OXFORD ECONOMICS

GEN Z'S ROLE IN SHAPING THE DIGITAL ECONOMY

TECHNICAL ANNEX

MARCH 2021

OXFORD ECONOMICS

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March 2021

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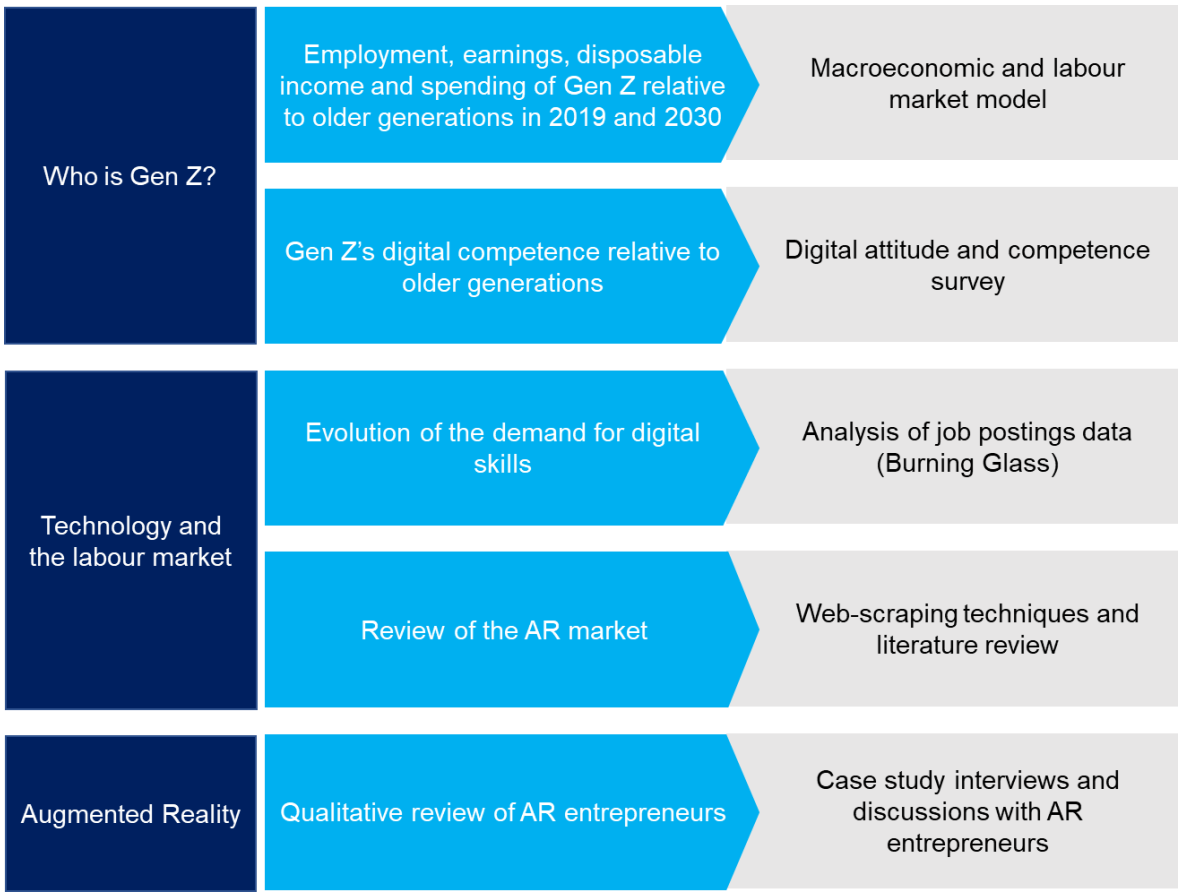
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1. INTRODUCTION

This technical annex provides more information on the methodology and data sources behind modelling used within our study for Snap, Inc. on Gen Z's role in shaping the digital economy.[1]

Fig. 1. Overview of our modelling approach



We have called upon evidence from a wide variety of sources as part of work (as shown in **Error! Reference source not found.**), including:

- **Macroeconomic and labour market position of Gen Z** based on research including a literature review and the collection of official data to help support and validate our propositions which lie outside the scope of the above.
- A **consumer survey** of individuals across all six markets in scope. Quota sampling was used to ensure a broadly even mix between different generations, defined as those aged 16 to 24 (Gen Z) 25 to 39 (Millennials) and 40 to 55 (Gen X).
- **Job postings data** purchased from Burning Glass (BG) covering the period between 2014 and 2019.

[1] [Insert link to report when available]

- **Web scraping techniques** to help collect information on the current size and economic contribution of the AR sector globally.
- **Interviews** with 15 AR experts working across the markets in our study.
- Discussions with experts from various fields including economics, education, skills and industrial policy. These have informed our calls to action.

The rest of this document is structured as follows:

- Chapter 2 presents a summary of our analysis of the macroeconomic and labour market position of Gen Z;
- Chapter 3 discusses the consumer survey;
- Chapter 4 discusses our analysis of the Burning Glass dataset;
- Chapter 5 discusses our review of the AR market and our interviews with AR experts who work as entrepreneurs in the various markets in our study.

2. MACROECONOMIC AND LABOUR MARKET POSITION OF GEN Z

The aim of the Gen Z macro and labour market model was to understand how the contribution of Gen Z to the economy and the labour market will evolve over the next decade. Our starting point was official statistical data in each market in our study which was used to develop a detailed picture of the pre-pandemic (end-2019). These statistics served as the foundation for our forecasts for Gen Z in 2030.

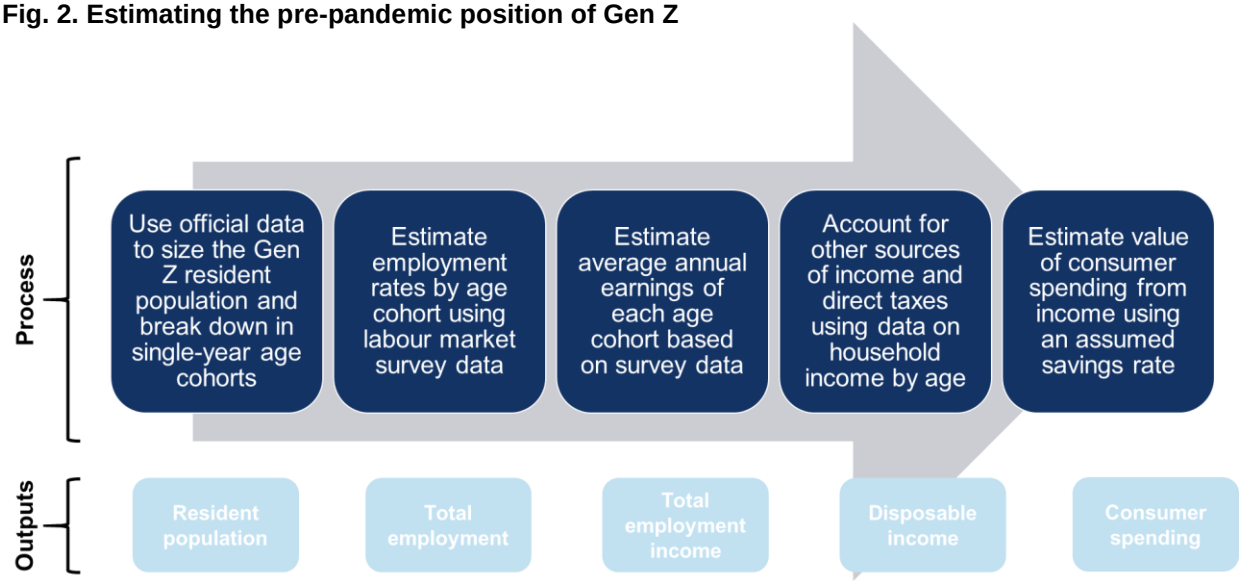
2.1 PRE-PANDEMIC POSITION OF GEN Z

The pre-pandemic position of Gen Z was estimated in the following steps, as described in Fig. 2:

- For Gen Z and the rest of the population, we estimated the **population sizes** by age cohort using national statistical sources, and **numbers in employment** and **employment rates** by age cohort using labour market survey data.
- **Total employment income** was based on estimates of average annual earnings by age cohort based on survey data.
- **Disposable income** was then estimated by accounting from income from non-work sources and taxes using data on household income by age.[2]
- **Consumer spending** by age cohort was then calculated from disposable income using an assumed savings rate.

[2] This analysis covers the spending that could be independently supported by Gen Z through their own income, i.e., it excludes spending influenced by Gen Z (e.g., instances where Gen Z influence their parents to make a purchase).

Fig. 2. Estimating the pre-pandemic position of Gen Z



2.2 FORECASTING THE MACROECONOMIC POSITION OF GEN Z IN 2030

To produce forecasts for the metrics listed above in 2030 we have relied on the following projections and assumptions:

- **Official projections** for the **resident population** by age cohort – these are produced using a model factoring in assumptions on the birth rate, mortality rate and net migration by demographic. [3]
- We have assumed that the **relationship between age** and an **individual's labour market status** (employment rate and earnings relative to the economy-wide average **remains as it was in 2019**).
- In-house **forecasts** for economy-wide **earnings growth** in each country. These reflect changes in inflation, labour market conditions and productivity.
- In-house Oxford **forecasts** for changes in the **structure of direct taxation** – these factor in any announced policy changes.

[3] In our forecasts, the size of Gen Z increases in 2030 compared to 2019 as the markets we are covering are expected to enjoy a net inflow of Gen Z migrants over the next decade. This seems intuitive given that wages in the six markets in our study (the key driver of economic migration) are significantly higher than the global average.

3. DIGITAL COMPETENCE SURVEY

For our study, we developed a bespoke measure of digital skills in each market by age cohort. The index was based on a survey of the adult population in each country. We describe the sample, questionnaire, and our methodology to construct the digital competence index in this chapter.

3.1 SAMPLE

The survey was based on a representative sample of respondents in each country. The number of people surveyed is shown in Fig. 3. The survey responses were weighted to give an accurate representation of the age composition within each age cohort. For the average results across all six markets, a simple average is used. Implicitly, this attributes the same weight to all countries irrespective of their respective population sizes.

Fig. 3. Survey sample by age cohort

	16 to 24	25 to 39	40 to 55
Australia	502	514	505
Germany	502	530	542
France	509	515	510
Netherlands	500	503	500
United Kingdom	514	537	521
United States	598	721	717
Total	**3125**	**3320**	**3295**

Source: YouGov data, Oxford Economics analysis

3.2 QUESTIONNAIRE

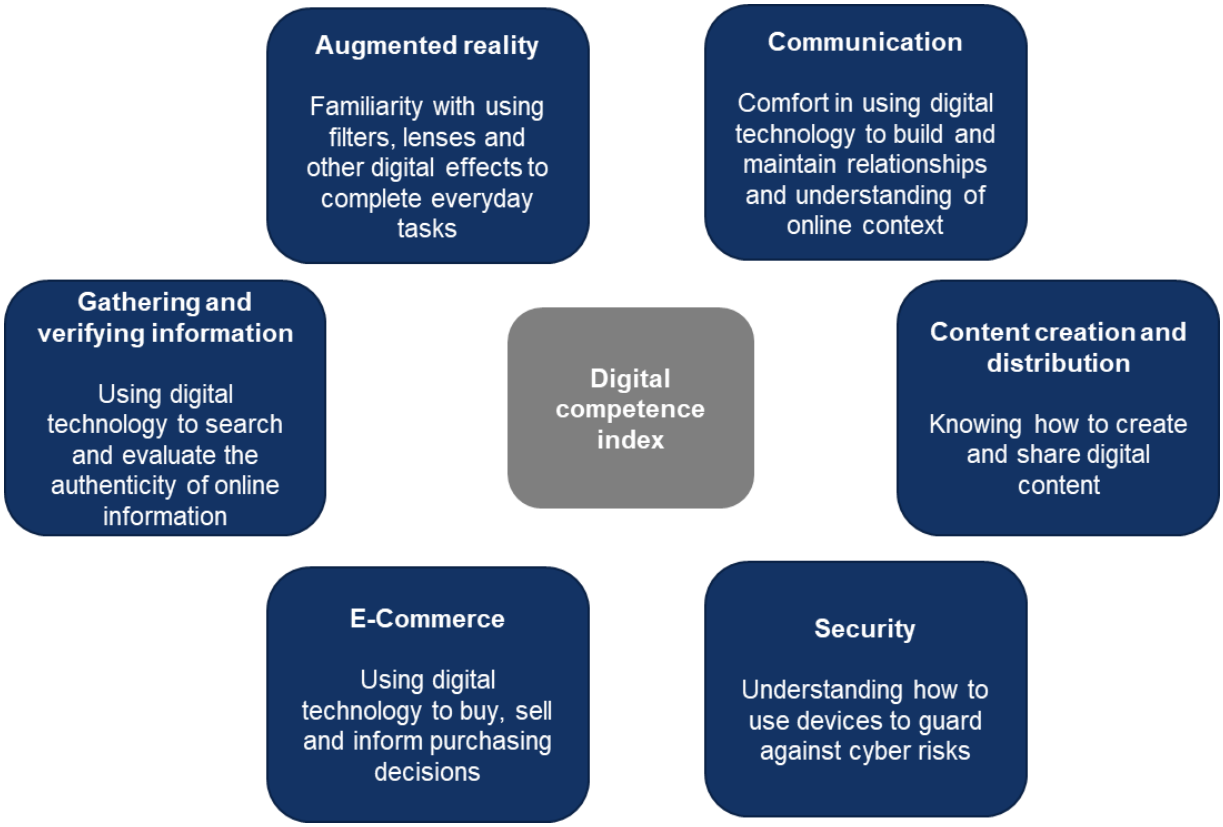
The survey questionnaire asked individuals to rate their attitudes towards digital technology, their ability and comfort in using digital technology and their experience in using digital technology for remote learning and/or remote working during lockdown.

The full questionnaire is presented in Annex 1.

3.3 DIGITAL COMPETENCE INDEX

We then combined the responses to the questionnaire to create a measure of digital competence for each individual respondent. Answers to each question were normalized and aggregated into an index where a score of 100 corresponds to the average of all respondents across the six markets.

Fig. 4. Components of the digital competence index

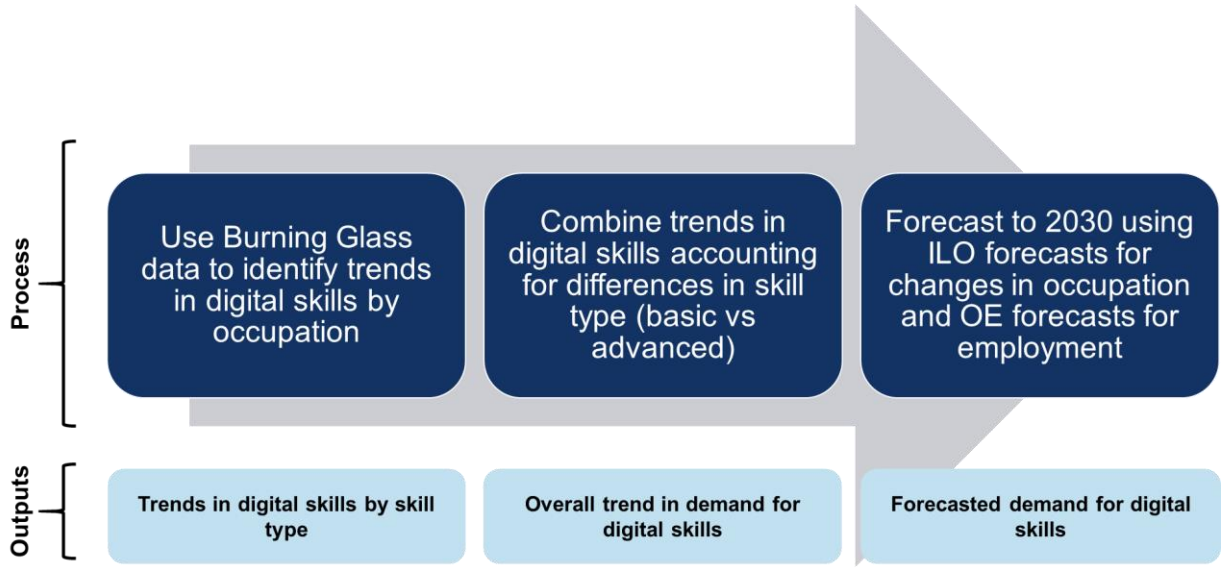


4. DEMAND FOR DIGITAL SKILLS

Our analysis of the demand for digital skills over the last few years, including post-pandemic, was based on data on job postings from Burning Glass. The data was used to test whether the demand for digital skills has been accelerated by the Coronavirus pandemic, and the extent to which these trends are likely to continue in the future.

We followed a three step process as described in Fig. 5 below.

Fig. 5. Estimating the demand for digital skills



4.1 BURNING GLASS DATASET

We obtained detailed job listings data from Burning Glass for six countries: Australia, France, Germany, the Netherlands, UK and the USA. This dataset identifies the skills listed as requirements for various jobs and classifies them as digital (further classified into various types such as ICT skills, information processing skills, etc.) and non-digital skills. A job that lists at least one digital skill among its requirements is classified as a digital job.

The taxonomy of skills (and their subsequent classification) is different for each country. We have mapped the skill types across countries for consistency and to enable cross-country comparison.

To account for the differences in the nature of digital skills, we created a score for each job by reweighting different skill types required by assigning higher weights to the more complex skills. In other words, basic skills get a weight of 1 whereas intermediate and advanced skills get a weight of 1.5 and 2 respectively.

The average score is then calculated for each occupation group, which is then weighted to account for the occupational structure of the economy (based on ILO data for the relevant year) and normalized for each country.

We then forecast the future growth rate based on the historic trend (using the average growth rate or the implied growth from a fitted polynomial).

The future growth is combined with the 2019 digital share of jobs and the Oxford Economics baseline data and forecasts for employment for 2019 and 2030 respectively to obtain the forecast for digital jobs in 2030.

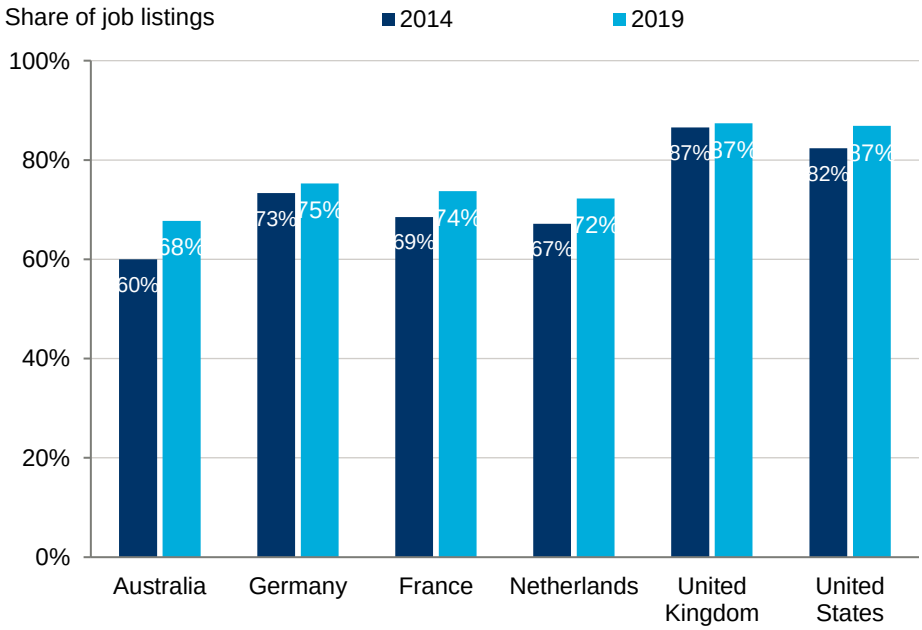
4.2 TRENDS IN DEMAND FOR DIGITAL SKILLS

Using the job listings dataset aggregated at the 'skill cluster' leve, we have analysed how the demand for digital skill clusters have evolved in each of the six markets in our study, both in absolute terms and controlling for the number of job listings.

At a very high-level our data points to a gradual digital shift in the labour market over the past five years. The chart opposite compares the share of 'digital' jobs in BG's listings – defined a job which requires at least one digital skill.

In all six markets this share was higher in 2019 compared to 2014 albeit the trend in the UK was very weak (although starting from a high base).

Fig. 6. Job listings requiring digital skills: 2014 – 2020[4]



Source: Burning Glass data, Oxford Economics analysis

We have combined the entire information provided by the BG skills listing database to create an index measure that captures the **digital intensity** of job postings. This was done by assigning a score to each digital skill term based on a previous study undertaken by BG.

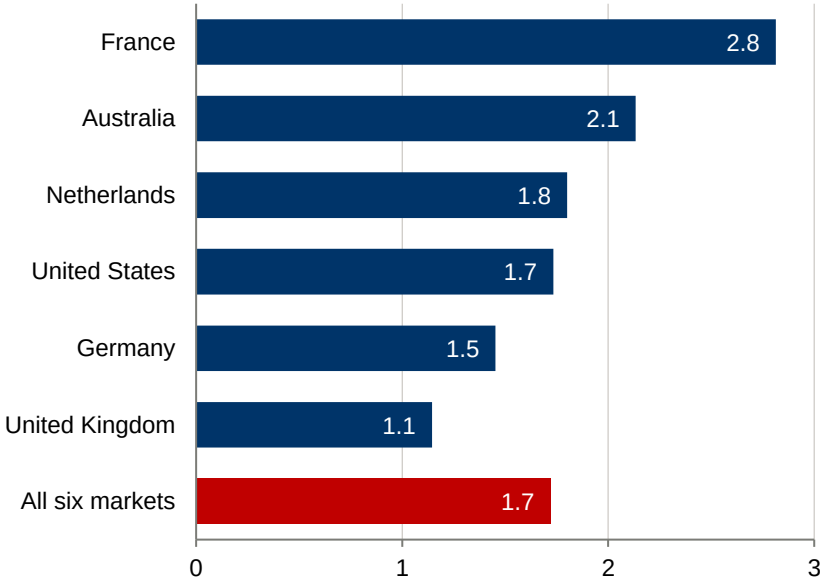
Therefore, the digital intensity index captures trends in **both** the **volume** and **complexity** of **digital skills** identified in job postings.

[4] The data presented above has been adjusted to allow for cross-country comparisons as the terminology used by Burning Glass to identify digital skills is not consistent across countries.

Based on this measure, we estimate that demand for digital skills grew at **twice** the rate of overall employment, averaged across the six markets. This analysis has been used to inform our labour market forecasts through to 2030.

Fig. 7. Growth in the demand for digital skills: 2014 to 2019

Digital skills demand growth, as a multiple of overall



Source: Oxford Economics

The demand for digital skills is expected to grow 3-4 times quicker than employment growth over the next decade. Our analysis suggests that digital complexity growth will outpace the increase in jobs across the economy.

We forecast the digital complexity of jobs to grow at 1.4% per year compared to 0.4% growth in all jobs between 2019 and 2030. Transforming our measure of digital complexity into jobs, we expect digital jobs to grow by 14% by 2030 which translates into 271 million digital jobs (Fig. 8). Of these, 222 million jobs, i.e., 81% of digital jobs, will require advanced digital skills (Fig. 9). Put differently, in 2030, 9 out of 10 jobs will require digital skills and three out of four jobs will require *advanced* digital skills.

Fig. 8. Digital jobs and employment

Country	Digital jobs			All jobs			Share of digital jobs		
	2014	2019	2030	2014	2019	2030	2014	2019	2030
Australia	6,920	8,713	13,685	11,531	12,863	15,478	60%	68%	88%
Germany	31,321	34,062	35,417	42,723	45,270	44,452	73%	75%	80%
France	18,725	21,003	25,886	27,334	28,481	29,847	69%	74%	87%
Netherlands	4,791	5,664	6,114	7,138	7,839	7,997	67%	72%	76%
United Kingdom	28,964	31,184	32,775	33,462	35,695	36,758	87%	87%	89%
United States	120,466	136,816	157,726	146,319	157,529	164,399	82%	87%	96%
Total	211,187	237,443	271,601	268,506	287,675	298,931	79%	83%	91%

Source: Burning Glass data, Oxford Economics analysis

Fig. 9. Digital jobs by complexity of skills required

Country	Jobs requiring advanced digital skills			Average annual growth in advanced digital jobs		Average annual growth in other digital jobs	
	2014	2019	2030	2014 vs 2019	2019 vs 2030	2014 vs 2019	2019 vs 2030
Australia	3,869	5,347	9,143	5.54%	5.00%	1.65%	2.76%
Germany	20,428	22,981	24,689	1.98%	0.65%	0.29%	-0.30%
France	13,206	13,400	18,241	0.24%	2.84%	5.49%	0.05%
Netherlands	3,195	3,906	4,354	3.40%	0.99%	1.63%	0.00%
United Kingdom	22,845	26,652	30,172	2.60%	1.13%	-4.88%	-4.92%
United States	98,225	114,635	135,703	2.61%	1.55%	-0.04%	-0.07%
Total	161,768	186,920	222,304	2.44%	1.59%	1.03%	-0.21%

Source: Burning Glass data, Oxford Economics analysis

4.2.1 Limitations of our projections

Despite the mapping of skills across markets, we were not able to control for inter-market differences fully, and therefore a degree of caution should be exercised when comparing historical and forecast trends across markets.

Nevertheless, the findings across Australia, the US and the UK for the 2014 to 2019 period offer a more comprehensive view of labour market trends over a sustained time period and have several key findings in common. The historic trends for these markets are presented in our report.

5. OUR REVIEW OF THE AR MARKET

Our survey analysis highlighted the higher competence of Gen Z in using **Augmented Reality (AR).** Our study highlights the role AR industry as an example of a new, innovative technology that has the potential to transform the way we use and interact in the physical world.

Our discussion of AR is based on a review of various AR/VR market reports, web scraping listings of AR companies and interviews with AR entrepreneurs in all six markets.

5.1 DESK RESEARCH AND WEB SCRAPING

We collated information from a number of existing secondary data sources to build a profile of the emerging AR business ecosystem. based on listings on various websites as well as AR/VR ecosystem reports from the AR/VR association, we have identified **2,610 companies** which have AR/VR capabilities globally. In almost all cases, AR/VR capabilities tend to be advertised together and it is not possible to isolate the two technologies.

In many instances, AR only forms a part of the companies' operations and it has not been possible to quantify how much of the company's operations are related to AR as opposed to other capabilities. For example, one of the companies identified in our research is Ubisoft which is a creator of gaming experiences and uses AR in its products. However, it has not been possible to identify what share of Ubisoft's operations are related to AR directly.

Important to note is that while our list shows many AR companies globally, we cannot be certain that it shows the overall number of AR/VR production companies, as the sources we cited don't include a lot of countries which might have smaller AR/VR production studios that don't necessarily advertise for the global market. Further, the countries listed might have additional companies that weren't listed in the sources, and therefore not included in our list.

5.2 INTERVIEWS WITH AR EXPERTS

To understand the emerging trends and issues in this nascent and fast-growing sector, we conducted interviews with Snap lens creators and AR experts working in the social and immersive reality space. Our discussions were centred on their journey in AR to understand the skills, tools and platforms that were most useful to them, and how they see the sector evolving in the future, both in terms of AR applications as well as in terms of the skills required to meet the increased demand.

5.2.1 List of AR experts interviewed

- Australia
  - David Loughnan, UNBND[5]
  - Abbas Sajad[6]
- France
  - Tess Inglis and Antoine Vu, Atomic Digital Design[7]
  - Ines Alpha, 3D artist[8]
- Germany
  - Julian Weiss, Headraft[9]
  - Aaron Jablonski, Exit Simulation[10]
- Netherlands
  - Tim van der Wiel, GoSpooky[11]
  - Anrick Bregman, ANRK[12]
- United Kingdom
  - Isabel Perry, Ashley Fletcher, Byte London[13]
  - Hamid Ibrahim and Danson Nkoja, Kugali[14]
- United States
  - Michael Nicoll, Blnk[15]
  - Frank Shi, Paper Triangles[16]
- Middle East
  - Mike Khouri, Tactical[17]
  - Hamad Saleh[18]
  - Georgio Copter[19]

[5] https://unbnd.com.au/
[6] https://lensstudio.snapchat.com/creator/K5XsdY0N1P71BMY1Hg_eNA
[7] https://atomicdigital.design/
[8] https://lensstudio.snapchat.com/creator/ZZW_3lVCEWh5Z0OMi4AXyA
[9] https://www.headraft.com/
[10] https://exitsimulation.com/
[11] https://gospooky.com/
[12] https://www.studioanrk.com/
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6. ANNEX 1: DIGITAL ATTITUDES AND COMPETENCE SURVEY QUESTIONNAIRE

THE VALUE OF GEN Z ACROSS SELECTED MARKETS

November 2020

In this survey, we would like to understand your attitudes towards digital technology and how you use and interact with digital technology in your day-to-day lives.

SECTION 1: ATTITUDES TOWARDS DIGITAL TECHNOLOGY

In this section, we would like to understand your views on what digital technology can do for you and for society generally.

Digital technology and society

1. Over the next 10 years, what type of impact do you expect digital technologies to have on the following societal challenges? [7-point scale from Very Negative to Very Positive]
    - The shift towards more sustainable and environmentally friendly practices
    - Empowering marginalized communities
    - Improving access to high-quality education
    - Improving access to high-quality health services
    - Minimizing the economic damage and disruptive impact of COVID-19
2. Overall, what type of impact do you think the following consequences of the growth of digital technology has had on society? [7-point scale from Strongly Disagree to Strongly Agree]
    - People now have more informal and flexible work opportunities due to the growth of platforms and apps
    - More people now have opportunities to express their opinions publicly online
    - People now consume information that is more representative of society and from a much wider set of sources beyond the mainstream media
    - Firms have been able to automate certain tasks within the workplace
    - More time spent online is detrimental to mental health
3. To what extent do you agree or disagree with the following statements about the impact of digital technologies on the economy? [7-point scale from Strongly Disagree to Strongly Agree]
    - On balance, digital technologies have made markets more competitive
    - Digital technologies have made it easier for people to become entrepreneurs from a younger age
    - Digital technologies will be a key driver of innovation over the next 10 years

Trust in online content

4. To what extent do you agree or disagree that the content and information available from the following sources are usually reliable and trustworthy: [7-point scale from Strongly Disagree to Strongly Agree]

    - Social/messaging/camera apps
    - Video sharing platforms
    - Websites and apps of mainstream media sources #(e.g. examples to be tailored to specific market)
    - Other websites, blogs and online forums
    - Information received on group chats (e.g. WhatsApp groups)
    - Information received through email or personal chats

Privacy concerns related to sharing data

5. Thinking generally, to what extent do you agree or disagree that your personal data (such as name and age) that is collected through websites and apps is secure online? [7-point scale from Strongly Disagree to Strongly Agree]
6. Which, if any, of the following would you be happy for websites and apps to collect and save the following personal information to provide a quicker or more personalized experience? Please tick all that apply

- Name, gender and age
- Location
- Telephone number
- Email address
- Online behavior (through cookies)
- Payment details (e.g., credit card details)
- None of the above

Comfort with forming relationships virtually vs in-person

7. To what extent do you agree or disagree with the following statements [7-point scale from Strongly Disagree to Strongly Agree]:

- Communicating through digital modes (social/messaging/camera apps, text message, video calls) makes me feel closer to my family, friends or classmates/colleagues
- It is easier to communicate through video/text messages than meeting face-to-face when interacting with my family, friends or classmates/colleagues
- I can meaningfully connect with someone through digital technology despite never meeting them face-to-face
- Digital technology has helped me to maintain personal relationships when physical distance has made it impossible for us to meet regularly face-to-face

SECTION 2: USAGE AND EXPERIENCE

In this section, we would like to understand how you use and interact with digital technologies in your day-to-day life.

Usage of filters, frames and lenses

Thinking about filters, lenses and other digital effects.

8. Which, if any, of the following do you know how to do? Please tick all that apply.

- Share photos or videos with friends and colleagues/classmates using Snapchat
- Share photos or videos with friends and colleagues/classmates using Facebook/Instagram
- Share photos or videos with friends and colleagues/classmates using apps other than Snapchat and Facebook/Instagram
- Look up information about an object or a place using my camera
- Learn a new skill using my camera (e.g., to learn words in a new language by pointing my camera at objects, to learn how to work through a maths question, etc.)
- Look up directions by using my camera as I am navigating to my destination (e.g., the filter or lens will give me real time directions when I point my camera at the street)
- Try on new products (e.g., cosmetics, clothes, shoes, furniture, etc.) before making a purchase
- Create new filters, lenses, or other digital effects
- None of the above

9. To what extent do you agree or disagree that in the future you would be comfortable using filters, lenses or other digital effects to ...? [7-point scale from Strongly Disagree to Strongly Agree]

- Share photos or videos with friends and colleagues/classmates
- Look up information about an object or place using my camera
- Learn a new skill using my camera
- Look up directions using my camera as I'm navigating to my destination
- Try on new products before making a purchase
- Help my doctor or nurse in diagnosing or providing treatments or providing medical advice (e.g., visualising veins using a camera)
- Be a part of my formal classroom experience (e.g., using my camera to visualise real-life scenarios).

10. To what extent do you agree or disagree that you would consider using digital (AR-enabled) eyewear such as Google Glass, Spectacles, etc. [7-point scale from Strongly Disagree to Strongly Agree]

Communication

11. Which, if any, of the following do you know how to do? Please tick all that apply.

- I know how to create a group on an app or website
- I know how to organize a group call or meeting (audio/video conference)
- I know how to set up a post to raise awareness about a specific social or political issue
- I know how to write a comment on a blog or website or forum
- None of the above

12. To what extent are each of the following true or untrue about you? [7-point scale from Very Untrue to Very True]

- I am careful to make my comments and online behaviors appropriate to the situation I find myself in online

- I feel comfortable deciding who to follow online (e.g. on services like Twitter or Tumblr #YouGov to adapt for different countries])
- I understand the benefits and limitations of different apps for different modes of communication
- I know how to choose the most appropriate mode of communication (email, messaging apps, chat rooms, video conferences, etc.) for each situation
- I am comfortable using different devices - my mobile or my tablet or my desktop – to communicate

Content creation and distribution

13. Do you know how to do each of the following? [Yes/No/I do not understand what this means]

- Create something new from existing online images, music or video
- Create gifs
- Create videos
- Design a website
- Edit content that others have produced
- Share pictures, gifs and videos online
- Post a blog online
- Monetise content
- Which different types of licenses (concerning copyright and usage rights) apply to online content

Gathering and verifying information

14. Which, if any, of the following do you know how to do? Please tick all that apply.

- Decide which keywords to use for online searches
- To find a website I visited before
- To verify the authenticity of information I see online on news websites or their social media pages
- To verify the authenticity of information I receive from friends and classmates/colleagues
- To open downloaded files
- None of the above

E-commerce

15. To what extent are each of the following true or untrue about you? [7-point scale from Very untrue to Very True]

- I understand what kind of websites would show up first when searching for a product or information online
- I know how to identify videos and blogs where influencers might be getting paid to feature a product or service
- I understand how social media ads for products and services are designed and targeted at me
- I know how to list an item for sale on an e-commerce platform (e.g., eBay)
- I know how to make a digital payment to send money to family/friends or to make a payment for a purchase

Security

16. Do you know how to do each of the following? [Yes/No/ I do not understand what this means]

- Activate pop-up blockers
- Use security software to protect against viruses and malware
- Determine whether apps/software are safe to download
- Identify fraudulent websites impersonating legitimate ones to collect information about me
- How to change settings that determine who I share content with (e.g. friends, friends of friends or public)

SECTION 3: REMOTE WORKING

In this section we are going to ask you some questions about remote working. This is an arrangement where you work outside of a traditional environment e.g. at home, in a coffee shop.

17. In 2020 have you been required or chosen to work remotely at any point? [Yes/No]
18. Thinking only about 2020 so far, how often, on average, have you worked remotely?

- Never
- Less than once a month
- At least once a month but less than once a week
- Once a week
- More than once a week but not every day
- Every day

19. Now thinking back to last year (2019), thinking about the time you had a job, how often, on average, did you work remotely?

- Never
- Less than once a month
- At least once a month but less than once a week
- Once a week
- More than once a week but not every day
- Every day
- Not applicable

20. When you have worked remotely in 2020, how would you compare the speed and reliability of your internet connection to your traditional working environment?

- Much worse when I work remotely
- Somewhat worse when I work remotely
- About the same
- Somewhat better when I work remotely
- Much better when I work remotely

- Not applicable
- Not sure

21. What do you think has been the impact of working remotely on the following aspects of your job? [7-point scale from Very Negative to Very Positive]

- My productivity
- My ability to meet deadlines
- My ability to communicate with colleagues
- My ability to develop and enhance relationships with clients
- My professional development
- My creativity
- My emotional well-being

SECTION 4: DISTANCE LEARNING

In this section we are going to ask you some questions about distance learning. This is a method of studying where lectures or lessons can be taken online without the need for the student to attend the school, college or university classes in-person.

22. Have you ever undertaken distance learning? Please tick yes if you have been required to undertake distance learning this year as a result of social distancing policies even if it was not the intended method of study?

- Yes
- No, I never had the opportunity to undertake distance learning
- No, I had the opportunity to undertake distance learning but chose not to

23. And for what types of educational qualification did you use distance learning? Please tick all that apply.

- Primary or secondary education
- University degree
- Higher degree (Masters or PhD)
- Professional qualification
- Other
- Not sure

24. To what extent do you agree or disagree with the following statements related to distance learning [7-point scale from Strongly Disagree to Strongly Agree]

- Studying online makes it harder to collaborate and support each other's education
- It is harder to concentrate when learning online
- Face-to-face learning allows students to develop a better relationship with their teachers
- Distance learning can be an effective substitute for face-to-face learning in a classroom
- Distance learning can be lonely
- Distance learning offers better value for-money compared to other means of education

25. In the last week have you done any of the following activities in your spare time? Please tick all that apply

- Participated in an online class that you're taking as part of a formal qualification
- Participated in an online class that you're taking just for fun
- Used an online chat forum to help you figure out a problem
- Watched an online video to help you complete an everyday task
- Watched a lecture online to learn about a new topic
- None of the above



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