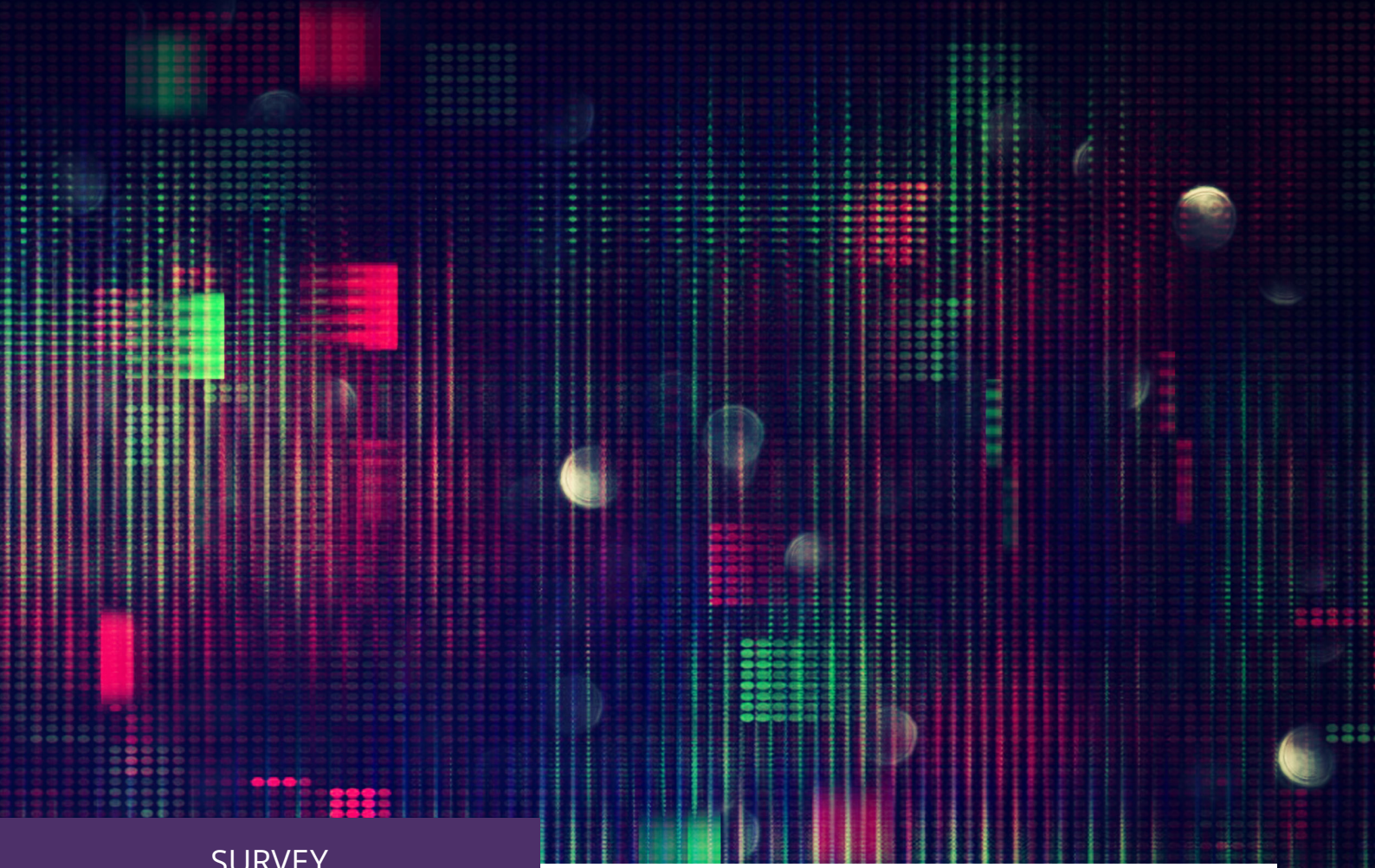

SURVEY

RICS Tech Partner Programme Survey

March 2023

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Jess Rogers

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Contents

Glossary

Term	Definition
360° cameras	Also known as a spherical camera, a 360° camera captures images and videos in all directions at once, creating a full 360° view of the scene. Unlike traditional cameras, which have a limited field of view, 360° cameras capture the entire environment, including the floor, ceiling and everything in between. They usually have two or more lenses that point in different directions, allowing them to capture a full sphere of the scene. These images and videos can be viewed on a computer or mobile device and can be interacted with by panning and tilting the view in any direction. A 360° camera can be used in a variety of applications such as virtual tours, real estate, tourism, etc. They can also be used for creating immersive virtual reality and augmented reality experiences, as well as for creating panoramic images for Google Street View. They come in different shapes and sizes, from small and portable to large and professional, and have different features such as resolution, frame rate and image stabilisation. They come in different price ranges.
AI (artificial intelligence)	A simulation of human intelligence processes by computer systems. These processes include: • learning (the ability to improve performance based on experience) • reasoning (the ability to understand and draw conclusions from data) and • self-correction. AI can be classified into two categories: • **narrow or weak AI**, which is designed to perform a specific task such as image recognition or language translation, and • **general or strong AI**, which has the ability to perform any intellectual task that a human can (also known as artificial general intelligence (AGI)).

Term	Definition
AI (artificial intelligence) (continued)	Different techniques are used to develop AI systems, such as rule-based systems, decision trees, artificial neural networks, genetic algorithms, etc. The field of AI is constantly evolving and researchers are working on developing more advanced AI systems that can perform more complex tasks and have a greater level of autonomy.
AR (augmented reality)	A technology that enhances a user's perception of the real world by overlaying digital information, such as images, videos or text, onto the user's view of the environment. Unlike virtual reality, which creates a completely simulated environment, AR enhances and augments the user's existing environment. There are different types of AR systems, including marker-based and markerless AR. • Marker-based AR uses a specific visual marker, such as a QR (quick response) code, to trigger the display of digital information. • Markerless AR uses the device's camera and sensor data to identify and track the environment in real-time. AR can be experienced through different mediums such as smartphones, tablets, head-mounted displays and smart glasses. It can be applied in various fields such as education, entertainment, industrial, etc. Some examples of AR applications include: • gaming and entertainment • training and education • visualisation and design and • maintenance and repair. AR has the potential to revolutionise the way we interact with the world around us, making it more interactive, informative and efficient.

Term	Definition
Big data	This refers to the large volume of structured and unstructured data that is generated and collected by organisations and individuals. It can come from various sources such as social media, sensors, transactional systems, etc. The data can be so vast and complex that it becomes difficult to process using traditional data-processing tools. Big data has several characteristics that make it unique: • **volume**: the sheer amount that is generated and collected • **variety**: the many different types of data, such as text, images, video, audio and sensor data • **velocity**: the speed at which data is generated and collected and • **veracity**: the uncertainty and lack of structure of the data. To handle big data, organisations use a combination of technologies and techniques such as distributed computing, NoSQL databases and advanced analytics. These technologies allow large amounts of data to be stored, processed and analysed in real time. Big data can be used for a wide range of applications such as customer analytics, fraud detection, predictive maintenance, etc. It has the potential to provide organisations with valuable insights that can improve decision-making, increase efficiency and drive innovation.
Blockchain	A decentralised, distributed ledger technology that uses cryptography to secure and validate transactions. It is the underlying technology of cryptocurrencies such as Bitcoin, but it can also be used for a wide range of other applications. A blockchain is essentially a digital ledger that records transactions across a network of computers. Each 'block' in the 'chain' contains a record of multiple transactions, and once a block is added to the chain, the information it contains cannot be altered. This creates a permanent and transparent record of all transactions on the blockchain, making it difficult to tamper with or falsify records.

Term	Definition
Blockchain (continued)	Blockchain technology has several key features that make it attractive for various use cases. • **Decentralisation**: the ledger is maintained by a network of computers rather than a central authority, making it more resilient to censorship or tampering. • **Transparency**: transactions are recorded on a public ledger that can be viewed by anyone on the network. • **Immutability**: transactions are recorded in blocks that are linked together in a chain, making it difficult to alter or delete past records. • **Security**: transactions are secured using cryptography, making it difficult to hack or otherwise compromise the integrity of the blockchain. Blockchain technology can be used for a wide range of applications such as digital currencies, smart contracts, supply chain management, digital identity, etc.
Cloud computing	Cloud computing is the delivery of computing services (including servers, storage, databases, networking, software, analytics and intelligence) over the internet ('the cloud') to offer faster innovation, flexible resources and economies of scale. There are three main types of cloud computing services. • Infrastructure as a service (IaaS) provides virtualised computing resources over the internet. Examples include Amazon Web Services (AWS), Microsoft Azure and Google Cloud Platform (GCP). • Platform as a service (PaaS) provides a platform for the development, running and management of applications and services. Examples include AWS Elastic Beanstalk, Microsoft Azure App Service and Google App Engine. • Software as a service (SaaS) provides a complete software solution that runs on the cloud. Examples include Salesforce, Microsoft Office 365 and Google G Suite. Cloud computing has several benefits over traditional on-premises IT infrastructure. • **Cost savings**: cloud providers handle the maintenance and upgrades, so the user only pays for what they use.

Term	Definition
Cloud computing (continued)	• **Scalability**: cloud resources can be easily scaled up or down as needed. • **Flexibility**: cloud resources can be accessed from anywhere with an internet connection. • **Collaboration**: cloud services enable remote teams to access and work on the same resources and files. Cloud computing has become a popular way for businesses to access IT resources and services, and it is expected to continue to grow in popularity as more companies move their operations to the cloud.
Digital twins	A digital replica of a physical object, process or system that can be used to simulate its real-world behaviour and performance and analyse, test and optimise it in a simulated environment. Digital twins can be used to: • improve the design and development of new products • optimise the performance of existing products, predict maintenance and prevent potential failures • monitor and control remotely and • plan and simulate. They can be created for a wide range of physical assets and systems including buildings, bridges, machines, vehicles and even entire cities. They can be used in a variety of industries such as manufacturing, construction, aerospace and transportation. Digital twins can be created using a combination of sensor data, three-dimensional (3D) modelling and simulation software, and can be updated in real time with data from the physical object or system. They have the potential to improve efficiency, reduce costs and enhance decision-making across many industries.

Term	Definition
IoT (the internet of things)	A network of physical devices, vehicles, buildings and other items embedded with electronics, software, sensors and connectivity that enable them to collect and exchange data. These devices can be connected to the internet to transmit and receive data, which can be used for a variety of purposes such as automation, monitoring and control. Examples of IoT devices include: • smart thermostats • security cameras and • wearable fitness trackers. The IoT allows for increased efficiency, accuracy and convenience in various industries such as healthcare, transportation and manufacturing.
LiDAR (light detection and ranging)	A technology that uses laser beams to measure distances and create 3D maps of the environment, which can be used for a variety of applications such as self-driving cars, robot navigation and surveying.
Metaverse	A virtual shared space where users can interact with each other and digital objects in a seemingly real-world environment. It is often described as a combination of virtual reality, augmented reality and the internet, creating a seamless and immersive experience across multiple platforms and devices. The metaverse concept includes a wide range of digital experiences such as virtual worlds, social virtual reality, gaming and immersive entertainment. It also includes the ability to interact with digital objects and services such as virtual commerce, education, etc. The metaverse is still in its early stages, and the technologies and standards that will define it are still being developed. However, it has the potential to change the way we interact with each other and the digital world, creating new opportunities for communication, entertainment and commerce. Some of the main players in this field are companies like Facebook, Google, Microsoft, Epic Games and Roblox. The metaverse is expected to become a new paradigm for how we live, work and play in the digital age, creating new forms of human connections and economic activities.

Term	Definition
ML (machine learning)	A subfield of AI that provides systems with the ability to learn and improve from experience automatically without being explicitly programmed. ML algorithms can learn from data, identify patterns and make decisions with minimal human intervention. There are three main types of machine learning. • **Supervised learning**: the model is trained on a labelled dataset where the correct output is provided for each input, and the goal is to make predictions on unseen data. • **Unsupervised learning**: the model is not given any labelled data, and the goal is to find patterns or relationships within the data. • **Reinforcement learning**: the model learns through trial-and-error interactions with an environment, and the goal is to maximise a cumulative reward. Examples of ML applications include: • image classification • natural language processing • predictive modelling and • recommender systems. ML is becoming a crucial part of many industries such as healthcare, finance and transportation.
SaaS (software as a service)	A software-delivery model in which software is hosted by a third-party provider and made available to customers over the internet. The software can be accessed through a web browser, rather than needing to be installed. Examples of SaaS include: • email platforms • customer relationship management software and • accounting software.
VR (virtual reality)	A computer-generated simulation of a 3D environment that can be interacted with using specialised equipment, such as a VR headset. The goal of VR is to create a realistic, immersive experience that allows users to feel as if they are in a different place or situation.

Term	Definition
VR (virtual reality) (continued)	There are different types of VR systems. • Non-immersive systems allow users to see virtual objects on a computer screen. • Semi-immersive systems use projection screens or multiple monitors to surround users with virtual images. • Fully immersive systems use head-mounted displays or other equipment to completely surround users with virtual images and sounds, blocking out the real world. VR technology can be used in many fields such as gaming, entertainment, education, training, therapy, etc. It has been used to simulate dangerous or inaccessible environments for training purposes, as well as to create interactive and immersive gaming experiences. VR technology can also be used in fields such as medicine, architecture and design, allowing professionals to visualise and interact with complex structures and simulations.
Web 3.0	The next evolution of the World Wide Web, where the web will become more intelligent, semantic and decentralised. The web 3.0 vision is to create a more human-like web, where machines can understand and interpret the meaning of data and content, as opposed to just reading it. Web 3.0 is often associated with the emergence of decentralised technologies such as blockchain and peer-to-peer networks, which allow for the creation of decentralised applications that can run on a distributed network without the need for a central authority. This enables users to have more control over their data and online identities and enables new forms of interactions and transactions. Web 3.0 also includes the use of AI and ML to create a more personalised and intuitive web experience. It enables web applications to understand the intent of the user and to automatically provide the most relevant information. The aim of web 3.0 is also to provide a more interoperable web, where data and services can be easily shared and integrated across different platforms and applications, enabling new forms of collaboration and innovation. Web 3.0 is still in the early stages, and the new technologies and standards that will define it are still evolving. Nevertheless, it has the potential to fundamentally change the way we use and interact with the web.

Foreword

Data and technology solution providers support every type of asset across the built and natural environment at every point of the land and property life cycle. Activity and innovation are taking place at pace across the globe in developed, emerging and developing countries.

Providers range from well-established firms to startups that are seeking various rounds of funding as they develop and seek adoption of their solutions.

The effects of the COVID-19 pandemic have turbocharged pre-existing trends, such as hybrid working and the ability to survey assets remotely. Together with the increasingly existential issues around environmental, social and governance (ESG), sustainability, climate change and the net-zero agenda, adoption of data and technology has accelerated.

Barriers continue to exist that will slow adoption across the sector. However, with the range of data and technology already available, these barriers appear to be focused on:

- change management
- culture
- skills
- leadership and
- the ability to implement solutions that deliver a clear return on investment and which solve business issues quickly using agile approaches.

Data availability, structure, quality, standardisation, sharing, governance and ethical considerations will continue to present challenges, and the use of artificial intelligence (AI) in its various forms across various use cases will require the sector to address challenges around its governance, risks and interpretability.

With the macroeconomic headwinds that the sector faces, like many other segments of the world economy, a focus on cost, efficiency and managing finite financial and other resources will act both as a barrier and driver to data and technology adoption. However, such adoption clearly has the potential to make firms and organisations more efficient in a sector that has not yet reaped the full benefits of digitalisation.

Despite the increase in interest rates across many markets, which are affecting the appetite of investors, the data and technology sector remains vibrant, with no immediate signs of consolidation and retrenchment in interest in the sector. Climate Tech is seen as a particularly attractive investment.

1 Introduction

This is the first annual report on the development and adoption of data and technology across the built and natural environment. It reflects on the years since the pandemic, which accelerated many existing trends across the sector, and summarises the outlook for 2023 and beyond.

1.1 The emergence of the innovative and disruptive

In addition to providing insight, this report has been produced by surveying our Tech Partner Programme community, as part of RICS' ongoing engagement with the profession. The Tech Partner community is a collaborative platform for innovative data and technology across the globe, producing thought leadership, content and market insight for the profession. RICS' Tech Partners provide solutions across the full land and property life cycle and are active in the UK, Europe, the Middle East, sub-Saharan Africa, Asia and Oceania, providing multiple perspectives on their and their client's journey to digitalise the sector.

1.2 An alphabet soup of technology terms

While the term 'PropTech' has come to represent the emergence of innovative and disruptive firms that develop solutions for the land and property sector, various other monikers are being applied to technology that either apply to other parts of the built and natural environment or are related to other sectors that themselves form part of the world of data and technology.

We find ourselves faced with an ever-increasing list of terms for data and technology that are used across the built and natural environment:

- ConTech for construction
- InfraTech for infrastructure
- LandTech for land
- PlanTech for planning and
- CRETech for commercial real estate.

We then need to add the following to our vocabulary:

- Climate Tech, for technology to address net zero
- LawTech for the legal system
- FinTech for the financial system
- InsurTech for the insurance sector
- RegTech for the regulatory sector and

- SupTech for the supervisory world.

These latter technologies often form part of, and support, the solutions being used across land and property.

This proliferation of terms, and the blurring of lines between technologies, is why this report focuses on the application of data and technology across the built and natural environment and avoids unnecessary terms and jargon.

However, there is one context in which the term PropTech is worth examining in more detail. PropTech has come to represent the emergence of startup firms that have innovated, disrupted and challenged incumbent market participants. This has driven the process of digitalisation across the sector, and there is an argument to be made that, as long-standing firms adopt and develop their own data and technology, we will no longer recognise a separate PropTech sector; rather, we will see a sector that embraces the opportunities of data and technology and uses external vendors and solution providers to complement their own internal capabilities. It should also be recognised that many of the solutions available to the sector are provided by mature, established software providers.

1.3 Mindset is key

The digitalisation of the built and natural environment has been driven not only by the emergence of PropTech but also by various demographic, economic and behavioural trends, coupled with the threat of climate change and the continued legacy of the pandemic. Land, real estate, property and infrastructure are being challenged by these changes, and data and technology form part of the solution that the sector will need to adopt.

It is perhaps a cliché to comment on the conservative nature of the sector, its fragmented nature, the historical lack of investment in research and development, and the lack of diversity in the workforce. However, all these factors have probably contributed to the sector's slow adoption of technology. Generalisations are usually unwise and, as this report demonstrates, many market participants are already using data and technology to deliver tremendous value to their operations, clients and customers. With the technology already available to the sector, it can be argued that the remaining barriers to digitalisation are around people, culture, behaviours, processes and investment.

1.4 Scope

Before reviewing the results of the survey, let us first briefly describe what solutions the data and technology sector can offer the land and property life cycle, in order to emphasise the depth and breadth of what is available. This list is not exhaustive but provides a sense of the wide range of solutions that are available.

- **Planning and development**: there are solutions to present land parcels overlaid with numerous datasets, providing visual means to select land for development, acquisition

and disposal; this makes the due-diligence process more efficient and incorporates issues around biodiversity, nitrates, phosphates and other environmental and land-use issues.

- **Construction** is well served with applications supporting quantity take-off from two-dimensional (2D) and three-dimensional (3D) sources, cost estimating, benchmarking and project history, quality assurance, project and contract management, scheduling, building information modelling (BIM), payment management, wireless site communications and material tracking.
- **Financing of projects** is available via peer-to-peer platforms, and tokenisation and other fractional forms of ownership are being exploited.
- **Valuation** continues to be automated using automated valuation models (AVMs) across residential lending and mass appraisal for property taxation of domestic and non-domestic properties, with other tools supporting commercial real estate by providing aggregation and analysis of lease and rent roll data, locational datasets and bond-type ratings for occupier covenant strength.
- **Brokerage of land, residential and commercial property is** being digitalised with online data for due diligence, virtual viewings, online auctions, anti-money laundering (AML), know your customer (KYC), anti-bribery and corruption (ABC), digital identity, qualified electronic signatures (QES) and platforms delivering 'one-click' rentals and other online transaction processing.
- **Property management** has solutions focusing on improving the occupier experience, client money handling, automated agreement documentation, and payment processing and reconciliation.
- **Asset management** is being supported with powerful data analytics at the asset and portfolio level to support planning, disposals and acquisitions.
- **Building management** has a wide range of solutions to help building surveyors and building managers manage the health and operational performance of their assets, with data collection provided by sensors, 360° cameras, smartphones and other devices. Building management systems (BMSs) provide real-time data to control smart buildings, and these are increasingly being deployed by retrofitting existing assets as well as being used on new developments.

With such a long list of assets that need some form of retrofit to improve their energy performance and reduce emissions, it is not surprising that firms are providing a variety of solutions using thermal imaging, satellites, geospatial data, sensors and energy-performance data to identify opportunities for solar power installations and improvements to building fabric.

2 Survey methodology

This first survey of the RICS Tech Partner Programme community posed the following questions via an online questionnaire to establish the profile of the firms and their views on the sector.

- What sectors and practice areas are you active in?
- What asset types are you active across?
- In which country is your main office located?
- Which markets are you active in?
- Are you a startup?
- What stage of fundraising are you at, if any?
- What have been the main drivers of data and technology adoption across the built and natural environment since 2020?
- What have been the main barriers to data and technology adoption across the built and natural environment since 2020?
- What new technologies have emerged since 2020?
- What will be the main drivers of data and technology adoption across the built and natural environment in 2023?
- What will be the main barriers to data and technology adoption across the built and natural environment in 2023?
- What new technologies will emerge in 2023?
- There will be significant consolidation across the data and technology sector in 2023 (strongly disagree to strongly agree).
- There will be a significant reduction in investment in the data and technology sector in 2023 (strongly disagree to strongly agree).

In addition, in order to inform this report with qualitative insight, the author spoke to Tech Partners directly and recorded more than 130 separate video discussions covering every area of practice and every world region. Direct quotations from these interviews appear throughout the document.

3 Survey results

3.1 Sectors and practice areas

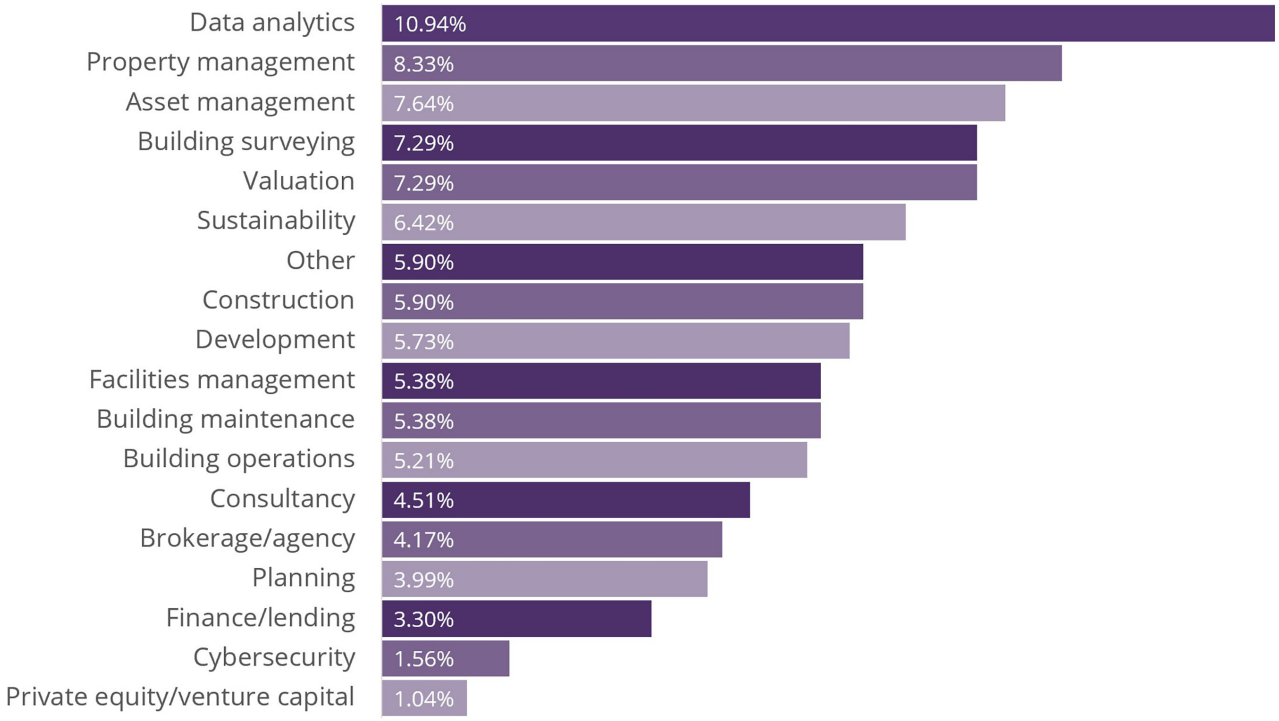

Figure 1: What sectors and practice areas are you active in?

The wide range of sectors and practice areas covered emphasises the need to apply broader terms and thinking to the benefits of using data and technology across the life cycle of the built and natural environment. It is worth highlighting the large number of respondents active in data analytics: turning often unstructured, siloed data into a form that supports improved decision-making is one of the key areas where technology can benefit the sector. There are huge opportunities to take advantage of both small and big datasets to turn data into information.

3.2 Asset types

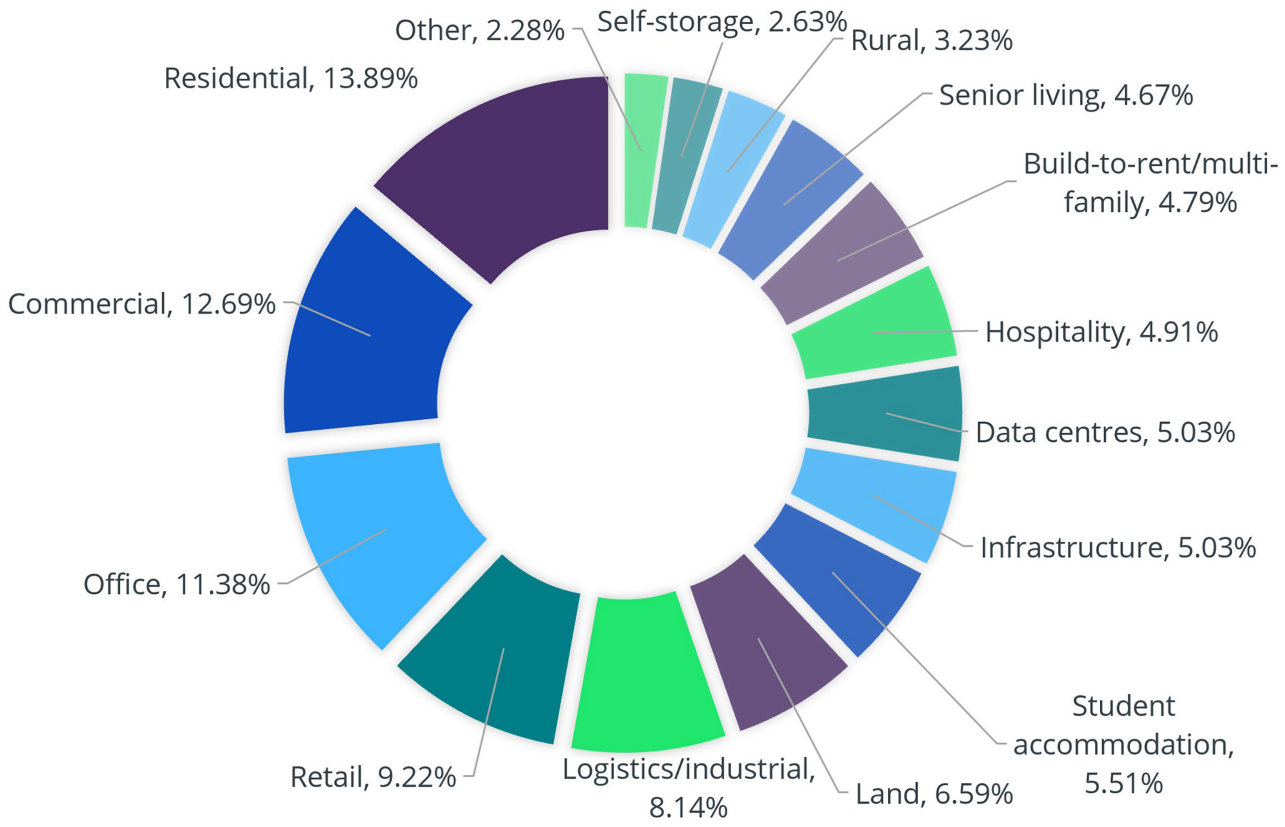

Figure 2: What asset types are you active across?

As with sectors and practice areas, a wide range of asset types are being supported. The rise of alternative assets is also highlighted, with activity across these now familiar, mainly operational assets. Residential stands out as an area of special focus with activity around valuation, property management, brokerage and client money handling, which are examples of common use cases.

3.3 Location of main office

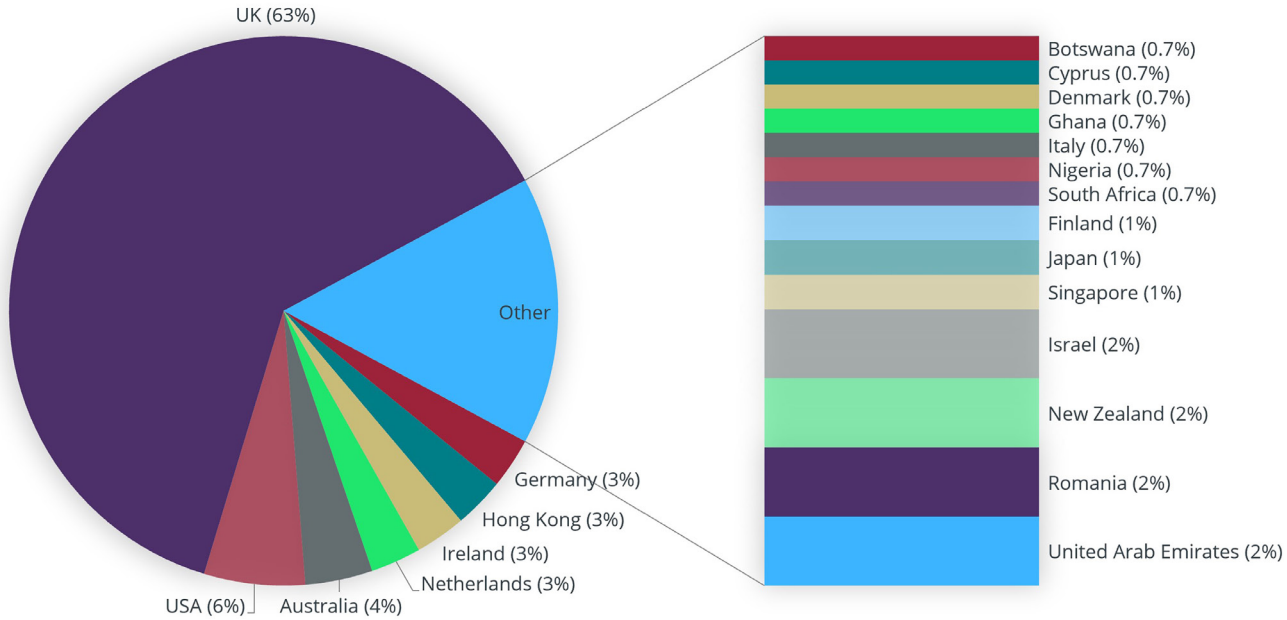

Figure 3: In which country is your main office located?

To a large extent, the distribution of Tech Partners reflects RICS' membership. Around two-thirds are headquartered in the UK and Ireland, with additional representation from Europe, the Middle East, sub-Saharan Africa, North America, Asia and Oceania.

However, it is wrong to assume that the reach and ambition of these firms is limited to their home countries. While many aspects of land and property have specific jurisdictional aspects, many fundamental practice areas are common and allow technologies to be developed and adopted across boundaries. In addition, to support firms' growth ambitions, this cross-border adoption should also provide useful learning from other markets to enhance the overall productivity of the sector.

Anecdotal evidence indicates that startup firms tend to develop and launch in their home markets and then embark on international expansion country by country and region by region. Interestingly, many expansion plans do not follow the gravity model of trade (i.e. entering new markets that are geographically close); rather, market attractiveness drives destination based upon size, language, similar legal systems, maturity of property market, etc. For example, a UK firm might expand first to the Middle East and Australia, a continental firm will expand first to the UK rather than an immediate European neighbour, and many firms will explore the US as their first international opportunity.

3.4 Active markets

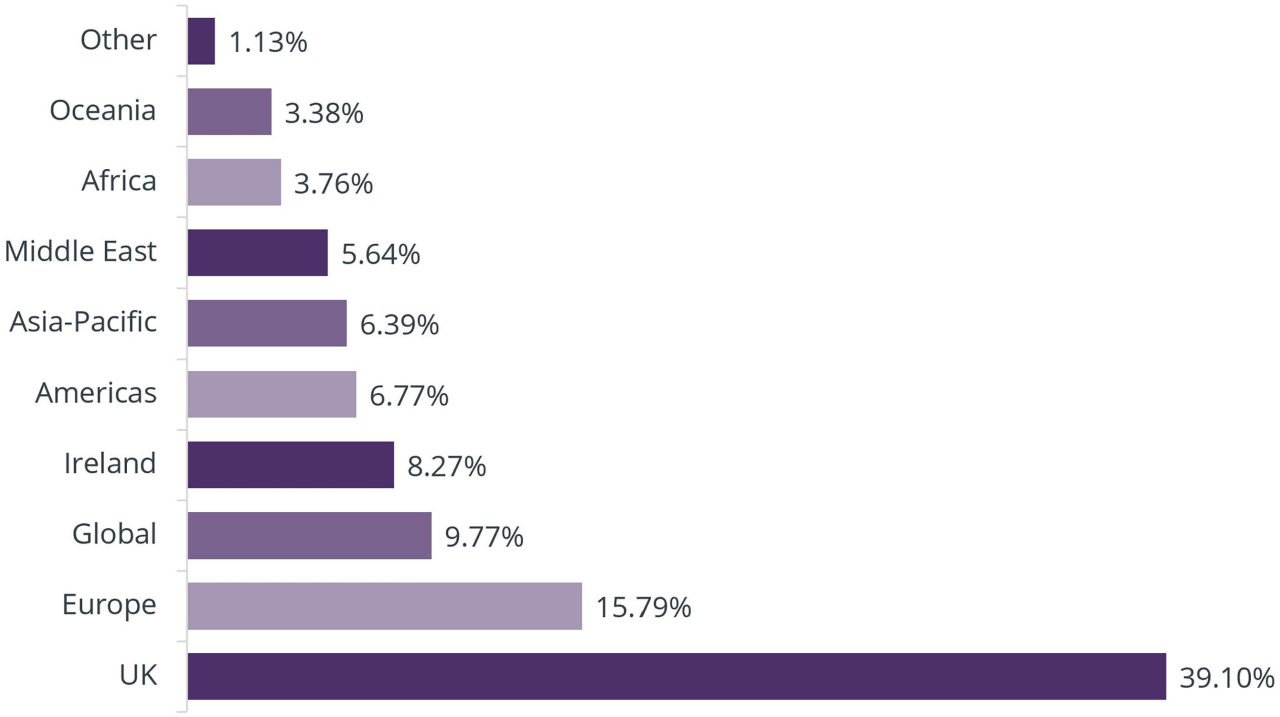

Figure 4: Which markets are you active in?

While the question in section 3.3 highlighted the high share of UK-based firms, the scope of market activity reported highlights that, while most firms are not active on a fully global basis, they still mostly operate at least on a regional (rather than single-country) basis.

3.5 Startups

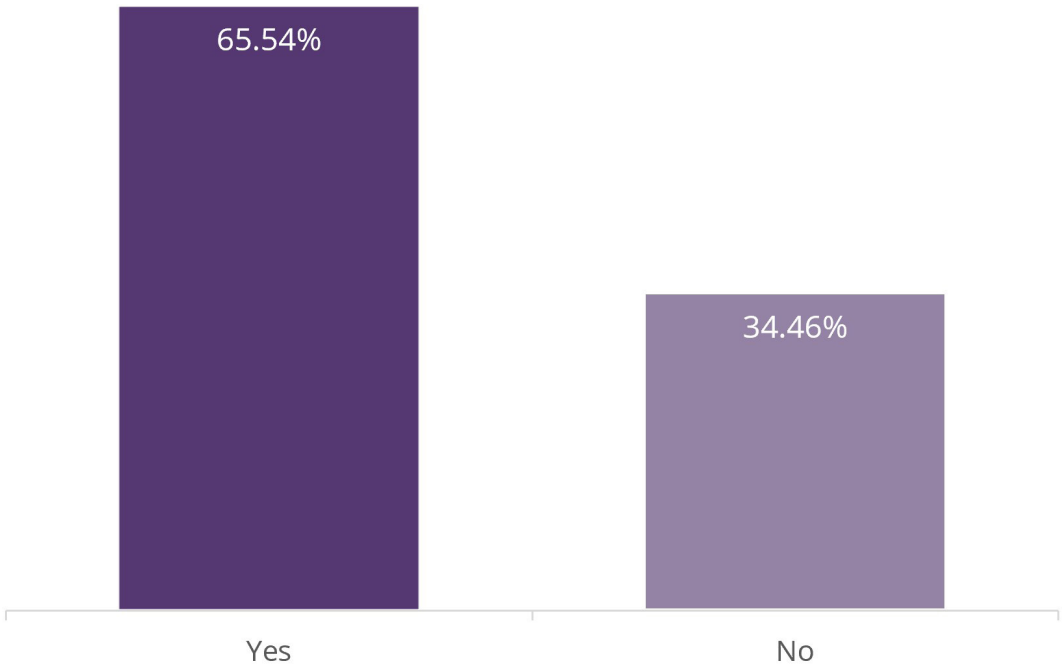

Figure 5: Are you a startup?

While the world of data and technology through the lens of PropTech is often seen to be dominated by startup firms that innovate and disrupt the sector, a full third of respondent firms are established market participants, many with decades of experience in providing mature and well-proven solutions.

3.6 Stage of fundraising

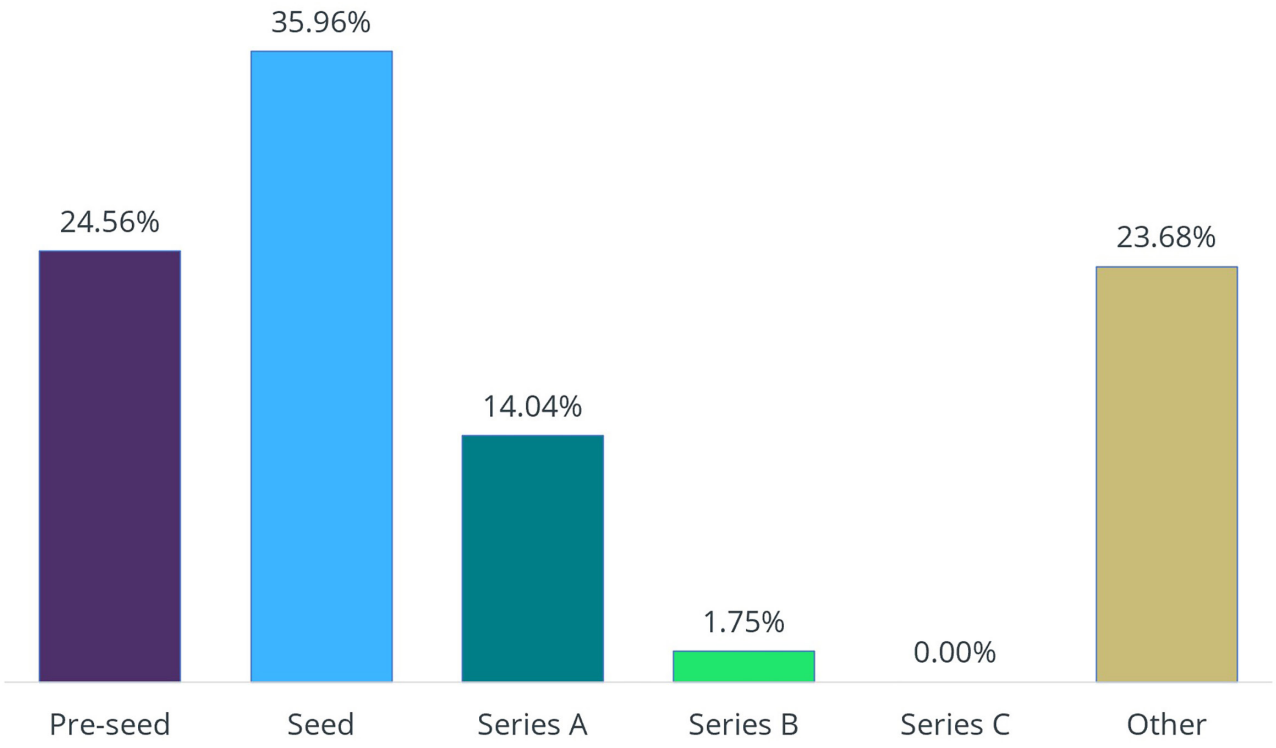

Figure 6: What stage of fundraising are you at, if any?

If we consider startup firms that are still seeking finance to support initial solution development, recruitment, marketing and other growth plans, the majority are still in the early pre-seed and seed stages, which come before the various funding rounds where investment levels are typically measured in millions of dollars/pounds.

In contrast, pre-seed funding often comes from the founders themselves, family, friends and other supporters, and is used to get the operation 'off the ground'.

The seed stage, which many of the startup Tech Partners are currently at, is the first official equity funding stage; again, it looks to founders, family, friends and other supporters for funds, but then extends to incubator funds, venture capital and other 'angel investors'.

Once firms are looking for series A funding and beyond, simply having a good idea is unlikely to support investment; instead, a strong strategy for turning a good idea into a successful, profitable company is needed.

3.7 Main drivers of data and technology since 2020

Figure 7: What have been the main drivers of data and technology adoption across the built and natural environment since 2020?

> 'Remote and hybrid working has played a huge role coming out of the recent pandemic. And the need to increase efficiencies across the sector, which still lags behind all other sectors, is driving the adoption of data and technology'.

The past three years have presented societies and economies around the world with profound challenges resulting from war, the pandemic, geopolitical instability and climate

change. The built and natural environment has not escaped the effects of these multiple crises.

> 'Since 2020, there have been two main drivers of technology and data adoption in our sector: an increased level of attention on sustainability, and the impacts of the COVID-19 pandemic on people and businesses'.

Rather than reflect on just the 12 months of 2022, respondents were asked for their views on the drivers of adoption since the start of the pandemic – arguably a point in time that changed the world for so many and at the same time accelerated and turbocharged pre-existing trends, the effects of which are still to be fully understood and embedded across the sector.

> 'We have seen a large adoption in users preferring to use automated solutions across the entire letting industry'.

The effects of COVID-19 have rippled through the sector, accelerating changes in the use of retail and office spaces and the need to survey land and built assets remotely. The 'new normal' of hybrid working has driven adoption of workspace solutions to plan and maximise utilisation and to provide more user-friendly, concierge-type services to occupiers and their employees to encourage the use of office space.

> 'The pandemic has accelerated the option of paperless and virtual solutions for tasks which would otherwise happen in person'.

The increasing affordability of visual-capture technology, coupled with augmented reality (AR) and virtual reality (VR) solutions, allowed assets to be surveyed and viewed remotely through construction into operational use. And powerful, visual aggregation of land and planning data has allowed land parcels to be reviewed at scale and to narrow down development options before physical site inspections are carried out.

> 'Many organisations are realising that data is paramount to managing the built and natural environment'.

With the sector lagging behind others in digitalisation in all its forms, the drive to use data and technology to drive process improvements and associated cost efficiencies is supporting adoption, with numerous examples such as AVMs, customer relationship management (CRM) and numerous decision-support use cases that use data analytics to speed up data collection and analysis.

Given the negative impact that the built environment has on greenhouse gas emissions, waste and other environmental impacts, coupled with the drive to improve social value and the governance of investments in the sector, ESG in all its dimensions is driving the adoption of technology to gather data right across the land and property life cycle to measure, manage and report on a vast range of metrics. With data on assets, particularly existing ones, ranging widely in availability, quality, structure and provenance, technology holds the solution to data collection. Sensors and other internet of things (IoT) devices are able to collect real-time measurements, natural language processing allows documents to

be turned into structured data, and AI and machine learning (ML) analytical tools enable the transformation of datasets, both big and small, into meaningful information for operational and reporting purposes.

Compliance, much linked to energy efficiency, ESG, AML/KYC and client money handling, has driven solutions to manage and optimise these regulatory requirements with the additional challenge of adapting and fulfilling different jurisdictional requirements for firms and organisations operating internationally.

3.8 Main barriers to data and technology since 2020

Figure 8: What have been the main barriers to data and technology adoption across the built and natural environment since 2020?

> 'The real estate sector is traditionally more resistant to change, set in traditional processes and the belief that cost and effort to adopt technology are high'.

It is perhaps no surprise that financial factors are cited as a barrier to adoption. The pressure to manage costs and investment, particularly during the economic disruption and uncertainty caused by the pandemic, will have stopped or delayed adoption by many market participants. However, the need for solution providers to demonstrate a clear return

on investment (ROI) was cited by many as a fundamental problem for both those providing solutions and those building internal business cases.

> 'Barriers between different trades and innovation being implemented at project level rather than with an aim to transform a company'.

> 'The ability of the technologies to show demonstrable ROI for any buying real estate firm. The number of solutions in the market is vast; however, their use case still needs to be proved in the real world. Many solutions struggle to evidence their claimed efficiencies once implemented'.

The sector is not unique in facing the challenge of implementing technology in a manner that shows a clear financial benefit and does so in a reasonably short period of time. Technology should never be an end in itself, and vendors and adopters need to continue to develop their shared understanding of the specific problems and opportunities that technology can cost effectively address with metrics that demonstrate financial returns. In many cases, an agile, sprint-based approach to solving a limited number of specific issues quickly can:

- help justify adoption
- show short-term ROI and
- foster a continuous journey to digitalise an organisation.

> 'People [are the main barrier to adoption] – fundamentally we see the issue as change management. We usually find a key stakeholder who is keen to adopt our technology but then the journey is really about pulling the team in the same direction for successful adoption'.

When we see words like 'skills', 'people', 'fear', 'culture', 'leadership' and 'inertia' appearing, we should consider the human dimension to adopting technology. While the sector's role is to manage real, physical assets, it relies heavily on the skills and interactions between people. As experience has taught so many other sectors, the process of adopting and implementing new technology is as much about people and behaviour change as it is about the technology itself.

> 'Data quality, lack of standards, lack of vision, fear of change'.

> 'Adoption of any new technology often comes down to a comparison of costs and benefit and lack of leadership driving new innovation'.

Whether or not the property sector is more conservative in nature than other sectors, it is people who will drive change and people who will, for many reasons, be resistant to it. Leadership will be key in recognising the opportunities, and risks, of digitalisation, and in driving sustainable adoption of technologies that provide real value. Change management will remain a critical competence for the sector, and vendors will need to continue to increase their knowledge of the sector to make sure their solutions deliver real value.

> 'Lack of structured data. Lack of standardisation at industry level, even inside the same organisation'.

Data issues around lack of structure, quality and standardisation are holding back adoption. Organisations should:

- recognise the benefits of moving from documents to data
- recognise the value of sharing data more widely and
- adopt industry data standards to support interoperability and address data structure, quality and governance.

In turn, vendors should also embrace common, open data standards to allow data to move between market participants in an orderly and well-governed way.

3.9 New technologies since 2020

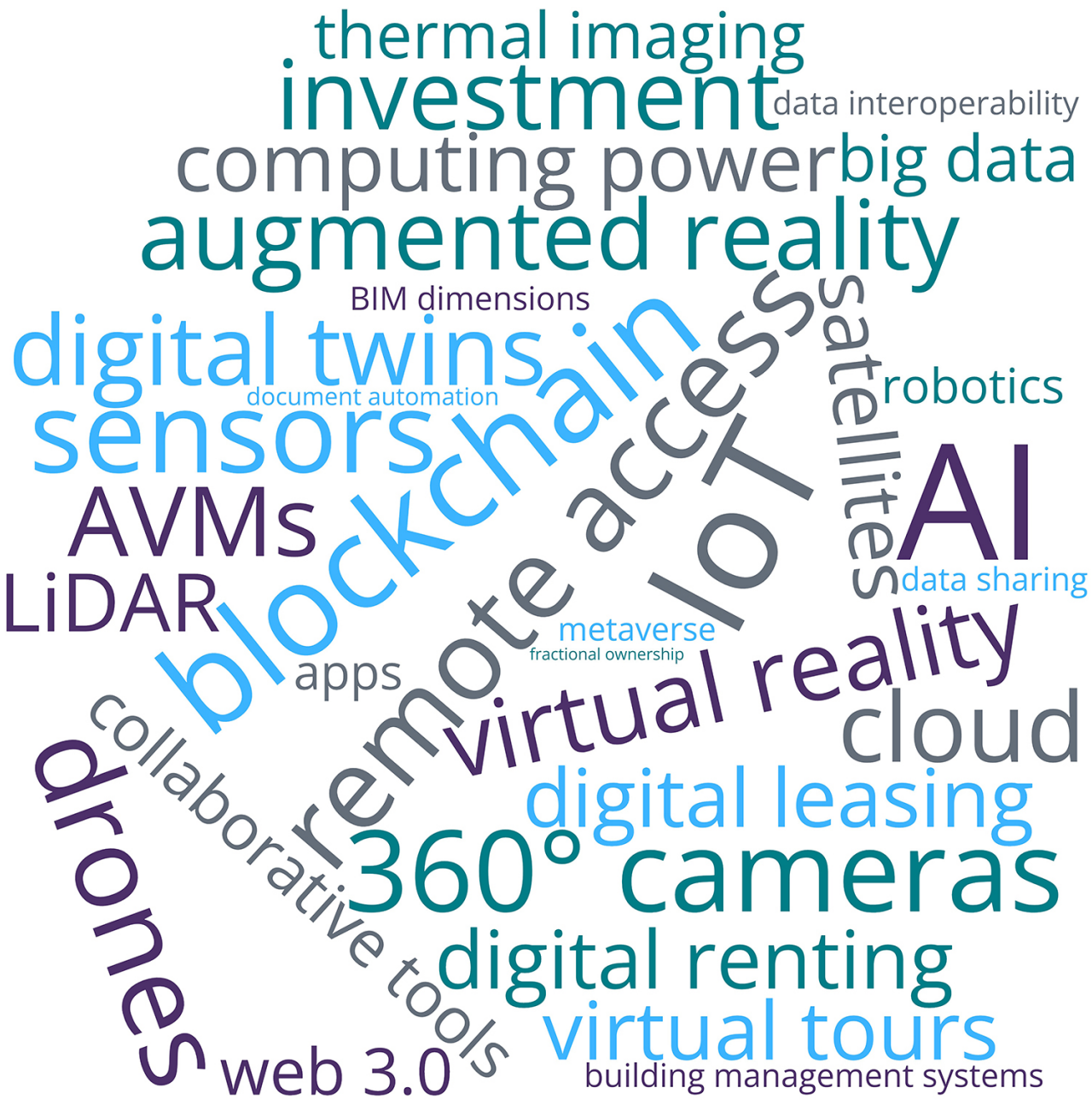

Figure 9: What new technologies have emerged since 2020?

'New applied solutions of AI/ML have emerged as opposed to new technologies'.

While all the of technologies cited in Figure 9 existed before 2020, their significance lies in their level of adoption since 2020.

'Data analytics using AI and ML is constantly improving'.

AI in all its various forms can be argued to be one of the most pervasive technologies to affect the sector. It has both sector-specific use cases, such as AVMs, and generic applications

such as customer service chatbots and recruitment tools. The strength of AI in data analytics plays a vital role in turning datasets of all sizes and varieties (that a human being would struggle to interpret) into information that enables decision support and modelling. AI can model complex scenarios, such as complex construction schedules, in a manner no human could achieve.

> 'AI-generated content and designs (text-to-image, text-to-video, image-to-3D, text-to-3D), remote sensing-derived analytics with higher precision and prediction models, faster VR/AR devices and software'.

> 'Real-time data capture on site is driving efficiencies and productivity across all sectors'.

With sensors and other devices now connected to the IoT, which is being adopted widely across the construction and operation phases of built assets, and to manage land use of various types, the sector now has access to vast datasets. Coupled with AI, these datasets support remote data capture, analysis, management and reporting. However, with these benefits comes a great responsibility to secure these devices from cyber-attacks and the resulting financial, reputational and operational damage that can result.

> 'Wider adoption of LiDAR [light detection and ranging] as a way of understanding geospatial issues'.

The ability to measure and observe land and built assets remotely using a mix of drones, 360° cameras, LiDAR and thermal imaging proved invaluable during the lockdown periods of the pandemic. The ability to manage assets remotely in this way is here to stay and, coupled with VR and AR, is delivering both highly visual digital twins as well as simpler virtual tours.

> 'In the past two years, we've seen the transition of 3D digital twins from an operational (build and manage) to a commercial (show and lease) side of real estate. Another new feature that we are piloting is interactive 3D space planning'.

The ability to host applications and their data on cloud platforms has enabled solutions to be deployed to all sizes of firms and organisations, with software as a service (SaaS) removing the need for in-house IT infrastructure and allowing solutions to be accessed on the desktop via a web browser and remotely on smartphones and tablets.

> 'Rather than new technologies, it feels that many new entrants and ideas are improvements on existing ones'.

> 'There isn't a lot of entirely new technology; however, it has been interesting to see how technologies have become more widely adopted – be that the IoT/sensors reaching a mass-market level or robotics being seen as commercially viable'.

Blockchain, or distributed ledger technology, receives much attention, particularly through the strong association with various cryptocurrencies such as Bitcoin and Ethereum.

With the recent collapse of the FTX cryptocurrency exchange, the continued volatility of cryptocurrencies themselves and environmental concerns over the energy used to mine cryptocurrencies, we should focus on whether the underlying technology itself has any useful applications across the sector. Some activity is already taking place in the field of fractionalised ownership of land and property, and no doubt other applications will emerge that deliver real value.

3.10 Main drivers of data and technology in 2023

Figure 10: What will be the main drivers of data and technology adoption across the built and natural environment in 2023?

Looking forward to 2023 and beyond, ESG, efficiency and cost savings are perhaps unsurprisingly seen as the most significant drivers for adoption. Compliance and competitive pressures also feature highly.

> 'Government-prescribed standards, the need to be green, tech to support flexible ways of working, clear demonstration of savings and benefits. Improved quality of data'.

> ‘New generations of buyers and stakeholders, ESG, increasingly blurred barriers between physical and virtual world’.

> ‘A combination of cost and efficiency drivers, but also legislation’.

Efficiency and costs savings will likely increase in importance as the macroeconomic factors of inflation, recession, falling property values, energy costs, etc. impact the sector and place organisations of many types under pressure.

> ‘Inability to compete without the ability to deliver services efficiently and effectively’.

> ‘Due to rising costs of living and inflation across the globe, people would like services delivered to them by adopting technological approaches to cut down cost, save time and optimise the expected output’.

3.11 Main barriers to data and technology in 2023

Figure 11: What will be the main barriers to data and technology adoption across the built and natural environment in 2023?

The drivers for 2023 and beyond are reflected in a more negative sense, with financial and economic constraints seen as the most significant barriers. The sector may face the dilemma of investment to drive efficiencies and cost savings being restricted, or even absent. A shared understanding of the ROI of adoption will be critical as the sector works with vendors to implement solutions that deliver value at pace.

> 'Proving the ROI will be the main barrier to adoption'.

> ‘There has been some deserved scepticism levelled at PropTech over the last few years, as an abundance of solutions have come into the market. Many firms report that the solutions are either not “flexible” enough to suit their unique business model or do not work as promised. Many PropTech firms will have a job to do in convincing buyers to adopt tech’.

Various terms relating to people such as ‘culture’, ‘skills’, ‘fear’, ‘inertia’, ‘leadership’ and ‘trust’ appear again, as they did when we reflected on previous barriers to adoption. Leadership and change management will be critical factors in ensuring that the sector continues to digitalise and realise its benefits despite an uncertain and challenging economic landscape in many, if not all, markets.

> ‘Lack of a strong vision and poor data quality’.

> ‘While we have seen greater interest in adoption, still, people being comfortable in the status quo will be an issue’.

Issues around data standards, data sharing and data quality emphasise that data as the foundation of the entire digitalisation process remains a significant challenge. With many standards to choose from, we need to see consolidation, and a recognition that standards need to work on an international basis despite the many jurisdictional factors that affect land and property. Concepts such as land tenure, value, costs, emissions, building attributes, etc. can be measured and reported on a cross-border basis to support benchmarking and international asset management as well as specific, local use cases. We need to recognise data’s value to firms, governments and society at large, and develop processes to structure, curate, assure and govern its use. With so much land and property data stored in silos, in document form, and in many cases simply absent and uncollected, this task will undoubtedly take time and effort, albeit supported by technology such as AI and natural language processing to turn ‘documents into data’.

> ‘We will probably need to see how the recession and markets go; a natural instinct for many is to retract investment plans when the macro picture is bleak’.

With a sector that is highly fragmented in terms of solution providers and the firms and organisations they support, the need to ensure that data is shared and flows more freely will be key to unlocking many of the benefits of digitalisation. While some of the factors affecting the ability to share are technical in nature, there is a strong argument that the most significant factors relate to market behaviours that discourage data sharing and support information asymmetry to the benefit of some market participants and the detriment of others.

> ‘Internal inertia, funding, lack of cross-sector collaboration and standards’.

> ‘A potential economic downturn making the investment case and return on investment appear more challenging along with the ongoing barrier of managing change’.

There will always be issues around commercial sensitivity, but the sector must reflect on:

- the need for more transparency, given that land and property need liquid markets, and
- the responsibility to address ESG issues and deliver better social outcomes and social value for society at large.

It is perhaps useful for market participants to focus on how they can differentiate themselves on their data-analysis capabilities, rather than their possession of the underlying data itself.

3.12 New technologies in 2023

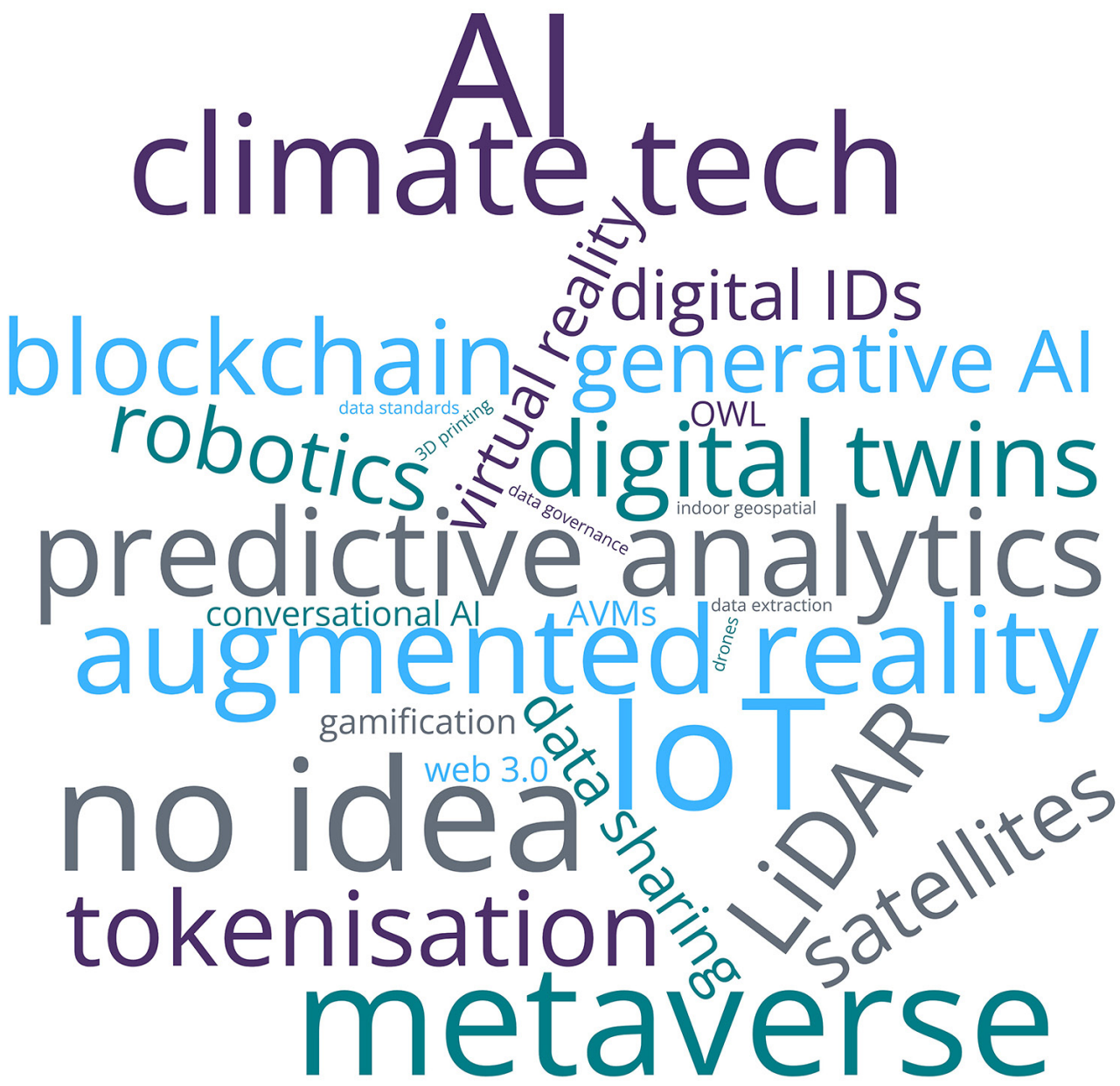

Figure 12: What new technologies will emerge in 2023?

Looking forward to 2023 and beyond, once again it is perceived that the full effects of AI are still yet to be felt. AI is already a pervasive set of tools being used across almost all areas of commerce. It affects firms in the business-to-consumer and business-to-business sectors as well as governments and regulators.

> 'Improvements in AI technologies (based off of more robust datasets)'.

> 'Using AI to not only learn from structured data but also unstructured data'.

In many cases, the application of AI in its many forms is not always visible to market participants and it remains hard to understand by non-experts. Its application across data collection, analytics and decision support will only grow, and the sector can take advantage of the benefits it will bring as well as manage the risks associated with governance, bias and the issues of some AI outputs being hard or impossible to interpret.

> 'Conversational AI, IoT, fractional property investment, automated rental and purchasing property platforms'.

While many people are understandably concerned around the potential impacts of AI on job roles, what is becoming clear is that AI allows analysis that humans are not capable of. It complements the skills that people bring, and represents an opportunity to automate repetitive tasks that are already allowing people to focus on higher-value activities.

> 'Everything will be about data sharing'.

It is interesting to note that, while blockchain and the related concept of tokenisation are mentioned, neither seem to be viewed as significant in the near term.

While much of the rhetoric around the term 'metaverse' is unclear and undefined, it is nonetheless true that the underlying tools such as VR, AR, drones and LiDAR are already creating immersive digital twins and other virtual spaces that will have valuable applications across the built and natural environment. Virtual site visits and virtual workspaces are just two examples of use cases that have been built using these tools. Whether claims about how people will increasingly live their lives in one or more virtual worlds are true is up for debate.

> 'More sophisticated IoT for sure, especially around climate technologies'.

> 'More and more IoT'.

'Climate Tech' is an overarching term to encompass the application of technology to reduce emissions, remove existing emissions and support measures to adapt and build resilience to the effects of climate change. It has emerged alongside ESG as an understandable area of focus. Climate Tech covers many existing and potential applications, and with many commentators resigned to the likely failure of the Paris Agreement made at COP21 (to limit global temperature rises to 1.5°C above pre-industrial levels), it is significant that the scope of Climate Tech accepts the need to focus on the removal of emissions, resilience and adaptation.

If 2022 has taught the world any lessons, it is that the effects of climate change are already here, and that the promised reductions in emissions are not enough to deal with the reality of conditions on the planet and their impact across the built and natural environment.

> 'I see a further acceleration of technology around ESG and especially technology that can support the holistic nature of ESG. Big themes in 2023 are collaboration between parties on ESG projects and breaking open "data silos" so that information becomes available'.

3.13 Opinions on consolidation in 2023

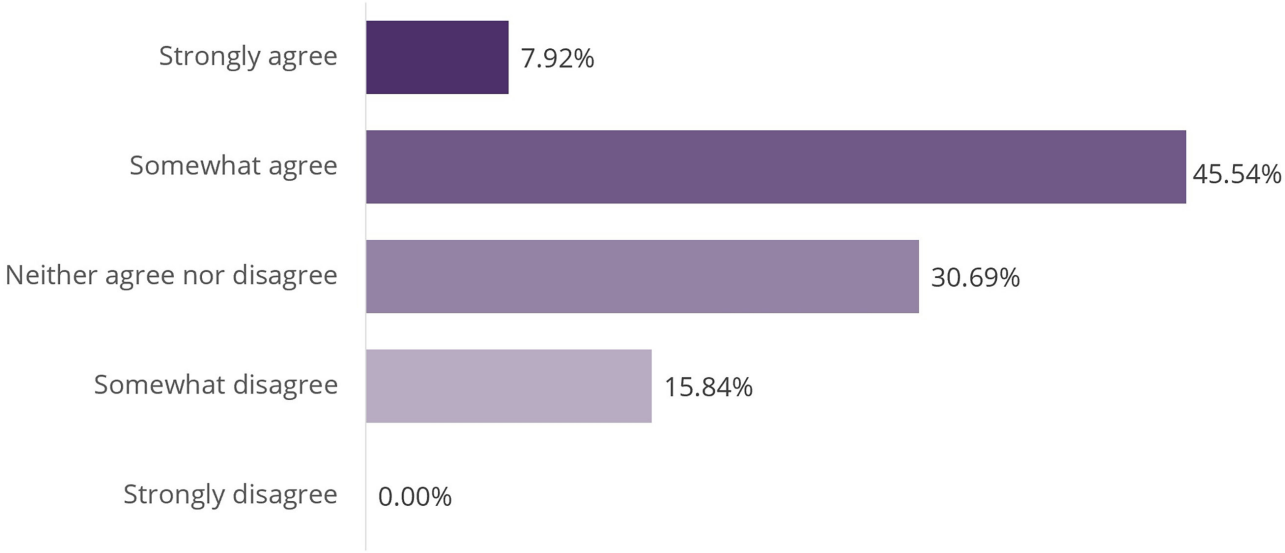

Figure 13: There will be significant consolidation across the data and technology sector in 2023 (strongly agree to strongly disagree)

Most respondents agree or are neutral on whether we will see significant consolidation across the sector.

According to unissu's PropTech company directory, over 10,000 firms are listed as PropTech sources. Ascendix's PropTech market map estimated global PropTech investment to be at some US$24.3bn in 2021. It would therefore seem likely that a sizable percentage of these firms, many seeking to deliver similar solutions, will either lack a path to profitability or will be acquired by other startups or established solution providers and other market participants. In either case, as the market matures and winners and losers emerge, a degree of consolidation seems inevitable. For those with long memories, one would hope we don't see the level of disruption that was associated with the bursting of the dot.com bubble in the late 1990s.

From another perspective, as the existing firms and organisations operating across the built and natural environment digitalise their operations and processes, either through external solution providers and/or through acquisition and internal development of skills, competences and tools, one can envisage a future where the term 'PropTech' becomes redundant, and we see a sector that has made the transition to a digital way of working and is supported by in-house and external vendors in the way that other areas of business currently operate.

3.14 Opinions on investment in 2023

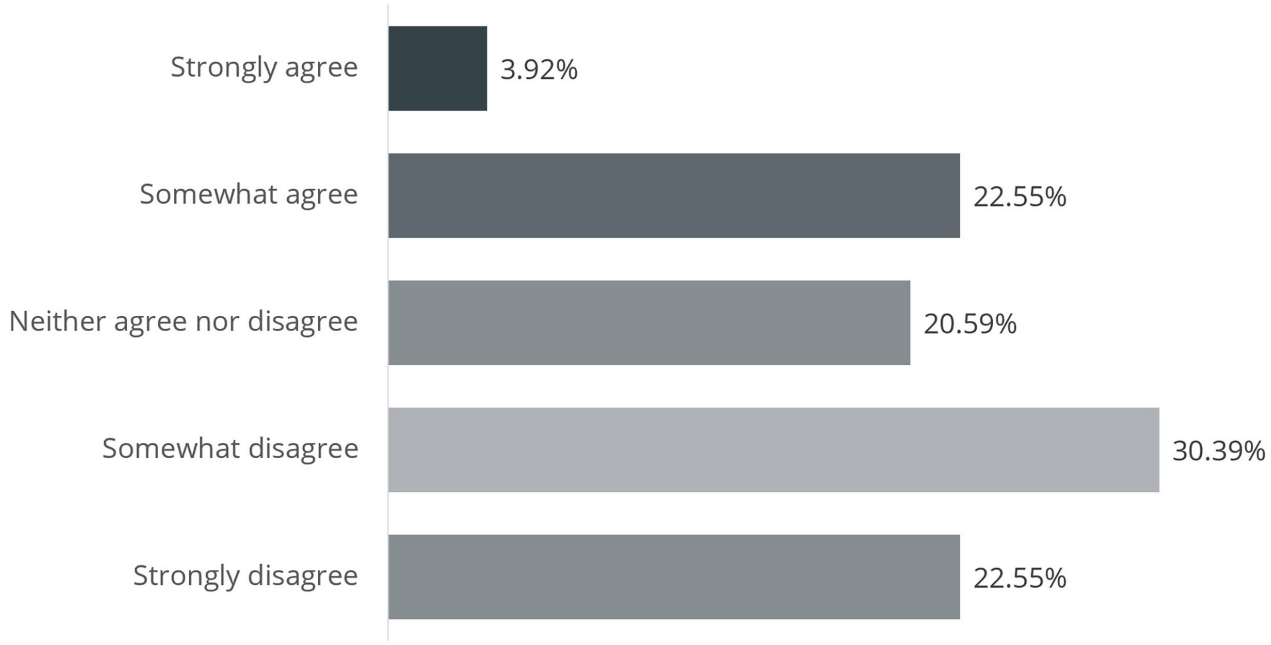

Figure 14: There will be a significant reduction in investment in the data and technology sector in 2023 (strongly agree to strongly disagree)

Just over half of respondents remain optimistic about the levels of investment in data and technology being maintained, despite the recent shift in interest rates and other macroeconomic factors that will present challenges to the land and property sector.

With many startup firms seeking to grow and raise funding during their pre-revenue and pre-profit stages, the rise in interest rates feeds directly into increased discount rates and reductions in valuations based on the net present value of predicted future profits.

These headwinds are balanced against the funds, or 'dry powder', that many early-stage investors still have available to invest, seeking returns coupled with the continued attractiveness of the sector and the opportunities to innovate, disrupt and create value.

Anecdotal evidence from investors highlights the attractiveness of firms focused on the specific Climate Tech sector mentioned earlier. Given the existential nature of the issues being addressed, investors see this sector as worthy of significant investment.

4 Cybersecurity, data governance and data ethics

As the sector continues to digitalise and adopt technologies such as AI to analyse big data and the IoT to harness the power of sensors and other devices, it is critical that issues of cybersecurity, data governance and data ethics are understood and managed by the profession.

Increasingly, data on all the sector's stakeholders and their land and property assets – whether that concerns corporate entities, individual consumers or employees – will be held digitally and will be used to drive decisions that affect them. All these datasets will need to be protected from those with malign intent.

5 Implications for RICS and the profession

The increasing digitalisation of the built and natural environment has profound implications for RICS and the profession it represents.

The success of RICS' focus on sustainability will depend in many ways on the data and technology that is already available to measure, analyse and manage the use of land and property and reduce its negative environmental impact, as well as to mitigate and protect against the effects of climate change that are already with us.

RICS will need to support new and existing members as they develop new skills and knowledge through training, continuing professional development (CPD) and the assessment of professional competence (APC) process. The increasingly digital nature of the profession provides an opportunity for the profession to broaden its demographic profile and increase interest from the next generation through RICS' early engagement activities.

RICS standards will increasingly need to reflect and align with digital processes, and as technical standards such as the International cost measurement standard, the International building operation standard and New rules of measurement are adopted as part of digital solutions, RICS will need to publish more of these standards in machine-readable forms.

Appendix A: Further reading

Below is a selection of related articles of interest that can be found on the RICS website.

- Automated valuation models (AVMs): implications for the profession and their clients
- Digital identities: on the internet, can anybody tell if you're a dog?
- Digitalisation in construction report 2022
- RICS Tech Partner Programme
- Tech Partner Programme blog.

Delivering confidence

We are RICS. Everything we do is designed to effect positive change in the built and natural environments. Through our respected global standards, leading professional progression and our trusted data and insight, we promote and enforce the highest professional standards in the development and management of land, real estate, construction and infrastructure. Our work with others provides a foundation for confident markets, pioneers better places to live and work and is a force for positive social impact.

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