

NavVis

STATE OF MOBILE MAPPING SURVEY 2022



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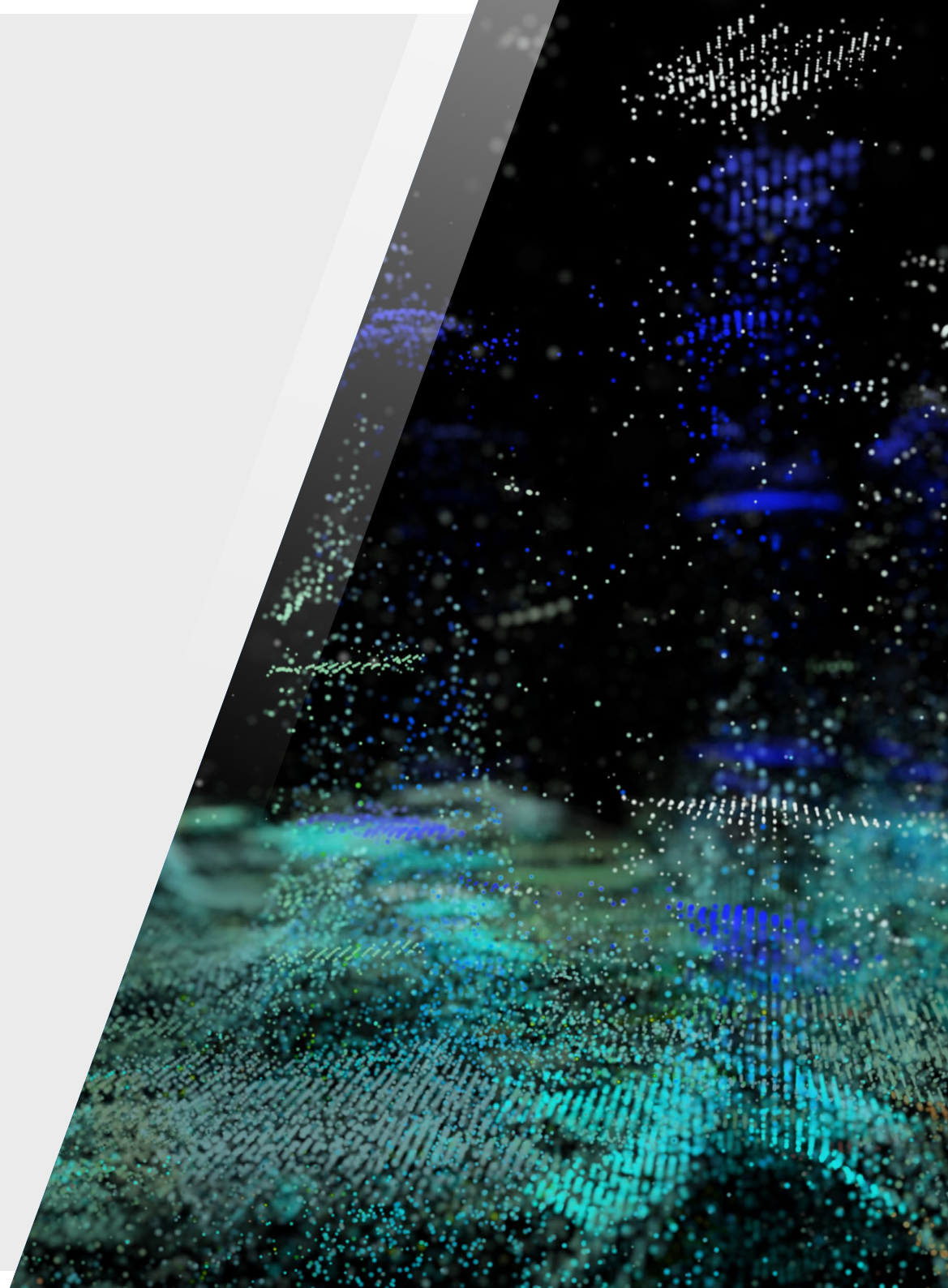
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Methodology

NavVis and its partners; Lidar News, Lidar Magazine, the American Surveyor, GoGeomatics, GIM International, Geo Week, BIMplus, Spatial Source and GeoConnexion, commissioned Statista to conduct a global study of surveying and scanning professionals in the laser scanning, surveying, and AEC industries.

The aim of the survey was to gather information and insights from the industry into the extent at which mobile mapping is being used across industries worldwide.

The study was conducted between May 24th and July 26th, 2022 by means of an online survey. 235* professionals participated in the study, drawn from 51 countries spanning Europe, South & East Asia, the Americas, Africa & Middle East, and Australia.

Limitations to comparisons with 2021 data: The 2021 State of Mobile Mapping study was conducted in 2021 with a total of 152 respondents. While the 2022 edition builds on the original survey and has been used for comparison, please be aware that differences in the data collection process of these surveys mean that caution should be exercised when making direct comparisons with data from 2021.



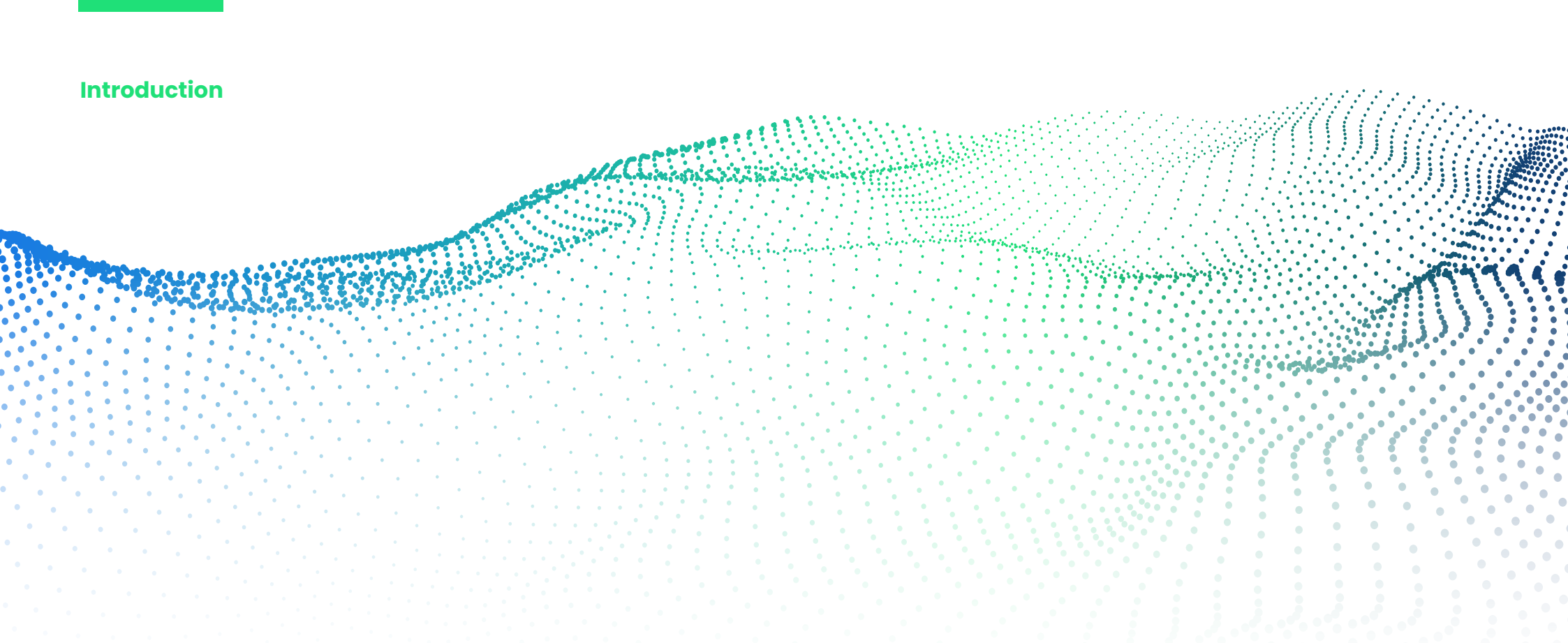
*Including 12 partial completes to Q15



Introduction

The state of mobile mapping 2022

Introduction



As a leading company for reality capture solutions, NavVis and its partners; Geo Week, BIMplus, Lidar News and GIM International, first sought to collect data on the geospatial industry in 2021 with the inaugural State of Mobile Mapping survey. This survey gave a first look into the surveying and laser scanning industry on topics such as the software landscape, desirable product features, and the obstacles that arise by using different products. With the continuation of this survey in 2022, NavVis partnered with Lidar News, Lidar Magazine, the American Surveyor, GoGeomatics, GIM International, Geo Week, BIMplus, Spatial Source and GeoConnexion to expand the reach of the survey. The goal was to map the trends and emerging needs developing in the industry and track the usage and impression of new technologies.

Executive summary

Mobile mapping technology is reshaping the laser scanning and surveying industry.

With the laser scanning and surveying industry undergoing a major shift, the monitoring of industry trends has become all the more important to understand how emerging technologies can be best utilized by customers and what new initiatives are about to reshape the industry. Or to put it another way, what are the new tools that surveyors should be adding to their toolkits.

In the second annual state of mobile mapping survey, we see that a baseline is being established, building on the 2021 survey we can observe:

- The adoption of mobile mapping devices
- The adoption of cloud-based software services
- Device ownership and purchase intent
- The use of hybrid workflows across industries and use cases
- The most important attributes in a mapping device



We are thrilled to be back this year with the State of Mobile Mapping Report 2022. We have seen that mobile mapping is driving significant positive change in a variety of industries – from surveying to laser scanning to AEC and more, and the results in the report are confirmation of that.

This year, we are proud to partner with some of the best in the industry to make this report possible: Lidar News, Lidar Magazine, the American Surveyor, GoGeomatics, GIM International, Geo Week, BIMplus, Spatial Source, and GeoConnexion. With them, we cover nearly every part of the globe, making the reach of this year's survey even broader.

We hope that this report will give you an insight into the exciting world of mobile mapping and what changes and innovations are coming next. Stay tuned!



DR. FELIX REINSHAGEN
Chief Executive Officer /
Co-Founder

Key takeaways

The 2022 state of mobile mapping results were largely consistent with the previous year's study, however some trends are already emerging in its second year.

Mobile mapping continues to fulfill its potential

While under two-thirds (62%) of survey participants in 2021 believed that mobile mapping technologies offer the potential to provide their end-clients with new services, this confidence grew to close to four-fifths (78%) of consumers in the 2022 survey.

Mobile mapping accuracy concerns are highest with those who do not use the technology

28% of terrestrial device owners saw a lack of accuracy as a barrier, compared to 16% of backpack mobile owners. However, the fact that this fear is held by far more intended owners of backpack devices (36%) than the 16% of actual owners, suggests that the device exceeds expectations on this front when purchased.

Cloud-based software is enriching the value of mobile mapping

Survey data reveals that we are on the cusp of this major shift. Now, nearly half (46%) of mapping experts are using SaaS solutions up from 35% in 2021.

Mobile mapping is proving to be essential in maintaining a competitive edge

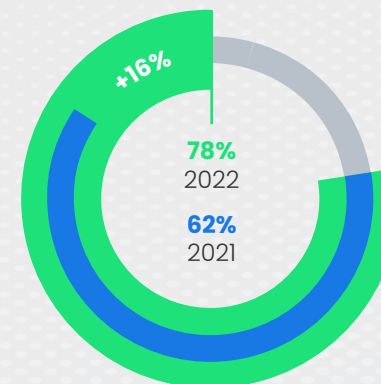
71% of professionals agreed that investing in mobile mapping device technology is in fact "essential" for enabling an innovator image and establishing a competitive edge to get ahead in the field. 69% also agreed with the statement that mobile mapping devices will help in "significantly" changing workflows and growing business.

Hybrid workflows are becoming the new standard

The data suggests that industry consumers are looking to mobile models to build up a "hybrid" collection of devices for their work. With existing ownership rates of total stations, terrestrial laser scanners, GNSS rover and drones already being above 50%, as well as backpack and mobile scanners set to surpass 50% in the coming two years, it can be concluded that consumers are looking to acquire more than one device for their professional needs. 69% also agreed with the statement that mobile mapping devices will help in "significantly" changing workflows and growing business.

Point cloud accuracy remains the most important aspect for business success

When asked to cite the most important features in a scanner that would aid business success, a 68% majority of respondents revealed that point cloud accuracy and high-quality imagery were among their top three priorities. Close to half (48%) ranked scanning speed and the time on site among the same priorities.



Three-quarters of experts see potential in utilizing mobile mapping for service development, **16% more than in 2021.**



Participant profile

Survey scope and participant demographics

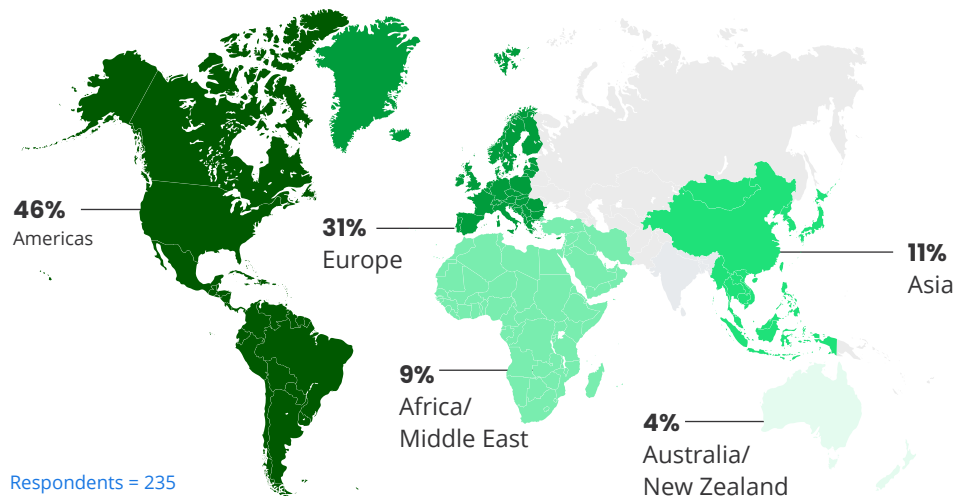
Demographics

Survey participants were screened to ensure that all respondents were professionals in the surveying, scanning, and laser imaging industry during June and July 2022. Participants hailed from all over the world and were predominantly laser scanning and surveying experts in the Americas and Europe.

The largest nationality group of respondents were from the United States making up 32% of the total respondents followed by Canada (8%) and the United Kingdom (5%). The fact that the largest share of survey participants were drawn

from the Americas (46%), ahead of second-placed Europe (31%) is a reversal from the equivalent 2021 report, for which Europeans made up the largest group of participants (44%), followed by those from the Americas (31%).

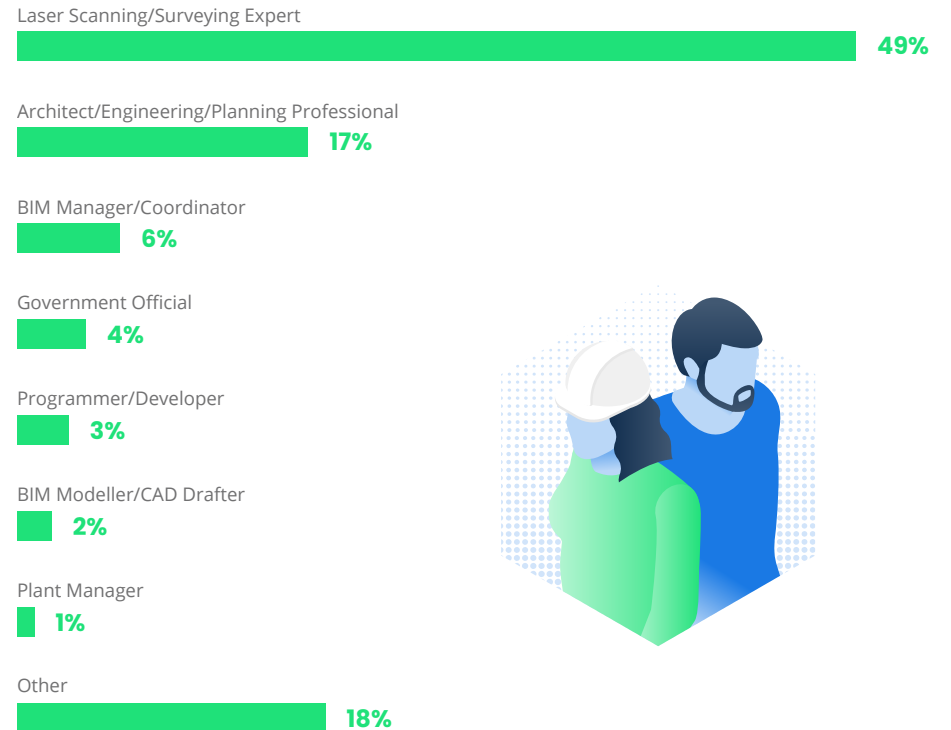
Figure 1
Share of respondents, by region



In terms of occupation, two thirds of the respondents were laser scanning and surveying experts (49%) or an architect, engineering or planning professional

(17%). Those who selected 'other' (18%) as their job function included project managers, surveyors and business owners among others.

Figure 2
Which of the following best describes your job function?



Company characteristics

Respondents were asked to identify their job function and type of company they worked for.

The majority of respondents worked for companies providing surveying and laser scanning services (38%) followed by architecture, engineering or construction (AEC) companies (23%). The third most common company type was the public sector, making up just 8% of respondents.

Figure 3

What type of company do you work for?

Surveying or Laser Scanning Services



Architecture, Engineering or Construction (AEC) Company



Public Sector/Municipality



IT & Digitalization Services



Engineering, Procurement, Construction (EPC) Company



Infrastructure Owner/Operator: Energy, Water, Electrical, Telecoms



Aerospace Manufacturing Company



Entertainment/Computer Graphics/Media Company



Mining Company



Facility or Asset Management Services



Other, please specify:



Respondents = 235



Company characteristics

While public sector respondents made up just 8% of mapping industry respondents, when we take a closer look at mapping services' clientele, it is evident that the outsourcing of such tasks is well established in the sector.

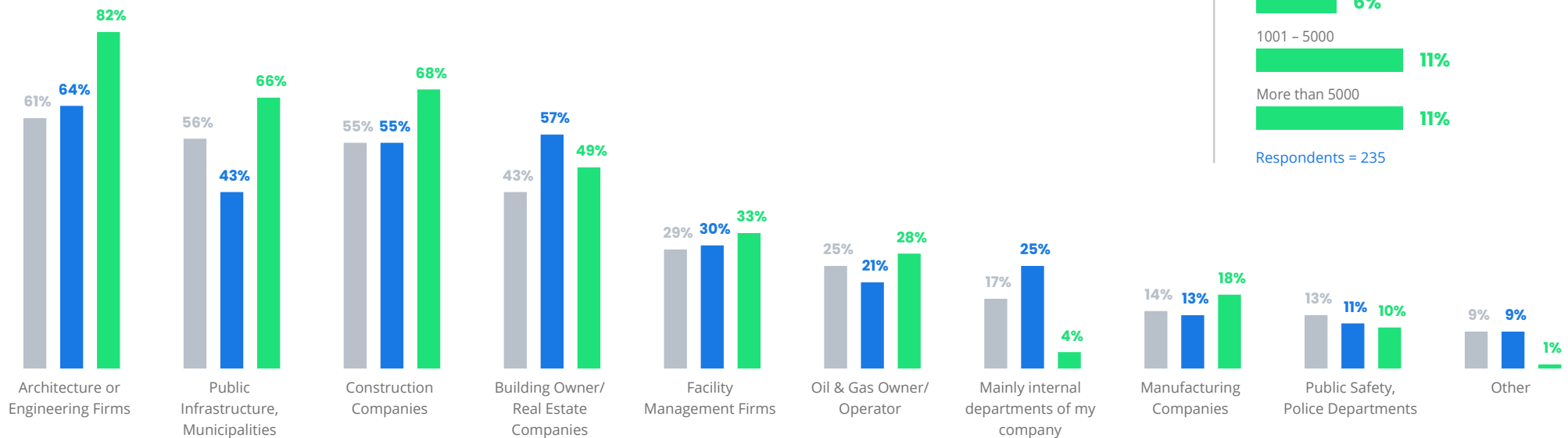
A similar point can be made about AEC companies. Despite the fact that they represent the second-largest company type (23% of respondents), AEC companies were in fact clients of 61% of all participants. Furthermore, an overwhelming 82% of surveying and laser scanning services had AEC companies as clients.

The majority of respondents represented companies with 200 employees or less, servicing clients from the architecture or engineering firms, public infrastructure and construction companies.

Figure 4

Who do you see as your clients? (Multiple answers possible)

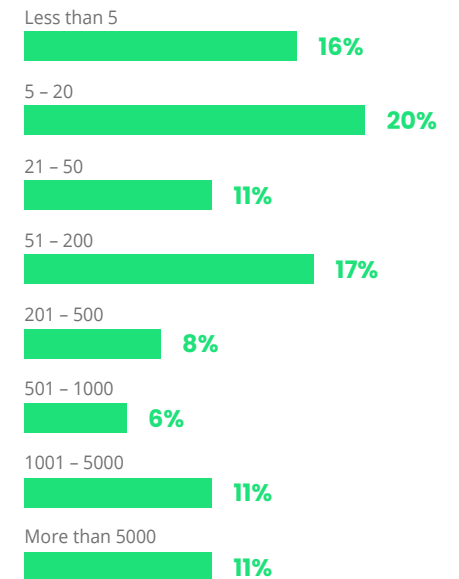
■ Total ■ Architecture, Engineering or Construction (AEC) Company ■ Surveying or Laser Scanning Services



Total respondents = 235; Architecture, Engineering or Construction (AEC) Company = 53; Surveying or Laser Scanning Services = 90

Figure 5

How many employees does your company have in total?



Respondents = 235



Laser scanning in practice

Use cases and the software landscape

Use cases

Respondents were asked about how they used scanning technologies in their day-to-day work. This provides us with an insight into how these technologies are being used and for what purpose.

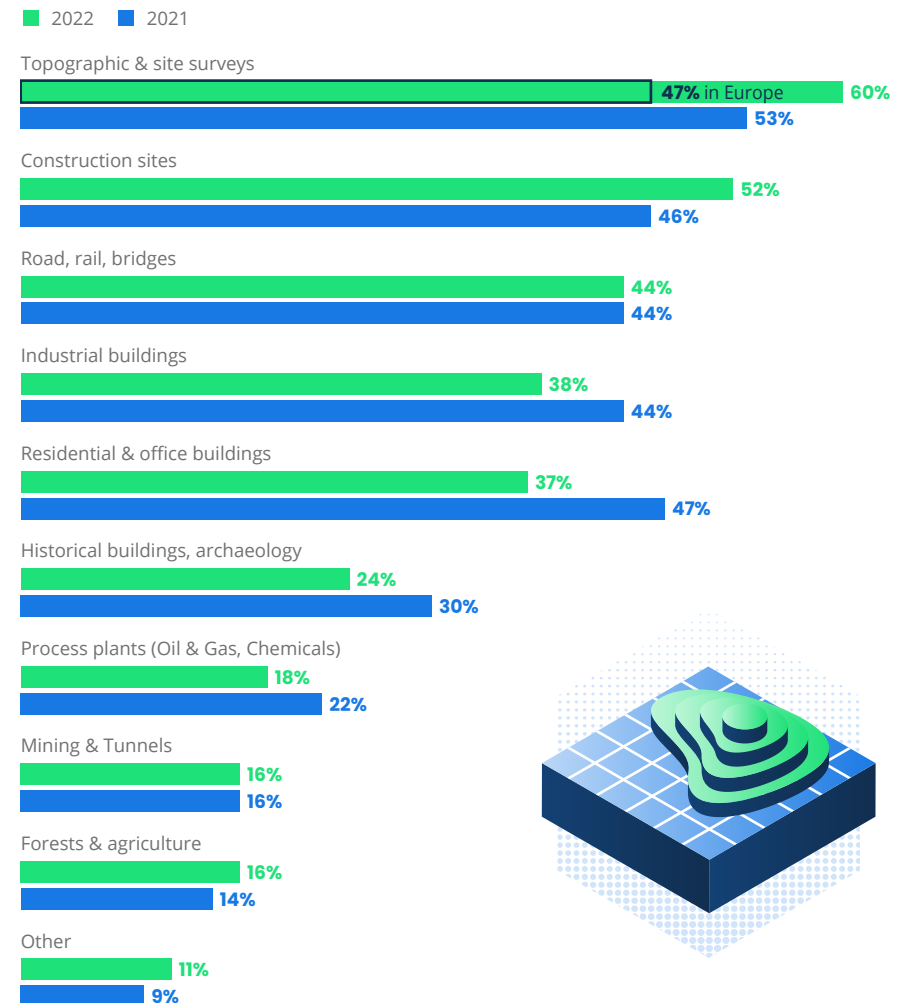
As with the 2021 survey, most respondents (60%) worked on topographic and site surveys, however, in 2022 construction sites overtook residential and office buildings to become the second most common mapping environment. Industrial buildings and residential and office buildings, on the other hand, appeared notably less frequently than in the previous year with these environments being surveyed by less than 40% of respondents this year (38% and 37% respectively).

As-built documentation 3D/BIM and 2D remain the most common scanning use cases for the industry, followed by construction verification. The top 3 use cases maintained their positions compared to the previous year but all three saw slight decreases in usage, in particular 3D/BIM which dropped from 72% in 2021 to 66% in 2022.

Only area survey for real estate rent or sale saw an increase in use cases from the previous year, moving from 6th place to 4th at 30%. The most significant drop in use cases was for scanning prefabrication and shop drawings which dropped 10 percentage points to 14%.

Figure 6

What types of mapping environments do you work with most often?

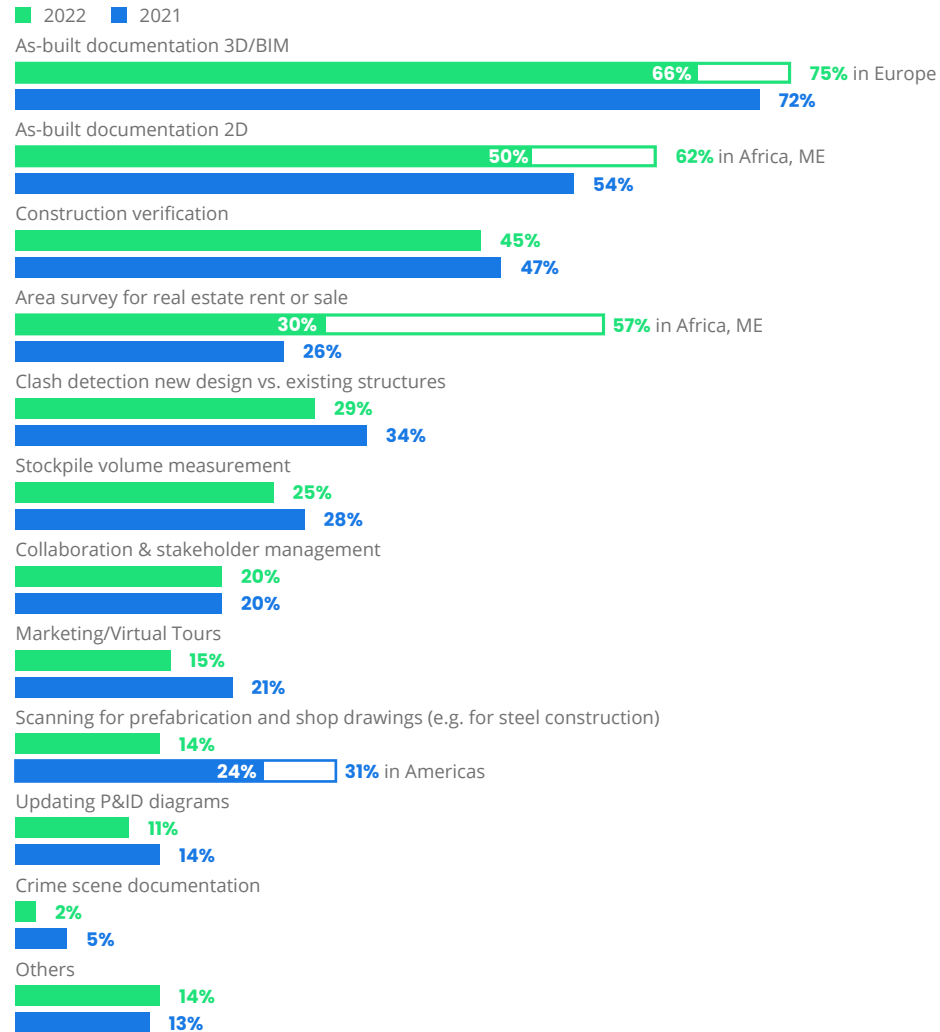


Respondents 2022 = 235; 2021 = 152

Use cases

Figure 7

What are the most common scanning use cases for your clients?



Respondents 2022 = 235; Europe = 72; Africa/Middle East = 9; Americas = 108; 2021 = 152

Due to the sample size, only significant regional differences should be taken into account, however, Europe was almost 10 percentage points more likely to be using as-built documentation 3D/BIM, and Africa and the Middle East were similarly more likely to be using as-built documentation 2D than the global average.

Furthermore, Africa and the Middle East stood out in the area survey for real estate rent or sale segment, indicating that 57% of respondents from this region engaged with this use case compared to 30% globally.

When the use cases are examined by company size, medium-sized companies of 51 to 500 employees were more likely to be engaged with as-built documentation 3D/BIM (76%) and 2D (57%) and more than twice as likely to be involved with scanning for prefabrication

and shop drawings as small and large companies. Large companies of 501 employees or more were significantly more prominent in the stakeholder management use case and were slightly more likely to be doing stockpile volume measurement (28%) and construction verification (49%). The only use cases where small companies outpaced large companies were in area survey for real estate and sale (34%) and marketing/virtual tours (17%).

Among existing owners of devices, an overwhelming majority of respondents with backpack mobile mapping systems (85%) selected 3D/BIM deliverables as an important use case in their work. Significantly more than owners of TLS devices (77%) and handheld mobile mapping systems (70%). This exceeded the usage rates of its 2D equivalent (58%) and construction verification (51%).

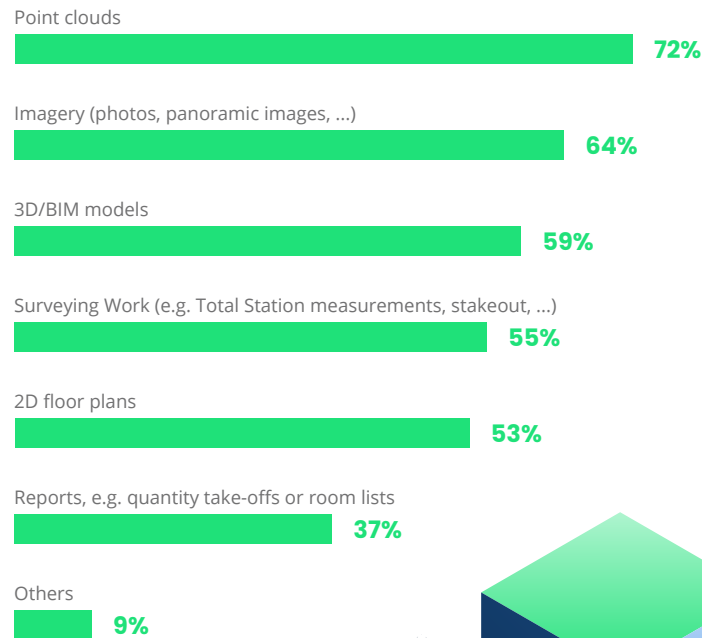
Use cases

Point clouds were the most common deliverable with 72% of companies indicating that they were amongst their current deliverables.

Company deliverables have remained largely consistent with 2021 data although a decrease in the share of respondents working on 3D/BIM models saw the deliverable drop down to third place in 2022. BIM models were most prominent amongst the deliverables of mid-sized companies (74%), however this only made up 25% or less of total deliverables for the vast majority (74%) of mid-size companies.

Figure 8

What are your current deliverables?



Respondents = 235

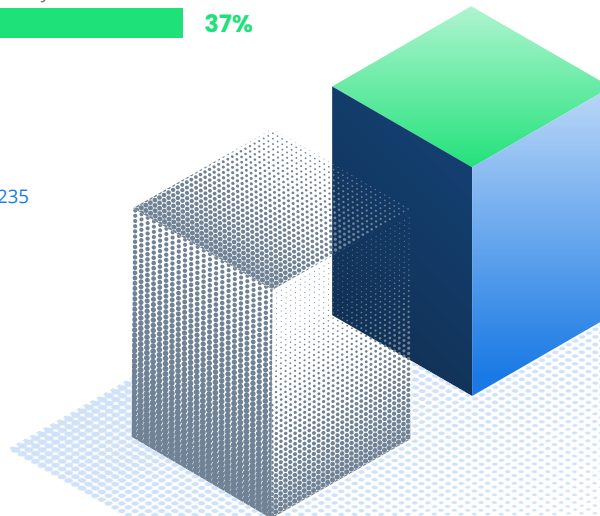
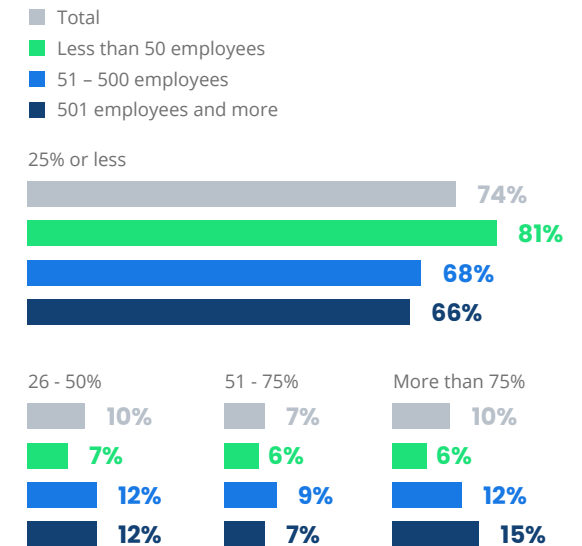


Figure 9

What proportion of the total number of projects you undertake are Building Information Modelling (BIM) projects or require BIM deliverables (e.g. BIM model)?



Total respondents = 235; Less than 50 employees = 109; 51-500 employees = 58; 501 employees and more = 68

Software uses

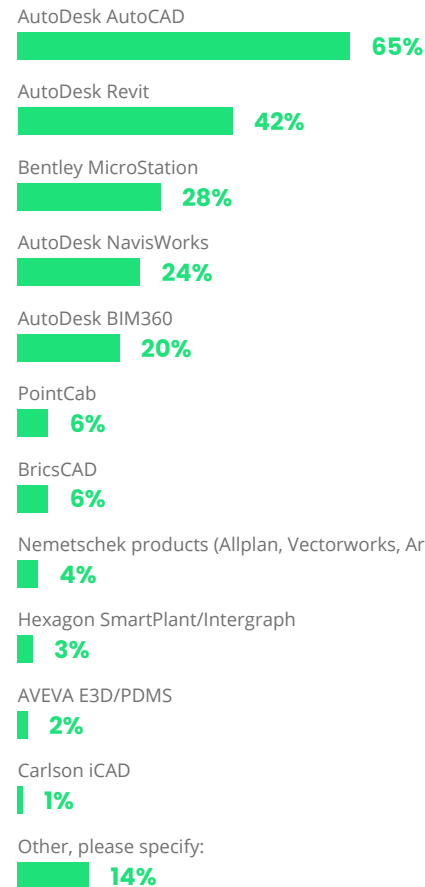
In 2022 the industry remains consistent where software usage is concerned. Industry leader AutoDesk dominates the CAD drafting and BIM modelling software market with four AutoDesk products features in the top five most used software.

The only non-AutoDesk software to grace the top 5 is Bentley MicroStation in third place with over a quarter of respondents indicating that they use it on a regular basis.

Cloud-based software and technologies are likely to have the most significant technology impacts on the surveying and mapping industry in recent times and survey data reveals that we are on the cusp of this major shift.

Figure 10

Which of the following CAD drafting and/or BIM modelling software do you use on a regular basis?



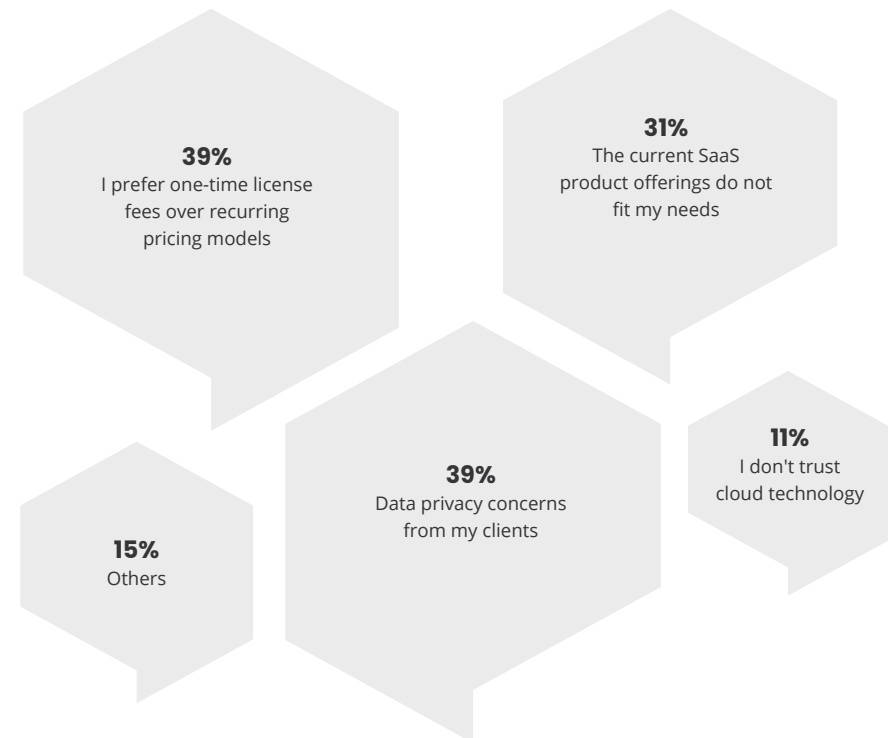
Respondents = 235

Now, nearly half (46%) of mapping experts are using SaaS solutions.

But ongoing licencing costs and data security concerns present a barrier for almost 40% or those who are not using SaaS solutions. A further 31% do not believe that current SaaS product offering suit their needs.

Figure 11

What are your reasons for not using any cloud-based solutions in your mapping workflow or for delivery of your projects?



Respondents : 127



Product characteristics and ownership

Most important product features and the current rates of possession

Product characteristic

In this section, we will discuss customers' needs with regards to mobile scanning devices in a professional context, as well as the key characteristics that influence purchasing decisions.

When asked to cite the most important features in a scanner that would aid business success, a 68% majority of respondents revealed that point cloud accuracy and high-quality imagery were among their top three priorities.

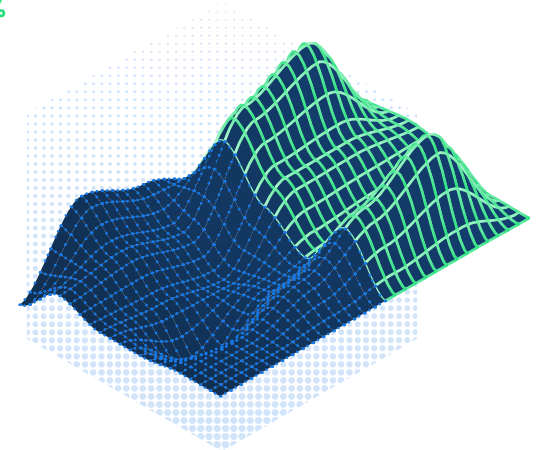
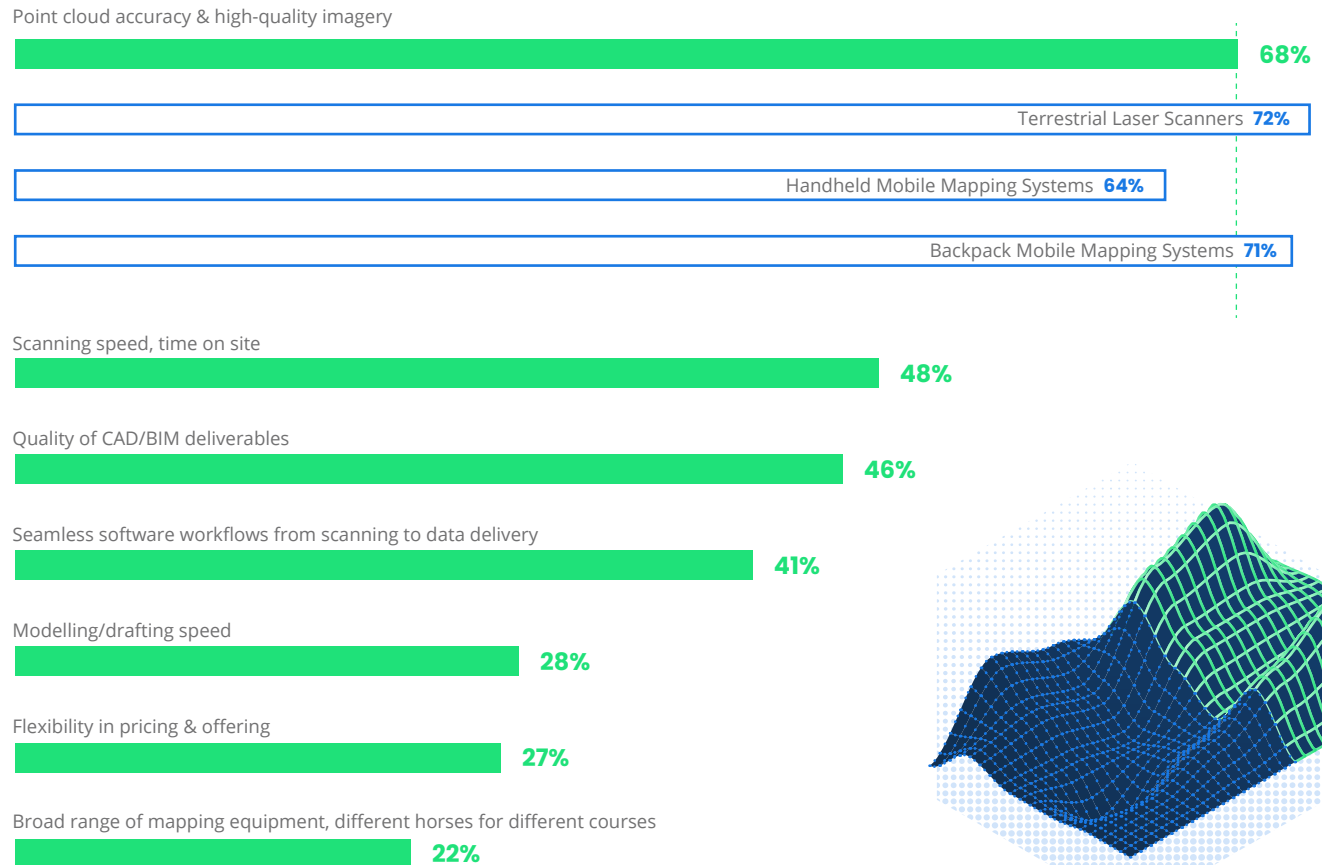
Close to half (48%) ranked scanning speed and the time on site among the same priorities.

At the other end of the scale, however, only 22% placed the same level of importance on a broad range of mapping equipment, while the need for differentiation from competition was ranked by only 21% of respondents.

Figure 12

Which of the following aspects are (or would be) the most important for you to be successful in your business?

(Multiple answers possible)



Total respondents= 235; Terrestrial Laser Scanners = 149; Handheld Mobile Mapping Systems = 84; Backpack Mobile Mapping Systems = 55

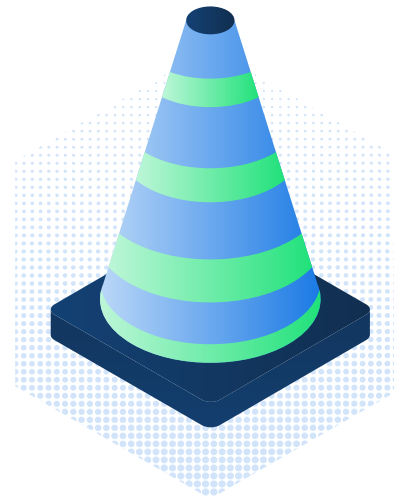
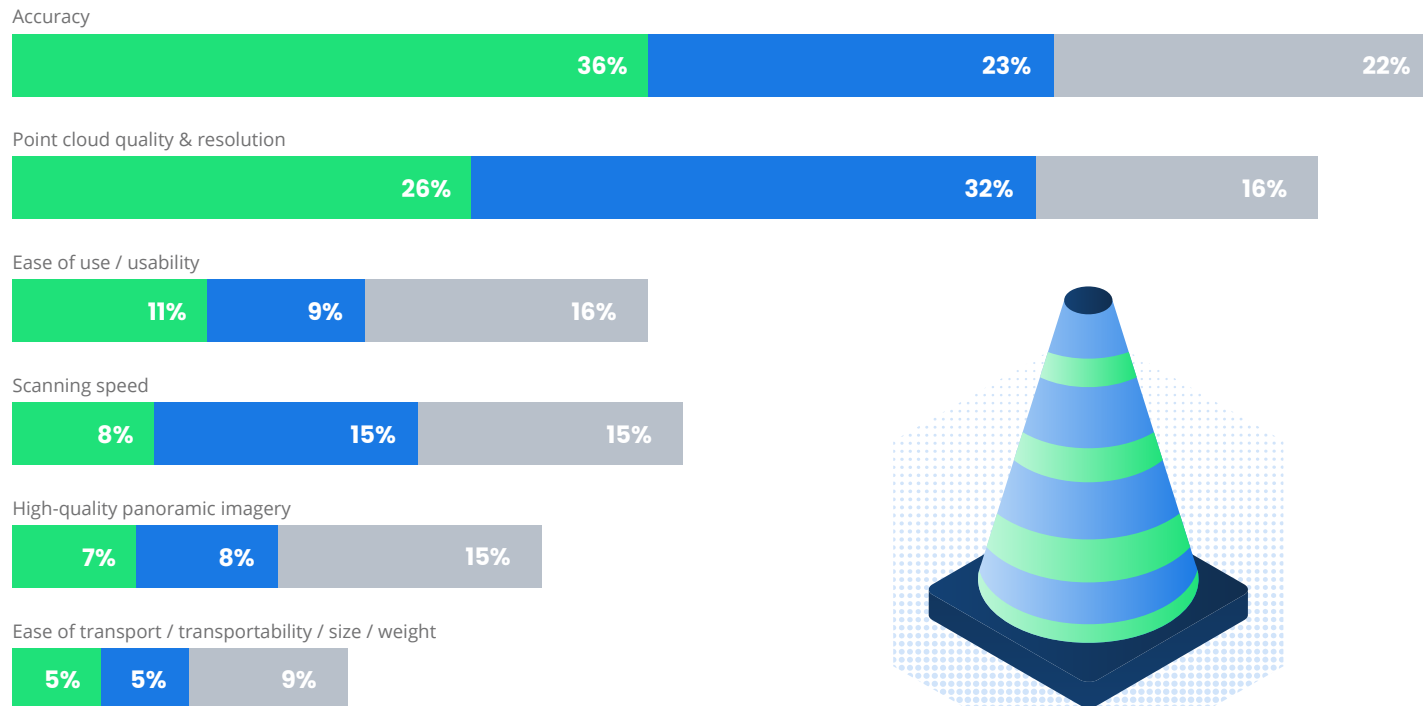
Product characteristic

Figure 13

Which product attributes are (or would be) most important when deciding what kind of scanning device to buy?

(Multiple answers possible)

■ Rank 1 ■ Rank 2 ■ Rank 3



Respondents = 235

Accuracy ranked as the number 1 priority for 36% of those surveyed, while ranking among the top 3 for 75% of respondents. Point cloud quality and resolution was listed in the top 3 by 73% of participants, with 26% listing it as their top priority.

With regards to the most important features considered by consumers when deciding on the type of scanning device they would be looking to buy, accuracy and point cloud quality and resolution clearly stood out as the most critical aspects.

While ease of use / usability was the third most popular top ranked choice – being listed in first place by 11% of consumers – it made the top 3 of only 36% of all respondents. Scanning speed, however, made the top 3 among 45% of participants, despite being the number 1 factor among only 8% of users.

Notably, point cloud accuracy and high-quality imagery was seen as almost equally important by owners of both terrestrial laser scanners (72%) and backpack mobile mapping systems (71%) – a number 1 ranking for both groups – thereby underlining the faith in the accuracy of mobile mapping devices.

Ownership

Participants were surveyed about their existing ownership and purchasing intentions for scanning devices within the next two years. Results have accordingly been broken down across different product categories.

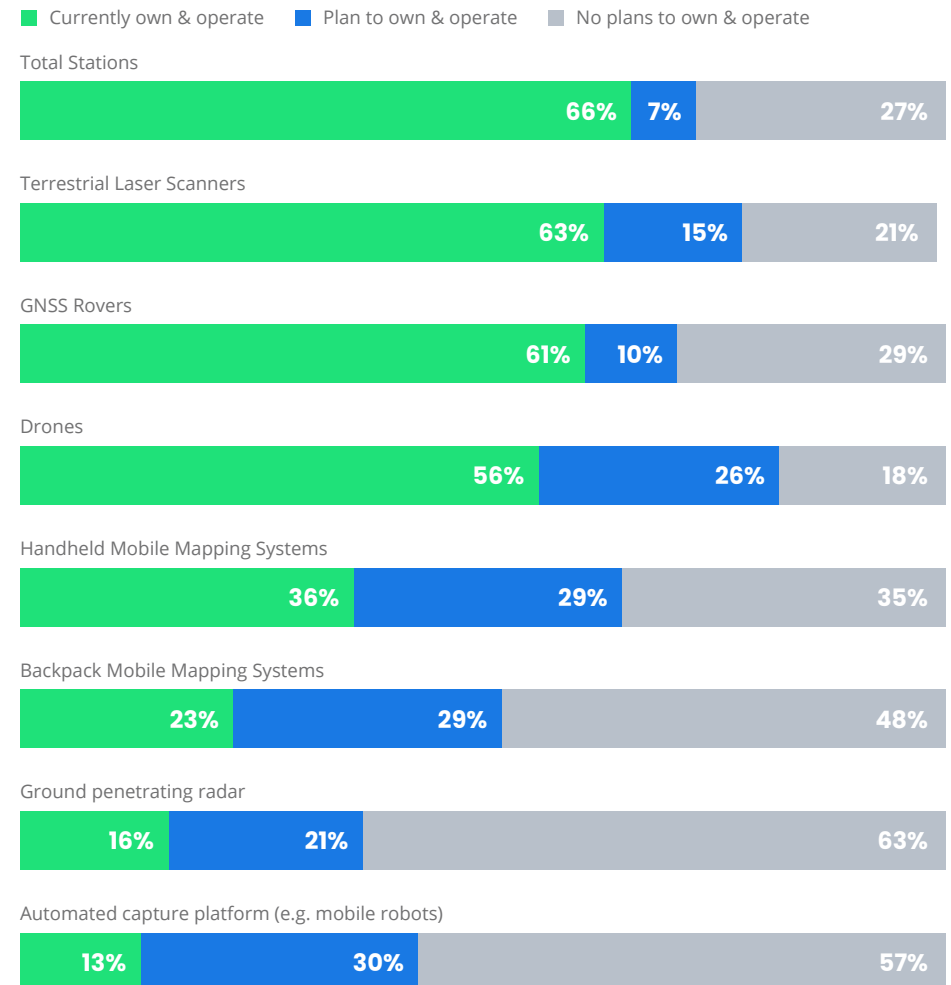
The most-commonly possessed device among participants were total stations, which had an ownership rate of 66%. Nevertheless, only a further 7% of respondents confirmed that they planned to acquire total stations devices in the coming two years and over one-quarter (27%) stating that they had no plans to acquire them at all. Consequently, it would appear that the device is reaching its upper ceiling for ownership.

Drones, on the other hand, would appear to be set to overtake all other categories in the coming two-year period. Already the fourth-most-owned device (56%), a further 26% of respondents suggested they would acquire the devices within the coming two years and therefore bring total ownership up to 82%. This would accordingly place drones ahead of all other categories.

While currently owned by only a minority of respondents, both handheld and backpack mobile mapping systems can be expected to see a significant growth in purchases over the coming two years that would see them each owned by more than 50% of surveyed consumers. Both devices saw a planned purchase rate of 29% each, a significant step forward given the current handheld rate of 36% and backpack equivalent of 23%.

Figure 14

Which of the following surveying devices does your organization own & operate or are you looking to own and operate in the next two years?

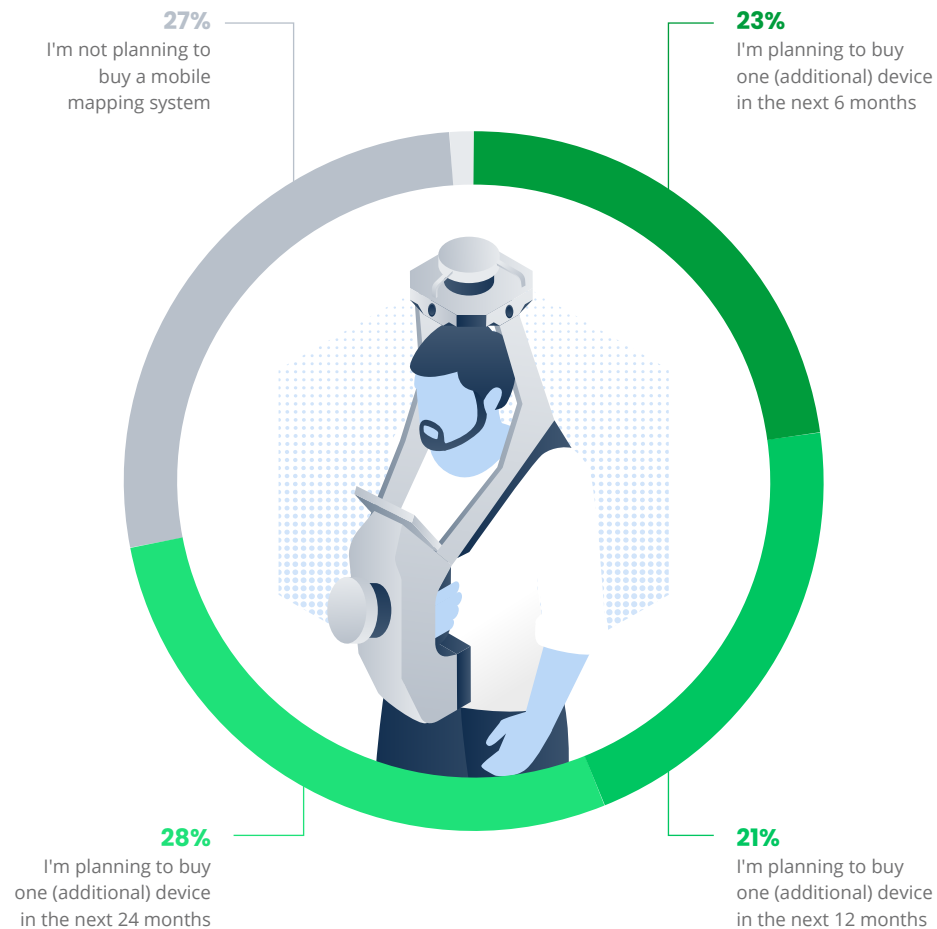


Respondents = 235; percentages may not add to 100 due to rounding

Ownership

Figure 15

What is your current perspective on mobile mapping using backpack or handheld devices?



Respondents = 173 professionals, who own/operate or are looking to own/operate mobile mapping systems; percentages may not add to 100 due to rounding

Altogether, with existing ownership rates of total stations, terrestrial laser scanners, GNSS rover and drones already being above 50%, as well as backpack and mobile scanners set to surpass 50% in the coming two years, it can be concluded that consumers are looking to acquire more than one device for their professional needs.

Furthermore, among the 173 out of 235 respondents who either already own, or are planning to acquire handheld or backpack mobile devices, 72% were looking to purchase a device in the coming two-year period, including those who already owned such devices and would be acquiring an additional one. Accordingly, only slightly more than a quarter (27%) of those surveyed were existing device owners with no plans to add to their collection.

The fact that handheld and mobile devices currently have relatively lower ownership rates, but a large share of survey respondents have plans to buy them would suggest that industry consumers are looking to mobile models to build up a "hybrid" collection of devices for their work.



Adoption barriers and drivers

What barriers exist to using a mobile mapping device
and what motivates consumers to buy them?

Adoption barriers

When surveyed on the key barriers surrounding their use of mobile mapping devices, the most common reason cited – with multiple answers possible – was a limited budget, as indicated by 38% of respondents.

However, there was a perceptible difference in answers depending on company size: limited budget issues were cited by close to half (45%) of companies with fewer than 50 employees, but less than a third of larger companies with 51-500 (31%) and 501 or more workers (32%).

Despite limited budget being the most-cited barrier among respondents, there is a notable gap between those for whom finances are insufficient (“limited budget”: 38%) and those that do not see the financial outlay worthwhile (“devices are too expensive for the results they deliver”: 31%).

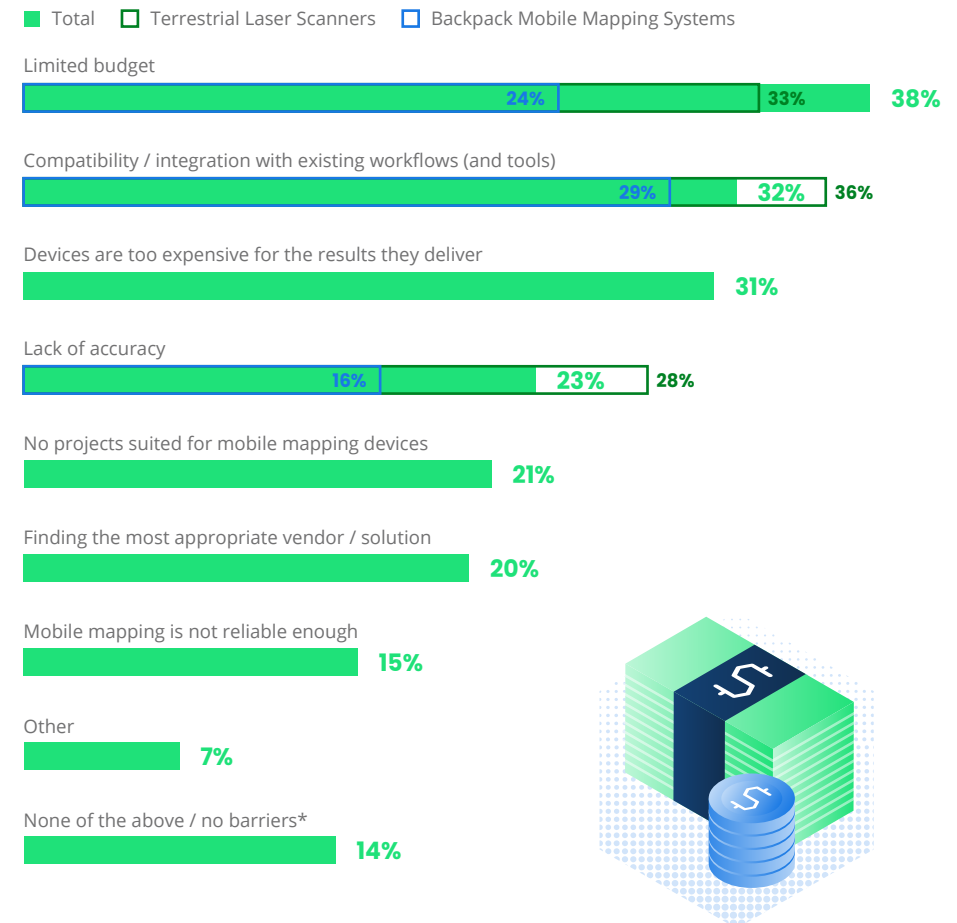
The belief that the results are not justified by the financial outlay is similarly felt more by smaller businesses; more respondents from companies with fewer than 50 employees (37%) cited this factor than those from companies with 51-100 (26%) or 501 or more (28%) employees.

When comparing and contrasting the feedback from owners and intended owners of terrestrial laser scanners and backpack mobile mapping systems, some interesting results emerge.

Among owners, one third (33%) of terrestrial laser scanner owners consider a limited budget to be a key barrier in purchasing a device, while this sinks to only 24% of backpack mobile mapping systems owners. A similar gap of 10% exists between those interested in acquiring terrestrial (44%) and backpack (34%) devices.

Figure 16

What are the key barriers or questions in your organization around using mobile mapping devices?



Respondents = 235; Terrestrial Laser Scanners = 149; Backpack Mobile Mapping Systems = 55



Adoption barriers

There is also a gap in the perception of accuracy of the two devices too. 28% of terrestrial device owners saw a lack of accuracy as a barrier, compared to 16% of backpack mobile owners. However, the fact that this fear is held by far more intended owners of backpack devices (36%) than the 16% of

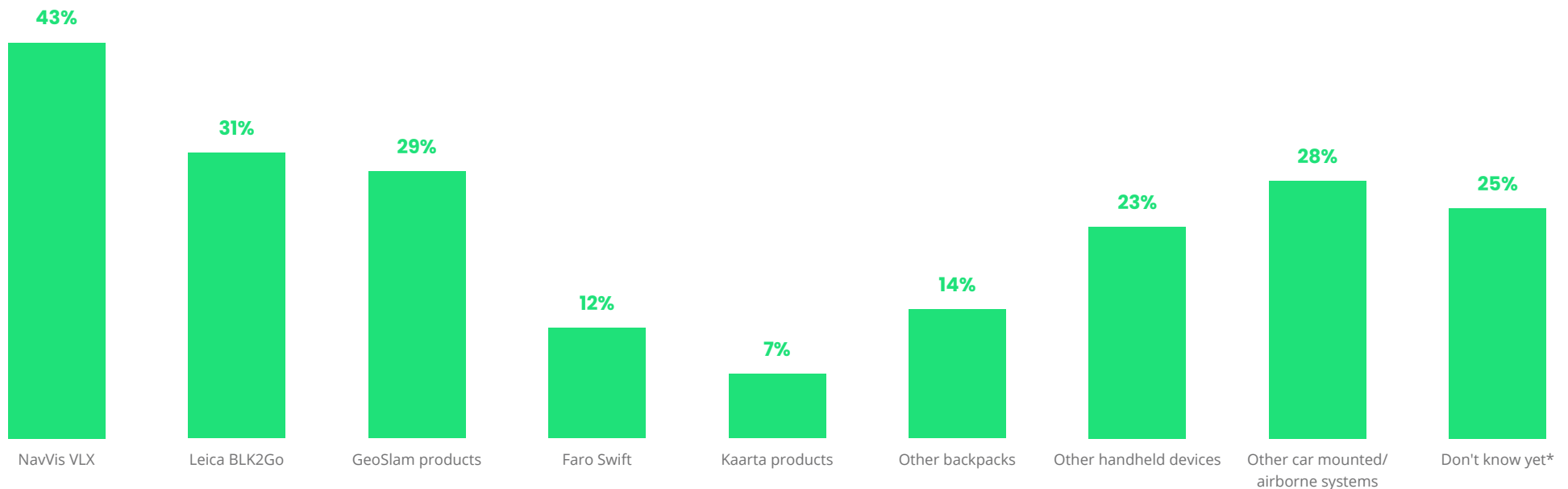
actual owners, suggests that the device exceeds expectations on this front when purchased. With terrestrial scanners, the inverse is in fact true: only 19% of intended terrestrial scanner owners cite a lack of accuracy as an issue, while a higher proportion of actual owners (28%) report this as a barrier.

Current and intended owners of mobile mapping devices were also given the opportunity to provide multiple answers when asked about the brands they would consider buying. NavVis VLX was a clear favorite among those intending to acquire backpack mobile mapping systems (52%), while 37% would consider GeoSlam products and 30% Leica BLK2Go.

NavVis VLX was also the top choice (50%) amongst existing owners of terrestrial laser scanners, while 36% reported considering Leica BLK2Go scanners and 34% GeoSlam products.

Figure 17

Which of the following mobile mapping devices would you consider buying? (Multiple answers possible)



Respondents = 173 professionals, who own/operate or are looking to own/operate mobile mapping systems

Adoption drivers

From surveying the opinions of consumers, it is possible to gain key insights into the motivational factors behind their purchases and thereby better understand the determinants influencing market growth.

The responses with the highest rates were largely linked to the quality and efficiency and mobile mapping. The two highest-performing reasons cited by respondents were that they could see the value of using both mobile and terrestrial scanning on the same projects and that “intuitive, web-based deliverables” accessible to all stakeholders allowed all stakeholders to get maximum value out of mobile mapping.

Conversely, only around one-in-four surveyed participants (27%) agreed or strongly agreed that mobile mapping was unable to meet their accuracy expectations, a figure that in fact fell to 19% among respondents from large companies with 501 employees or more.

Figure 18

To what degree do you agree or disagree with the following statements?

Strongly agree Tend to agree Tend to disagree Strongly disagree Don't know

We are worried we will fall behind our competitors if we don't invest in new technologies



We don't think that mobile mapping can achieve our accuracy expectations



Using mobile mapping, I can deliver more projects and create higher revenue in a reliable manner



Mobile mapping will help me to fundamentally change internal workflows and to grow business significantly



I always want to own the newest technology on the market to be perceived as innovator and maintain my competitive edge



I can see the value of deploying mobile mapping and terrestrial scanning on the same projects



Mobile mapping will help to significantly increase the quality of construction projects by performing as-built vs as-planned comparisons on a regular basis



Intuitive, web-based deliverables that all stakeholders can access are key to getting maximum value out of mobile mapping



Respondents = 235; percentages may not add to 100 due to rounding

Future of mobile mapping

Insights into consumer sentiment
surrounding market outlook

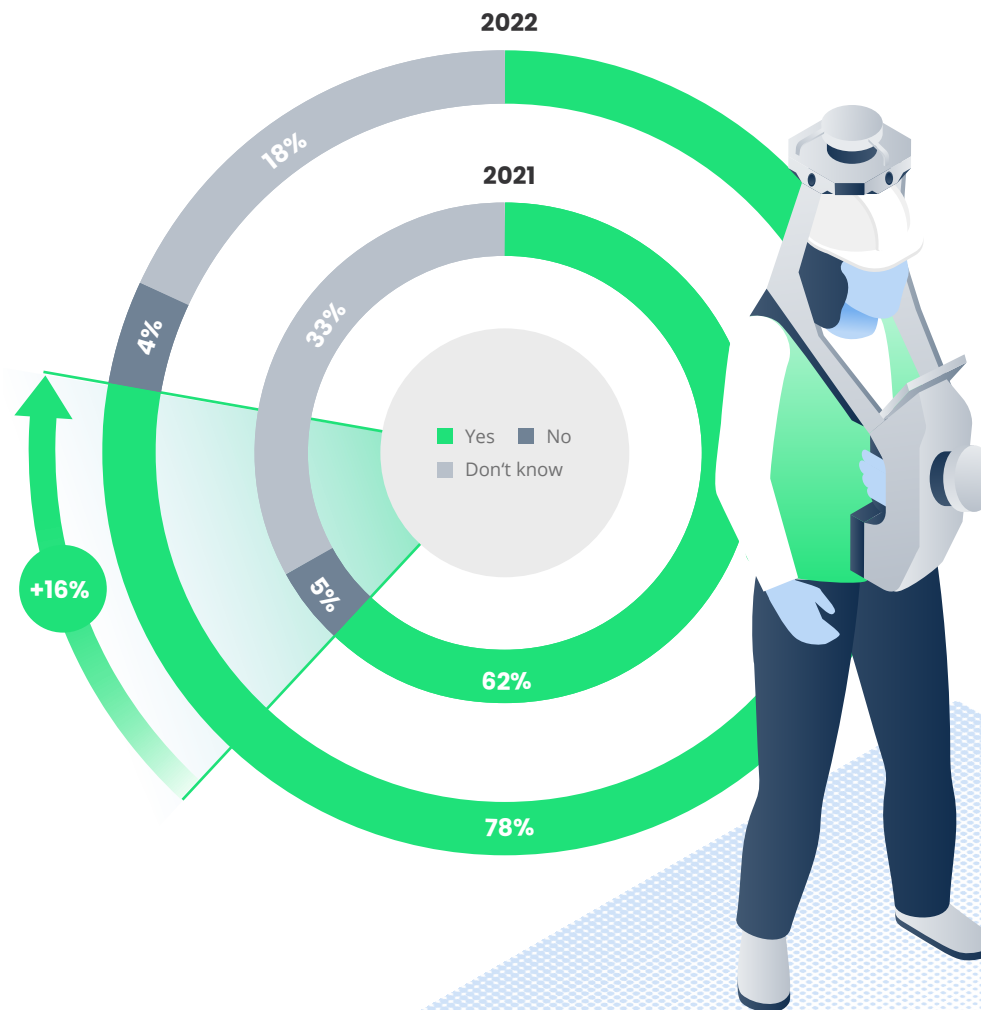
Future of mobile mapping

Looking forward, the future of the market suggests that mobile mapping will continue to become more successful as time passes.

In the 2021 edition of the State of Mobile Mapping survey, 62% of respondents agreed that they saw the potential for being able to offer new services to their end-clients based upon the use of mobile mapping technologies. A third (33%), nevertheless, reported seeing no potential for offers, with the remaining 5% unsure.

Figure 19

In the future, do you see potential to offer new services to your clients by using mobile mapping technology?



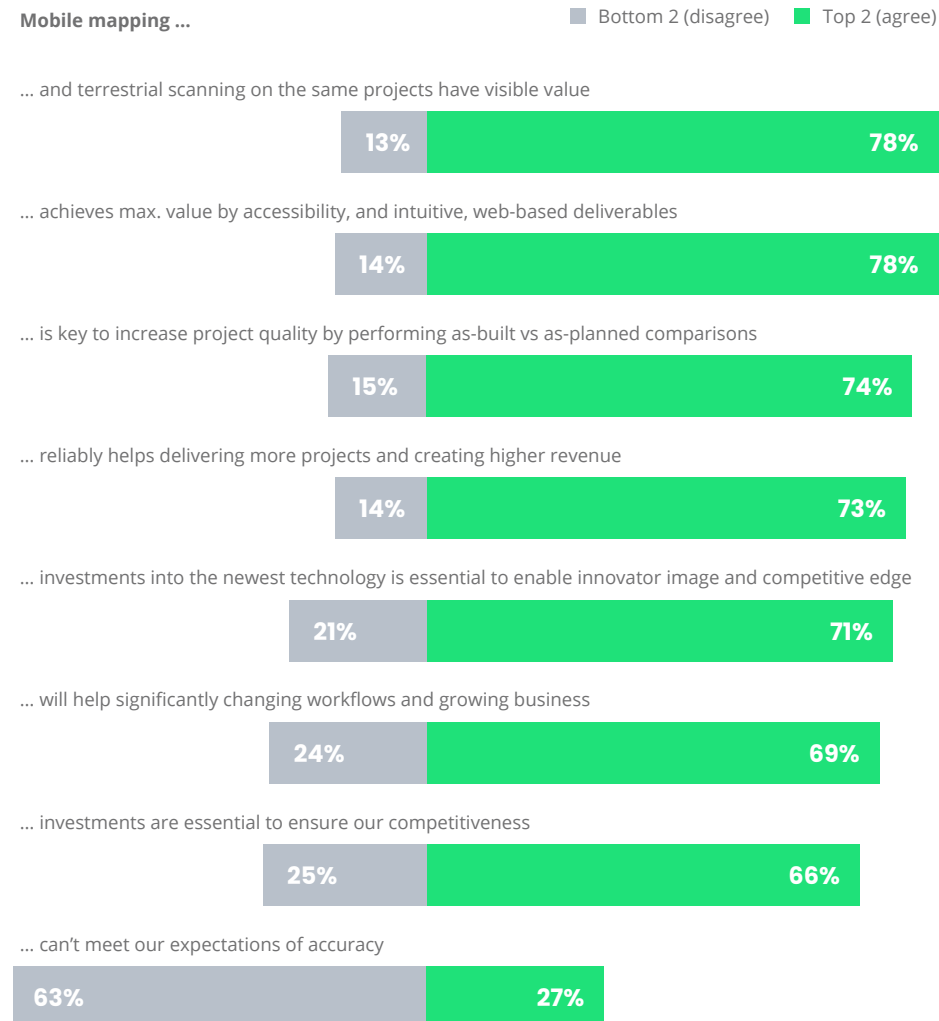
Only one year later, however, there has been a marked growth in confidence in the technology. While under two-thirds (62%) of survey participants in 2021 believed that mobile mapping technologies offer the potential to provide their end-clients with new services, this confidence grew to close to four-fifths (78%) of consumers in the 2022 survey. This accordingly represents an increase of 16 percentage points within the space of only 12 months.

Likewise, this trend was closely matched by a decrease from 33% to 18% in those reporting that they did not see the potential. This accordingly means that the share of unconvinced consumers shrank from one-in-three to less than one-in-five over the course of only one year.

Future of mobile mapping

Figure 20

To what degree do you agree or disagree with the following statements?



Respondents = 235

Continuing to look to the future, it is clear that professionals are soundly convinced by mobile mapping as a valuable component within their work.

The statements “I can see the value of deploying mobile mapping and terrestrial scanning on the same projects” and “intuitive, web-based deliverables that all stakeholders can access are key to getting maximum value out of mobile mapping” were both agreed with by a share of 78% of respondents. The overwhelming endorsement of these factors among consumers reinforces the perception that the trend for “hybrid” use of multiple devices is becoming well-established.

Beyond quality and efficiency factors, there was also a strong recognition of the products’ innovative side. 71% of professionals agreed that investing in mobile mapping device technology is in fact “essential” for enabling an innovator image and establishing a competitive edge to get ahead in the field. 69% also agreed with the statement that mobile mapping devices will help in “significantly” changing workflows and growing business.

Conversely, close to two-thirds of all respondents (63%) actively disagreed, or even disagreed strongly, with the sentiment that mobile mapping devices were unable to meet expectations of accuracy.

Future of mobile mapping

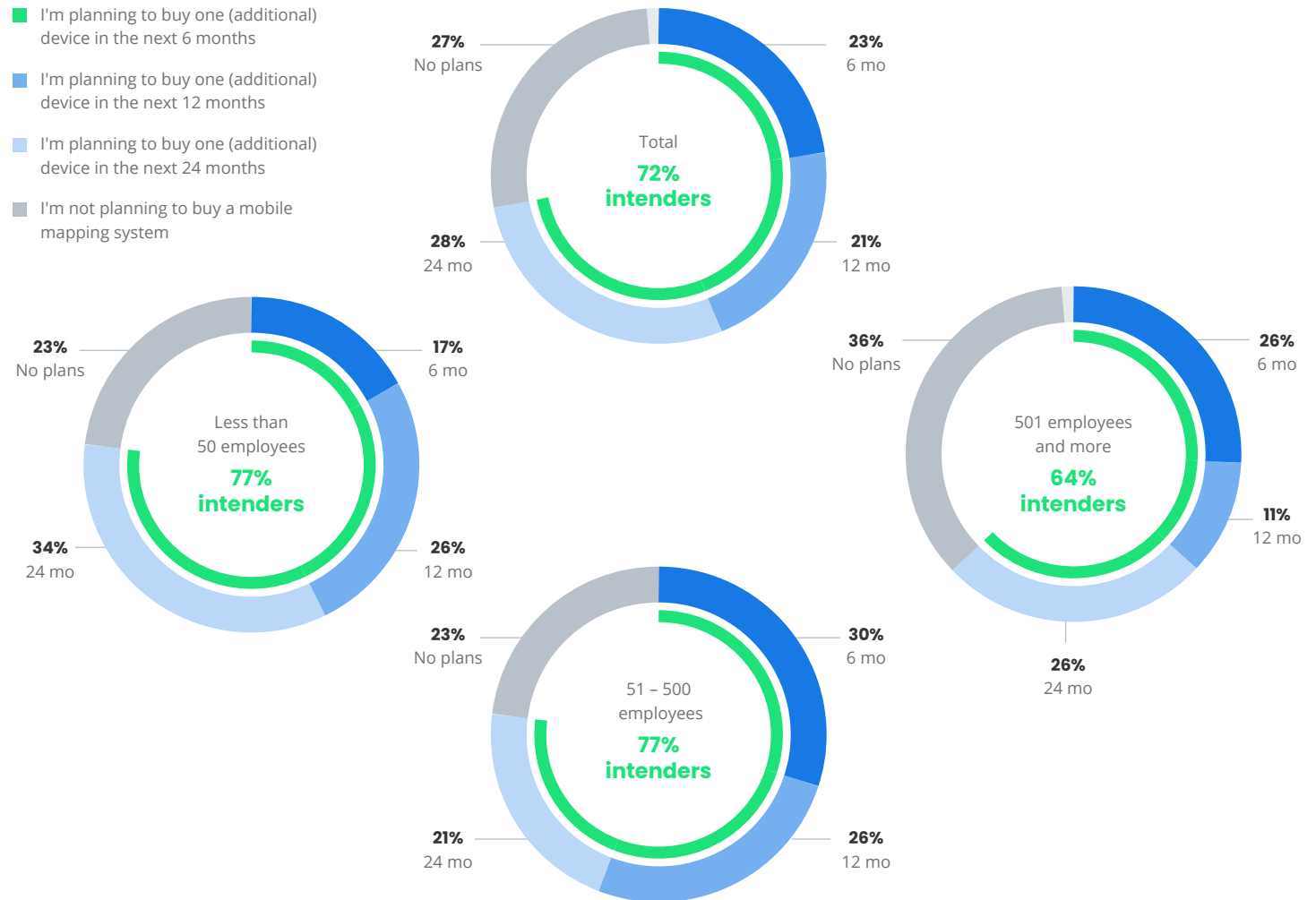
When it comes to following through with aspirations to purchase devices, small and mid-sized companies of 500 employees or less are overrepresented among current and intending owner participants reporting that they planned to buy a device in the near future.

For example, a combined 56% of surveyed participants from mid-sized companies employing between 51 and 500 employees reported that they would wish to purchase a device - regardless of previous ownership - within the coming six-month (30%) or twelve-month (26%) timeframe. Less than a quarter of respondents from mid-sized or small (<50 employees) reported having no plans to purchase a device, a sentiment shared by 23% of each category.

Figure 21

What is your current perspective on mobile mapping using backpack or handheld devices?

- I'm planning to buy one (additional) device in the next 6 months
- I'm planning to buy one (additional) device in the next 12 months
- I'm planning to buy one (additional) device in the next 24 months
- I'm not planning to buy a mobile mapping system



Total respondents = 173; less than 50 employees = 77; 51-500 employees = 43; 501 employees and more = 53; percentages may not add to 100 due to rounding

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