


2022

# State of the Nation

UK DIGITAL TELEVISION



The background is a dark blue gradient with a complex pattern of glowing, light blue lines. Some lines are straight and parallel, while others are curved and intersect to form a grid-like structure. The lines have a soft glow and some appear to have a slight motion blur or depth. The overall effect is futuristic and digital.

RRP £1,995

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# Executive Summary

## Introduction

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**A**fter a turbulent 2020 that provided both challenges and opportunities in equal measure, the UK television industry continued to innovate and evolve in 2021, providing a solid bedrock to ensure consumers' TV viewing experiences continue to push through boundaries and break given norms.

The UK continues to be at the forefront of television innovation across both technology and content, further supported by the continued wave of significant investments in TV and film production in the UK.

By reinforcing its reputation as a hotbed and innovation hub for high-end television production, the UK remains central to the development of the worldwide digital television sector. This is also augmented by a dynamic television and video viewing consumer base, served by a wide range of high-quality free and paid-for platforms and services across both broadcast and IP delivery.

The shift towards IP delivery is driving this innovation and content investment. Consumers across all demographics continue to embrace

streamed content across an increasingly broad range of services. This year's DTG's State of the Nation survey, undertaken for this study in February 2022, highlights that close to half of UK consumers say IP-delivered sources are their 'go-to' way to watch TV programmes. Indeed, 94% watch streamed video at least monthly.

In recent years, consumers' broadening content and service preferences have encouraged the television ecosystem to drive 'Television Beyond Imagination,' as new paradigms such as the metaverse become steadily pervasive, despite most consumers currently being unsure of exactly what it is.

This DTG State of the Nation report for 2022 highlights consumer preferences and behaviour relating to TV viewing and the connected device and technology landscape. In addition, an update on key enabling technology is provided, giving a rounded view of the 'State of the Nation' for the UK Digital Television industry in 2022.

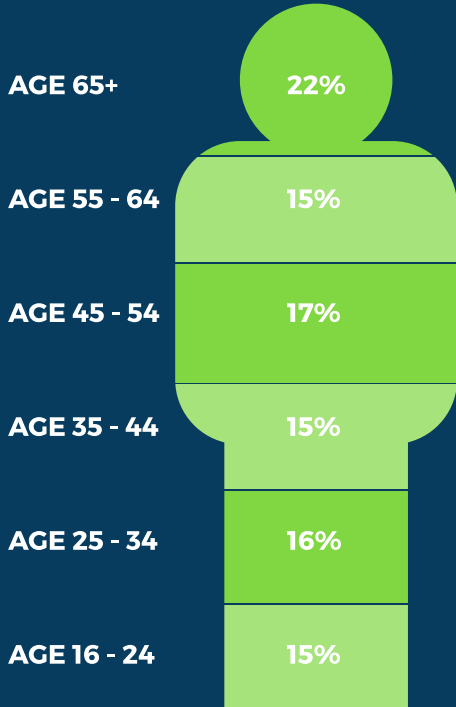
# Methodology

The consumer survey was undertaken in the UK amongst 2,008 respondents in February 2022 on behalf of the DTG and conducted by Futuresource Consulting. It was achieved online amongst 16-year-olds and over, with the sample nationally representative of the total population across age and gender.

The survey focused on television viewing and device trends, evaluating the landscape, viewing behaviour and consumer attitudes towards various elements of TV and video viewing. A comparison with the previous survey was possible for many questions and new lines of questioning were added in this wave.

## ONLINE SURVEY RESPONDENT BREAKDOWN:

2,008 respondents  
Gender: Male 45%, Female 55%  
Age breakdown:



# Key Findings

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- Strong broadcaster VoD (BVoD) and subscription VoD (SVoD) uptake is driving viewing of IP-delivered full-length TV programming; both have close to 80% monthly adoption.
- However, Free-to-Air (FTA) broadcast remains robust. Watching free live TV channels is still the leading way to watch television programmes in the UK, with 30% of UK consumers saying this is their primary way to watch, ahead of SVoD at 28%. More than half overall say their go-to way is via a broadcast source.
- The TV set has established itself as the dominant way to watch on-demand TV; almost 4 in 5 consumers state it is their preferred device, either directly on the smart TV platform or through a device connected to the TV.
- Despite over two-thirds of UK households paying for some form of television subscription (either Pay-TV or SVoD), the free TV landscape continues to expand and fragment largely through IP delivery, driving increased consumer choice. 1 in 4 consumers watch free 'new wave AVoD' services such as Rakuten TV or Samsung TV Plus at least once a month.
- Despite the prevalence and impact of global video services providers, significantly more UK consumers prefer British TV shows over US/ international TV shows, partly justifying the 29% increase in investment in UK high-end TV shows and movies in 2021 compared with 2019. In addition, 71% of UK consumers agree that it is important everyone in the UK has access to free, national television in the future, although only 54% of 16-24's agree with this.
- TV set upgrades and wider uptake of IP-delivered services have been key to driving improved TV viewing experiences, with 32% of UK consumers saying their experience is better than it was pre-pandemic, compared with just 13% who say it is worse. Picture quality, audio quality, and UI/search and navigation are the most cited ways a consumer would like to see their TV viewing experience improved.

- Interestingly, since last year's survey, respondents say the importance of a TV being pre-installed with SVoD apps has overtaken the importance of BVoD apps being pre-installed.
- The audio experience continues to be important to TV viewers; inconsistent audio levels are a key and growing source of annoyance. 39% are interested in technology that would enable clearer audio when watching TV. The use of subtitles has also increased over the past year, from 40% to 44%, driven by SVoD users.
- Non-video and smart-home applications such as home security are steadily increasing in prominence in TV sets. But many consumers remain cautious about the integration of cameras and microphones in their TV; 41% of UK consumers don't want these in their TV set, just 22% do, with privacy concerns paramount.
- That said, while currently less than 1 in 4 TV owners claim to use any type of voice control to control their TV, almost half of TV owners say they expect to use some form of voice to control their TV in the future.
- Despite there being almost 30 million smart TVs in use in the UK, only 14% of TV owners are confident of how to ensure their Connected TV is safe from a cyber-attack, falling to just 4% of over 65's. The introduction of a security certification programme would be welcomed by consumers, with 45% of UK consumers more likely to buy a TV with an official certificate for high-security standards over one that doesn't. Only 14% have no interest in such a programme.
- Energy efficiency has emerged as a key consideration for TV buyers. It is now the second most desired feature considered when buying a TV, behind Smart connectivity and ahead of 4K UHD. However, there has been a fall in those who would consider streaming at a lower quality to reduce emissions; just 1 in 4 would now, down from 40% a year ago.
- There is growing consensus that 4K HDR is the new baseline for the foreseeable future, augmented with spatial audio formats such as Dolby Atmos and DTS:X. Production in UHD and HDR is rapidly becoming the "gold standard" for the television and film industry for content creation. The move towards entirely IP-based production workflows – as witnessed at BBC Wales – is facilitating this transition.
- DTG's State of the Nation 2022 survey suggests a shift in attitude towards watching content in the highest resolution possible. Only one-third say watching in this way doesn't matter, compared with 47% a year ago. And only 24% are currently interested in watching 8K content on their TV.
- The long-term move towards the metaverse is inevitable, but current consumer understanding of it, and what applications it could be used for, are low. 64% of UK consumers have heard of the metaverse, but most of those aware don't know what it is and only 7% have used a metaverse application. Watching TV is the most cited application consumers think they will undertake in the metaverse in the future, although only 1 in 5 say they will do this, highlighting confusion over potential use cases and adoption.
- The video industry is at an inflection point, with the newer coding standards being positioned as credible alternatives to AVC, HEVC and even AV1. Today the industry is dealing with the politicisation of codecs, as companies involved attempt to gain commercial value from their investment in video standards. Streaming video providers will likely position AV1 (and its successor AV2) for VoD, given the efficiencies gained. Broadcasters favour VVC because of the more lightweight live encoding requirements.
- AI is also being applied to video encoding to enhance efficiency. Its application is under examination by the major video standards organisations worldwide. Work underway today is likely to create an AI-based codec before the decade's end.
- Broadcast capability has become an integral part of the 5G standards by enabling high power high tower (HPHT) 5G network installations to distribute television and radio services. Local trials of 5G broadcast technology have successfully delivered live video experiences to audiences within stadia – for instance, the 5G VISTA programme in the UK. Meanwhile, debate continues over whether 5G broadcast technology could, or indeed should, augment existing digital TV broadcasting standards, especially given the challenges of expanding TV services within the confines of decreased terrestrial spectrum.
- The introduction of Bluetooth LE Audio into televisions alongside other consumer audio products, including headphones and, notably, hearing aids, promises to improve accessibility to television services by enabling wearers to have their own audio profile. Bluetooth LE Audio offers new codecs that elevate audio quality and allow concurrent endpoints, increasing the market opportunity for soundbars with wireless speaker components.

# The UK TV and video landscape

*“Many consumers remain cautious about the integration of cameras and microphones in their TV; 41% of UK consumers don’t want these in their TV set, just 22% do, with privacy concerns paramount.”*

The UK remains one of the most advanced and dynamic television and video landscapes in the world. Consumer adoption across a diverse range of television platforms and business models is at mass-market levels, with IP delivery fuelling this continued dynamism. Such behaviour was evident before the pandemic, but accelerated IP content consumption and service awareness have further fuelled video viewing fragmentation.

The viewing of TV shows in the UK over IP is driven by the almost universal uptake of Broadcaster Video On Demand (BVoD) services such as BBC iPlayer and ITV Hub and Subscription Video on Demand (SVoD) services such as Netflix. Both have close to 80% adoption monthly amongst consumers and are strongly adopted amongst a broad demographic; two-thirds of over 65s use BVoD services monthly, compared with almost half who use SVoD services. BVoD’s steady proliferation is particularly evident, increasing from 75% to 77% of all consumers between early 2021 and early 2022.

Despite the continued growth of IP television services, FTA broadcast television remains robust and the most popular ‘go-to’ way to watch television in the UK. 30% of all those who watch television say that live free TV channels are the primary way to watch, just ahead of SVoD services. However, this ‘go-to’ way is highly fragmented, with Live Pay-TV, recorded programmes on a STB and BVoD services the next most popular, with 11%, 10% and 8% respectively.

This highlights the diverse makeup of the UK television viewing population, particularly in relation to the mix of broadcast or IP-delivered

viewing. More than half (51%) say their ‘go-to’ way to watch TV is from a broadcast source (live or recorded on a STB), slightly ahead of the 47% who say their ‘go-to’ way is through an IP-delivered source.

This proliferation of IP-delivered, on-demand services is driving a steady change in scheduled viewer behaviour; almost one-third (32%) of UK consumers now say they are less likely to watch TV programmes when they are broadcast live, compared with a year ago.

While television platforms and services have fragmented, the TV set has established itself as the dominant way to watch streamed TV shows and movies. In DTC’s State of the Nation 2022 survey, 79% of respondents say that their primary way to watch this type of content is on a TV. 31% of respondents say watching directly on a smart TV’s interface is preferred, meaning that 48% prefer to watch streamed content on a TV using an ancillary device such as a Pay-TV box or streaming stick.

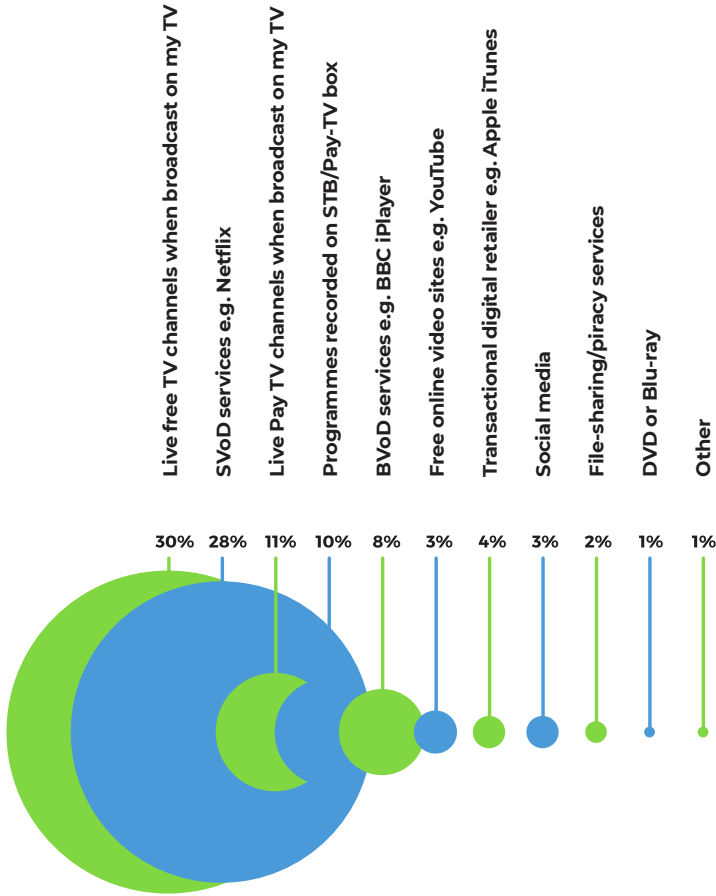
Meanwhile, even among the digitally-native 16-24 demographic, 65% say their most dominant screen/device to watch streamed movies and TV shows is on a TV screen, even though only 80% claim to have use of a TV in their household.

*“Almost one-third of UK consumers say they are less likely to watch TV programmes when they are broadcast live compared with a year ago”*

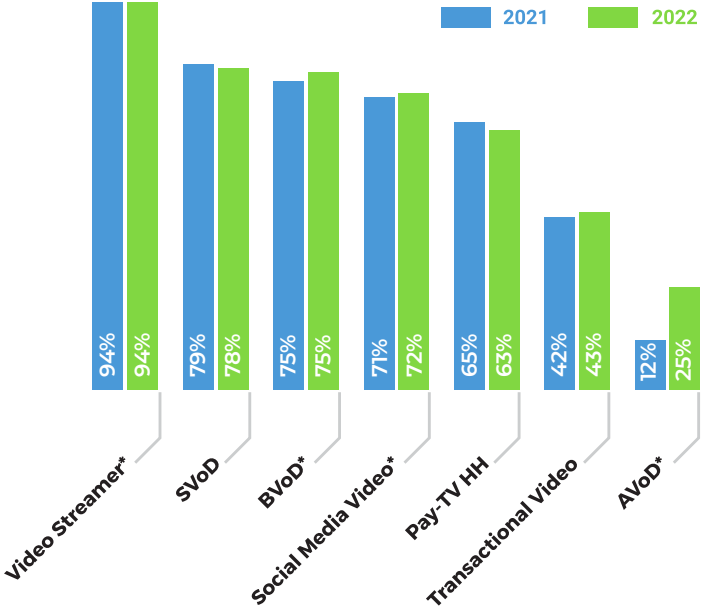
### 'GO-TO' WAY TO WATCH TV PROGRAMMES IN THE UK

Q: What is the main way you watch TV programmes?

Base: All those who watch TV programmes



### UPTAKE OF VARIOUS VIDEO TYPES AMONGST ALL RESPONDENTS



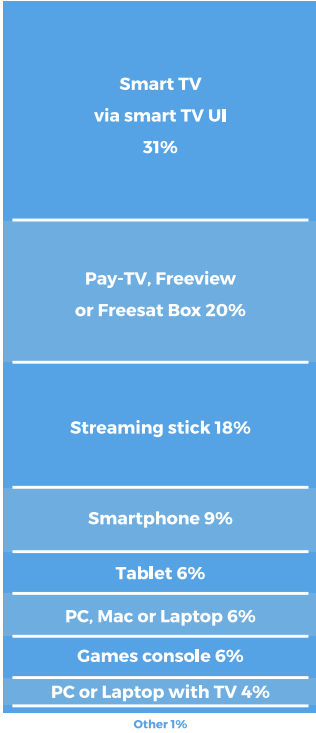
\*used in last month

*“79% say that their primary way to watch on-demand TV shows or movies is on a TV, 65% amongst the digitally native 16-24 year olds”*

### SCREENS/DEVICES VIEWED MOST TO WATCH ON-DEMAND TV SHOWS OR MOVIES

Q: When watching on-demand streamed TV shows and movies on services such as Netflix or BBC iPlayer, in which way do you watch these the most?

Base: Streaming TV/movie users



# The Free TV landscape: Expansion and fragmentation

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*“Three-quarters of UK consumers watch free TV channels, despite 68% of households having access to some form of paid TV”*

Many of the key headlines surrounding the television and video landscape in recent years have focused on the continued proliferation of SVoD services such as Netflix. The UK in particular has established itself as one of the leading SVoD markets worldwide. Futuresource estimates that 63% of UK households paid for at least one SVoD service at the end of 2021, up from 29% five years previously.

SVoD services have also driven an increase in UK households paying for any form of television (excluding the license fee). At the end of 2021, the total number of households who pay for either Pay-TV or an SVoD service stood at 19.7 million according to Futuresource up from 14.1 million ten years prior (Netflix launched in the UK in 2012).

Therefore, despite the number of Pay-TV subscribers steadily falling in recent years in the UK, the number of TV households who solely rely on Free TV as their primary source of television viewing has also decreased.

However, it is important to note the continued importance and resilience of FTA broadcast linear television against the backdrop of the evolving IP content sector. Three-quarters of UK consumers watch free TV channels, despite 68% of households having access to some form of paid TV.

Content is the key driver, with consumers stating they watch these channels for reasons such as interesting TV shows, a preference for British TV or for a specific TV show.

However, as OTT prevails, the wider landscape for free television in the UK has notably fragmented, with the choice of free television content increasing as a result. The evolution of free BVoD services such as BBC iPlayer and ITV Hub has been significant, providing additional viewing

choice to both FTA households and Pay-TV streaming households, although it is the latter where uptake is higher; 77% of all UK households are monthly BVoD users, although this is just 66% amongst FTA households, according to the DTG 2022 State of the Nation 2022 survey.

In addition, A 'new wave' of free, advertising-funded VoD (AVoD) services has emerged in the UK in the last two to three years, driven by international players. A number of these services provide both linear Free Ad-supported Streaming (FAST) Channels and on-demand content with an EPG similar to traditional TV platforms.

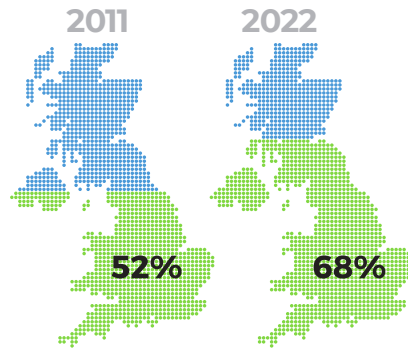
New service launches, service/content improvements and increased visibility of these services on Smart TVs have seen these services grow in acceptance, with 25% of all UK consumers now accessing AVoD services at least monthly, up from 12% one year ago. These services include Pluto TV, Samsung TV+, LG Channels, RakutenTV, The Roku Channel, Xumo and Amazon's Freevee.

Uptake of such AVoD services in the UK remains significantly lower than in the USA, mainly due to the legacy of the free broadcast environment and the fragmented nature of the wider European broadcast and advertising sector. Futuresource's Living With Digital survey suggests that approximately half of all US consumers are monthly AVoD users.

The sector has some challenges to overcome if it is to become a significant source of advertising revenue in the UK, not least increasing advertising efficiency. Not all new wave AVoD services require customer login, so ads cannot be effectively targeted, though targeted advertising continues to divide opinion amongst UK consumers.

While over half (53%) of UK consumers broadly accept targeted advertising, the majority of these (63%) say that it makes them feel a little uncomfortable. 36% of all consumers don't like it at all – they are not keen on broadcasters or online services knowing too much about them, with this feeling strengthening significantly with age.

**HOUSEHOLD PENETRATION OF PAID TV HOUSEHOLDS IN THE UK (TAKE PAY-TV AND/OR AT LEAST ONE SVOD SERVICE)**



However, the growth in users of the various services in the last two years and the continued increased visibility of services on Smart TV platforms will see AVoD services become an increasingly accepted source of free full-length content moving forwards.

In addition to new wave AVoD services, access to free TV shows and movies is set to widen further, with the announcement that YouTube, the dominant video streaming service worldwide, is set to offer free advertising-funded TV shows and movies in the USA, and is expected to follow suit in the UK and beyond.

This will also be supported by content holders and broadcasters further developing their FAST strategies, with British content availability expected to increase steadily on these services.

The expansion of such free, IP-delivered TV initiatives in recent years, and how consumers now access their news content point to an increasingly diverse free television landscape in the UK.

*“Over half of UK consumers broadly accepting targeted advertising; the majority of these say that it makes them feel a little uncomfortable”*

**LEADING REASONS TO WATCH FREE TV CHANNELS**

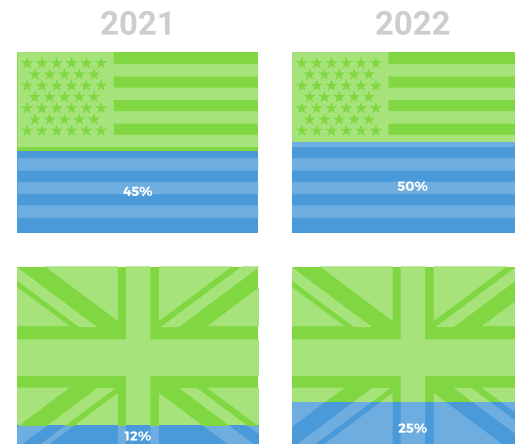
**Q:** You mentioned that you watch Free TV. Why do you watch this?

**Base:** All who watch free TV channels

- 1 The TV shows interest me
- 2 Don't want to pay to watch
- 3 Favour British TV (e.g. news & drama)
- 4 A specific TV show that I like
- 5 Easy to find TV shows/movies
- 6 Can switch on & watch straight away
- 7 Familiar TV shows/movies
- 8 Don't mind watching ads

**NEW WAVE AVOD UPTAKE - USED IN LAST MONTH**

**Base:** All respondents - DTG State of the Nation 2022 survey and Futuresource Living With Digital Dec 2021



*“71% of UK consumers agree that it is important that everyone in the UK has access to free, national television in the future”*

## Globalisation undeniable, but Brits back British

The impact of global video service providers and ‘Big Tech’ platforms has been evident in many ways at both an industry and consumer level in recent years and has been increasingly notable since the beginning of the pandemic. The viewing share of these platforms has increased year on year.

However, despite the proliferation of international television and video viewing options, 71% of UK consumers agree that it is essential that everyone in the UK has access to free, national television in the future. But this sentiment is not felt as strongly amongst all consumers and falls to just over half (54%) of 16-24’s.

This younger age group has significantly different views on television than their older peers. Amongst the leading full-length online TV services in the UK, 36% of all UK consumers say that Netflix has the highest quality content, compared with 16% for BBC iPlayer. This preference for Netflix is evident amongst all age groups under 65. And among 16-24-year-olds, BBC iPlayer ranks 5th in having the highest quality content behind Netflix, Amazon Prime Video, Disney+ and YouTube.

There is, however, a big swing in attitudes in over 65’s, where 30% cite BBC iPlayer compared with 16% for Netflix.

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There is, however, a big swing in attitudes in over 65’s, where 30% cite BBC iPlayer compared with 16% for Netflix.

The DTG State of the Nation 2022 survey suggests that 80% of all respondents use TV and movie-focused streaming video services from British-based companies, driven by BVoD services, which is similar to those who use services from international companies. However, the vast majority (>85%) of the estimated 46 million SVoD subscriptions in the UK at the end of 2021 were for US-based services.

Despite the SVoD landscape being focused on these US-based services, 44% of all UK consumers have a distinct preference for British TV shows, compared with just 16% who have an overriding preference for US/ international TV shows. This preference remains similar even amongst users of global services such as Netflix.

The key reasons cited for this preference are better humour (especially in older consumers), being easier to relate to, and better storylines.

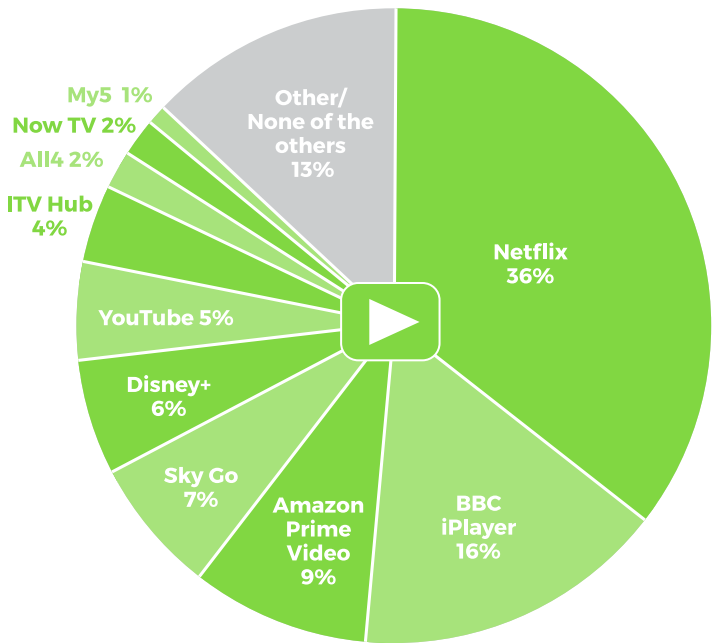
Local, British content also remains an important driver of FTA television; amongst those who watch FTA television overall, ‘Favouring British TV’ is cited as the third most popular reason behind a ‘TV show that interests me’ and not wanting to pay to watch content.

While the consumer preference for British television in the UK is clear, the investment in high-end British television production from both local and international entities shows no signs of slowing down. The BFI reported that £4.1 billion was spent on producing high-end television in the UK in 2021, in addition to £1.55 billion spent on UK film. This total of £5.64 billion is 29% more than the pre-pandemic year 2019 and cements the UK’s reputation as a global centre of premium content production, with international services such as Netflix and Amazon Prime Video continuing to increase their investment in UK-focused originals and UK-based production.

*“44% of UK consumers prefer British TV shows, compared with 16% who prefer US/international TV shows”*

**WHICH ONLINE SERVICE DO YOU ASSOCIATE WITH HAVING THE HIGHEST QUALITY TELEVISION CONTENT?**

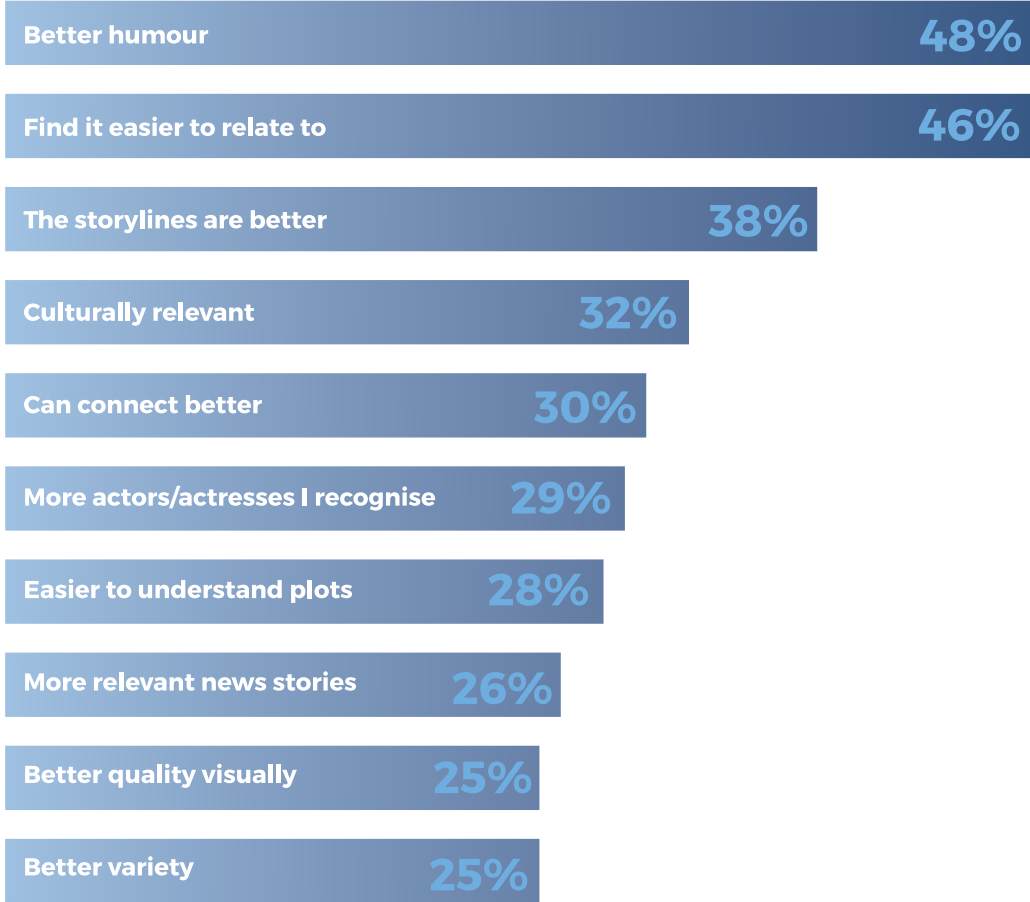
**Base:** All respondents



**TOP 10 REASONS TO PREFER BRITISH TV SHOWS**

**Q:** Why do you prefer British TV shows?

**Base:** Those who prefer British TV shows over US/International



# The evolution of the viewing experiences and discovery

*“32% of UK consumers say that their TV viewing experience is better than two years ago, compared with just 13% who say it is worse”*

Since last year’s survey, overall consumer attitudes towards TV viewing experiences remain broadly similar. Still, the wider reach of improved TV hardware, software, and services translates to an improved consumer experience. As IP-based viewing takes an increasing share of consumers’ overall viewing mix, 32% of UK consumers say that their TV viewing experience is better than two years ago (i.e. just before the pandemic), compared with just 13% who say it is worse.

Despite this general attitude toward a step up in the TV viewing experience over the past two years, respondents in the DTG State of the Nation 2022 survey cited a range of ways in which their TV viewing experience could be improved. The fundamental aspects of picture and audio quality lead the way.

When asked in an open text format which feature or trick respondents would like to see introduced, responses relating to picture quality or screen features are the most commonly cited reasons, increasing in importance since the previous wave, with UI/search and navigation issues the 2nd most mentioned.

There is also a perception that TV show discovery has improved: more consumers find it easier to find TV programmes than a year ago (22%) compared with those who find it more difficult (7%). This is particularly evident amongst under 45’s, with over 45’s typically not noticing much difference in this experience.

Despite this improvement in discoverability, almost 1 in 4 (24%) don’t know what they will watch when they turn on their TV, compared with 43% who do; under 35’s in particular are less sure of what to watch.

There has also been a notable increase in the importance attributed to various streaming and content features when buying a new TV. Of note is the importance of a new TV being pre-installed with SVoD apps such as Netflix, which has overtaken a TV being installed with BVoD apps such as iPlayer in importance. The ability to switch between favourite TV channels and streaming apps remains the most important among the attributes listed.

Overall, there has been little change in what consumers want to see when they first turn on their TV, with this preference fragmented across a more traditional screen view or an app-based view.

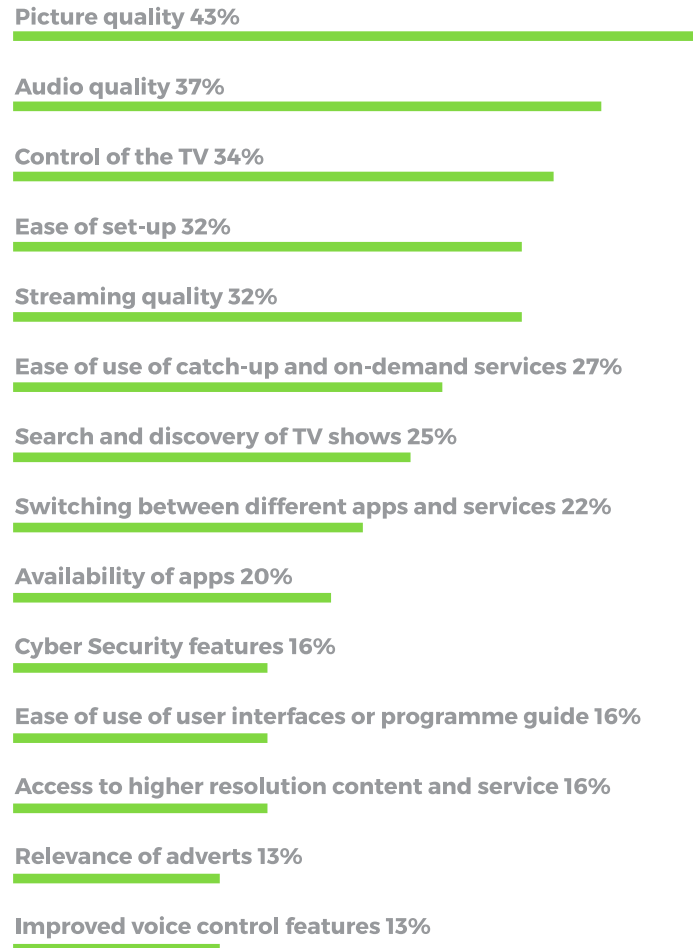
As witnessed in the 2021 DTG survey, one-third of respondents would prefer to see some type of streaming/app interface when they first turn on their TV. However, the overall preference is for a more traditional view, with the last TV channel watched the top individual response at 25%. The most notable shift in preference to what consumers want when they first turn on their TV over the last year has been towards a UI combining an EPG, TV channel and apps all on one screen.

Separately, if consumers had to choose between searching for TV shows using a traditional EPG or using apps, 41% would prefer the former compared with 28% for the latter.

*“The importance of a new TV being installed with SVoD apps is now higher than for BVoD apps, a reverse of one year ago”*

**IN WHICH OF THE FOLLOWING WAYS WOULD YOU LIKE TO SEE YOUR TV VIEWING EXPERIENCE IMPROVED:**

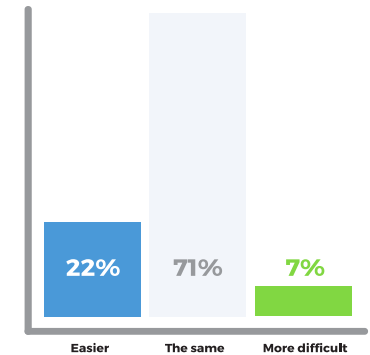
**Base:** All respondents



**CHANGE IN EASE OF FINDING TV PROGRAMMES**

**Q:** Do you find it easier or more difficult to find TV programmes and movies on your TV than you did one year ago?

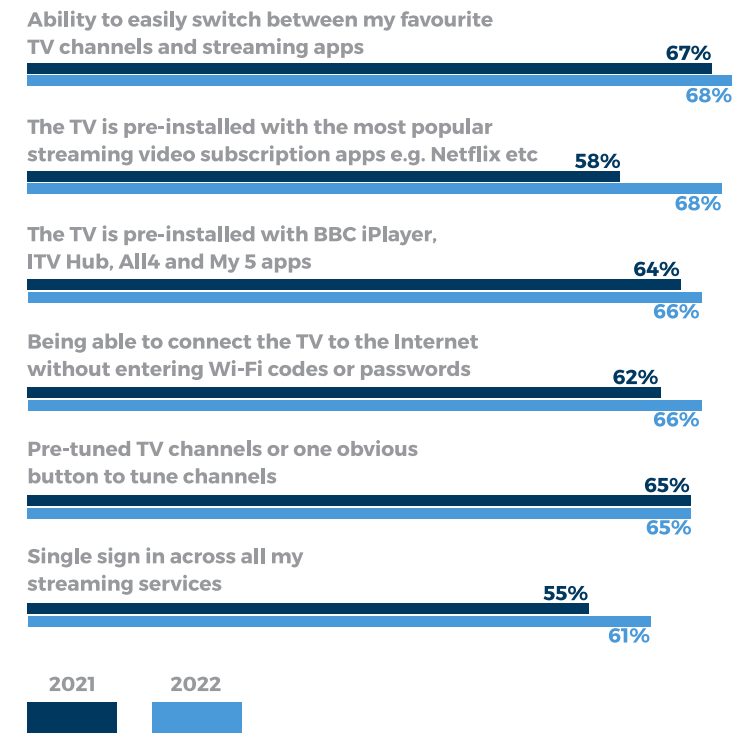
**Base:** All respondents



**IMPORTANT CONSIDERATIONS WHEN BUYING NEXT TV: % OF RESPONDENTS WHO SAY THEY ARE IMPORTANT**

**Q:** Which of the following would be important to you when buying your next TV? Please rate on a scale of 1 to 5, where 1 is not important, 3 is neither important or not important and 5 is very important

**Base:** All respondents



# Audio remains critical for viewing experience and accessibility

As witnessed in last year's survey, audio remains a key pain point for consumers when watching TV and an area where improvement would be welcomed. 72% of consumers claim to be annoyed by inconsistent audio levels when watching TV, up from 67% in 2021, consolidating this as the key TV viewing annoyance factor of those listed.

When consumers were asked what feature or trick they would like to see introduced to make watching TV a better experience, audio-related experiences were some of the top responses. Although not as commonplace when asked the same question in the previous year, when it was the leading topic they identified.

In addition, 39% would be interested in technology that enhances their ability to listen to audio more clearly when watching TV. More specifically, 45% of TV owners are interested in being able to adjust the balance between voice and background audio, with this interest increasing with age.

The use of subtitles was highlighted as a widespread activity in the 2021 DTG State of the Nation report and has increased in importance further during the last year. 44% of consumers now claim to use subtitles on their TV, up from 40% previously. This is particularly evident in under 55's and SVoD users, where there has been a noticeable change - almost half (49%) of SVoD users now watch subtitles, up from 37% a year previously, with the success of foreign language content such as Squid Game helping driving awareness and therefore usage in these cohorts.

However, despite the interest in broader accessibility features, they are generally not used amongst the older demographic. Just 8% of over 65's use any accessibility feature (excluding subtitles), such as voice control, bold text and visual descriptions, compared with over half of 16-24-year-olds who claim to use these.

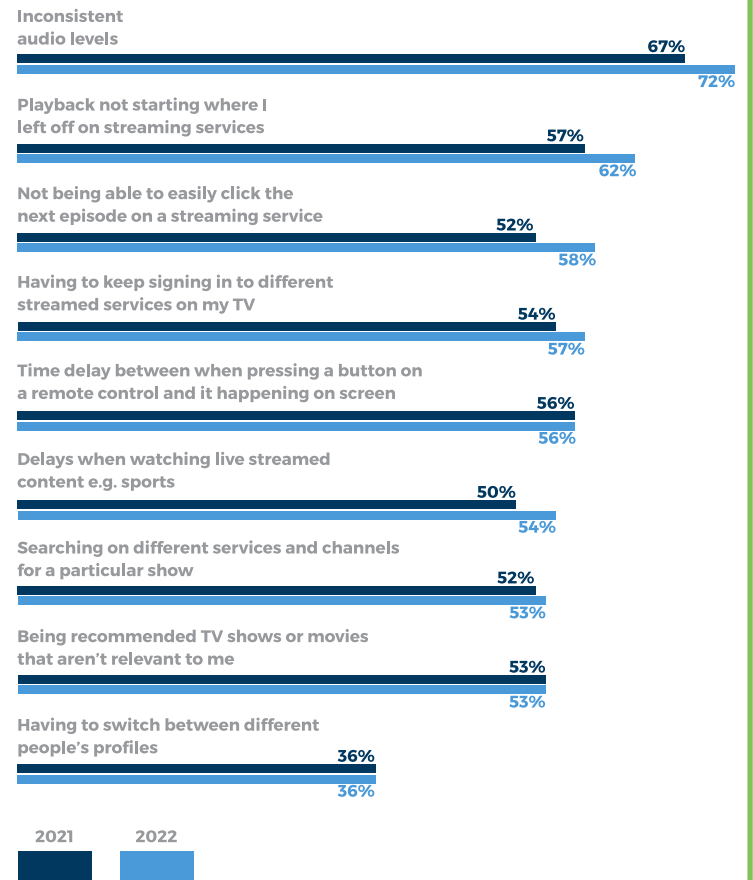
*"44% use subtitles on their TV, up from 40% one year ago"*



## KEY TV VIEWING ANNOYANCES: % OF ALL RESPONDENTS WHO CLAIM TO BE ANNOYED WHEN THE FOLLOWING SITUATIONS OCCUR

**Q:** When you are watching television, please describe how you feel when the following situations occur

**Base:** All respondents



## Consumer attitudes

### A shift to de-cluttering?

The launch of Sky Glass in 2021 is another example of UK-centred innovation; not only is it claimed to be the world's first carbon-neutral TV, but its key USP is to bring IP-delivered television content direct to the set, with no additional devices required. It also aggregates the full Sky service and a wide range of third-party streaming services. This 'de-cluttering' of hardware and services focuses on delivering a content-centric but straightforward consumer experience.

The 2021 DTG State of the Nation report highlighted that the leading feature respondents would like to see introduced is a better or simpler UI. This year's survey suggests that consumers not only want an easy-to-use UI but also they prefer to be clutter-free. 43% of respondents in this year's survey say they would prefer not to have any additional boxes or devices physically connected to their TV, compared with just 12% who are happy to have multiple boxes or devices physically connected.

In addition, 37% of respondents are interested in owning a television such as Sky Glass, which does not have any additional boxes to access a wide range of content, compared with just 12% who are not interested in this. The appeal of such a television is particularly strong amongst 25-45-year-olds and households with children under 12, where approximately half of these sub-groups are interested.

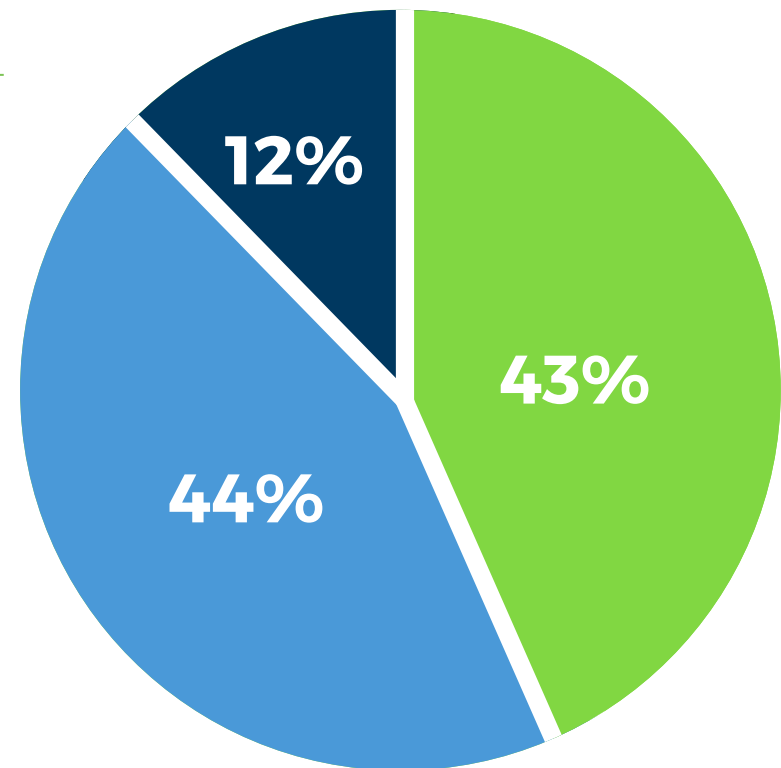
These attitudes toward fewer devices also extend to remote controls. 57% of consumers prefer to have as few remote controls as possible, whereas 18% prefer multiple remotes.

The practice of de-cluttering devices is appealing to many. It helps pave the way for future display technology, including holographic displays and even the metaverse, where thinking beyond a rectangular viewing experience becomes possible.

### ATTITUDES TO DE-CLUTTERING OF TV HARDWARE

**Q:** Which of the following statements do you relate to the most?

**Base:** All respondents



- I would prefer not to have any additional boxes or devices physically connected to my TV
- I have no preference either way regarding the number of boxes or devices physically connected to my TV
- I am happy to have multiple boxes or devices physically connected to my TV

# Integrated voice technology

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The way consumers interact with their devices has evolved significantly in recent years, with the prevalence of the smart speaker being the key device driving the acceptance of voice control. (At the end of 2021, there were approximately 20 million smart speakers in use in the UK).

For televisions, the remote control has long been unsurpassed as the primary way to control the television. Still, voice control has now become a standard feature across Smart TVs in one form or another, effectively granting consumers a “shortcut” through sometimes complex user interfaces. Consumers have the option of using their favourite assistant – usually Google Assistant or Alexa – via a Smart Speaker or can otherwise use an assistant integrated directly into more current TV sets.

At the end of 2021, Futuresource estimated there were 16 million TVs in use with voice capability in the UK, equivalent to 55% of all TVs in use, up from 43% at the end of 2020 and 30% at the end of 2019. The majority of these can be paired with smart speakers or smartphones for voice control, with the remainder having in-built voice technology.

Media discovery is one of the favoured use cases of voice in TV sets; this can lead to revenue opportunities – such as a movie rental or user retention strategies. Voice is also used for standard TV functions, such as changing TV channels and adjusting the volume, although actual usage of the feature is far from universal. Less than 1 in 4 TV owners say they use voice control to control their TV, with the majority of these using their remote control to “push to talk”.

Near-field microphones have become a common feature in Smart TVs and remotes offering built-in voice technology, included in around 20% of Smart TV sets sold today.

However, TV brands are now expanding the benefits of providing far-field microphones, driven in part by consumers’ increasing inclination towards a hands-free voice control experience for other functions, such as Smart Home

control, with the TV itself effectively becoming another smart display in the home.

Far-field voice technology has seen more limited adoption by TV vendors, mainly due to the practicalities of the technology. However, built-in far-field solutions have improved, and most manufacturers are starting to include this feature in some sets in their range.

Leading brands, including Samsung and Sony, launched their new range of Smart TVs with Google TV OS, which now includes hands-free voice control. All major Chinese brands announced premium Smart TVs with dedicated far-field microphones during 2021; for instance, Hisense unveiled its proprietary OS VIDAA U5, featuring hands-free voice control and TCL launched updated versions of its 5-Series and 6-Series 4K TVs with support for Google Assistant. Skyworth has also announced updates for their existing series of TVs enabling far-field voice control.

Key challenges in the adoption of far-field are the use of complex and integrated audio processing algorithms, which require new silicon alongside beamforming microphone arrays, and increased cost. But this also means that TVs must have a special standby operation to continually listen for wake-words, which often goes against power efficiency and sustainability objectives. The main obstacles to its deployment are placement of the microphone array, distorted voice inputs, and delayed response to voice commands. Widespread adoption of far-field technology will therefore require seamless performance and, as a result, is only found in a small minority of Smart TVs sold today.

Consumer attitudes towards voice in TV sets moving forwards are positive; almost half (48%) of TV owners say they expect to use some form of voice control for their TV in the future, nearly double the current level of usage. Consumers also feel that far-field technology will help drive the uptake of this feature, with 27% of TV owners saying they expect to control their TV by talking to it directly in the future. This sentiment is echoed across all demographic types, not just the tech-savvy. However, rollout is expected to be steady due to the challenges noted above, despite the apparent consumer interest, therefore, usage will ultimately be relatively limited for the foreseeable future.

# Attitudes toward cyber-security

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As Smart functionality becomes dominant amongst the UK TV installed base, the evidence suggests both a need and consumer demand for increased security certification and measures in these devices.

At the end of 2021, there were close to 30 million Smart TVs in use in the UK, with an additional 4.5 million forecast to be sold in 2022.

It is clear from the DTG State of the Nation 2022 survey that most consumers are not prepared against a cyber-attack on their TV; only 14% of TV owners are confident of how to ensure their TV is safe from a cyber-attack; this is just 4% amongst over 65's.

However, 29% of all TV owners believe they have made some effort to make sure their set is safe from a cyber-attack.

There is also a perception that TVs are less at risk of a cyber-attack than many other connected devices. Only 31% of consumers feel that a Smart TV has more than a moderate risk of a cyber-attack, compared with 51% for PC/Laptops.

The DTG 2022 State of the Nation 2022 survey suggests that the introduction of a certification programme, such as SafeShark, a Joint Venture between DTG Testing and Connect Devices and backed by BSI, would be welcomed by many consumers. 45% of UK consumers are more likely to buy a TV with an official certificate for high-security standards over one that doesn't. Only 14% of respondents have no interest in such a certification programme.

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*“45% of UK consumers are more likely to buy a TV with an official certificate for high-security standards over one that doesn't”*



## Energy efficiency now a key consideration for TV buyers

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The global energy crisis appears to have had a knock-on effect on the key features consumers require for their next TV. Whilst over half of existing TV buyers stated that smart/connected was a feature they would consider, the second most popular response was energy efficiency/lower running costs, meaning it is a more significant consideration for TV owners than 4K/UHD or owning a larger TV. This preference for a more energy-efficient TV increases in line with the age of a consumer's existing TV. It is also more of a consideration for over 55's and those who already own a smart or 4K TV.

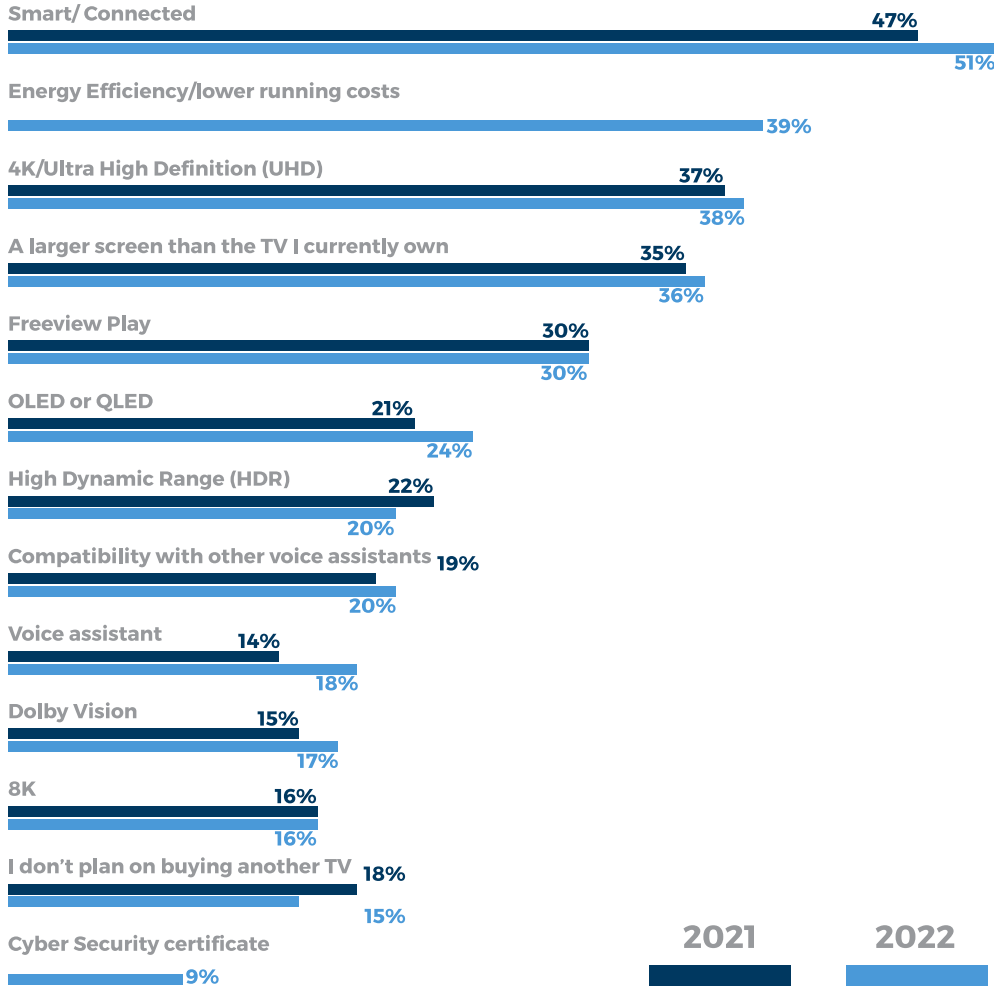
When the question was expanded to broader purchase criteria rather than just hardware-focused features, more TV owners considered it of greater significance than criteria such as build quality, the length of warranty or even the brand.

However, attitudes towards 'greener streaming' have shifted slightly since last year. There has been a fall in those willing to stream at a lower resolution to reduce emissions; just 1 in 4 say they are prepared to do this, compared with 40% previously. However, a similar number to previously (42%) say they would be willing to pay a little extra for green streaming alternatives, with 16-35's twice as likely to pay compared with over 55's.

**FEATURES DESIRED IN NEXT TV**

**Q:** Which of the following features would you consider when buying your next TV?

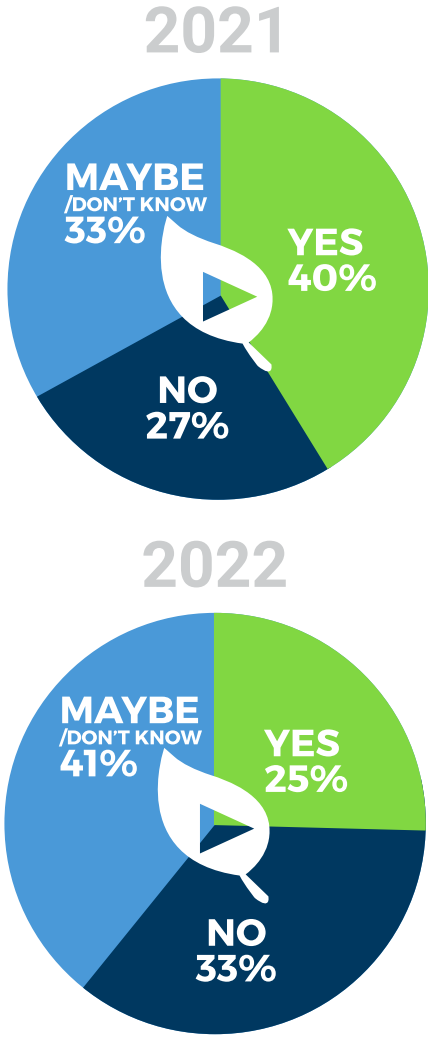
**Base:** TV Owners



**FEATURES DESIRED IN NEXT TV**

**Q:** Would you consider streaming at a lower quality to reduce emissions?

**Base:** All respondents



# The challenges of Ultra High Definition

## 4K is becoming the new baseline

There continues to be much debate on the migration to UHD services. There is growing consensus that 4K HDR is the “sweet spot” for the foreseeable future, augmented with spatial audio formats such as Dolby Atmos and DTS:X. For content creation, production in UHD and HDR is rapidly becoming the “gold standard” for the industry. However, the transition is slowing somewhat.

With most of the global streaming services now delivering their flagship shows in 4K, UK Public Service Broadcasters appear behind the curve, with only a handful of programmes available in 4K UHD, typically via their streaming services. The BBC has been testing 4K content on iPlayer since 2016 when Planet Earth was streamed in UHD and HDR on supported devices.

Furthermore, consumers face confusion in discovering how to receive 4K television services: for example, the BBC UHD trial is not available on smartphones or PCs; on streaming sticks, Amazon's Fire TV 4K is not supported presently (despite the name) but their Fire TV 4K Max can receive the BBC's UHD output; Roku's 4K devices are compatible, yet Google's Chromecast Ultra is not supported. Sky Q UHD is also not supported currently, but Sky Glass – the new 4K TV from Sky – does present BBC iPlayer in UHD. Access is therefore awkward, although it is worth noting that the BBC continues to define the iPlayer UHD service as a “trial”, hence, it does not need to be universally available.

Meanwhile, commercially-funded broadcasters are considered to have limited benefit in introducing 4K services. After all, an advertisement slot in 4K will deliver the same revenue as one presented in HD. And with UK digital terrestrial TV spectrum being reallocated for 5G mobile coverage, there is restricted bandwidth available for UHD on terrestrial broadcast

services unless other channels, and therefore consumer choice, are sacrificed. Satellite and cable maintain the bandwidth for 4K television services, meanwhile, broadband continues to illustrate potential as the most favourable transport mechanism for UHD content.

For UHD SVoD services, broadband download speed is the governing factor. HD (1080p) requires around 3.1 gigabytes of storage per hour of content, whilst 4K requires about 7.0 gigabytes. These translate into streaming bitrates of 6.9 Mbit/s and 15.6 Mbit/s, respectively, although consumers need slightly higher bandwidth for reliable delivery of 4K video when transport overheads are included. A transition to VVC (H.266) encoding from HEVC (H.265) should offer another 40% to 50% reduction in bandwidth – a 90-minute 4K UHD movie can be stored in around 5 gigabytes when encoded in VVC, which equates to around 7.3 Mbit/s.

When this data is compared with broadband capabilities, 4K UHD over IP can be considered feasible across most (but not all) of the UK today. Ofcom states that median broadband speeds in the UK are now 50 Mbit/s and that 85% of UK broadband lines had an advertised download speed of 30 Mbit/s or higher (as of March 2021). Ofcom also discovered that the disparity between urban and rural performance is narrowing, with rural peak-time speeds now averaging 41 Mbit/s compared with 55 Mbit/s for urban areas. The outcome is that population coverage is steadily becoming broader for UHD services, despite the absence of content via traditional broadcast mechanisms. However, there will still be a sizeable number of UK households to which 4K UHD content delivery over broadband is impossible.

Despite the availability of UHD television being far from widespread, the growing availability of UHD premium content on SVoD services, together with a steadily increasing installed base of 4K UHD TVs, has driven what appears to have been a shift in the past year in attitudes towards higher resolution. Now only one-third of UK consumers in the DTG State of the Nation 2022 survey say that watching in the highest resolution possible does not matter, compared with 47% a year previously. However, 43% of UK consumers don't check the resolution before watching television,

*“All other factors being equal, an advertising slot in 4K delivers the same revenue as one presented in HD”*

compared with 31% who always try to watch in the best possible quality, highlighting polarised attitudes to watching high-resolution content amongst British consumers.

While a significant proportion of UK TV viewers are ambivalent towards resolution and video quality, if consumers were to choose between better quality video or better quality audio, 42% would choose the former compared with 28% for the latter. This is even though substandard audio and dialogue are cited as the key annoyance factor (as highlighted earlier in this report). Yet, amongst those over 55's, the preference is for better quality audio over better quality video on average.

### 8K under consideration despite limited consumer interest

Leading TV manufacturers are now rolling out 8K in their premium ranges. However, uptake in the UK is expected to remain low compared with 4K TV sales in the short to medium term, with only 17% of TV owners saying it is a feature they would currently consider in their next TV.

Interest in watching 8K video content is also relatively muted: only 24% of consumers are interested in watching 8K content. Industry feedback suggests that most viewers would not be able to notice a significant

difference between 4K and 8K on screens under 60 inches. (Futuresource estimates that only 13% of TV screens currently in use in the UK are over 60 inches).

The situation relating to the delivery of 8K UHD differs markedly from 4K: typical storage requirements for 8K video are 30 gigabytes per hour of content; that's 4.3x larger than for 4K. When streamed over the Internet, this translates into a median bit rate of approximately 67 Mbit/s. There are also IP transport overheads to consider, so consumers actually require higher bandwidth on their broadband line for reliable 8K UHD video streaming. As proof of concept, during the Tokyo 2020 Olympics last year, NHK demonstrated that IP delivery of 8K Super Hi-Vision was feasible using around 80 Mbit/s of bandwidth.

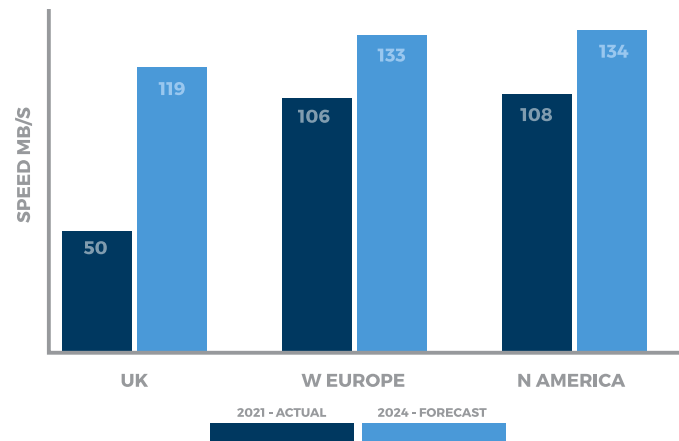
The UK falls behind the average broadband speeds in Western Europe. When that 80 Mbit/s minimum bandwidth requirement was overlaid onto UK average broadband speeds in 2021, this illustrates that 8K video content cannot be streamed widely across the country. Therefore, a bandwidth saving is crucial for wider 8K adoption over IP, and that will come from the 40% to 50% efficiency improvements gained from a move from HEVC to VVC coding, in tandem with broadband speeds improving as consumers switch to hybrid fibre or full fibre solutions.

*“Only 24% of UK consumers are interested in watching 8K content on their TV”*



## AVERAGE BROADBAND SPEEDS BY REGION

Source Ofcom, Futuresource Consulting



Without satellite, 8K may remain niche in broadcast circles; however, it is now possible for consumers to create their own “user-generated” content in 8K UHD. For example, the Samsung S20 smartphone released in February 2020 is capable of recording 8K video; likewise, Xiaomi’s Mi 10 Pro is equipped with a 108-megapixel camera that can capture 8K video; Apple’s iPhone 14 is rumoured to have similar capabilities when it launches later this year.

With 8K video likely to be delivered via IP, the issue of sustainability becomes more pertinent. At the data centre, streaming video in 8K typically creates 4.3x more emissions than streaming in 4K and 9.7x that of HD. However, as mentioned previously, only a quarter of consumers are prepared to stream at a lower quality to reduce emissions.

The industry consensus appears to be more forgiving; DTG’s canvassing of television technology executives suggests that, although just in the minority, many believe that a resolution and frame rate ceiling of 4Kp120 should be set to help accurately define and meet sustainability targets – effectively meaning that many believe that the adoption of 8K should not be encouraged at the expense of sustainability.



## Beyond television: Other TV features

With the television being the central feature in many consumers’ living rooms, there has been a long-standing interest in the wider industry in using the television for other activities other than to watch TV and video. However, most of these activities, including gaming and shopping, have struggled to make it into the mainstream. But with the vast majority of TVs now IP enabled, there is some renewed interest in exploring ancillary features on a television, with a focus on features outside of the entertainment sector, as smart home uptake increases.

Using a TV to help control other smart home features (e.g. security), video calling, and playing games directly through the TV are features that are set to steadily increase in prominence in the coming years. However, it is evident that many consumers are not yet interested in these additional features. For example, smart home features on a TV remain relatively niche; only 5% of TV owners say they view and control a doorbell camera on a TV. A similar number says they use their TV to monitor home security cameras.

Whilst far-field voice technology integration into TVs is set to slowly increase, as consumers steadily talk to their TV to control it, as well as video calling becoming the norm since the start of the pandemic, there is a sense of cautiousness around having microphones as well as cameras in their TV sets; 41% of respondents say they don’t want them in their next TV set, compared with 22% who do.

However, sentiment to these features varies significantly by demographic. Older consumers are strongly opposed, whereas more 25-45’s and households with children are more likely to want these features than not. General ambivalence to the features and security concerns are key obstacles; 53% of those who don’t want these features simply say they aren’t interested in video calling on their TV, but 52% say they might invade their piracy.

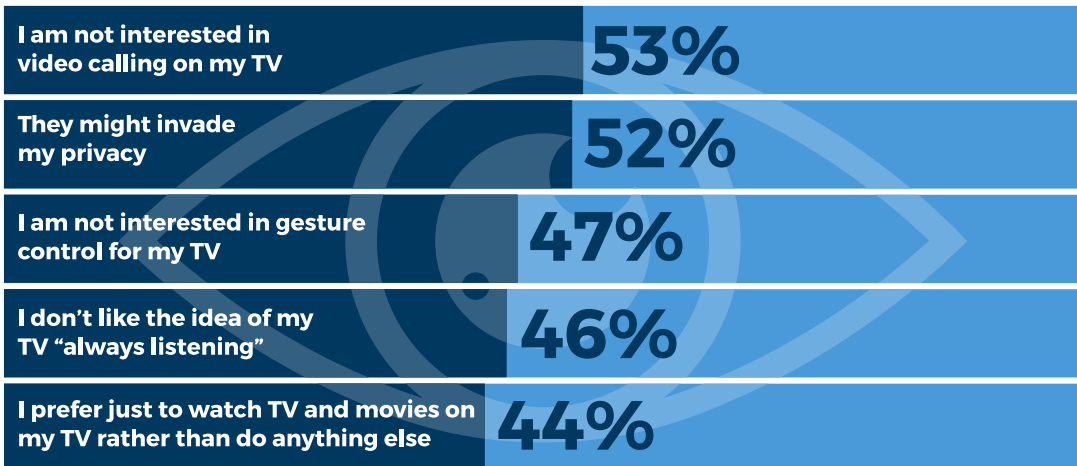
*“41% of UK consumers don’t want cameras and microphones in their next TV set, just 22% do”*

In addition, 1 in 5 UK consumers are interested in playing games directly on a TV, higher amongst 35–44-year-olds and households with children under 12. This suggests that whilst there could be an audience for such an activity, it is unlikely to become truly mass market in the immediate future and will be some way off the success achieved by other forms of video gaming. Such non-video entertainment applications are expected to steadily grow in prominence, driven by third-party apps. Still, there is not likely to be a ‘killer app’ for the TV set, beyond watching television. Instead, the TV will, for many, steadily become another device in a consumer’s wider smart home ecosystem, complementing other devices such as smart speakers, smart speakers and smart displays such as the Amazon Echo Show.

### CONSUMER BARRIERS TO MICROPHONES AND CAMERAS IN TV SETS

**Q:** You say that you don’t want a microphone or camera in your next TV set? What are the reasons for this?

**Base:** Those who don’t want a camera or microphone in their next TV set



# Future innovation in Digital TV

## Bridging consumer expectations and industry innovation

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As highlighted so far in this report, consumer's expectations regarding TV viewing experiences have evolved significantly in recent years, driven by the proliferation of IP-delivered content and smart devices.

As well as a consumer survey, the DTG also conducted an industry survey to garner key thoughts on opportunities and challenges amongst companies in the television technology industry.

The major consistent finding from this survey was that digital TV innovation and experiences should focus on the integration of broadcast and IP technology, in turn enabling a seamless search and navigation experience for consumers.

Threats to Digital TV innovation in the UK are perceived to stem from standards being increasingly developed outside of the UK and that broadcast innovation may be side-lined in favour of streaming.

The current status in the UK of key technology which enables this broadcast/IP integration and future seamless viewing experiences is covered in the remainder of this report.

A particular focus is placed on the role 5G, new video codecs and AI have in digital television sector moving forwards.

# A fork in the road for video standards:

## Transition to new codecs

Following several years of H.264 (AVC) being dominant, there is now a split happening between video codecs used for broadcast and those favoured for video distributed via broadband or mobile. Indeed, the video industry is at an inflexion point, with the newer VVC, EVC and LCEVC standards competing to become credible alternatives to AVC, HEVC and even AV1.

For live television, AVC and HEVC continue to be much better positioned than AV1 presently because the complexity of AV1 demands highly capable server hardware for live encoding. Nevertheless, there is an expectation that AV1 will accumulate more hardware support over time in TVs and STBs, and this is one element driving streaming video providers' interest in using AV1 for offline encoding of video assets for SVoD.

VVC (or H.266) is a codec based upon HEVC; notable developments are happening currently. In February 2022, the DVB formally endorsed the inclusion of VVC as part of its core specifications, the minimum requirement being a baseline receiver capable of supporting resolutions up to 4K and with HDR. With chip vendors including MediaTek and Qualcomm heavily invested in VVC, many believe that the standard has the most chance of becoming the favoured codec for television as UHD services proliferate. Qualcomm, Huawei and MediaTek are amongst the largest owners of VVC patents, so they will integrate VVC into Android smartphone chipsets, helping to drive adoption. More widely, hardware decoders are under development to provide support for VVC on TVs, STBs and PCs.

It is also widely believed that companies participating in the Media Coding Industry Forum (MC-IF) will be the first to adopt it. Yet, it will likely be three to five years before all CE products generally support VVC, and forecasts suggest the new codec will not be widely used until 2027. Equally, it may not necessarily replace H.264 and HEVC entirely, but instead, the



industry will contemplate the coexistence of multiple codecs.

Meantime, a new licensing structure announced in August 2020 proposed a "Joint HEVC + VVC Platform License". So, products containing both VVC and HEVC technologies are expected to enjoy a substantial discount. From this respect, the future utilisation and popularity of the VVC codec look more promising. VVC has an obvious advantage in the efficient transmission of 4K and 8K content, especially considering the onset of the 5G era alongside growing consumer appetite for UHD in broadcasting and entertainment.

Another codec worth watching is LCEVC. This hybrid technology uses an existing codec to produce a low-resolution base layer and adds another codec in an enhancement layer to boost resolution to the full target and final quality. For instance, a video file encoded with an AVC base layer will be accessible to any TV or STB that can play H.264, even without a LCEVC decoder. But add an LCEVC decoder into the device, and it can then receive full resolution and quality. The primary benefit here is that LCEVC offers a credible pathway for transitioning to a newer codec and could even use VVC as the enhancement layer. Many in the industry believe that LCEVC is likely to have an impact because of the more favourable licensing terms. Nevertheless, the best indicator of LCEVC's viability will not just be in recognition of its potential but through active deployments by top-tier content publishers and streaming service providers.

Twenty years ago, the industry embraced H.264 because it was the best codec, yet today we are battling with the politicisation of codecs. Indeed, there are several years before this is all resolved. But streaming video providers are likely to select AV1 (or the forthcoming AV2) from the Alliance for Open Media (AOM) and broadcasters will favour the MPEG standards, most likely VVC.

*"In February 2022, the DVB formally endorsed the inclusion of VVC as part of its core specifications"*



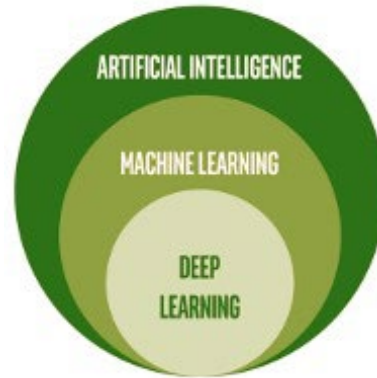
## Applying AI to improve efficiency

Initial interest in applying AI to the challenges of video encoding began around four or five years ago with the promise of faster deployment and greater efficiency. Machine learning techniques can be employed during video encode to reduce file sizes and bit rates while maintaining visual or perceptual quality. The technique allows professional encoders to optimise video encode parameters on a scene-by-scene basis whilst feeding the results back into the system to enhance future encoding sessions. The feedback loop aims to ensure the AI applies better encode parameters in subsequent sessions, which over time approach the optimum compression for a given scene.

The technology is not limited to optimising video streaming bandwidth, especially important for 4K and future 8K services. AI further allows encoders to compress whole or partial frames individually and predict future action based on past ones, determine the areas within each frame that will matter least to viewers, and compress those areas more than the others. And it's these features that are likely to form the basis of new encoding schemes.

The promise of AI means it is considered an essential new tool in developing future audio and video codecs. Indeed, its potential application is under examination by the major video standards organisations worldwide. Work here is likely to create an AI-based codec before the end of the decade; this has been tentatively named DNNVC (Deep Neural Network Video Coding).

Shorter-term, AI presents an opportunity to augment existing coding methods with new tools. Machine learning and AI certainly have a place in helping define advanced video coding mechanisms. However, the industry widely reports that traditional coding tools still outperform AI-based alternatives in most areas today. Over 30 years of engineering effort and hundreds of companies are involved in developing the knowledge and perfecting video compression standards; this isn't easy replicated or quickly replaced simply by introducing AI into the discipline.



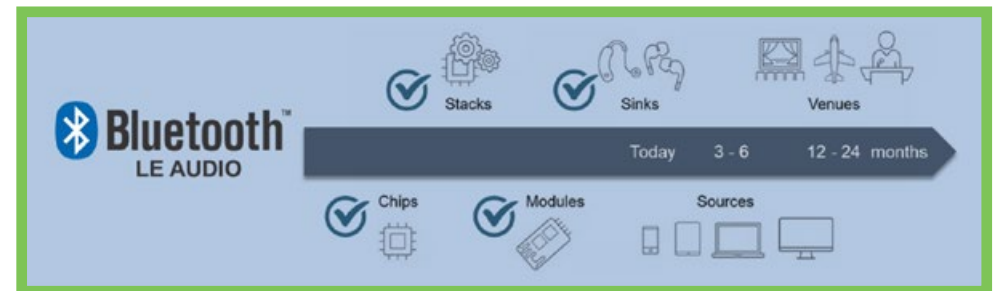
*“The application of AI is under examination by the major video standards organisations worldwide”*

## Improved TV experience with Bluetooth LE Audio

The Bluetooth SIG (Special Interest Group) published Bluetooth 5.3 in July 2021. The new specification adds several feature enhancements that provide device makers and application developers with improved connection reliability, further energy efficiency and better security through enhanced key encryption. Silicon vendors will release firmware updates for existing Bluetooth chips and modules.

### The new specification drives Bluetooth LE Audio elements further, which offer the following enhancements:

- Audio streaming can be achieved over low energy radios, improving battery longevity for headphones, true wireless products and hearing aids.
- Multi-stream configurations are standardised, which enables concurrent audio streams to be synchronously sent to devices. This creates products with lower complexity, notably those explicitly designed as low-cost receivers for audio.
- Support for audio broadcast; this is an extension of multi-stream operation, allowing audio to be sent to multiple receivers simultaneously. This is an interesting feature for the digital TV sector because it allows transmission of TV audio locally to viewers with different sound preferences, listening via Bluetooth LE Audio compliant true wireless or headphones. More importantly, it promises to improve accessibility for hearing-impaired viewers, who can listen in via Bluetooth hearing aids and select their own audio profile.
- The standard offers new audio codecs, LC3, alongside an optional LC3plus codec for hi-res audio streaming. Both improve the clarity and quality of audio at lower bit rates. The application here enhances the quality of wireless soundbars, especially those with satellite speakers connected over Bluetooth LE Audio.



New silicon is required to support Bluetooth LE Audio. Both the source (for example, the Smart TV or soundbar) and receiver (for instance, headphones or hearing aids) must support Bluetooth 5.2 as a minimum. Chips, modules and Bluetooth stacks became widely available in 2021, with products now appearing that support Bluetooth LE Audio features.

Meanwhile, in the mobile space, Android 12 added APIs for Bluetooth LE Audio, expanding the opportunity for smartphones to support the new standard as a baseline. Developments here are steadily filtering down into Android-based Smart TVs.

## 5G extends the television opportunity:

### Expanding network reach

Regarding network coverage across Europe, 5G services are now available to all 27 EU Member States. The EU is on track to meet its coverage objectives since at least 50% of households across Europe were reached by at least one 5G network as of January 2022.

Due to local radio spectrum allocation and the need to coalesce around common transmission frequencies for 5G bands, communications regulators worldwide have cleared and relicensed previously assigned spectrum to make this available to 5G services – notably the 700MHz mid-band in Europe previously occupied by digital terrestrial services, and C-band satellite spectrum in the USA. Network operators worldwide are favouring the mid-band spectrum for 5G services, yielding the coverage and capacity necessary during the early build-out of those networks; plus the 5G ecosystem on mid-band is the most mature of all options today in terms of device support.

In the UK, uptake of 5G handsets continues its momentum, estimated to account for 10% of devices by the end of 2021. 5G data carried over the UK's mobile operator networks increased from 1% of total traffic in 2020

to 3% in 2021. According to Ofcom, 5G is now available from at least one network operator in the vicinity of 42% to 57% of UK premises, with higher reliability of receiving a service at the lower end of this range. One in five masts in urban areas now have 5G deployed on them, compared with only 5% in suburban areas.

For UK TV broadcasters and content providers, 5G creates an opportunity to broaden their reach across a wide range of end devices; for mobile network operators, it expands their service portfolio by building upon existing networks and resources; and for consumers, it affords them access to even richer content on their smartphones, tablets and TVs.

### Debate over 5G broadcast

Broadcast capability became an integral part of the 5G standards by enabling high power high tower (HPHT) 5G network installations to distribute television and radio services. This is enabled by the specifications for 5G, including a capability called Further evolved Multimedia Broadcast Multicast Service (FeMBMS), which essentially adds broadcast modes to 5G networks. New codecs and media formats were also added to the 5G specifications that more broadly align with broadcast TV industry requirements.

Debate continues over whether FeMBMS and its derivatives could, or indeed should, replace existing digital TV broadcasting standards, especially given the challenges of expanding TV services within the confines of decreased terrestrial spectrum. Nevertheless, broadcast still serves millions of people across the UK and Europe with television and radio services, raising questions over the advantages of switching to 5G HPHT networks.

Public service broadcasting carries many requirements such as universal coverage, free-to-air access, and prominence, all of which must be maintained if delivered on a mobile network. Although delivering these services over 5G HPHT is technically feasible – and trials in Germany proved successful in principle – there are commercial and regulatory challenges that must be considered. Further studies investigate the feasibility and opportunity for 5G to carry digital radio using FeMBMS, which ultimately could allow television, radio and mobile data to share a common infrastructure.

## Live events over 5G

Alongside the COVID-19 pandemic, which forced a swift change to remote production techniques and accelerated the transition to IP networks, 5G is now promising to transform how the industry operates when broadcasting live events. Indeed, broadcasters increasingly use wireless networks for everything from uploading news stories from the field to using LTE-connected video cameras during live sporting events and 5G is set to extend the bandwidth and boost the reliability of these transmissions.

In February 2022, the 5G VISTA (Video in Stadia Technical Architecture) project, lead by the DTG, successfully demonstrated the potential of using 5G to enhance the fan experience during live sporting events. Six live streams were broadcast locally using FeMBMS in the MK Dons stadium, Milton Keynes, and made available to 5G-capable handsets to a group of trial participants. Attendees were able to enjoy instant replays via these smartphones and access an unprecedented amount of content instantaneously during the live game, from a selection of multiple camera angles to in-depth background information on their team. FeMBMS essentially overcomes the problem of insufficient bandwidth being available during live events by broadcasting the content from a single 5G tower to multiple users, rather than one to one, maintaining the quality of service regardless of the number of viewers.

BT is also actively evaluating the opportunity as part of their 5G Edge-XR programme. For live sports events, the company recently demonstrated a mixed reality stadium experience for 5G-enabled smartphones that presents spectators with augmented graphics on a live rugby game. For this to happen, the technology analyses the camera feed from the smartphone to accurately identify where the pitch and goals are; it also recognises the most important aspects that appear on the pitch, including area markings, player positions and the location of the ball. Working with partner companies, Gilbert and Sportable, the system tracks the ball in real time, calculates which direction the smartphone camera is pointing, then generates a video layer containing graphics with game statistics that is transmitted back to the 5G phone to superimpose over the live action.



**Live augmented graphics on 5G smartphones**

Beyond the enhanced in-stadia experience, broadcasters are seeking to harness the additional capabilities that 5G can bring to curate and deliver live content from multiple viewpoints simultaneously. This affords opportunity to present rich multi-screen experiences to audiences watching on TV at home. Moreover, there is also potential to capture user-generated content from 5G smartphones and introduce these live videos into feeds for broadcast and social media.

# Metaverse: The final digital frontier

One of the key emerging megatrends for 2022 is the metaverse, creating significant hype, with many believing it will transform user experiences this decade. In fact, there will be several metaverses – completely digital environments where users can congregate and inhabit a virtual space as avatars. The application of AI behavioural recognition can transform avatars into precise virtual representations of real people, including social preferences, communication and manners. Behind the metaverse are several layers of technology, ultimately driving a range of opportunities.

The metaverse is of significant interest to a huge range of companies across the media and technology space due to the revenue potential, including through data harvesting, content consumption, digital merchandising or advertising; some metaverses even allow the purchase of digital real estate in the virtual world.

Although Meta (formerly Facebook) and other companies outwardly portray the metaverse as futuristic, the concept itself isn't new; for instance:

- **Second Life was released in 2003.**
- **Roblox now has over 37 million active users.**
- **Fortnite pivoted from game venue to concert venue when Epic built a studio space in Los Angeles, complete with a large stage, to capture and inject live music concerts into the platform.**

Despite the notable hype, awareness and understanding of the metaverse are fragmented amongst the general public, as highlighted in the DTG State of the Nation 2022 survey. While most (64%) of UK consumers have heard of it (even amongst those over 65), the majority of these don't know what it is, with only 7% having used metaverse applications.

But whilst there is a current lack of understanding of the metaverse amongst consumers, there is undoubtedly an opportunity for the television

industry to think beyond the 'rectangle' in the longer term.

Many consumers believe that the metaverse will be an environment to watch premium video content in; 27% state they will watch TV or movie content in the metaverse in the future, higher than any other activity listed in the DTG Consumer Survey. 1 in 5 specifically selected watching TV (increasing to 35% amongst existing metaverse users).

Experimentation in the TV industry is evident. In February 2022, BigScreen began offering over 100 TV channels from Pluto.TV alongside live streamed content from Twitch, presenting an opportunity for users to collaborate and socialise within the metaverse.

The full range of applications in the metaverse will be diverse, although the benefits of the metaverse are not yet fully known by consumers. The majority are unclear what activities they will undertake in it: 53% of UK consumers aren't sure or won't do a range of commonly associated metaverse activities in the future.

Beyond the obvious immersive gaming worlds in VR, there is also the opportunity to socialise with friends in digital environments, for instance at virtual music concerts or even recreating the cinema experience entirely digitally. Notably, Paramount Pictures announced a partnership with BigScreen back in 2017 to evaluate the VR experience for movies. They recognised that completely immersive digital environments might offer alternative and lucrative revenue streams.

Earlier in 2021, the Sundance Film Festival offered attendees a way to experience the potential of a "virtual future" by showing movies within the metaverse experience.

The metaverse represents a transition from physical hardware to completely software-based rendering for audio and video; indeed, audio is a vital asset in driving deeper immersion levels in such platforms. Beyond the early implementations, there are opportunities for tactile sensing, and future ambient intelligent experiences.

The industry may utilise the existing end-to-end video delivery chain to stream UHD content into the metaverse and inject this video into the virtual world. But the expectation is that everything is rendered on server farms remotely and delivered entirely as a graphical representation of the

virtual world, combining video and graphics in the cloud, then delivering one set of visuals to the metaverse, such that all inhabitants receive the same audio-visual experience simultaneously, each from their own vantage point.

Although many necessary technologies exist to construct it, there are many challenges to resolve in building the metaverse. Who owns these environments? How are they regulated? What laws are followed – both real and virtual? What jurisdiction do they have? But use cases are wide-ranging, including but not limited to virtual conferencing/meetings, or education, as well as television and broader entertainment opportunities.

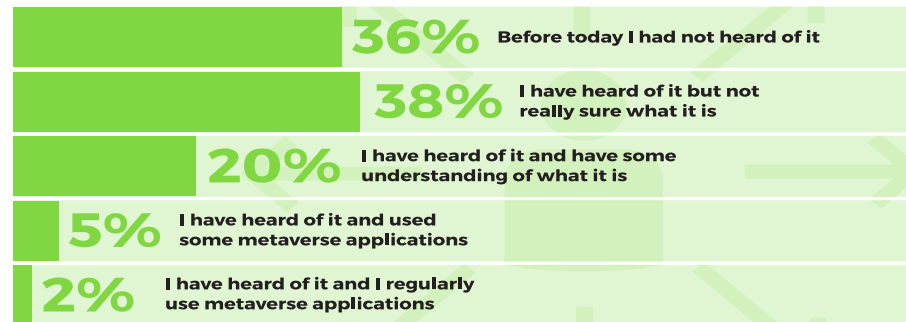
The key enabling technologies discussed here, such as AI, 8K, 5G and new video codecs, will all play a role in creating seamless television experiences in the metaverse, although the timescale for mass market adoption is unclear given the current low base of understanding and legacy television infrastructure.

But whatever happens, regardless of whether it takes more time and ingenuity to create than anyone imagined, and whatever final form it takes, the move towards the metaverse is inevitable, and television could well be central to consumers' experience of it.

## METaverse AWARENESS, UNDERSTANDING AND USAGE

**Q:** Before today, how familiar were you with the Metaverse?

**Base:** All Respondents



## FUTURE METaverse ACTIVITIES (TOP 7 RESPONSES OF 13 LISTED)

**Q:** What activities do you think you will do in the metaverse in the future?

**Base:** All Respondents

# Appendix

## UK Television Innovation Timeline

- 1996: D-Book published (DTT technical specification)
- 1998: Kingston Communication launches UK's first VoD service
- 1998: DTT launched
- 1998: Sky Digital launched
- 1999: Cable and Wireless Communications launch UK's first digital cable service
- 1999: BBC Red Button launched
- 1999: Sky Sports broadcast world's first interactive football match
- 2001: Sky+ launched
- 2002: Freeview launched
- 2005: Sky Mobile TV launched
- 2006: Channel 4 launched world's first broadcaster VoD service
- 2006: BBC launches world's first interactive daily news bulletin
- 2006: HD Channels start broadcasting
- 2007: BBC iPlayer launch
- 2008: Freesat launch
- 2010: Sky launches Europe's first 3D TV channel
- 2010: Virgin partners with TiVo
- 2012: Netflix launches in the UK
- 2013: Digital switcher over completed
- 2013: YouView launched
- 2013: Netflix becomes available on Virgin Media TiVo boxes.
- 2014: Sky launches AdSmart
- 2014: Sky launches Buy and Keep model – world's first widely available VoD movie and DVD hybrid service
- 2015: Timeline launches Europe's first purpose-built UHD 4K Outside Broadcast truck
- 2017: BT Sport broadcast UEFA Champions League Final in Virtual Reality
- 2017: Channel 4 launches world's first VoD adverts with personalised audio and 360° video
- 2018: UK Basketball game the first live fully automated live stream using AI
- 2018: Virgin Media broadcast UK's first 4K HDR broadcast
- 2018: Channel 4 launches world's first AI-driven TV advertising technology
- 2018: EE and BT Sport demonstrate first live broadcast with remote production over 5G
- 2018: Gravity Media and Snell Advanced Media launched world's first uncompressed UHD IP remote production trial
- 2019: BT Sport launches world's first HDR streaming service
- 2019: EE streams world's first augmented reality concert over 5G
- 2019: First UK broadcast insert over 5G by the BBC
- 2019: BBC develops world's first-ever interactive factual programme, using object media technology
- 2019: Britbox is launched by ITV
- 2020: BT Sport and Samsung broadcast first UK 8K live sports event
- 2020: BBC announces its own Voice Assistant, Beeb
- 2020: Sky announced net zero carbon target by 2030
- 2020: Sky News produced world's first fully remote news programme
- 2020: ITV airs "Isolation Stories" – a new format drama recorded in lockdown
- 2020: BT Sport first to provide Dolby Atmos for live-streamed content across multiple connected devices
- 2020: ITV launches Planet V addressable advertising platform
- 2021: ITV launches Shoppable TV, first UK service allowing viewers to shop from its programmes directly on a TV
- 2021: Sky launches its Sky Glass Smart television, world's first television to be carbon neutral
- 2021: EE and BT Sport launch immersive sports-viewing experiences, including 'holographic boxers'
- 2021: Channel 4 and Instagram create 'You Do You' – world's first real-time social media reality series
- 2022: DVB approves VVC for audio and video coding in broadcast and broadband applications
- 2022: 5G VISTA in-stadium 5G live broadcast at Stadium MK

# Economic Importance of the UK Television and Broadcast Industry

35.4k people work in the broadcast industry, 26% of whom are on the technical and engineering side

*Source: OFCOM, Employee diversity profiles for the UK radio and TV industries, 2018-2021*

In addition to this, 121k people work in motion picture, video and television programme production

*Source: Office for National Statistics: Employees in the UK by industry 2021*

£4.1 billion was spent on high-end TV production in the UK in 2021

*Source: BFI*

Commercial broadcaster revenues in 2020 totalled £10.2bn, down 6.4% year-on-year.

*Source: OFCOM Media Nations: UK, 2021*

TV advertising spend estimated to have totalled £5.5 billion in 2021, 26% growth on 2020.

*Futuresource Consulting analysis; The Advertising Association/WARC Expenditure Report April 2020 and Press Release 27 Jan 2021*

£2.07bn was spent by PSBs on first-run programming in 2020, down 18% year-on-year

*Source: OFCOM Media Nations: UK, 2021*

BBC TV Licence revenues totalled £3.75bn in 2020/21, a 7% year-on-year increase.

*Source: House of Commons Licence Fee Statistics.*

Consumers spent £12.5billion on Pay-TV and SVoD subscriptions, Home Video, and the TV licence fee in 2020.

*Source: Futuresource Consulting*

47 UK companies and individuals were named in the filing of 99 TV-related patents worldwide in 2021.

*Source: Futuresource analysis of patents filed on ESPACENET.*





[dtg.org.uk](http://dtg.org.uk)