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Global Expert Mission
South Korea Immersive Technologies

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Funded by

AUDIENCE OF THE FUTURE

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Welcome

Innovate UK launched the Global Expert Mission (GEM) programme in October 2017 to help businesses become truly global enterprises through strategic international innovation collaboration. Delivered by the KTN in partnership with the UK Science and Innovation Network (SIN), the Expert Missions provide an expert-led evidence base to strengthen Innovate UK's global investment strategy: how and where it should invest to create UK business opportunities in partnerships with key economies.

Built around UK business, policy and research representation, each mission selects representatives from the UK's business, policy and research community, with objectives to:

1. **Inform UK businesses and government**
   The findings and opinions of experts on the topic of the mission are made available to UK businesses and government departments. These inform UK businesses about potential opportunities for innovation in the country and the UK government on how it can help businesses make the most of those opportunities.

2. **Build international collaborations**
   The expert insights will help inform how Innovate UK can best help UK businesses find and exploit the opportunities for innovation partnerships. The mission creates connections with key organisations and people that will deepen and widen the collaboration with the partner country to the benefit of UK business.

3. **Showcase and share UK capabilities**
   During the mission, the delegation of experts will use the opportunity to promote and share the UK's innovation strengths.

The Audience of the Future Challenge Fund (AotF) has invested £39.3 million to date in bringing together creative businesses, researchers, and technologists to create striking new experiences that are accessible to the public, creating the next generation of products, services and experiences that will capture the world's attention and position the UK as the global leader in the creative and commercial implementation of immersive technologies.

A Global Expert Mission, funded by AotF and focused on immersive technologies in South Korea, took place virtually in April 2021, during a period of COVID-19 travel restrictions. Delegates met virtually with representatives from the public and private sectors, including government, industry, research and academia, to meet the following aims:

1. To help determine how Innovate UK can support UK businesses more effectively and efficiently when considering partnerships with South Korea.
2. To provide insights into where there are synergies between the two countries and whether there is appetite for further collaboration.
3. To identify and showcase key market opportunities/ challenges for innovative products and services to UK businesses who may be interested in collaborating with South Korea.

This report summarises the information and insights gathered during the mission.

A full list of the participating organisations is included in Annex 1 and 2.

Executive Summary

The Immersive Technologies Global Expert Mission to South Korea took place online in April 2021. The aim was to better understand the immersive technology landscape in South Korea and to identify synergies and opportunities for collaboration between the two countries. The delegation focused on a broad range of thematic areas and how immersive technologies apply, ranging across gaming, healthcare, engineering, manufacturing, training and education.

South Korea and the United Kingdom have rich immersive technology landscapes, and experts from both countries demonstrated an appetite to strengthen collaboration opportunities and explore mechanisms to facilitate bilateral research and development.

The South Korean Immersive Technologies landscape is diverse and sophisticated. Through the mission, UK delegates learned about supportive South Korean government policies and technological capabilities. Furthermore, both the UK and South Korea share a passion for immersive technologies and a belief in their future application and adoption.

While both countries have shared priorities, the mission also noted a number of shared challenges, including hardware limitations, barriers to mass adoption and access to funding and finance. Overcoming such challenges will require a collaborative and interdisciplinary approach.

Through the mission, delegates were able to identify a number of key opportunities for collaboration and knowledge exchange, which could leverage the strength of the two countries.

Example opportunities include:

- **AR glasses:** The development of smart glasses, which can open new opportunities for both businesses and customers.
- **Content creation:** The generation of immersive experiences that can help customers across education and training, as well as entertainment for consumers.
- **Market penetration:** How both countries can work together to reach new markets with their products and services.
- **Technical skills:** How South Korea's extensive hardware development skills can help companies in the UK build hardware.
- **Echnical skills:** How South Korea's extensive hardware development skills can help companies in the UK build hardware.
- **Knowledge transfer:** How both countries can share best practices for mutual benefit.

"In April 2021, experts in Immersive Technologies from across the UK and South Korea came together virtually to share learning and experiences. The resulting discussions clearly highlighted the importance of new and emerging immersive technologies across all sectors, from healthcare to gaming.

This mission also took place against the backdrop of COVID-19, and we witnessed more than ever the need to build mutually beneficial partnerships and facilitate knowledge transfer to address common challenges and opportunities. Innovate UK and the Audience of the Future Challenge Fund are committed to supporting UK businesses to collaborate internationally and to be the most successful and innovative they can be. This mission is an important step towards delivering on this commitment in the Immersive Technologies space."

Matt Sansam, Head of Delivery for Audience of the Future Challenge Fund, Innovate UK

Acronyms and Definitions

AI: Artificial intelligence

AotF: Audience of the Future

AR: Augmented reality

Chaebols: Large companies based in South Korea

GEM: Global Expert Mission

HMD: Head-mounted display

IoT: Internet of things

JITT: Just-in-time training

ML: Machine learning

MR: Mixed reality

NHS: National Health Service

OECD: Organisation for Economic Cooperation and Development

OEMs: Original equipment manufacturers

OLED: Organic light-emitting diode

SaaS: Software-as-a-service

SME: Small and medium-sized enterprises

UX: User experience

VR: Virtual reality

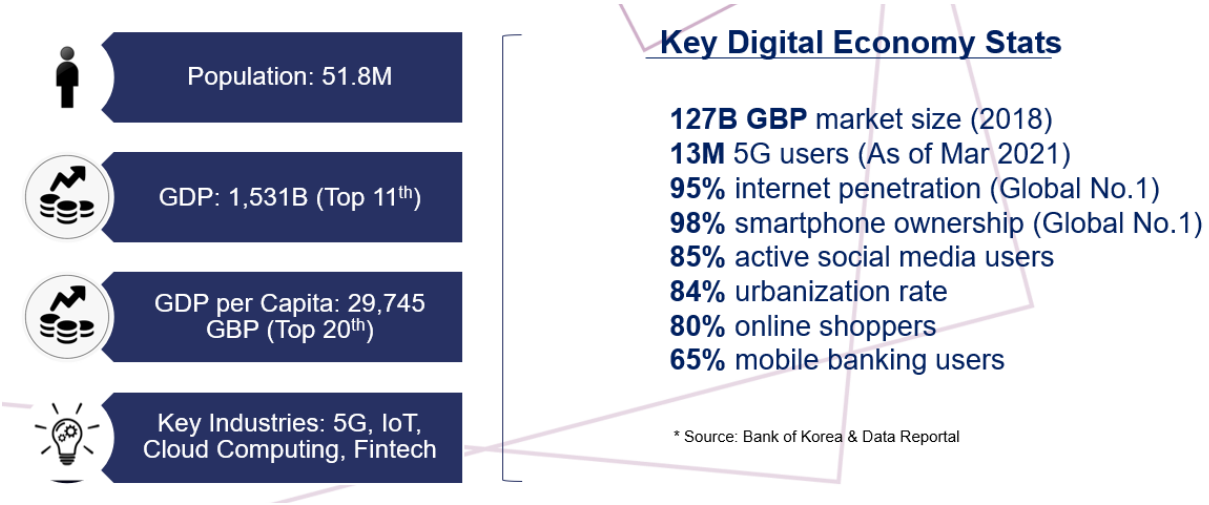
WebXR: Web-based immersive reality

XR: Extended reality - an umbrella term for all the immersive technologies

1. South Korea's Digital Economy

South Korea has a well-developed technology infrastructure, leading the world in terms of internet penetration (95%) and smartphone ownership (98%).[1] The country has a strong standing as a hardware manufacturer and as a global digital leader that lives and breathes technology (see Figure 1). As an example, gaming is one of South Korea's largest internal markets, with 55% of the population describing themselves as 'gamers' and spending 49 minutes each day on mobile games. The country's main industries within the digital economy are 5G, IoT, Cloud Computing and fintech.

Figure 1: South Korea digital economy snapshot[2]



South Korea has a vibrant ecosystem of companies, ranging from international conglomerates, such as Samsung, LG and Hyundai, to embedded players who are dominating the taxi-hailing market, including Kakao T with an 80% market saturation, and internet search engine market, with Naver being the default. These larger organisations are known as chaebols; large family-owned industrial conglomerates which dominate South Korea's economy. Conglomerates and venture capital firms are also active in the digital space, running well-known incubators and investing in the country. The country is also home to eleven unicorns, many of whom are supported by the Ministry of SMEs and Start-ups. These unicorns include Coupang, Krafton, Woowa Brothers and Viva Republica.[3]

While South Korea's start-up scene is relatively nascent, it has grown quickly over the last few years. However, one barrier is that many of these start-ups lack the knowledge or expertise to move beyond the country's borders. By way of contrast, larger-scale companies often invest significantly in R&D, with the gulf between SMEs and conglomerates consequently widening. Nonetheless, with the government's support, SMEs hope to maintain a competitive edge as they access new markets over time.

[1] https://www.oecd.org/economy/surveys/korea-2020-OECD-economic-survey-overview.pdf
[2] Data presented by the British Chamber of Commerce in Korea during the session.
[3] http://www.douglaskorea.com/startup-technology/11-biggest-k-unicorns-in-korea/

2. The Immersive Technologies Landscape

South Korea's policies can be split between public policy and private sector strategies to capitalise on the rapidly growing immersive technologies space.

2.1 Policy

The South Korean government implements a number of policies and support mechanisms to assist domestic start-ups and help them grow into sustainable enterprises that can boost employment and drive innovation.

2.1.1 The 2019–2023 Immersive Technologies Roadmap

An inter-governmental department coalition named the 5G+ Strategy Committee is now in the midst of executing its 2019-2023 Immersive Technologies Roadmap, which will lead to a total investment of £847 million in immersive technologies. The roadmap supports the formation of a strong ecosystem of innovation through services provided by designated regional virtual reality (VR) and augmented reality (AR) production centres.[4]

Priorities under the 2019-2023 Immersive Technologies Roadmap include:

- training applications (the country employs conscription, and training is a core part of military service);
- introducing VR/AR in public spaces;
- developing holographic and light-field camera technologies;
- setting up content creation studios and nurture start-ups;
- establishing an ICT regulation sandbox for defence, healthcare and holography.

2.1.2 The Digital New Deal

Efforts are now being redoubled by the government's Digital New Deal, announced on 14 July 2020, in response to the economic difficulties caused by the outbreak of COVID-19. A total investment of £543 million will be made by 2025 to drive efforts to generate employment and growth in four broad areas; expanding the number of cloud data centres to create a form of 'data dam', integrating the 5G network with the artificial intelligence ecosystem, developing the digital and online education infrastructure and further deepening a contactless society through increased remote healthcare as well as the creation of smart factories.

As part of the Digital New Deal, the South Korean government has also pledged to transfer all internal data centres in public offices to private or public cloud servers by 2025. Furthermore, the government has also launched the Cloud Flagship Project, which will provide £16.6 million to local private sector companies to create cloud solutions for applications in the five areas of manufacturing, logistics, healthcare, education, and social welfare.

The Digital New Deal will also remove a number of regulations that have impeded deployment[5], such as:

- providing personal data handling guidance and teaching guidelines for using HMDs;
- distributing HMD and AR manuals to be used for quality control and inspection in manufacturing;
- utilising AR for telemedicine;
- permitting AR glasses while driving;
- streamlining the VR/AR content authorisation stage.

2.2 Business Development Strategies

South Korea's VR/AR market has grown quickly, with an annual growth rate of 33% since 2013 (see Figure 2). Its growth is largely due to South Korea's expertise in display and optics technologies – two key components for building HMDs. The country owned 50% of the global market share of display technologies in 2019 and plan to own 70% by 2025.

Immersive technologies have already been adopted across multiple sectors, with significant uptake in South Korea's manufacturing sector in particular, currently worth 29.4% of GDP[6]. The country seeks to keep its technical manufacturing

[4] Innovate UK internal Immersive Technologies Global Technology Report 2020
[5] https://english.moef.go.kr/pc/selectTbPressCenterDtl.do?boardCd=N0001&seq=4940
[6] https://data.worldbank.org/indicator/NV.IND.MANF.ZS?locations=KR

in the country, using VR/AR technologies to upskill workers via AR manuals and staff training. South Korea is looking to boost its domestic capabilities using immersive technologies and to revolutionise the smart factories of the future.

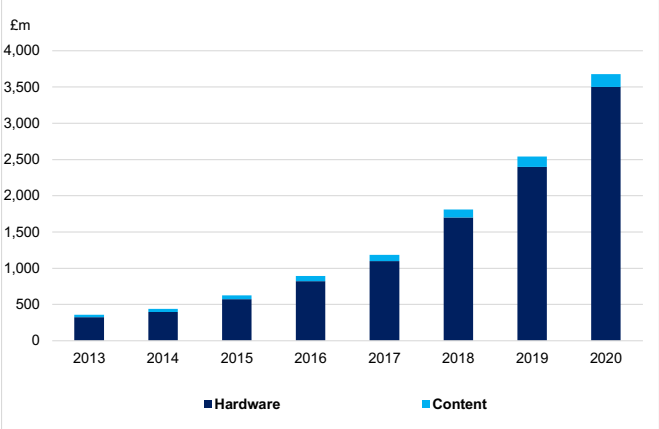
Within the private sector, Korea's digital economic growth has traditionally been driven by world-leading electronics companies and mobile carriers. In mid-2020, for example, SK Telecom (SKT), Korea Telecom (KT), and LG U+ all agreed to invest $2 billion before 2022 to boost 5G infrastructure across South Korea[7]. These technologies also blend into the use of AR and VR, as content can be streamed at lower latency onto hardware. We are now starting to see small and medium-sized companies, such as Virnect and Meddiction, driving investment and innovation.

While the country has a natural advantage in the space due to its world-leading manufacturing capabilities, there are opportunities for growth. The country imports 90% of HMDs from overseas, as they do not have any domestic companies that specialise in building headsets[9]. The same is true with sensor technologies, where the country imports capabilities internationally.

In terms of research and innovation, much of it is being conducted by larger companies rather than start-ups. Chaebols promote a large bulk of R&D investment, dwarfing the 92.3% of players who operate as SMEs. By comparison, start-ups do not conduct as much R&D into their own services[10].

Recognising the opportunity, South Korea imports a range of technologies to help spur their technological research, as well as investing in home-grown talent via their universities. With the wide-ranging investments from the South Korean government and the venture capital of several conglomerates, South Korea works hard to maintain its leading edge in the tech space.

Figure 2: South Korean AR/VR market size[8]



[7] https://www.rcrwireless.com/20200716/5g/south-korean-operators-invest-22-billion-5g-networks-2022
[8] Data presented by the British Chamber of Commerce in Korea during the session.
[9] https://www.kistep.re.kr/board.es?mid=a10306020000&bid=0031&b_list=10&act=view&list_no=34949&nPage=19&keyField=&orderby=
[10] https://www.kocca.kr/cop/bbs/view/B0000147/1837191
do?searchCnd=&searchWrd=&cateTp1=&cateTp2=&useAt=&menuNo=201825&categorys=0&subcate=0&cateCode=&type=&instNo=0&questionTp=&u
Setting=&recovery=&option1=&option2=&year=&categoryCOM062=&categoryCOM063=&categoryCOM208=&categoryInst=&morePage=&delCode=0&qtp=&pageIndex=1

3. Impact of Immersive Technologies in Industries

Spurred by both public and private investment, South Korea is one of the most predominant immersive technology markets globally. Home to major original equipment manufacturers (OEMs) like LG and Samsung, the country influences multiple markets with their hardware innovations. The country's lead in developing display technologies makes the country critical for creating key components for both VR headsets and smart glasses[11].

This section explores how immersive technologies impacts individual industries, and how it provides new ways for businesses to improve education, learn new skills, and many other approaches.

3.1 Gaming and Creative Industries

With the rise of VR and AR, companies have begun exploring how immersive technologies can be used to entertain and delight users. From VR arcades to AR minigames, both South Korean and UK companies are pushing the boundaries for what immersive gaming can do.

Gaming is a national pastime in South Korea, with tens of millions of gamers who play each day, 90% using their mobile phones[12].

South Korea's VR/AR gaming industry was estimated to be worth £1.84 billion in 2018, growing over time as more players are introduced to the new technologies[13].

Against this backdrop, the general consensus is that VR and AR will have a seismic impact on the gaming and creative industries in South Korea over the coming years; however, the hardware is not yet sufficiently developed for a wider rollout.

3.1.1 Overview of South Korean Participants

Let's moim spatial community[14]

Owned by Thirteenth Floor Corp., the Let's moim spatial community introduces a way for companies to create avatars and give presentations in shared spaces, fit for meeting rooms, conferences, or cinemas. The initiative is part of a wider suite of services, helping clients create virtual worlds or games to service their project briefs.

Innotech Media[15]

Innotech Media provides a suite of services like motion simulators and AR experiences. The team works across a range of practice areas, from creating animations to digital theme parks.

Emotionwave[16]

Emotionwave was founded to connect humans with their emotions, using technology as the carrier. A principal focus is musical experiences, creating engaging VR conferences where users can hop into virtual worlds and enjoy musical performances.

The company also provides AR music visualisation tools, expressing music via new dimensions, as well as an MR streaming platform so that it is easier to livestream the content across multiple platforms.

3.1.2 Sector Insights

It became apparent during the mission that wearables could be a game-changing innovation that will likely influence the gaming and creative sector. With hardware adding a virtual layer to users' interactions, it opens new doors to the way companies can create engaging and creative experiences for consumers.

It is undeniable that the COVID-19 pandemic of 2020 brought new challenges and opportunities to the gaming and creative industries sector. While it became difficult for teams to work together, forcing companies to develop new solutions for users

[11] https://www.nature.com/articles/d41586-020-01466-7
[12] https://www.statista.com/statistics/832113/south-korea-share-of-gamers-by-platform/
[13] https://english.msit.go.kr/eng/index.do
[14] Let's moin spatial community is a part of Thirteenth Floor Corp. To learn more about the company, visit: http://thirteenthfloorcorp.com/
[15] http://intmedia.co.kr/
[16] https://emotionwave.com

to wear VR headsets and interact with new virtual worlds. These devices are not yet widely used, though the release of the Oculus Quest 2 in 2020 spurred a rise in interest across South Korea on its potential. This was largely prompted by SK Telecom, which is selling the device in the country[17].

Collectively, many South Korean companies want to provide a metaverse service; live virtual worlds or interactive planes where users can congregate, socialise and create new experiences. While this will operate on a more experimental stage, South Korean experts are already looking ahead. One UK delegate observed that many young people have the skills to develop metaverse content, such as in Roblox, but are unemployable due to their age[18]. As such, one recommendation is to create a pipeline of skills that can help young people train, ahead of their employment.

A significant barrier that became evident through the mission is the standardisation of content. Both South Korean and UK companies lack the common framework for an agreed filetype for immersive content, essentially a JPG or PNG equivalent for VR/AR; Pixar created a format, called the Universal Scene Description[19]. By having a standard format that everyone can agree on, it will become easier for multiple virtual worlds to be built and interact with one another, stimulating the sector's growth further.

Another challenge is user interactions and comfort. Across both the UK and South Korea, markets are more comfortable with mobile phones and PCs than headsets or displays, which add friction to user experiences. To combat the friction, VR headset manufacturers are focusing on higher-quality HMDs with a better resolution, reduced motion sickness and reduced friction of access. Beyond hardware, the main obstacle for many users is fatigue and nausea caused by extended play; this is a key area that should be resolved[20].

A final barrier that came to light is finding the right area of collaboration. Given that the market is still relatively nascent in the gaming and creative industries, the main opportunities for partnership working are linked to established technologies like 5G.

As mentioned earlier in the report, 5G is an important part of South Korea's policies and it impacts the gaming sector, providing a new way to deliver content to customers. Instead of buying hardware, customers have the option to wirelessly stream their content via mobile connectivity, as a cloud-based service. Further, 5G has lower latency, making user inputs more seamless. One delegate noted that they would like to see telco companies continue their work incorporating 5G with VR, so that experiences can be delivered seamlessly via the cloud without powerful hardware on-site. Exploring more ways to deliver content to customers, South Korean delegates are excited about how it could reduce the price and weight of VR headsets and facilitate ease of access to the market. If deployed successfully, immersive technologies can then reach millions of potential gamers who are using 5G technologies, opening new commercial opportunities for companies.

In summary, the mission revealed an interest in how immersive technologies can and will be used across the gaming and creative sectors, whilst noting that there needs to be further hardware innovation before the market can reach its potential. However, when it does, South Korea aims to be prepared with software solutions that use the technology to its best degree, such as interactive metaverses, which were widely discussed in the session. South Korean companies may be able to help build virtual worlds that the UK can help export to other countries, or the UK can help the development of new ways users can interact with one another.

3.2 Healthcare

South Korea is using immersive technologies to combat challenges related to chronic illnesses, overpopulation and lack of high-skilled personnel in healthcare. The uptake of immersive technologies in healthcare has grown steadily, estimated to be worth 17% of the market[21].

The South Korean government continues to explore the area to improve processes and maintain their healthcare system. Immersive technologies form a part of their research and investment.

3.2.1 Overview of South Korean Participants

Looxid Labs[22]

Looxid Labs is a tech start-up working to seamlessly integrate an emotion recognition system with VR using an eye and brain interface. Their emotion recognition system for VR users analyses users' emotional states in real-time by measuring physiological information, including brainwave, eye movement and pupil size and employing machine learning algorithms.

The company is developing the world's first technology that seamlessly integrates an emotion recognition system and thus

[17] http://www.koreaherald.com/view.php?ud=20210201000801
[18] https://venturebeat.com/2020/07/28/roblox-expects-to-pay-250-million-to-its-mostly-teen-developers-this-year/
[19] https://graphics.pixar.com/usd/docs/index.html
[20] For more information on cybersickness: https://www.frontiersin.org/articles/10.3389/fpsyg.2019.00158/full
[21] https://www.khidi.or.kr/eps
[22] https://looxidlabs.com/

contributes to developing a completely new VR interaction technique.

Daegu Gyeongbuk Institute of Science and Technology (DGIST)[23]
Daegu Gyeongbuk Institute of Science and Technology is an internationally recognised university working on creative and challenging R&D projects. The university contributes to the advancement of knowledge and the prosperity of its region, country and the international community.

The university is particularly invested in immersive technologies, such as AR-assisted human-robot interaction devices and AI-assisted tracking in VR. It is investigating how to innovate and implement greater efficiencies in healthcare.

Daejeon University[24]
Daejeon University is investigating the use of VR to improve healthcare, including how it can support collaboration and enact health-related procedures. The university's research team aims to create a VR environment for smart healthcare, where businesses can use virtual technologies to improve their work.

Korea Research Institute of Standards and Science (KRISS)[25]
The Korea Research Institute of Standards and Science is the national measurement standards laboratory for South Korea. It is a government-funded organisation responsible for providing national standards and advancing technologies.

3.2.2 Sector Insights

During the mission, South Korean experts pinpointed the two largest areas where immersive technologies are being applied in healthcare; education on medical procedures and neurorehabilitation.

One barrier South Korean experts noted is the license authorisation process in the country; while they understand that regulations are important for safety, these do create hurdles for the deployment of their services as they navigate the approval system. The UK faces the same barriers in its National Health Service. For both countries, it can take years to commercialise a product and incorporate it into the healthcare system.

Another blind spot is around data; South Korea experiences challenges in collecting normative data. This challenge renders it difficult to test the impact of new healthcare innovations across a broad swathe of patients, producing gaps in knowledge that mask the influence of innovation. The UK could help with this process, as the country has a robust system of collecting relevant data for medical usage (although the country also has barriers regarding approvals for collection and cybersecurity).

While there may be scope for collaboration, all delegates agreed that there need to be further discussions on how to work together. Healthcare is a large and complicated field with major differences between the countries, and the delegation agreed that it warrants further exploration. There is a clear opportunity for both countries to share their knowledge and insights in the future and to learn from one another in the healthcare space.

3.3 Education and Training

As part of its industrial strategy, South Korea dedicates a lot of time and effort to improving its training programmes across education and industry. Recognising the benefits of upskilling workers to high-value roles, the country is exploring new ways in which workers can learn their curriculum, either in a role or in an educational institution.

The country's approach includes investment to boost development in key sectors, in an effort to spur high-quality job creation and improve the quality of its education across businesses and schools[26].

3.3.1 Overview of South Korean Participants

M-Line Studio[27]
Founded in 2005, M-Line Studio creates VR training simulations for its clients. The team is specialised in increasing safety awareness, helping employees navigate their professions and conduct their roles safely. Recently the M-Line Studio has started to expand its content library to include job training, rehabilitation and exhibition experiences, applying its skillset across multiple new areas.

SAMWOO Immersion[28]
SAMWOO Immersion is a company that specialises in developing intelligent monitoring solutions based on immersive technologies. The team is carrying out various national R&D tasks and projects and focusing on creating training simulations for companies across multiple sectors. The company has helped with upskilling workers in several smart factories to help them learn the core skills of their role more effectively.

[23] https://www.dgist.ac.kr/en/
[24] https://www.dju.ac.kr/en/main.do
[25] https://www.kriss.re.kr/eng/main/main.html
[26] http://www.koreaherald.com/view.php?ud=20201210000379
[27] http://m-line.tv/
[28] http://www.samwooim.com/en/main

ClassV[29]
ClassV is a contactless VR classroom, a secure service where pupils can log into virtual worlds and educate themselves on important topics. Linked to this is Comix V, a content provider that supplies the materials for the classrooms. Collectively, these immersive training solutions help pupils learn new skills and topics that can help with their education and development. An example is web-based coding development, enabling pupils to make their own WebXR experiences after learning in class.

3.3.2 Sector Insights

In the education and training space, universities are testing and experimenting with immersive technologies to improve education, and there is now a push for schools to use these new and emerging technologies as well[30]. The mission drew a differentiation between tools and programmes; solely providing tools without guidance leads to minimal impact for the end-user who may not use tools to their greatest potential. In order to maximise the opportunity, tools must be paired with programmes that help teach their use.

The mission demonstrated how location-based VR training centres are a successful way forward for services, allowing companies to create sophisticated environments that do not need to be moved and where companies can train their workers with a wide range of equipment and tools. While the construction of training centres and subsequent access can take time, the benefits include a system where companies can rotate in and out when needed. This proposition appealed to UK delegates who deploy their services rather than run location-based systems.

The mission demonstrated an appetite for both countries to collaborate in this space. The UK has a strong position in content creation, which could be transferred to South Korea for their own training systems. Additionally, South Korea would like more bilateral funding opportunities so they can work together with the UK.

3.4 Manufacturing and Engineering

South Korea is one of the leading countries in the world in manufacturing. Its manufacturing sector accounts for 29.4% of its domestic GDP, the highest amongst all OECD countries, and comprises over four-fifths of exports. Globally, the country is ranked third after the US and China[31].

As part of their continued dedication to improving their processes, companies are exploring how immersive technologies can improve the supply chain.

3.4.1 Overview of South Korean Participants

Augmented Knowledge Corp[32]
Augmented Knowledge Corp. is a spin-out from Inha University AI Laboratory. Since 1991, the team has strived to unify AI and AR, and implement the two for Industry 4.0 applications, such as technical maintenance.

Magenta Robotics[33]
Magenta Robotics is an IT company specialised in researching new technologies and facing industrial challenges. The company prides itself in leading domestic robot industries and is leading the way in robotic controls and image recognition.

Nexivil[34]
Nexivil is a company specialising in design automation consulting within the civil engineering field. Through the fusion of the latest web technology and civil engineering, the company helps engineers work more efficiently and produce successful design results.

3.4.2 Sector Insights

In South Korea, smart factories are a key area where immersive technologies have witnessed a sizable adoption across the country. As the country has a world-leading factory supply chain in place, the deployment of immersive technologies in facilities maintenance is already helping the country improve its productivity and efficiency.

The mission highlighted an interest in the use of immersive technologies with safety tags that can be scanned on-site, whereby workers are taught the core skills required for the safe operation of a system. By scanning tags on-site, for example, engineers could receive a full analysis of the supply chain, which they can incorporate as part of their daily process. This helps workers have a broad overview of the chain, and cements their skills as they understand the whole process. Additionally, use-cases will appear in the future where workers could work remotely to fix issues or conduct maintenance, such as incorporating VR with a robot that is then deployed on-site. By controlling the robot from a remote location, workers can safely navigate potentially dangerous areas to maintain systems – and by using VR, workers can better understand their environment and perform their role better.

Immersive technologies naturally work closely with digital twins, as a virtual replica of a real-life object can then be used with

[29] https://comixv.com/
[30] https://www.ajudaily.com/view/20201112095430606
[31] https://data.worldbank.org/indicator/NV.IND.MANF.ZS?locations=KR
[32] https://augmentedk.com/
[33] https://en.magentarobotics.com/
[34] https://www.nexivil.com/

various VR/AR deployments. Companies can create a virtual twin of a complex object, such as a Boeing 737, and interact with the intertwining systems and connections to analyse potential problems or areas of efficiency improvement. The same concepts also apply to the development of smart cities, to help workers visualise how the interconnected components of a city work together to improve efficiency. Much of this is supported by the South Korean government via support and funding, similar to other industry areas.

The mission demonstrated that South Korean universities have a lot of resources that can help test solutions before wider deployment across manufacturing, such as 5G capabilities. This is one area where the UK could work with the country, as UK companies could test their capabilities within South Korean university training labs or facilities.

A debate occurred between the uses of smart glasses and mobile phones. On the one hand, mobile phones offer a means of deploying AR experiences with an easy-to-use interface that works across the smart factory, using a device that nearly everyone has access to and cuts costs on using specialised hardware. But, on the other hand, mobile phones are more limited than smart glasses, which offer 3D visualisation and a hands-off way to provide contextual information.

The mission highlighted how clustering SMEs together as part of a programme, rather than asking individual SMEs to work out areas of partnership, could be beneficial. By bringing SMEs into one group, it would be easier for all participating companies to attain the benefits of working together and achieve growth, breaking barriers between businesses.

3.5 Cross-Sector Insights

Immersive technologies are used in South Korea in numerous ways, depending on their application area and use-cases. Common themes observed across sectors include:

- **Smart glasses:** As AR is increasingly used in wearables, new types of interactions will greatly benefit manufacturing and create new gaming types.
- **Metaverse:** South Korea is keen for a potential metaverse where people can converse in a virtual world.
- **VR headsets:** Delegates agreed that hardware needs improvement before it is more viable for mainstream adoption, such as reduced weight. 5G is a key part of this, as content can be delivered via the cloud instead of running on-site hardware.
- **Dynamic policy:** South Korean policies, from bodies such as the Ministry of Science and ICT (MSIT), allow companies to move quickly and adopt new technologies that the UK can learn from; one example is the Digital New Deal. It includes changes like allowing AR glasses while driving and streamlining VR/AR content authorisation – both of which are designed to spur innovation[35].

[35] https://english.moef.go.kr/pc/selectTbPressCenterDtl.do?boardCd=N0001&seq=4940

4. Collaboration Opportunities

The mission highlighted how both countries have a lot to learn from each other in terms of best practice and applicability. Additionally, both countries want to understand more about how immersive technologies can be used across multiple markets.

The UK has a strong content creation capability and creative industry that can be used to supply relevant use-cases for South Korea. That said, further discussions are needed on precisely what content may be required for the partnership to flourish. Moreover, the UK offers a platform where South Korean companies can access international markets, creating a broader reach for all participating companies.

South Korea maintains a world-leading specialism in display technologies, such as holoprojection. Much of the country's innovation comes down to chip development and technological expertise, which South Korea leads on a global scale. By working together to combine strong content with seamless hardware, users would benefit from a cohesive package that reduces the friction of entry to VR and AR.

A prominent area of discussion was the metaverse. South Korea, in particular, is excited by the prospect of the metaverse, which could impact multiple industries. While there are multiple definitions bouncing across countries, the metaverse is commonly understood to be a virtual world where people can socialise. Start-ups in South Korea are excited to contribute their services to these upcoming shared spaces. One area of clarification needed is to identify the benefits for investors and stakeholders, as well as defining a purpose for the use of the metaverse to help shape its expansion. As the metaverse is global in nature and transcends boundaries, it is a discussion that directly impacts not just the UK and South Korea, but the world.

5. Conclusions

The mission highlighted an enthusiasm for immersive technologies in both the UK and South Korea and a belief in their future use. All delegates agreed that there is a need to integrate immersive technologies with other trends, such as digital twins and 5G, to offer new possibilities for consumers and businesses alike.

A barrier that both countries face is the hardware limitations of current HMDs and clarification on the ways in which both countries can work together to expand their reach. While the technology opens new opportunities for businesses, it has not reached the stage of mass adoption for funding models to be accessible by companies or the specifications to reduce nausea. However, there is a sense that in five years' time both countries will be ready to deploy their services once the hardware catches up with the software.

Some broad conclusions that delegates reached during the sessions include:

- Progress is needed on the development of smart glasses, which will open new doors for both enterprise and consumer users.
- The potential for VR headsets is evident, but further innovations are required before they are applicable for widespread use.
- Applying 5G is one path to reduce the cost of VR headsets, as content can be delivered via the cloud instead of on-site components.
- South Korea finds it difficult to collect normative data that could be used for medical research, a system that the UK could assist with.
- South Korea is incredibly dynamic, pushing technological advances via a nimble approach and structure.
- By working with the UK, South Korean companies can access not just the UK market, but also additional global markets.
- South Korean universities have top-tier assessment facilities, where UK companies could use their services to test before deployment.
- By bringing all the SMEs into one area, all participating companies may find it easier to collaborate and deliver information. In this way, it breaks down the barriers between businesses and fosters collaboration.
- South Korea's excellence in display technologies would greatly benefit companies in the UK building hardware.

Annex 1

List of UK Participants

Advanced Manufacturing Research Centre
ARUP
British Embassy, Seoul
Digitalnauts
Fictioneers
Hatsumi
Immersive Rehab
Innovate UK
Make Real
Manchester Metropolitan University
National Health Service
Retinue
Sentireal
Shadow Robot Company
UK Department for Culture, Media and Sport (DCMS)
University of Leeds

Annex 2

List of South Korean Participants

Augmented Knowledge Corporation
British Chamber of Commerce in Korea
Daegu Gyeongbuk Institute of Science and Technology (DGIST)
Daejeon University
Emotionwave
Hwang Korea VR AR Industry Association
Information & Communication Technology Promotion (IITP)
Korea Institute for the Advancement of Technology (KIAT)
Korea Research Institute of Standards and Science (KRISS)
Looxid Labs
M Line Studio
Magenta Robotics
Ministry of Culture, Sports and Tourism
Nexivil
SAMWOO Immersion
Thirteenth Floor Corp.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