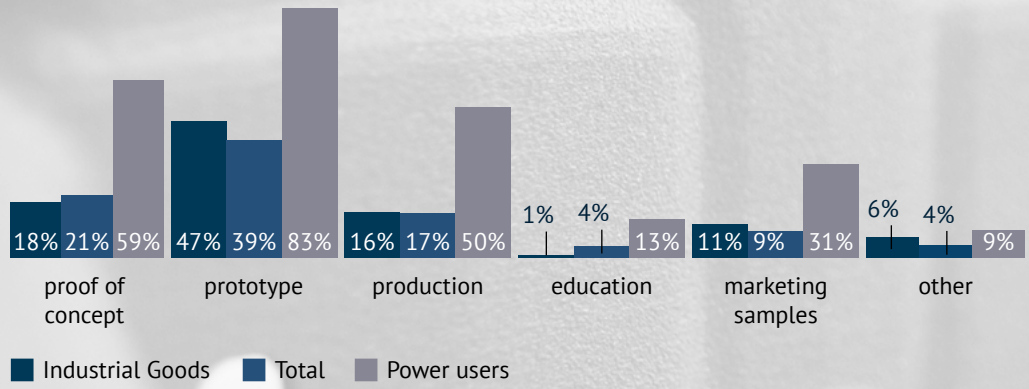
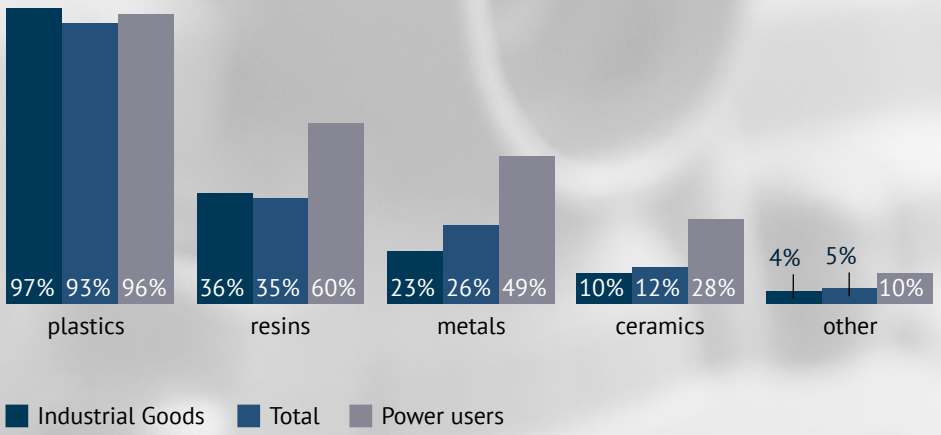



## MATERIALS



# INDUSTRIAL GOODS

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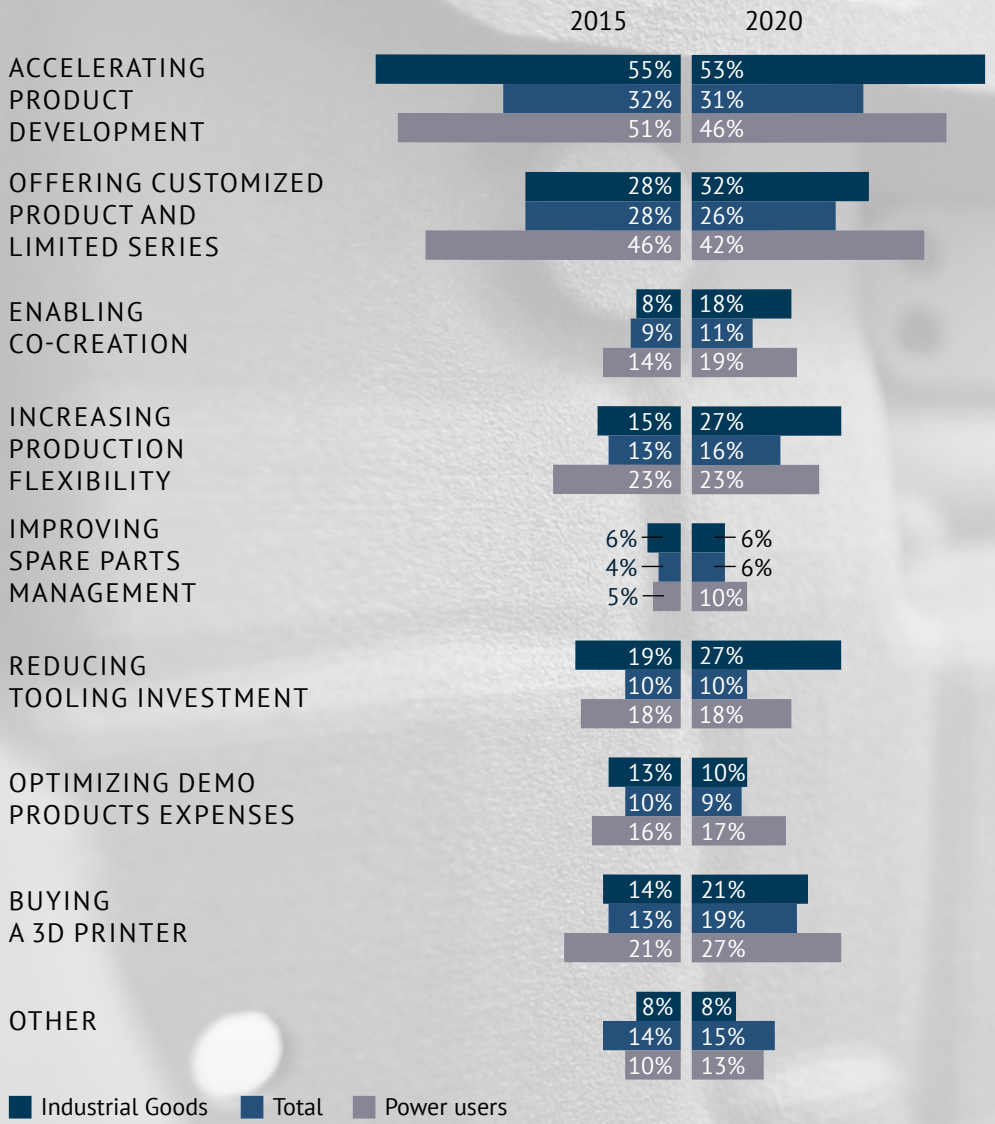


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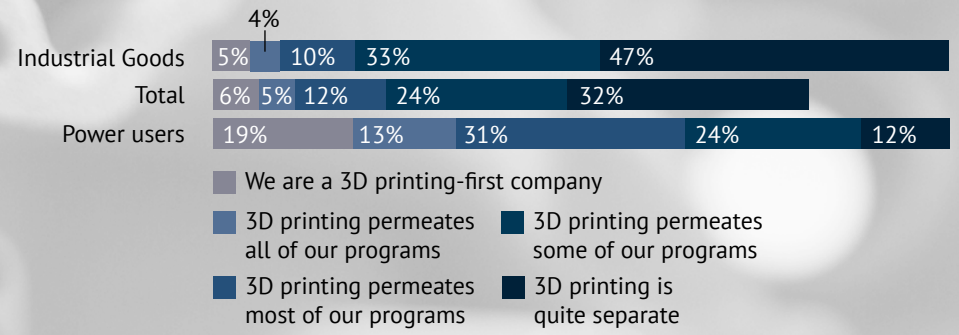
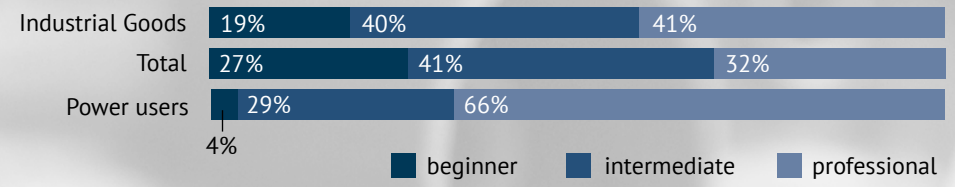



## EXPERTISE



# HIGH TECH

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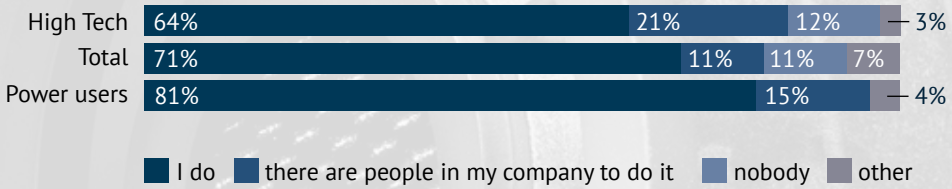
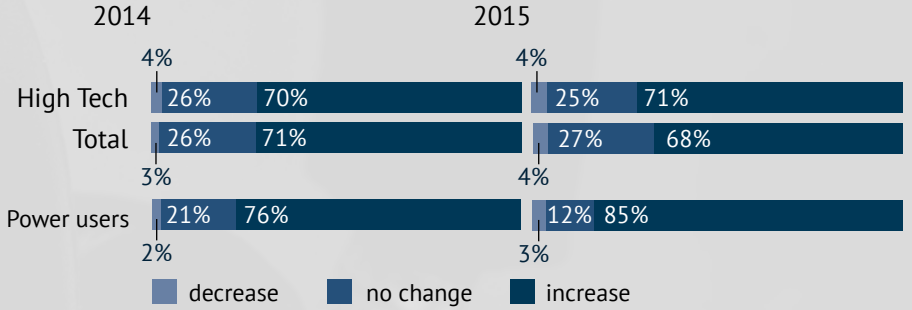



## EXPENSES

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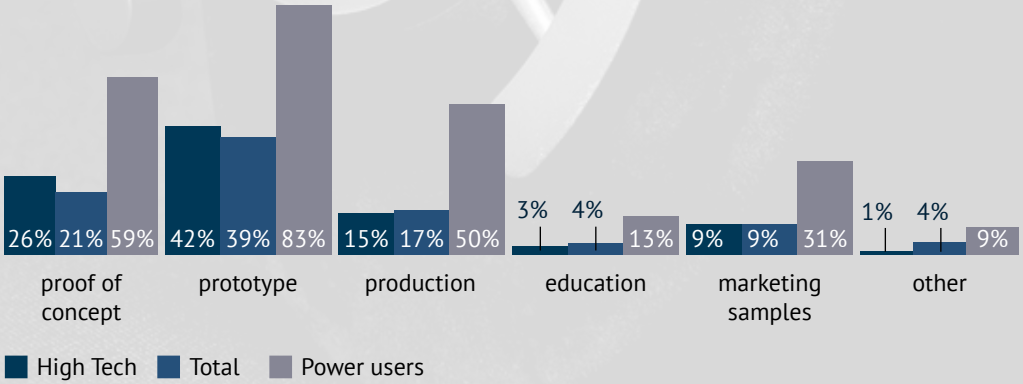


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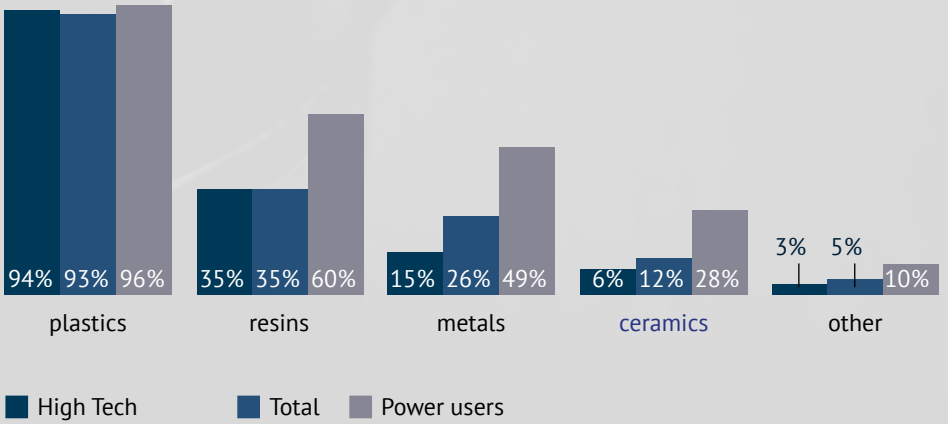

# HIGH TECH

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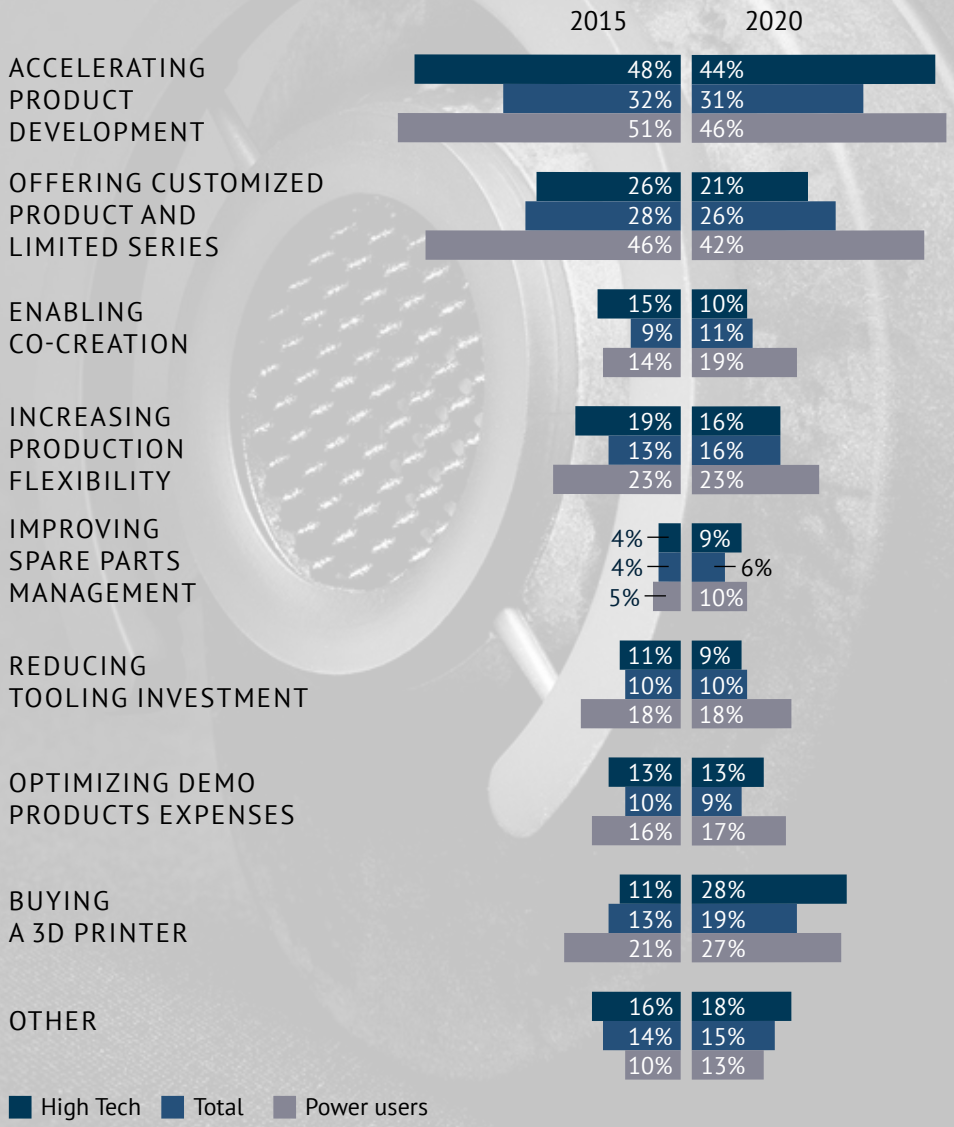


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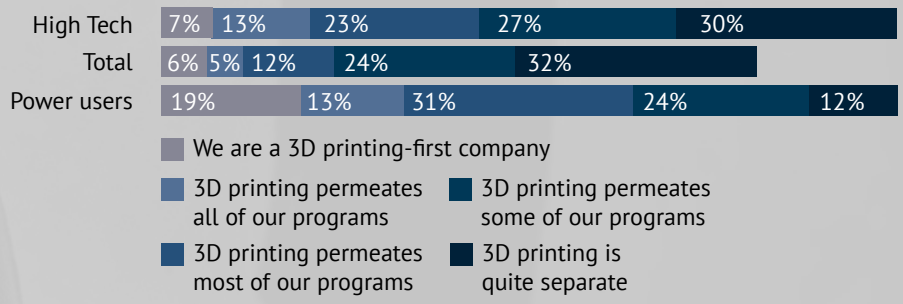


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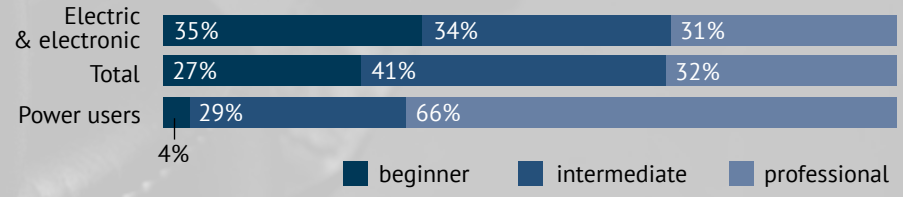


***"A grille like the one used in our NightHawk headphones, with its intricate diamond cubic latticework, couldn't have been mass-produced five years ago. The only way it could be created is through today's advanced 3D printing. So, from the very start of our development process, we intended our production parts to be 3D printed. Designing with 3D printing in mind is quite liberating because there are far fewer restrictions and boundaries, enabling otherwise impossible forms and complexity. Without Sculpteo's expert help, we simply wouldn't have been able to produce as compelling a product. We are very thankful for Sculpteo's support and excellent work."***

Stephen Mejias
VP Communications at Audioquest

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