

Thinks

2 — Insight & Strategy —

Connected Places Higher Education Sector Research

**Report prepared for the Department for Science,
Innovation and Technology (DSIT)**

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1. Introduction

1.1 Background and objectives

To support policy development, the Secure Connected Places Team within the Department for Science, Innovation and Technology commissioned Thinks Insight & Strategy to conduct qualitative research with professionals in the higher education sector responsible for the procurement, deployment, and management of connected places technologies.

The objective of the research was to provide insight into approaches to connected places and cyber security, specifically:

- How do professionals in higher education understand connected places?
- How, if at all, is connected places technology currently being deployed in higher education organisations?
- What are the drivers and barriers to uptake of connected places technology?
- What approaches are being taken to cyber security?
- What is the role of cyber security guidance, if any?
- Are there any future trends for connected places technology in these sectors?

This summary report forms part of a wider series of research into approaches to connected places in non-local authority sectors. Further detail can be found in the overarching thematic report, transport sector summary report, and sports and culture sector summary report.

1.2 Method and sample

Thinks conducted 20 x 60-minute in-depth qualitative interviews with professionals in the higher education sector. Following the interview professionals completed a 5-minute survey.

All interviewees were employed by higher education institutions either directly or as a consultant. All had responsibility for at least one of the following:

- Designing and procuring connected places
- Deploying and managing connected places
- Cyber security associated with connected places.

Participation in the research was on an anonymous basis, but some example job titles in the sample included: Chief Information Officer, Director of IT, Head of Digital Architecture, and Head of Operations.

Greater detail on the methodological approach can be found in the technical report.

2. Executive summary

2.1 Typologies of organisation

In our analysis, we have differentiated organisations into three audiences according to their awareness, experiences, and knowledge regarding connected places.

Pioneers: A handful of organisations that purposefully employ individuals and teams to deploy connected places (often as part of a broader digital portfolio). These organisations draw on the high expertise of their staff and use connected technology to future-proof their organisations. They express an interest in pushing the boundaries of smart campuses, innovating approaches and learning from other organisations.

Pioneer, Midlands

Deployment: This university has integrated centralised and sophisticated connected places technology to optimise all areas of its operations; a campus wide smart energy system integrating timetabling and occupancy data, a centralised CCTV system employing AI facial recognition, and geolocation to support student navigation.

Drivers: They are currently working on developing a digital twin for the campus which will encompass both how their spaces are used for research, and for day-to-day usage.

Barriers: The primary barriers this university faces are a lack funds and staff time, limiting their ability to experiment and push further with their implementation of connected places.

Approach to cyber security: This university has highly experienced staff responsible for cyber security who engage with the broader cyber security sector regarding best practice whenever new connected places technology is implemented.

"It's a bit of everything... we have a single governance. Which means we can do more than a smart city can do because we can actually control the environment in a better way... around a digital campus which includes digital twinning, all of how we use our spaces for research, as well as how we use [the campus] on an operational day-to-day basis."

Mainstream adopters: Most of the organisations in our sample. These organisations deploy some connected places technology, for example to monitor footfall and control energy usage. However, while these organisations are curious to explore the technology further, they are not aware of the full benefits connected places can bring and therefore deployment is not an organisational priority.

Mainstream adopter, Midlands

Deployment: This university has made progress in the adoption of connected places technology, primarily directed towards the goals of environmental sustainability and improved student experience.

These technologies include occupancy sensors helping to optimise building management and heating systems, sensors monitoring water usage and waste, and geolocation to support student navigation. They are currently working to integrate their operations with local public transport systems.

Drivers: The main driver of this university's implementation has been their sustainability goals, which they describe as a core principle in their strategic decision making. This driver has been somewhat reoriented to cost reduction in recent years in response to rising energy costs. They note that while many of the actions remain the same in terms of reducing energy consumption, motivations have shifted.

Barriers: The key barrier is a lack of expertise and capacity to analyse and interpret data collected, particularly from a holistic, campus-wide perspective.

Approach to cyber security: This university has a robust set of staff dedicated to cyber security. All staff are provided with annual cybersecurity training and regular penetration testing is carried out. There is limited awareness of external guidance specific to connected places technology.

"Sustainability is all about smart technology, so occupancy sensors, effective building management systems, hybrid and flexible office spaces where we're looking at the water usage and waste, and that kind of thing. Energy efficiency."

Late adopters: A handful of organisations which show a limited awareness of connected places, developments and projects. These organisations may have some technology in place, for example a digitised attendance tracker, but they do not see it as part of a 'connected place'. Low understanding of connected technology's potential, combined with a lack of resource and funding significantly limit these organisations' potential to implement connected places technology.

Late adopter, South

Deployment: This university has only deployed minimal connected places technology. They have installed occupancy sensors in classrooms to gain more accurate information on usage which ensures that only rooms in use are heated.

Drivers: Their usage of connected places technology has been in response to increased energy costs.

Barriers: The primary barriers to a further adoption of this technology are the challenges of retrofitting technology to existing buildings, concerns about potential cybersecurity implications, and the incompatibility of different types of connected places technology.

Approach to cyber security: This university takes a cautious approach to cyber security which has limited their implementation of connected places technology. Cyber security is managed by the broader IT team, and all products procured must go through a cyber security risk assessment.

"I think it is around looking at what those other strategic goals are and then devising the technology to fit and support those strategic goals. That's the sort of route through."

2.2 Understanding of connected places

- **Higher education professionals think about connected places technology and projects as a means to an end.** Their understanding therefore is based on the extent to which and how it is used within their own organisation, rather than as a broader category of technology.
- **Most do not see connected places technology as distinct to other types of technology.** This is particularly true for components such as networks which are used more widely than connected places projects.

2.3 Aims, facilitators and barriers to deploying connected places

- **The majority of higher education organisations are not striving to be connected.** Instead, they are deploying the technology to meet various organisational needs often relating to more effectively managing their estate.
- **For most higher education organisations the benefits to users (e.g. staff and students) are secondary to benefits to the organisation.** Whilst certain connected places projects do benefit students (e.g. showing where free desk spaces are), this is often not the primary aim.
- **None of the higher education organisations in our sample had a connected places strategy.** Instead deployment tends to be ad hoc in response to needs of the organisation or as part of associated strategies e.g. sustainability or digital.
- **Higher education organisations face knowledge and opportunity barriers (such as lack of funding) to further deploying connected places.** Pioneer organisations have taken steps to overcome capability barriers but can still face other challenges to deploying connected place technology.

2.4 Operating connected places

- **Higher education organisations are most commonly using sensors connected to the network via Wi-Fi** to deliver connected places projects.
- **For most organisations, management of connected places is the responsibility of the Estates and IT departments.** Only a handful of Pioneer organisations have a staff with specific responsibilities to manage this kind of technology.

2.5 Future trends of connected places

- **The majority of professionals feel the use of connected places technology will increase within their organisation in the next 5 years.** This is largely due to the increasing digitisation of universities, but also the expected improvement in technological devices and networks.
- **Most professionals struggle to envisage specific trends or future use cases,** however, Pioneer organisations expect connected places projects to become increasingly integrated.

2.6 Cyber security and connected places

- **All professionals understand deployment of connected places technology carries a security risk. However, it feels only different in degree rather than type to existing cyber security considerations.** Professionals do not see connected places projects as being distinctly risky compared to other technology used within their organisation.
- **In that context, professionals do not feel connected places projects require a bespoke cyber security approach.** Instead, they manage the risks in the same way as other technology projects.
- **Higher education organisations feel confident managing the cyber security risks** due to having a dedicated security team, a thorough procurement approach for new technology, and regular training for staff and students. **That said, some question the extent to which staff and students follow processes in practice.**
- **Professionals most commonly use guidance from the NCSC and JISC to inform their approaches to cyber security.**

3. Understanding of connected places

Key findings:

- **Higher education professionals think about connected places technology and projects as a means to an end.** Their understanding therefore is based on the extent to which and how it is used within their own organisation, rather than as a broader category of technology.
- **Most do not see connected places technology as distinct to other types of technology.** This is particularly true for components such as networks which are used more widely than connected places projects.

3.1 Familiarity with connected places

Most professionals are fairly familiar with connected places technology and projects; a minority are at either extreme claiming to be very or not very familiar.

Familiarity with connected places technology is influenced by:

- **The extent to which connected places technology is deployed within their organisation**, as most professionals do not look outward to the broader higher education sector.

"I would say I haven't actually come across an organisation I've been involved with that I've sat back and gone, 'Wow, we need to look at these people'".

Pioneer, Midlands

"There have been a few roundtables and universities getting together, that kind of thing... I've got people in my team whose job it is to be there... go to conferences, understand what the latest technologies are, and work with some of our partners."

Mainstream adopter, Midlands

- **Their specific job role**, with those with responsibility for technology more familiar than those responsible for information security.

"I'm responsible for all the tech across the university, whether it be our infrastructure or the hardware and software or applications or everything that drives the university, basically. And Smart Campus, Connected Places, is part of my remit."

Mainstream adopter, Midlands

3.2 Understanding of connected places

Professionals tend to use the sector specific terms 'smart campus' or 'smart university' instead of the broader term 'connected places'.

Despite being aware of the term 'connected places', it is not commonly used by professionals. Instead, professionals are more likely to use sector specific language (i.e. 'smart campus' or 'smart university') or simply describe the specific project (e.g. 'capacity monitoring in the library').

"We would tend to use smart campus as the sectorial definition for this type of activity... connected places is a term I'm familiar with and something I've heard before but tends not to be used so much in the university sector."

Mainstream adopter, Scotland

Professionals often think about connected places as a means to an end. They tend not to think about the component parts of technology.

The benefits of using the technology or what the technology facilitates are more front of mind than the composite parts. For example, professionals are more likely to talk about monitoring occupation and what that allows (e.g. better use of space), rather than the sensors which do that.

When prompted most are aware of various connected place technologies and software. However, most consider only Internet of Things (IoT) devices such as sensors as "connected places technology".

On the other hand, networks such as Wi-Fi or Bluetooth are less commonly associated with this type of technology. Although professionals do recognise it is how IoT devices are connected to the network, the technology is felt to be broader than the "connected places" category.

"So all sorts of sensors... gathering data, believe it or not, on air quality... carbon reduction... transforming how we light our buildings, there have been specific activities as I say around sensors, BLE sensors, wireless sensors... Sensors specifically dedicated to occupancy and stuff like that."

Pioneer, Midlands

Lack of detailed understanding of the category means professionals can often conflate other types of technology with connected places.

Some professionals describe software such as Microsoft Teams and Miro as connected places technology. Many professionals point out that the Covid-19 pandemic set a new standard for online learning and connectivity. As such,

technology to connect students and staff remotely is expected to be the new norm.

"We've also got our collaborative spaces in terms of Teams, and we've used the discord stuff. So there's a whole Microsoft suite that we use and then we're utilising things like Miro, which is enabling for this online workshop space. So that completely connects everybody with where we are."

Pioneer, Midlands

4. Aims, facilitators and barriers to deploying connected places technology

Key findings:

- **The majority of higher education organisations are not striving to be connected.** Instead, they are deploying the technology to meet various organisational needs often relating to more effectively managing their estate.
- **For most higher education organisations the benefits to users (e.g. staff and students) are secondary to benefits to the organisation.** Whilst certain connected places projects do benefit students (e.g. showing where free desk spaces are), this is often not the primary aim.
- **None of the higher education organisations in our sample had a connected places strategy.** Instead deployment tends to be ad hoc in response to needs of the organisation or as part of associated strategies e.g. sustainability or digital.
- **Higher education organisations face knowledge and opportunity barriers (such as lack of funding) to further deploying connected places.** Pioneer organisations have taken steps to overcome capability barriers but can still face other challenges to deploying connected place technology.

4.1 Aims of deploying connected places technology

Higher education organisations are not trying to achieve the goal of “being connected” in and of itself.

The large majority of organisations understand connectivity to be a means rather than an end; they see it as leading to other tangible benefits, for example a better student experience.

The exception to this are Pioneers whose deeper understanding of connected technology (and the benefits and trade-offs associated with it) means they are more likely to have a strategic aim of delivering and running a ‘smart’ or ‘intelligent’ campus.

Higher education organisations are primarily deploying connected places technology to better manage their estates.

University campuses typically span very large and complex spaces (especially those integrated with their surrounding town or city). And, while some buildings are used regularly, others are occupied much more sporadically. This is particularly true in recent years following the COVID-19 pandemic, which altered the needs and behaviours of staff, students and the public, and which has

therefore affected the ways in which facilities are used – for example, the increased amount of remote teaching and learning.

Given the vastness of the university estate, professionals want to make sure it's being used efficiently. The definition of 'efficiency' varies across organisations, but it spans making sure rooms are being allocated, heated etc. in a 'smart way' depending on occupancy.

Better estate management is felt to facilitate the following benefits:

- **Saving energy costs.**

"With the energy cost increases that we've seen over the last couple years, [...] the driver [...] is now the one about reducing energy costs."

Mainstream adopter, Scotland

- **Making their organisation more sustainable.**

"So, sustainability agenda is a big one. If you think around capacity or utilisation of certain rooms, switching lights off, turning heating down in certain areas is a big one, obviously, because you don't need to have the heating on 24/7 and it only kicks in, or light only comes on or electricity is only powered into rooms when it sees footfall."

Mainstream adopter, Midlands

- **Making effective resourcing decisions.** For example, ensuring teachers are allocated appropriately sized rooms for the numbers of students, and managing timetables both for teaching and operational staff (e.g., cleaning teams).

"Our biggest challenge in the university is space utilisation and that's where our main focus on this stuff is, so from a teaching timetabling perspective, which is the main one, we want to know how much space is being timetabled and how many of those timetabled rooms are then used by the number of people that they're timetabled for. Can we be more effective in our use of teaching space?"

Mainstream adopter, North

- **Managing capacity in real time.** For example, facilitating hotdesking, linking up with room booking data to indicate where meeting rooms are

free or by using digital signage to communicate capacity, thereby encouraging students to use areas which are less populated.

- **Informing other logistical processes** such as waste collection, air quality management, attendance monitoring and energy use (e.g., heating, lighting, air conditioning)

"Our physical infrastructure is understandable in that digital twin sense of being modelled in a connected way. So that we can have better awareness of... what capacity they have, people, their energy consumption, which is a really important priority for the university, the health and safety of the buildings, the scheduling of maintenance and upkeep."

Mainstream adopter, South

Professionals also want to improve the student and staff experience via connected places technology. However, this aim is often secondary to operational focused aims.

Professionals also cite student experience as an organisational goal, and acknowledge that connected places projects are usually intended to benefit students and other users of their space. However, this is often not the reason why an organisation will deploy connected places technology. For example, creating a digital twin is helpful for students to find their way around campus but also provides the organisation data on how the space is being used.

"We use a company called MazeMap, we've mapped all of our campus onto MazeMap... any student can just type in the room or the lecture theatre and it'll tell you where it is and how to get to it."

Mainstream adopter, Midlands

A minority of organisations want to connect to the space beyond the university campus to create a seamless experience for students. For example, working to integrate their technology to the wider city to give updates on public transport.

However, professionals note that any effort to improve the student experience also has an indirect organisational benefit: namely, it will increase overall satisfaction with the University.

"We're working on a project to integrate with public transport in [local city]... so that we can show students outside of the city when the next things are coming, and vice versa."

Mainstream adopter, Midlands

4.2 Facilitators to deploying connected places technology

No organisations interviewed had a specific 'smart campus' strategy in place to facilitate the growth of connected places technology.

For most organisations, the deployment of connected places technology is piecemeal, driven in response to a specific need or challenge the organisation is facing.

"At the moment, it is disjointed, ad hoc; it tends to be on building by building basis. [...] How do we do things like HVAC and all the rest of it? How do we monitor footfall? How do monitor desk usage and various other bits and pieces?"

Mainstream adopter, North

However, in some organisations connected places technology is driven by being part of an adjacent or broader strategy.

In line with understanding connected places technology as a tool to achieve other goals, its usage in some organisations is driven by its inclusion within:

- Sustainability strategies.
- Digital strategies.

"So at the minute we've just released a new digital strategy. So we're moving everything across into that digital space. So you're utilising AI, upgrading the network servers and then that will allow us to see the footfall across the across the university, using the devices that are registered of track where people are and where people are being busy."

Pioneer, Midlands

The construction of new buildings on campus facilitates use of connected place technology by design.

For example, a new library or student union which is designed to incorporate greater connectivity. In these situations organisations face fewer barriers (described in the following section) due to:

- Employing a supplier to design the space who will have the requisite knowledge about use cases to include.
- Budget being 'allocated' and therefore not having to find additional resource.
- The building itself being a 'blank slate' and therefore having no structural barriers associated with older buildings.

In the future, organisations expect deployment to be facilitated by wanting to have an edge over their competition.

Professionals acknowledge that we are living in a world in which we will soon expect increased connectivity. Therefore, they expect that connected place technology may become a selling point for future students who are part of the first fully digital generation. In particular:

- **If students expect the technology on campus as 'the norm'** due to experiencing it in other settings.

"I think what will drive it again will come back to that student experience. It will be that pupils expect some of this and they'll see it in other areas of their lives and they'll wonder why they're not experiencing that on a university campus"

Mainstream adopter, South

- **If students want to attend a university with strong environmental credentials** and uses technology to reduce its environmental impact.

"Smarter campuses, what are they doing to reduce carbon footprint, sustainability? They are clued up on everything, you know, 'They're doing great smart things for the environment, climate change,' etc. Yes, that's where students make their mind up and go to university, because it's a competitive market out there."

Mainstream adopter, Midlands

4.3 Barriers to deploying connected places technology

The barriers to deploying connected places technology fall into two categories:

- **Knowledge barriers**, namely do organisations have the requisite knowledge and skills to deploy connected places technology further.
- **Opportunity barriers**. Once aware of a use case to deploy, do external factors make deploying that use case possible?

Pioneer organisations have taken steps to overcome knowledge barriers.

This includes hiring staff who have the requisite technical expertise to design and manage connected places. This in turn leads to greater awareness about the potential benefits of connected places which allows them to 'sell' the projects more within their organisation.

On the other hand, the primary barrier for other organisations is a lack of knowledge about what connected places technology could facilitate.

Other organisations feel they 'don't know what they don't know' and as a result acknowledge there may be several use cases which could be beneficial to their organisation which they're not using at the moment. Lack of knowledge is underpinned by two factors:

- **A lack of a standout leader in the higher education sector to replicate how they use connected places technology.**
- **A lack of technical knowledge of internal staff** to proactively seek out use cases.
- **Difficulties recruiting the experts.** Professionals in non-Pioneer organisations feel that it is challenging to recruit staff that are sufficiently skilled in this area.

"Often the technologies involved require significant technical expertise, especially new technologies or technologies that go across the pillars of technical knowledge. Most organisations just aren't scaled to deliver that internally."

Pioneer, Midlands

Professionals note that even if there is a desire to deploy a connected places project, then limited funds restricts the speed of deployment.

Professionals across the sample noted that universities are under considerable fundings pressures, which leaves them with more limited funds to pursue projects.

"Some of the things that we would really like to do are going to be quite costly... if we wanted to put sensors across every single campus, and every single room, we've got 5 campuses, we've got thousands of rooms. So even if a sensor is just £5, it adds up when you want to do all of those things"

Mainstream adopter, Midlands

In particular, organisations which have older or listed buildings feel deployment is even more expensive due to:

- **A sense that older buildings are 'not worth the investment'** due to likely being replaced in the near future.
- **Or older or listed buildings may not allow for the technology to be installed.** Either because networks such as 5G will not work adequately within the confines of older buildings or their listed status will not allow changes to the built environment.

"One of our really big impediments is that we have a very, very ancient built environment. It's physically difficult and a ridiculously large proportion of it is listed. We just have a lot of inertia around doing anything in our built environment."

Mainstream adopter, South

In the context of low knowledge and funding pressures, connected places fall down the list of organisational priorities.

Some professionals note that even when a connected use case feels like it could be helpful, it is often not prioritised due to:

- **A sense that there are more pressing priorities.** Professionals across all organisations described a challenging context for universities, having to do more with less resource. As a result, connected places often feels like a longer term aim which can be deprioritised in the short-term.
- **Lack of knowledge at a senior leadership level.** Some of those implementing connected places technologies feel that some in senior positions hold traditional mindsets; it can be difficult to convince them of the value of prioritising connected places projects.

"I think we've got a skills gap [at the level of] a lot of executives across universities, councils, big corporates. What is it you're trying to sell them or what are you trying to get them to buy into? They can easily buy into building a new building because they can see bricks and mortar, but anything that's a tech initiative there's still a bit of a sales job to do in terms of getting them to try and understand that."

Mainstream adopter, Scotland

5. Operating connected places technology

Key findings:

- **Higher education organisations are most commonly using sensors connected to the network via Wi-Fi** to deliver connected places projects.
- **For most organisations, management of connected places is the responsibility of the Estates and IT departments.** Only a handful of Pioneer organisations have a staff with specific responsibilities to manage this kind of technology.

Professionals are aware of a range of technologies used within their organisation to deliver connected places projects. These include:

<p>Used by more organisations</p>	<p>IoT – e.g., lighting, heating, air conditioning</p> <p>Occupancy/footfall monitoring (e.g., infrared sensors or tracking mobile data)</p> <p>Sensors for heat / CO₂ / air quality monitoring</p> <p>Wi-Fi</p> <p>CCTV</p>
<p>Used by a few</p>	<p>Bluetooth beacons</p> <p>Interactive screens / dashboards, digital signage</p> <p>Route mapping apps</p> <p>Cloud data storage</p> <p>AI (e.g., to assist CCTV)</p>

However, professionals tend not to think about the connected places in terms of devices and instead focus on how it’s used.

Since professionals who interact with connected places projects come from a wide range of roles, most are not employed as specialists in connected place technology. Some roles, including Chief Information Officer or Director of IT, have a wider strategic vision for technology, while others such as Head of Digital Learning or Head of Operations operate across numerous departments and strategies.

When considering a potential connected place project, professionals are much more concerned with the use case that would bring benefit to their organisation. Thinking about the specifications of the particular technology will usually be limited to the procurement stage, along with other factors such as cost.

Case study: Sustainability

This university strives to be the most sustainable in the country, a goal which drives its implementation of connected places technologies. To achieve this, it employs:

- **Occupancy sensors**, combined with **smart heating and lighting** systems, to ensure that energy is used in its buildings only when necessary
- **Smart timetabling** to make the most efficient use of campus space and adapt to increasingly hybridised working patterns

The university are also currently working towards **integrating its operations with local public transport systems** to make it easier for students to sustainably travel to campus: "Future trends in this sector will be about how universities are connecting with other connected places in their cities."

Case study: Air circulation and attendance monitoring

Since the Covid-19 pandemic, this university has used **CO₂ sensors** to look at air circulation, as well as **under-desk infrared sensors** to understand room occupancy and avoid overcrowding.

Going forward, this organisation's priorities include **monitoring footfall** and **student attendance**: "It's a UKVI requirement that we monitor attendance to lectures and seminars, and currently we haven't got a good solution. We have 50 departments and, basically, 50 Excel spreadsheets and Google Forms. We've experimented with Bluetooth and barcode scanning, but one of our considerations is that every student is wandering around with a smartphone; is there a better way to check in? That's something we're exploring now."

At the moment, connected place use cases are deployed in isolation. They do not ladder up to a whole 'smart campus'.

Currently, organisations feel their current projects lack the scale and joined-up approach needed to run a fully integrated smart campus.

"We're only playing about with sensors and what they do and at the moment, it's all relatively unconnected, so we've got sensors

that are looking at utilisation and we've also got sensors that are measuring air quality, but they're not all in one big dashboard."

Mainstream adopter, Midlands

The exception to this is a minority of Pioneers are already working on synthesising data from various projects into one platform, in order to offer a more holistic approach, as well as to automate more decision making. Professionals from these organisations feel that they have data of sufficient scale and quality for this to be a useful and cost effective pursuit.

"That's kind of our overarching piece where we bring on our students, but we track the entire journey from registration through to alumni and all of that is making sure that the life of the student is a success. That's kind of the connected places piece because we're connecting with them right from the very get go all the way through to the point of which they've qualified."

Pioneer, Midlands

In most organisations, there is no designated department responsible for the management of connected places.

Instead, responsibility for the design and management of connected places technology tends to sit with the combination of the Estates Management and IT teams, with the former managing the upkeep of physical devices and the latter managing the digital aspects, such as network integration and cyber security.

"We have around about 25,000 sensors across the campus. These are largely managed and maintained by our Estates team, however, because they connect into the physical IT systems then that's where my role is in that."

Mainstream adopter, Scotland

In some collegiate universities, the responsibility of connected places is more fragmented. Individual colleges are responsible for rolling out their own connected places technology (if they so desire). That said, professionals in these organisations emphasise that they are supported by the central university IT department.

"The colleges each own significant physical infrastructure within the university and they operate it, they have authority over it. Everyone collaborates to quite a high degree, but ultimately, if a college decides that it's going to run its buildings a certain way, then that is a decision for the colleges."

Mainstream adopter, South

All organisations have a team responsible for the security of their connected place, even if 'connected place' is not the term used.

For most organisations, physical and digital security are monitored by the Estates and IT teams respectively. Some also employ third party IT providers who have a responsibility for the cyber security of the organisation's network.

All organisations have an official procurement process for new technology.

When considering new connected place projects, most professionals first specify a need and business case for the technology. Once objectives for this use have been defined, they will then look at the right types of technology for the project, which meet certain criteria, for example, cost, capabilities, and cyber security certifications. As public bodies, universities will then decide on technology suppliers through an official tender process, which typically includes multiple rounds of pitching, ethics assessments and risk and security assessments.

Professionals often collaborate in this process with other teams across their organisation, particularly at larger organisations or for larger connected place projects. For example, an IT team might discuss the ethical requirements around data storage with legal and governance teams, and might also be consulted by other departments with regards to cyber security specifications.

Once a contract with a supplier has been agreed, most organisations then pilot the technology before rolling it out. During this time, they monitor the performance and value added of the technology over a defined period of time.

There are occasions where this process is less formal, for example where the desired technology providers are existing suppliers, or where the particular project or team is smaller.

"A tender normally takes the format of expressions of interest, then a selection of the top tier candidates and presentations... costings and what your capabilities and value added and all of those sort of things... As part of any tender or any supplier relationship, certain guarantees have to be put in place and there are questions that are asked, 'Do you have-?' or 'Are you able to?'"

Pioneer, Midlands

"We have two means of procurement. One is through our existing suppliers; Microsoft come to us and say, 'Hey, how about this, do you want to test this?'"

We've got a good relationship with some of our big partners; as you can imagine we spend quite a lot of money with them. The second way is us saying, for example, 'We want to have a better way of helping people to get around campus, so therefore, who provides this technology?' And we go through a normal public sector procurement process."

Mainstream, Midlands

6. Future of connected places

Key findings:

- **The majority of professionals feel the use of connected places technology will increase within their organisation in the next 5 years.** This is largely due to the increasing digitisation of universities, but also the expected improvement in technological devices and networks.
- **Most professionals struggle to envisage specific trends or future use cases,** however, Pioneer organisations expect connected places projects to become increasingly integrated

Whilst professionals expect the use of connected places technology to increase in general, most struggle to envisage specific use cases.

Professionals across the higher education sector believe connected places technology will have a larger role in how their organisations operate compared to the present day. This is largely due to a sense of society becoming increasingly connected and technology improving. For example, professionals at older universities anticipate better network connection (e.g. 5G) will mean they can use more sensors in older buildings.

"At the moment it's a bit of a retrofit and it's a bit of a bolt on... 5G technology will allow far easier deployment of these sensors because at the moment they need physical Wi-Fi networks or cabling, 5G will allow us to go for really cheap sensors that connect over the mobile networks."

Mainstream adopter, Scotland

However, in line with the knowledge barriers many face, they struggle to imagine specific use cases for how the technology will be used. In this context, most assume use of the technology will continue to increase in response to business needs and strategies as and when they arise.

"I think more and more new technology will be implemented. New technology for sustainability, internet of things is coming out all the time, it's really rapidly evolving... because obviously universities have got a responsibility for corporate sustainability and that will be in their annual plans and visions and strategies."

Mainstream adopter, Midlands

The exception to this are professionals based in Pioneer and some Mainstream Adopter organisations who anticipate a more integrated connected place.

These organisations anticipate taking steps to join up the various individual projects into one overarching integrated connected place. In some cases, they expect their connected place to extend beyond their campus and integrate with 'smart city' technology in their local area.

However, some of these professionals note various challenges that will make it difficult to take this next step, including:

- The use of different suppliers may create compatibility issues.
- Funding the integration.

"The only other thing that starts fitting all of this stuff is compatibility. Different technologies are incompatible with each other and making sure that what you've got works and talks to it... things aren't quite as plug-and-play as you'd like them to be. And that's due to a lack of standardised specifications."

Late adopter, South

Professionals in Pioneer and Mainstream Adopter organisations anticipate that increased use of technology will pose additional security risks.

This is due to the assumption that it will include more invasive monitoring, such as facial recognition. Professionals feel this will potentially pose greater security risks that they may not be equipped to tackle at the moment (e.g. due to lack of standards).

"Connected places technology can actually just be a very intrusive surveillance system, and then if we as a university are collecting that information, we suddenly have potentially quite a serious risk around disclosing that in an uncontrolled manner."

Mainstream adopter, South

7. Cyber security and connected places

Key findings:

- **All professionals understand deployment of connected places technology carries a security risk.** However, it feels only different in degree rather than type to existing cyber security considerations. Professionals do not see connected places projects as being distinctly risky compared to other technology used within their organisation.
- **In that context, professionals do not feel connected places projects require a bespoke cyber security approach.** Instead, they manage the risks in the same way as other technology projects.
- **Higher education organisations feel confident managing the cyber security risks** due to having a dedicated security team, a thorough procurement approach for new technology, and regular training for staff and students. That said, some question the extent to which staff and students follow processes in practice.
- **Professionals most commonly use guidance from the NCSC and JISC to inform their approaches to cyber security.**

7.1 Understanding of the cyber security risks

As with all technology, professionals are aware: increased use comes with increased risk.

Professionals – particularly those in information security roles – acknowledge there are risks associated with an increasingly connected place. Namely, spreading the network surface area increases the potential for vulnerabilities.

"One of the main risks is the more things that we connect, the more disruption can happen if something goes wrong. [...] It'd be bad enough to take down the network, but if we took down the power infrastructure as well and all of the other things that are associated with that in one hit, then that's really serious and it's how we then recover from that."

Pioneer, Midlands

However, they do not feel the devices themselves are particularly risky.

Instead, they feel in line with other technology devices used within their organisation. This is especially true in the context of a large and disparate user-base of the university network. Some information security professionals believe individual students or researchers could potentially be using their devices (e.g. laptops) in a riskier way.

Only a minority of professionals are aware that IoT sensors can be less secure.

"Although it feels like a lot of that secure IoT sensors is coming or on the way, it's not quite there yet."

Mainstream adopter, South

7.2 Management of the cyber security

Professionals feel the management of connected places technology does not require a different approach to other technology projects. All are confident in their organisation to manage the security risks of connected places projects in theory.

This is due to their tried and tested approach, which includes:

- **A dedicated in-house cyber and information security team** who are responsible for managing technology projects and ensuring they are secure. This involves the development of policies and frameworks, as well as regular testing of the security of the network.

"We've got a strategy and policy and have a sit down and make sure that they have the right protocols in place. For example, procuring a new system, maybe cloud-based, you look at their policy and strategy for that system, what principle incident controls have they got? Multi-factor authentication, are they using that? And how are they controlling patching etc? So we work together really and make sure that that's all controlled and managed accordingly."

Mainstream adopter, Midlands

"We have a detailed risk register. We also have appointed a Chief Information Security Officer and we're building a robust, cybersecurity strategy to address many aspects of cybersecurity. We constantly have cyber-simulations that we're doing, simulated attacks, and partnering with technology companies to strengthen our cybersecurity posture overall."

Mainstream adopter, Midlands

- **Robust procurement processes to ensure suppliers meet their security standards.** As noted above, the procurement process to acquire new technology is thorough and suppliers have to give evidence of the information and cyber security credentials (e.g. ISO accreditations).

- **Training of students and staff**, either developed in house or procured by external suppliers. All organisations say they deliver this regularly.

"Every end-user is responsible for the security of their IT account and any devices that they register on the network with their IT account, and we do push that quite strongly. We have mandatory training, which applies to all staff and research students."

Mainstream adopter, North

The majority of organisations develop their own cyber security frameworks, many also refer to the National Cyber Security Centre and the Joint Information Systems Committee as essential sources of guidance.

Organisations typically draw on this guidance to inform their processes. Most professionals feel this guidance is sufficient to also manage the security of connected places in their organisation.

Only a handful of professionals were aware of any specific guidance for connected places. This included the JISC working group on connected campuses and the NCSC Connected Places Principles.

"The main place we go to is JISC, because they run the JANET Network. So, Jisc is a good source for us. NCSC is another good source for us. So those are the 2 go-to's in terms of ensuring we're doing the latest and keeping track of what's happening."

Late adopter, South

"We develop our own in-house training and content. Obviously, we've got a team of 15 security professionals, so we keep ourselves abreast of the news. NPSA is one of my go-to places for the more physical threat as it pertains to digital, and that's been quite an interesting shift, from CPNI to NPSA."

Mainstream adopter, North

Despite feeling confident in theory, some professionals question if connected places projects are being well managed in practice.

Most professionals attribute this to user (e.g. student and staff) behaviour. For example, deploying connected places projects outside of the official channels of procurement.

"I'm pretty happy, I'm pretty confident but, as we all know, nothing's 100%. No system's 100% as Manchester University found out recently, as Sunderland found out. You can have all these systems in place, do everything you can but something, somewhere may go wrong. But that's just a bit of awareness really, we can all do what we can."

Mainstream adopter, Midlands