State of the Art Review (WP2)

Higher Education Institutions/Universities
Responses to Digitalization (IO1)

Scotland Country Report

Author: Dr Aleksandra Webb,
University of Stirling

Date of Release: 1st September 2020

Contents

List of Abbreviations

AD	Academic Development
AI	Artificial Intelligence
CEDEFOP	European Centre for the Development of Vocational Training
DC	Digital Champion
DCMS	Department for Digital, Culture, Media and Sport
DESI	Digital Economy and Society Index
ESCALATE	Coordinated Higher Institutions Responses to Digitalisation, Erasmus+ KA2 - Cooperation for innovation and the exchange of good practices, KA203 - Strategic Partnerships for higher education
EU	European Union
HEIs	Higher Education Institution(s)
HES	Higher Education Sector
ICT	Information and Communication Technology
L&T	Learning and Teaching
MOOCs	Massive Open Online Courses
ONS	Office for National Statistics
PC	Partner Country
PG	Postgraduate
QAA	Quality Assurance Agency
SHEEC	Scottish Higher Education Enhancement Committee
SOTA	State-of-the-Art
UG	Undergraduate
UK	United Kingdom

USA	United States of America
VLEs	Virtual Learning Environments
WP	Work Package

1 Introduction

1.1 Overview

Digitalisation is transforming the skills needed by Europe's young and working population to successfully engage in the world of work in a globalised modern economy. Digitalisation is changing the way students learn, as well as the ways institutions deliver education. As digitalisation remains high on European, national, regional and institutional agendas, universities across Europe are undergoing constant transformation in order to respond to the needs of the societies and the labour markets (EUA 2020). Strategists advise that the only way for the universities to stay relevant in the increasingly competitive Higher Education sector is to develop digital capabilities matching the needs of digital age (PwC 2015). This means that universities as institutions have to develop digital strategies and digital literacies amongst academics and staff to respond to the current demands for on-line delivery and global connectivity. Innovative learning and teaching increasingly involves use of digital technologies and Scottish universities also strive to embed digitalisation in the curriculum and capitalise on opportunities digital university brings to staff and students. In addition, there is high societal expectation that universities should drive development of digital skills and influence digital agenda in their localities to benefit wider society and economy.

Despite the overall high ranking of the United Kingdom (UK) in the European Commission Digital Economy and Society Index (DESI) 2019, which places UK in the fifth position out of the 28 EU Member States, the UK currently faces a digital skills gap. As the digital employment is predicted to rise, these digital skills shortages are predicated to increase in the next five years, and they will continue to impact all UK nations' businesses, commerce and productivity. Currently the whole UK workforce do not have sufficient levels of basic and advance digital skills required by businesses and key growing industries in this age of digitalisation. The percentage of the population with at least basic digital skills is 71%, compared to an EU average of 57%, and the percentage of those with above basic digital skills is 46%, compared to an EU average of 31% (ibid.). Despite strong demand for Information and Communication Technology (ICT) graduates, the UK ranks poorly in the percentage of graduates with an ICT degree, with only 3.6% of all UK graduates graduating with an ICT degree. This equates to 16th in the rankings, just above the EU average of 3.5%. Similar shortages are observed across e-commerce and other newly growing sector relying on advance digital, technological and analytical skills. Despite the skills gap and the barriers in digital infrastructure and connectivity, particularly in rural Scotland, the changing landscape of work and digital advancements has already created and will continue to create demand for new type of jobs.

In Scotland, the Scottish Digital Strategy aims to build an inclusive, ethical, innovative and productive digital nation (Scottish Government 2017). The strategy promises investment in the connectivity, digital infrastructure and digital skills development for individuals, communities and organisations. It also highlights technological ambitions to drive further developments in Artificial Intelligence (AI) and machine learning, and to capitalise on growth attributed to data revolution. It echoes the UK-wide policies and

strategies, and it is promising a significant investment in education, training and support for equalising access to good employment opportunities and supporting development of digital and cognitive technology skills, which are aligned with the European Union's digital competency framework (Appendix 4). Some important initiatives to tackle the digital skills gap and digital connectivity, improving the nation's digital capability and reducing digital exclusion have been already set up, such as new E-commerce Institute, multiple digital hubs and centres spread across the country, or local and national Digital Skills Partnerships, which bring together regional businesses, large employers, charities, and public sector organisations to tackle local digital skills challenges and build thriving and inclusive local economies. Scottish universities, are also responding to demands and ambitions set out by the Scottish Government with national and local practices aimed at improving digital skills of students and staff, and offering competitive and demand driven programmes and courses across ICT, AI, Cyber Security (Appendix 3), as well as embedding digital skills and competencies more widely through the curricula.

1.2 Methodology

This report[1] reviews the policy context and current knowledge demonstrating how Scottish universities respond to digitalisation related opportunities and theatres. It contextualises digital skills development in the Scottish national labour market characteristics and explores how these demands for digital skills are currently affecting universities, educators and students, and foresees the longer-term impacts of digitalisation. Most immortally, the report lists innovative digital practices collected from the local Higher Education context at a Scottish University case-study, including practices that the sector implemented during disruptive and unprecedented times of 2020 Coronavirus epidemic.

This report draws on literature on digitalisation and data which describe the impact of digitalisation on the labour market, future of work, and higher education in Scotland, with some references to some other developments in the UK. This report specifically focuses on Scotland by reviewing policies and initiatives that aim to address the nation's digital skills gap where disaggregated data is available[2]. Sources such as key statistics, web-pages, reports and articles were searched for and accessed through online search engines and website of key institutions concerned with employment in digital economy or leading on HE digitalisation agenda. The most up-to-date national and European data were included from sources such as UK's Office for National Statistics and European Commission, buy paying specific attention to key publications from the Scottish Government, Skills Development Scotland, Scottish Council for Development and Industry and Digital Scotland.

Local initiatives were identified via local experts and colleagues at a Scottish University. These experts from a range of backgrounds were chosen based on either their experience of teaching digital skills in HE

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[2] *For the review of the current state of knowledge of digitalisation response of HEIs in the UK, see UK Country Report (WP2).*

or using digital technology for learning and teaching (i.e. use of innovation and technology in the workplace), or their familiarity and knowledge of policy related to digitalisation and employability in HEI.

The following questions were used to guide formal interviews and informal discussions with experts:

Given the potential and likely impacts of digitisation and artificial intelligence on jobs and work

1. Do you think enough is happening nationally to improve digital skills in society?
2. Are you aware of particular national policies that are driving university activity in this area?
3. Do you think University senior leaders are well-informed about these changes?
4. How can HEIs better identify future labour market needs, and make sure that all students gain the digital skills they need in their curricula e.g. humanities students?
5. Do you know of any interesting examples of how universities are providing students with the digital skills they need?
6. Are you aware of any particular good practice in other areas?
7. Are Degree Apprenticeships part of a possible solution?
8. Where are the gaps? i.e. who is slipping through the current provision of digital skills both in HEIs and more broadly in society?
9. Covid-19 has catalysed the pace of change of digitalisation across most sectors. Is this driving the rate of take-up and expansion of delivery of digital skills?
10. Have you anything else to add and would you like to be kept informed of this piece of research?

2   The potential impact of digitalization

Digital transformation is generating a fierce debate among education providers, policy-makers, economists and industry leaders about its societal impact. As much as digitalisation can support greater work productivity and break down many access (geographical) barriers, it can also profoundly disrupt society. Concerns are growing about how it is affecting issues such as jobs, wages, inequality, health, resource efficiency and security. Current estimates of global job losses due to digitalisation range as high as 2 billion by 2030 (World Economic Forum 2020). There is also a growing concern about its impact on wages, working conditions and the future of work more widely. This section presents positive and negative impacts of digitalisation, paying attention to both digital opportunities and digital threats, if unaddressed, arising from technological advancement that shapes the future of work.

2.1 Productivity, Innovation and Inclusion in Digital Economy

A digital strategy for Scotland sets out a vision for Scotland as an inclusive, ethical, innovative and productive digital nation (Scottish Government 2017). Such vision rests on Scotland's aspiration to "harness the technologies of the Fourth Industrial Revolution to increase economic and social prosperity" (SCDI 2019.:2). Enhancing innovation and increasing productivity seems to be two core dimensions by which social and economic prosperity is to be achieved in the age of digital living and working. Highly-digitised and data-driven economy would help Scotland to meet another key objective of industrial strategy, which concerns efforts to create a low carbon economy by driving efficiencies through technological innovation (ibid., SCDI 2016, Scottish Government 2016) that capitalise, for example, on cloud computing, 5G, Internet of Things, and Big Data, and successfully implement these technologies into new business models, practices, products and services across government and the wider economy (FutureScot 2020). 'City and Region deals' led by Scottish Cities Alliance and funded from the Scottish European Regional Development Fund Programmes, 'Smart Cities Scotland programme' and 'innovation centres/digital hubs projects are currently being rolled out across the country to promote and support actions focused on supporting digital transformation cross the wider economy and growth in digital sector (Scottish Government 2017).

Industry expert believes that the number of people employed in digital technology roles/jobs across Scotland has the potential to rise to 150,000 over the next five years. The European Commission estimates that a fully-functioning Digital Single Market (DSM) could add €415 billion to the EU's GDP (Scottish Government 2017). Industry experts advise that Scottish companies are well-placed to contribute to this growth. They would substantially benefit from the opportunities which the DSM will create, however, Brexit presents a serious threat to this vision. Despite this uncertain conditions, digital focus continues to be at heart of Scottish economic strategy and a core driver of productivity and inclusive economic growth.

Digital connectivity has transformed the way people work, learn and communicate, and is an essential part of modern life and business. According to ONS (2017a), 90% of households in Great Britain had internet access compared to 57% in 2006, and 73% of adults accessed the internet using a mobile, which is more than double the 2011 rate of 36%. The availability and take-up of faster broadband speeds is predicted to add £17 billion to the UK's economic output by 2024 (HC 2018). This shows that digital connectivity is an essential driver of economic growth in today's increasingly digital economy. Digital connectivity and infrastructure are also key in delivering Scotland's ambitions for green, sustainable and inclusive economic growth and a successful transitioning to a low carbon economy. Excellent digital infrastructure is vital to enabling innovation, helping to reduce travel, addressing climate change and reducing emissions, opening up employment and leisure opportunities, addressing isolation and remoteness, and thus delivering far ranging social, environmental and economic benefits to Scotland' population.

According to DESI 2019 the UK performs relatively well in Digital Connectivity. It ranks 10th, which is above the EU average, but still lags behind on ultrafast broadband coverage and take-up. Despite the overall positive DESI scoring, report on Digital Connectivity (ibid.) still shows gaps in infrastructure and provision. Ofcom's latest data shows that the area covered by 4G mobile services from all operators in Scotland increased by 76% between June 2017 to January 2018. Scotland's broadband coverage has improved significantly in recent years, increasing by 20% since 2015 to the current rate of 94% for urban areas compared to 56% for rural areas. Despite improvements in recent years, Scottish mobile and broadband coverage is still behind the rest of UK with Scotland's large rural geography posing significant challenges. As a result, there is 38% gap between rural and urban coverage. Scottish rural economies are built on local businesses, tourism and the property market which depend on digital and mobile connectivity and impact on housing/relocation choices, consumer preferences/experience and recruitment of workers. Scottish Government is committed to improving digital connectivity in Scotland. To address the existing infrastructure gap announced expenditure on digital connectivity doubled in the 2020/21 budget rising to £63.4m, from £32.9m in 2019/2020 (FutureScot 2020). This investment presents an opportunity to equalise the access and ensure that a greater proportion of Scottish population can lead successful reliable businesses and enjoy the opportunities of working from home, and thus as many academics and practitioners alike argue, have a better work-life balance that results from ability to work remotely.

These measures align with the Scottish Government's drive towards swifter transition to a low carbon economy chieved through the exploitation of opportunities digital technologies offer. Importantly, digitalisation create jobs. It is estimated that 5G technology alone has the potential to add £17 billion to Scotland's GDP and create 160,000 new jobs by 2035 (ibid.). New job creation is a particularly important aspect as increasing use of automation and machine-learning can directly and quickly displace workers from performing specific jobs or tasks (the so-called displacement effect). Such displacement can lead to "work eradication" (e.g. warehouses fully operated by robots, or customer service delivered by smart machines) but more commonly, leads to "work augmentation" - where AI teams up with people to improve work outcomes. The implications of automation and job displacements on the future of work are discussed below.

2.2 Automation and job displacement

As a result of the evolving digital landscape and advancement in technology, a number of jobs are likely to change or disappear, while some existing jobs are likely to be transformed. UK-wide research suggests that up to 30% of UK jobs could potentially be at high risk of automation by the early 2030s, lower than the US (38%) or Germany (35%), but higher than Japan (21%) (Berriman and Hawksworth 2017). In Scotland, 78% adult in the working age will still be of working age by 2030. Equally, over 46% of jobs (1.2 million) in Scotland are at high risk of potential automation over the next few decades (Thomas and Gunson 2017). In the UK service-dominated economy, with a similar picture in Scotland, the risks of automation appear highest in sectors such as transportation and storage (56%), manufacturing (46%) and wholesale and retail (44%), but lower in sectors like health and social work (17%). Commentators explain

that jobs in services sectors, health, education and personal care are less likely to be automated because of their task composition. Main drivers for potential high risk of job automation are: repetitiveness, routinisation and a need for greater physical exertion (e.g. jobs in manufacturing or transportation and storage). On the other hand, jobs that require social and literacy skills (in sectors such as education and healthcare) are more resilient to loss by automation. PwC research suggests the proportion of jobs at potential high risk of automation is over 2.5 times greater in the wholesale and retail trade (44%) than in health and social work (17%). Regardless whether automation is more likely to fully eradicate need for some jobs or only alter tasks within existing jobs, employers expect that 37% of the roles in their workplace are likely to alter significantly within the next five years as a result of digital disruption (ONS 2019). These trends are likely to affect some social groups more than others, with young people and women likely to be disproportionately affected (Arntz et al. 2016, Servoz 2019) Indeed, the ONS (2019) found that 70% of the roles at high risk of automation are currently held by women.

A distinction between jobs in services that have high degree of social intelligence seems to be currently a factor preventing from a wave of automation in the nearest future. According to Frey and Osborne (2013), the Social Intelligence (SI) element remains a substantive barrier to full computerisation of jobs, and it is a necessary element of jobs in many person-focused services. SI constitutes abilities such as Social Perceptiveness (being aware of others' reactions and understanding why they react as they do), Negotiation (bringing others together and trying to reconcile differences); Persuasion (persuading others to change their minds or behaviours), and Assisting and Caring for Others (providing personal assistance, medical attention, emotional support, or other personal care to people). These components are crucial in a range of jobs and are essential to work tasks in many services. Frey and Osborne argue, while most workers in transportation and logistics occupations, office and administrative support and in production occupations are likely to be substituted by computer capital, people-centred occupations, with strong SI requirements, are not. A good example of such person-centred sector of growth in Scotland is Early Learning and Childcare, which has been recently stimulated by the policy-driven expansion in free childcare offer (Webb and McQuaid 2020, 2019, Webb et al. 2020).

The McKinsey Global institute (2019) predicts that, in addition to digital skills, social and emotional intelligence[3] and higher cognitive skills[4] will grow in demand over the coming decade due to automation. Jobs requiring caring, creativity or emotional and social intelligence will be less affected by AI or extensive automation, as machines cannot yet match uniquely human interactions and performance in those roles. Global projections expect expansion demand in healthcare providers; professionals such as engineers, scientists and analysts; IT professionals and other technology specialists; managers and executives; and

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[3]*Social and emotional skills:* including entrepreneurship and initiative taking; leadership and managing others, advanced communication and negotiation skills, adaptability and continuous learning, interpersonal skills and teaching and training others.

[4] *Higher cognitive skills:* including creativity, complex information processing and interpretation, critical thinking and decision making, project management and quantitative and statistical skills.

educators and people in creative industries (artists, performers and entertainers) (McKinsey 2017). It is anticipated that economies like the UK and USA, where creative occupations make up a large part of the workforce, may be better placed than others to deal with the disruption of employment from future advances in automation (Nesta 2015). However, in the currently highly polarised labour market, danger of automation and replacement is being associated with a range of occupations, not only low-waged jobs. Therefore workers in those jobs will need to reallocate to tasks that are non-susceptible to automation – i.e. tasks requiring creative, emotional and social intelligence, (but successful acquisition of creative and social skills is prerequisite for such transition) or develop advanced digital skills for new jobs and sectors of growth in digital economy.

2.3 New jobs and sectors of growth (Artificial Intelligence, Cyber Security, E-commerce)

While some traditional sectors might be declining in employment terms (especially agriculture and traditional manufacturing industries) the CEDEFOP report (2016) confirms a pan-European trend of continuing shift from the primary sectors towards services and the knowledge-intensive sectors where the majority of future jobs are expected to be located. According to the Scottish Labour Market Strategy 2014-2024 employment in ICT and digital technology is predicted to increase substantially (84,000 to 150,000) by 2025. Forecasts suggest that there could be as many as 11,000 job opportunities each year in ICT and digital technology roles presenting a major opportunity for young people. Roles include software and web development, project management and sales. A PwC study estimated that around 6% of all UK jobs in 2013 did not exist in 1990 and these were mostly relating to digital computing and communications technologies (Frey and Hawksworth 2015). It is further predicted that by the 2030s, 5% or more of UK jobs may be in areas related to new robotics and AI. However, not all lower-skill level jobs may become automated for a variety of economic, legal and regulatory reasons. Hiring more people, rather than incurring potentially large up-front costs by investing in new technologies such as AI and mobile robots is not always economically viable, and legal complexity in relation to ownership and responsibility for new technologically driven solutions might deter many companies from replacing humans with machines (Berriman and Hawksworth 2017). Replacement by technology is a potentially common and real danger for many existing occupations and jobs, as technological solutions ICT and AI can produce more results quicker, and often with better quality and less potential for errors, thus massively increasing economic productivity of any business and sector. Interestingly, income generated by adoption of technology is estimated to be fed back into the wider economy (i.e. by means of spending or investing in other areas, including in sectors that are less automatable, such as healthcare and other personal services where robots may not be able to totally replace human touch input for the foreseeable future).

Cyber Security is an example of new growing sector, in response to proliferation activities happening increasingly or predominantly online, and a corresponding increase in the criminality. All activities and

transaction happening online, whether those related to consumption, professional work, personal and private engagements or citizenship duties can expose financial, health and other sensitive personal and commercial information to be stolen, exploited or disrupted. These risks are predicted to further increase but high proportions (approximately 653,000 businesses, (48%) of UK businesses, report a lack of staff with basic cyber security skills (DCMS 2020). Approximately 408,000 businesses (30%) have more advanced technical skills gaps, in areas such as penetration testing, forensic analysis and security architecture, while a quarter (27%) have a skills gap when it comes to incident response and governance skills needed to manage their cyber security.

As Scotland strives to be "a secure place to work, learn and do business" (Scottish Government 2017) focus placed on safety and security is paramount, so is developing cyber resilience[6] of individuals businesses and the nation (Scottish Government 2015, 2018). This means that the demand for professionals being able to respond to the needs of business, public institutions, consumers and citizens and help to establish Scotland as "a recognised as a world leader in cyber resilience" is likely to contribute to creation of new cyber-security labelled jobs, for which specialist digital skills and qualifications are expected or cyber-enabled jobs, which include some cyber security functions among other job duties (e.g. network engineers whose role includes, but is broader than network security). The most common roles in demand are security engineers, security analysts, security architects, security managers, and security consultants.

A recent Cybersecurity Workforce Study (ISC) has revealed that at present there are around 2.8 million cyber security workers globally, with the UK accounting for 289,000 workers (2nd highest after USA), however the demand is much higher than the number of skilled professionals available. In 2019 in Europe/ EMEA region alone the shortage of cyber security professionals is estimated to have reached 291,000 (TEISS 2019). At a global level, the workforce gap has a projected shortage of 1.8 million professionals by 2022 (CCSE 2017). It is estimated that there were likely to be 360 – 480 unfilled vacancies in 2017. In the absence of positive interventions to increase skills supply, these figures are expected to rise by 20% per year in Scotland (in line with the rate of growth in demand for cyber skills UK-wide). downloaded cloud (Scottish Government 2015). Already across the UK Around 7 in 10 cyber sector businesses (68%) have tried to recruit someone in a cyber role within the last 3 years. These employers reported a third (35%) of their vacancies as being hard to fill. The sectors most in demand of cyber talent are the finance and insurance, information and communications, and professional services sectors. The geographic hotspots of activity in the cyber security labour market currently exist, Edinburgh being one of three key spots (next to London and Belfast)(DCMS 2020).

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[6] The Strategy for Scotland makes a distinction between cyber resilience and cyber security, with 'cyber security" referring mainly to the technical aspects that help protect equipment and electronic data from cyber-attack, and that contribute to the wider outcome of "cyber resilience" as an ability to prepare for, withstand, rapidly recover and learn from deliberate attacks or accidental events in the online world.

Another sector of accelerated growth enabled by technology and stimulated by a rapid transformation in the consumer behaviour is E-commerce (Institute of Ecommerce 2019). Ecommerce synthesises the latest advances in cloud computing, AI, big-data and business process engineering to build complete automated businesses. This wide mix of component technologies and processes is brought together to transact products online. As buying products online is now seen as the preferred method of purchase in most countries, it is predicted that by 2040, 95% of purchases will be facilitated by e-commerce (Ecommerce Foundation 2019). The UK is the third biggest e-commerce market in the world, behind only China and the US (Nation Master 2019). E-commerce currently accounts for 19.2% of the UK's total retail sales, and is predicted to rise to 53% by 2028 (Ecommerce News 2019). A growing popularity and accessibility of mobile commerce market (M-commerce) facilitated by the high ownership of smartphones and high confidence in the safety and ease of mobile purchases and 'e-wallet' payments play an increasingly important role in this rapid growth process. In 2017, The UK e-commerce was worth over £560 billion and was growing at around 21% a year (ONS 2017, Institute of Ecommerce 2019), while m-commerce was worth €55.9 billion (Ecommerce News 2018).

The Scottish Government estimates that ecommerce in Scotland generates £26.4 billion in online sales (Indez 2019), but with the potential to generate around £55 billion in online sales. Currently gaps in skills and infrastructure are identified as two key barriers in ecommerce development. Institute of Ecommerce (2019) suggests that well-built ecommerce systems and well-trained staff commonly result in improved productivity and increase in business export. However, there are currently no college or university courses and no apprenticeship schemes specific to ecommerce on offer in Scotland, with exception of one new course intuitive for experienced managers which started in newly formed Institute of Ecommerce set in January 2020 at the University of Strathclyde Business School (see Section 6.2). The blueprint for Scottish ecommerce development recommends a broad set of reskilling and upskilling activities to be made available to Scottish businesses to create a critical mass of ecommerce activity in Scotland.

In response to retail thriving in the digital realm, there is likely to be a significant decline in the numbers of physical shops. Recent figures show that over 85,000 high-street retail jobs have been lost over the past few months as shoppers look online to find better prices and convenience (Indez 2019). Some commentators and researchers have already observed the negative impacts of e-commerce on traditional channels. Terms such as 'death of the high-street' or 'the high-street Armageddon' or 'retail ghost-towns' suggests that the decline in traditional retail has had dramatic consequences not just on the local economy but also on the livelihoods of local communities (Sparks 2020). Despite these implications, the deterioration in traditional high-street and retail parks is expected to further stimulate online growth as well as the merger of physical and online retail channels (Jones and Livingstone 2017).

2.4 Digital skills and Digital skills gap

Based on the evidence reviewed in this section, it is clear that new sets of skills are and will be required and sought by employers in the context of changing nature of jobs and continuing advancements in

technology. Digital skills in particular are in high demand for all sort of jobs, however, the term "digital skills" covers a wide array of competencies, knowledge and skills. An important distinction has been made between 'baseline' digital skills (i.e. those that are easily transferrable from one role to another, and from one sector to another), and 'specific' digital skills (i.e. those that are role or sector-distinguishing) (Nania et al. 2019). 'Baseline' digital skills are commonly required by employers, with over 75% of job openings across all skills levels requiring digital skills, which suggests theses are near-universal requirement for employment. 'Specific' digital skills are commonly described as the following seven clusters: Software & Programming, Computer & Networking Support, Data Analysis, Digital Design, CRM, Digital Marketing, Machining & Manufacturing Technology (see **Error! Reference source not found.** in Appendix 2 for a description and common occupations). These specific digital skills tend to be required for jobs in a specific role or domain. Based on analysis of millions of online job adverts in the UK, evidence suggests that digital skills are required in at least 82% of online advertised openings across the UK but the precise skills demanded are not uniform across the country (Nania et al. 2019). Specific digital skills may help workers reduce their risk of automation by 59% and will support career progression and increase in wages as roles requiring digital skills pay 29% over those roles that do not. This difference is apparent at all skill levels, but the wage differential increases at higher wage bands.

Therefore, in additional to range of soft skills (such as communication, teamwork or project management skills) current and prospective workers need to develop more specific digital skills to maximise chances of employment and success in the digital economy. This may include becoming competent in using of digital tools and software such as Adobe Photoshop for designers; computer-aided design for engineers and manufacturing workers; customer relationship management software for sales and marketing professionals; and computer programming and networking for IT professionals. These specific digital skills are required in 28% of low-skill jobs, 56% of middle-skill jobs, and 68% of high-skill jobs (ibid.) Despite our positive DESI 2019 ranking within the EU, the UK currently faces a digital skills gap which means that many workers simply do not have the skills to meet the demands required by business and industry in the digital economy. Currently the whole UK workforce do not have sufficient levels of basic and advance digital skills required by businesses and key growing industries in this age of digitalisation. The percentage of the population with at least basic digital skills is 71%, compared to an EU average of 57%, and the percentage of those with above basic digital skills is 46%, compared to an EU average of 31% (ibid.). Despite strong demand for Information and Communication Technology (ICT) graduates, the UK ranks poorly in the percentage of graduates with an ICT degree, with only 3.6% of all UK graduates graduating with an ICT degree. This equates to 16th in the rankings, just above the EU average of 3.5%. Similar shortages are observed across e-commerce and other newly growing sector relying on advance digital, technological and analytical skills.

It's recognised that 88% organisations across UK are currently lacking in digital skills, with many expecting these shortages to increase in the next five years (OU 2019). As almost all jobs require basic level of digital skills, 72% of employers state that they are unwilling to interview candidates who do not have basic IT

skills (CEBR 2018). Interestingly, despite concerns related to loss of jobs due to automation and new consumer trends, not all employees express to be interested in acquiring new digital skills. According to the Open University (2019) study, overall, just half (48%) of employees say they want digital training. This level increases amongst younger workers, with two thirds (67%) of 18-34 year olds, and a fifth (22%) of younger employees are even funding their own training in this area. In contrast, just one in four (26%) over 55s say that they would like digital skills training.

As the digital employment is predicted to rise, these digital skills shortages are predicated to increase in the next five years. They will continue to impact all UK nations' businesses, commerce and productivity, particularly as new sectors of economy will be driving the employability figures (as highlighted in Section 2.3). Therefore, barriers in digital infrastructure and connectivity (Section 2.1), specific digital skills gaps and access inequalities (including e.g. female underrepresentation in Cyber security and similar training and roles (DCMS 2020) and digital exclusion most generally (CEBR 2018), need to be address to allow people to participate fully in digital economy, and also fulfilling the UK and the Scottish Government's ambitions for inclusivity and productivity. Because of the 'digital skills' heterogeneity, governments, skills and training bodies need to be aware of difficulties related to a design of interventions that address specific digital skills needs.

3   Current policy and educational/universities responses

The UK and Scotland's industrial strategies pledge a strong commitment to support public, private and third sector organisations' delivery of digital skills training and to increase the digital capability of those who are digitally exclude (Section 2.1). To support the implementation of the strategy, in August 2018 the UK launched a £1m Digital Skills Innovation Fund to address local or regional digital challenges. In Scotland Skills Development Scotland continues to drive digital skills training and employment agenda, promoting, organising and evaluating all skills-driven interventions across schools, colleges, HEIs and work-based sites. Digital Foundation Apprenticeships available in three pathways (Hardware, Software and Creative & Digital) is an example of such focus[7]. Higher education institutions (HEIs) play a key role in providing the digital skills required by the labour market and Europe's population working in the globalised modern economy. They must swiftly and appropriately respond to the needs of the quickly changing labour market but also to the challenges such digitalisation brings about. HEIs in Scotland recognise opportunities deriving from the industrial strategy and their role in enhancing local and economic growth (Universities Scotland 2017)[8]. To date, there have been many examples of positive developments in addressing and setting strategies on digitalisation needs, on the one hand, and in filling in the digital skills gap across university degree programmes, on the other hand. This section describes these initiatives range from:

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[7] https://www.skillsdevelopmentscotland.co.uk/news-events/2017/march/digital-foundation-apprenticeships-can-help-bridge-digital-skills-gap/

[8] https://www.universities-scotland.ac.uk/opportunities-industrial-strategy/

increases in the university offer of new digital courses (including conversion course in data science and AI[9]), degree Graduate Apprenticeships, strategies for development of wider digital skills and competencies embedded in degree programmes and additional employability-focused activities for students, upskilling of staff to meet digital delivery needs. HEI are also aware of the challenges that digitalisation poses in terms of how education is delivered.

3.1 Higher Education and Digitalisation: the impact of digitalisation on Higher Education provision

In the last decade various terms emerged and are prominent in teaching and learning scholarship, such as *digital university, digital literacies, virtual learning, e-learning, on-line and blended learning, technology-enhanced learning*. New teams across campuses have been created to enhance learning in the digital university for two reasons (Weller 2016). On the one hand, initiatives led by digitalisation strategy emphasise importance of digital delivery as reflecting the way students want to learn and thus enhancing student participation and engagement. On the other hand, the argument of efficiency emphasises the operational advantage the learning with technology offers to HEI to carry out teaching in more cost and time effective, and potentially scalable manners, especially in the context of increased numbers of students. As outlined in Section 2, another key reason for universities engaging with digitalisation is their institutional responsibility for the preparedness of students for work (PwC 2015a,b) As such employability agenda has been at the heart of HEI policies and practice, particularly in order to meet the demand for specific skills and also to address the gasp in skills often reported by employers (UKCES 2014).

While the need for digitalisation within HEI is politically and economically motivated, the adoption of digital strategies and embeddedness of digital practices focused on development and championing of digital skills have initiated a debate around the pedagogical impact of digitalisation. Although technologies have always shaped pedagogic process and have been used to support learning, the exponential growth of use of internet and web-based technological tools in learning and teaching, is profoundly testing the technical competence and confidence of many university teachers and educators (Weller 2016). A term 'digital immigrant' (Prensky 2001) suggests that generational difference in exposure to technology often makes educators overwhelmed with the choices digital realm offers, despite of motivation and enthusiasm for adopting digital technologies in teaching. Similarly, despite the wide embeddedness of some aspects of technology in day to day communication and living, questions emerged about digital capacities of students and their ability to effectively use and navigate through digital environments of learning, despite being considered as 'digital natives' (ibid.). In this context of ever-increasing and fast-moving embeddedness of technologies in teaching, learning and working practices, development of digital knowledge, skills, attributes and behaviours seem to be an area of a paramount importance.

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[9] https://www.officeforstudents.org.uk/advice-and-guidance/skills-and-employment/postgraduate-conversion-courses-in-data-science-and-artificial-intelligence/

This technological shift has called for rethinking of traditional face-to face pedagogies and alteration to how universities work (the Economist 2014). This is why in recent years, universities around the world, and also Scottish universities, have heavily invested in the development of digital infrastructures such as Virtual Learning Environments (VLEs) than enable applications of blogs, wikis, document sharing, discussion forums, podcasts, lecture captures, virtual laboratories, screencasts and e-portfolios/e-submissions in on-line or blended learning. Massive Open Online Courses (MOOCs) are examples of wholly online learning experience, which utilises Web 2.0 technologies and social media tools, provide a new way of learning, connecting and collaborating away from the university campuses. Scholars argue that because these new developments have given students more freedom as to where and when they want to study, technology 'adds value to learning for all learners (Jisc 2009:8 in Weller, 2016: 174). As the new knowledge is being created through and with the technology-enhanced learning, connectivity and digital interactions are being recognised as expected and needed conditions for creating and sharing knowledge in digital age (Siemens 2005, Cormier 2008). This trend somehow reflects the creation of knowledge and innovation in the world of work and matches the new flexible patterns and structures of working (Skills Commission 2014).

For many institutions, despite the appetite for becoming digital universities, the implementation of digital needs and skills is a rather an ongoing incremental process, rather than an already fulfilled mission. Intestinally, the 2020 Covid-19 epidemic has highlighted that HEI needs to support both staff and students in acquisition of wider digital competencies and not just selected digital skills. At the same time as this digital integration happens, many unintended consequences of learning and teaching in digital realms are surfacing, such as personal data protection issues, cyber-security and ethicality of student attendance and performance monitoring practices. Only slowly are these issues getting recognised as challenging and potentially altering the nature of university education.

3.2 Scottish Universities response to digitalisation

Scotland's higher education sector (HES) has a long history and it is recognised as diverse and internationally successful. It has ambition to be the best place in the world to learn, educate, research and innovate (SFC 2020). Scotland with a population of 5,463,300 (NRS, 2020), is home to 19 Scottish universities: 15 campus-based universities, as well as the Open University in Scotland and three small, specialist institutions; the Royal Conservatoire of Scotland, Glasgow School of Art and Scotland's Rural College (SRUC) (Universities Scotland 2013). These institutions are funded by the Scottish Funding Council and have direct impact on lives and likelihoods of graduates, but they also create wider economic and social benefits for the Scottish communities. Scotland's higher education institutions (HEI) are an important part of Scotland's ambition for inclusive growth through the development of people's talents and skills (Section 2.1).

Universities in Scotland respond to the increasing market demand for digital skills in multiple ways. There is a great awareness amongst university leaders, educators, learning technologist and career/student support services, that the response to digitalisation has to be holistic. This means that such response includes more than just the education offer that directly develops knowledges and skills for specific Digital Skills Clusters, such as data analytics, digital design or programming (See Appendix 2 for a typology of Digital Skills). A wider understanding of digital literacies as a response to the labour market needs involve developing student skills and behaviours such us: being able to navigate through the digital environments, work collaboratively using VLEs and various platforms, software packages and social media, search for, critically appraise and use multiformat sources of information by articulating knowledge through various digital artefacts, present themselves professionally in the online realm. Such widened understanding of digital literacies is inherently linked with the employability agenda, which is one of the key focuses of HEI at present.

In Scotland, the key policy-driven initiatives and programmes driving digitalisation in HEI are aligned with the vision for Scotland as productive, innovative and digital nation with educated and skilled workforce able to successfully engage in the world of work in a globalised modern economy (QAA 2020). The activities focused on the improvement of strategy, policy and practice are led, supported and monitored by the sector's body, the Scottish Higher Education Enhancement Committee (SHEEC) managed by Quality Assurance Agency for Higher Education (QAA). Focus on the HEIs' role in development of digital skills has strengthen the long present preoccupation with development of graduate skills and attributes and their readiness for work, thus ever so closely entangling the employability and digitalisation agendas. The drive for digitalisation, however, has also highlighted the preparedness and gaps in the digital skill base of academics and educators directly tasked with the skills development of their students.

3.3 Examples of digital innovation and skills development (Scottish University)

This section presents a range of examples showcasing the innovation in digital skills development. Examples from the local context at the Scottish University have been selected and described. Although these are specific practices enacted in a specific institutional context, similar activities have been introduced or implemented across the HEIs in Scotland.

3.3.1. New courses in digital topics

To response to the needs of today's labour market, an increase in a range of courses focused on development of digital skills have been observed in Scotland, especially in areas such as Data Science, AI and Computing. Locally at the Scottish University six tailored specialist undergraduate (UG) programmes and nine post-graduate (PG) programmes are currently in the university educational offer. All of these courses have been designed to develop a range of specialist digital skills such as Software & Programming, Computer & Networking Support, Data Analysis, Digital Design, Digital Marketing and Customer Relationship Management (CRM) (Nania et al. 2019, Appendix 2). These are essential skills for finding work

and developing careers in computing science industry, commerce, finance, medicine, media, law enforcement and security and public life. A list of all digital skills programmes currently offered at the University in Stirling, with skills develop during each programme, can be found in Appendix 3. In addition, the Scottish University offers Graduate Apprenticeship in Data Science (BSc) designed as a combination of work-based learning and high-quality teaching delivered by experts in the field. This practical degree programme is focusing on developing mathematical and analytical skills needed to begin a career as a data scientist or analyst. It is a graduate-level qualification developed by Skills Development Scotland (SDS), the national skills agency, which is responsible for implementing the Scottish Government's strategies for upskilling Scottish workforce. Graduate Apprenticeships are delivered in partnership with the industry and the education sector to provide work-based learning opportunities for individuals who are currently employed, which means that Graduate Apprentices work for their employer whilst studying and developing their skills at the Scottish University.

Also, *Digital Skills Development Webinars Series* for students and recent graduates is currently run by Innovation and Enterprise hub (Summer 2020). The Enterprise Programme, supported by the Scottish University Vice-Chancellor's Fund, aims to help develop essential digital skills for future professionals and entrepreneur. The first series focused on digital strategy, digital marketing, web-design and E-Commerce platforms.

3.3.2 Innovative assessment and Digital Literacy

In addition to digital subject offer, universities are increasingly embedding digital content to support student in their learning. They help students develop a range of other digital skills and literacies through authentic and innovative assessments, which increasingly features development of graduate skills needed in today's world of work. These assessments either enable students to present solutions to a problem (often based on data handling and analysis) or communicate gained knowledge in a format of a digital artefact (e.g. presentation, video, podcast, digi-essay), thus in addition to the theoretical and practical insights the innovative assignment require from students to gain a high level of working skills in usage of specific software. Another innovative use of assignments is focused on developing specific working practices and professional behaviours that in contemporary world of work take place increasingly in the on-line space. These skills are often essential in graduates' competition for jobs or their successful exploitation once already employed.

For example, as part of the core skills element of the MSc HRM at the Scottish University, the assessment methods were adjusted in 2017 so that students were asked to demonstrate a level of digital competence that the course leaders felt was becoming essential to the employability of HR graduates. Realising that companies were increasingly making use of online video conferencing and meeting platforms as an alternative to face-to-face meetings, students were given instruction on good video meeting set-up skills – paying particular attention to lighting, sound, background, and camera contact. Mindful also of the increasing use of video CV formats in job interviews, the MSc programme built in assessments where

students were asked to speak to camera about their skills and attributes without the use of notes in addition to the technical competencies in terms of camera set up. The module that instructs students on practice skills (interviews, presentations, holding difficult conversations with staff) also makes use of an e-portfolio of video evidence of the skills in actions, and also gave students the opportunity to set up their own practice blog site – not visible publicly – where they marketed themselves and wrote short pieces about HR topics. Digital competence is now firmly embedded as an aim and in the learning outcomes of all HR degrees at PG and UG level at the University. The University's move into digital competences was noted by the Chartered Institute of Personnel and Development in their accreditation of the degree. The programme team was ahead of the curve in relation to the embedding of digital skills as a key element of being an effective HR practitioner and led to 'Digital Working' being incorporated into the CIPD Profession Map in 2018.

3.3.3 Developing Digital Skills of Staff – courses in online and blended learning

In the last five years, Scottish Universities have been expanding their teams of learning technologists who support, develop and run ranges of courses focused on the online/blended learning for university educators. The objective is to develop digital skills of academics teaching students. Even before the Covid-19 global epidemic, the uptake of VLE has been increasing and blended ways of learning has been championed by institutions as way of engaging students in more innovative, collaborative and inclusive learning developing higher order skills and reappraising the value of independent learning and critical thinking. Some institutions also encourage and support staff to think about digital accessibility and therefore place a lot of effort on promoting a wider and varied use of digital resources in teaching, and particularly the engagement with/use of the open-source resources. At the Scottish University staff is encouraged to attend various CPD opportunities, such as *the Blended and On-line Learning and Teaching course*, HEA fellowship development opportunities, and a wide range of Teaching Bites sessions focused on digital delivery and tools to deliver pedagogically sound student learning experiences. The most recent emphasis on upskilling academic staff in online delivery has been accelerated by the 2020 Covid-19 pandemic (See Section 4.1)

3.3.4 Digital transformation of student learning and experience

Digitalisation has been positively linked with student learning experience (JISC 2018a,b). As the universities use of digitalisation for learning becomes more popular and important, so is the need to support students in confident use of the digital learning infrastructure and resources throughout their university journey. According with its strategic vision focused on the enhancement of student experience, the Scottish University launched the student digital experience insights survey pilot in both 2016-2017 and 2017-2018 (JISC 2018). The evidence gained from these insights has been significant in helping to lead transformation initiatives in digital learning and services offered to students, which includes development of a new digital learning approach, improvements to services and digital provision (software, hardware and the learning environment), purchase and implementation of a new virtual learning environment (VLE) and lecture recording systems, support with the effective use of students own digital devices, quality of

digital teaching on course and in digital security and online safe professional behaviour. The interest in student expectation and engagement with student voice have been successfully embedded in the process of information gathering through 'Let's get digital -Tell us your digital study needs' campaign with a strong marketing brand and distinctive, eye-catching images with focused messages that were changed every few days. This brand was used in a series of promotional activities in areas of high student footfall, as well as on digital screens around the university, notices on the VLE and student portals, and in the student bulletin. All gathered evidence contributed to development of the Digital Learning Project Board, which provides the direction, scrutiny and governance around the digital learning agenda at the Scottish University. This board is currently shaping a new learning and teaching strategy. Some of the initiatives that the university has already undertaken in response to the evidence gathered include:

- Ongoing awareness raising and cyber security training. The #stircybersec campaign runs for a month every semester and has an ongoing presence on Twitter and Facebook throughout the year.
- The creation of a new knowledge base and self-service portal to provide online support and guidance for digital issues (e.g. information in bite-sized, easily digestible, chunks and is available to students at any time and via any device).
- Use of a variety of channels and different styles to engage with and respond to students (e.g. the student bulletin, articles on the information services blog, use of memes and little snippets released via social media).
- Investment in Panopto, a media management system that offers media creation and management options. Lecture recording is compulsory at the university and the aim is to use Panopto to promote and share its effective pedagogic use across the institution.
- The introduction of a new stakeholder engagement toolkit for all staff to use which promotes use of innovative UX techniques and shares findings from surveys and other activities.
- A laptop loan scheme is being planned to supplement desktop provision and address student feedback requesting more computers.
- Development of a training module for the institutional VLE (Canvas) to support online learning which is available to new students on pre-arrival along with additional content designed to support their use of the library as well as the development of information, productivity, digital and data literacies (including on-line collaboration/team tools, such as Office 365) and cyber security awareness.

This commitment to transforming the experience and digital capabilities of students at Stirling echoes the JISC[10] NUS student digital experience benchmarking tool (JISC 2016). It has been embedded across all the

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[10] JISC is the UK's higher education digital technology agency which supports post-16 and higher education sector by providing advice, digital resources, network and technology services, and thus it supports HEIs in developing the culture, infrastructure and practices in digital capabilities. JISC is funded by a combination of the UK further and higher education funding bodies, and individual higher education institutions.

Student Support Services and the Career Centre, that offers a range of academic skills, development and employability workshops, in group and one-to-one formats (for more information, see https://canvas.stir.ac.uk/courses/5117/pages/digital-literacy-1).

4   Impact of the 2020 Coronavirus pandemic

There might be too early to assess the true scale of impact of the Coronavirus pandemic (Covid-19) on the HEI sector in 2020. It is clear that the epidemic has caused an unprecedented disruption in education and training systems. Such assessment is much needed and will be ongoing. For example, on 19th June 2020, following the unprecedented use of digital technologies in schools and universities and an unexpected switch to distance/online learning during the pandemic, the European Commission has launched a public consultation to learn from this major event[11]. This public consultation will be available from 9 July until 4 September 2020. It will include a distribution of a survey and a series of summer online outreach events, which will be open to the general public, educational institutions and public and private organisations to ensure a wide range of views and perspectives. A new Digital Education Action Plan will be devised upon recent experiences and practices to consolidate a new European vision for the immediate Covid-19 recovery period and the long-term support for education and training sector's digital transformation.

In the UK/Scotland similar numerous small and big scale research projects and impacts-focused feedback gathering events and initiatives are currently being undertaken. The 2020 Covid pandemic has highlighted the importance of digital delivery of learning and teaching in HEI in a globally connected world, particularly in the face of unexpected disruption of such a massive scale. Institutions such as the Open University were able to capitalise on their business model that has always featured flexible and remote, and recently also increasingly digital, delivery of learning. Some HEIs with solid technological infrastructure and confidence in using the virtual environment were also able to quickly adjust and complete the intended programme of learning. In other underinvested, smaller or more traditional universities, the 2020 Covid-19 pandemic has questioned institutional and individual preparedness for online learning and remote working. Such rapid requirement for switching to on-line learning took many institutions by surprise. After the initial shock, there is currently a clear mobilisation in the HEI in Scotland for collating and sharing best practices to ensure that both staff and students are able to confidently use technology for teaching, learning and working in the post-Covid reality. A general optimism is detected amongst academics in Scotland, who despite some concerns related to the substantial time investment needed for transition to the on-line teaching, see this as unavoidable response to the changing times escalated by the pandemic.

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[11] UKRO updates (2020) 'Public Consultation on new Digital Education Action Plan', more information available on: Last accessed on 26.06.2020

4.1 Digital Champions and training for staff.

Initiatives, such as "Digital Champions" (DC) schemes are currently rolled out across Scottish HEI to enable academics with greater knowledge and experience of using digital tools in learning to support colleagues in their departments and schools. These champions tend to be trained and supported by Academic Development (AD) teams and institutional learning technologists. At the Scottish University, 'Faculty Digital Champions' initiative appointed two 'Champions' (i.e. academic members of staff with online teaching experience) from each of the five Faculties. The two areas of this role evolve around:

1. Augmenting the support on offer (Digital Champions are to give advice of how to 'translate' the traditional face-to-face delivery into delivery in VLE and enthuse colleagues to a greater and more student-focused digital academic practice and act as mentors.
2. Being a conduit between AD and the Faculty and ensure better communication in both directions (in order for messages from the AD to flow to academics, and also in the opposite way, so AD can identify existing gaps and organise training).
3. Sharing best practice with colleagues (from the Champions themselves, from the sector, and from other Faculties. A new Online Learning & Teaching Sharepoint site has been set up on the intranet, which brings together all available resources, and links to external sites).
4. Helping AD in the design and delivery of workshops, teaching bites, masterclasses and podcasts to help engage academics across the University. There is already a wide range of support on offer, which include a programme of events and masterclasses, a weekly drop-in session where staff can run ideas past AD and LT and DC, and a new week-long module for staff on Online Teaching[12]. In addition, a new VLE module template (for all modules) with embedded online checklist for staff has been designed to guide preparation.

The overall objective of the scheme is to create self-supporting communities of practice confidently and meaningfully embedding the technology in teaching. The knowledge and innovative solutions these communities can offer will be important in the post-Covid times, when campus-bound learning might become a thing of the past and more flexible ways of learning will be expected form geographically dispersed student populations. Less is being done to train staff in GDPR related complexities and to make them aware of potential consequences of delivery on-line that might enable third party providers to engage in unethical practices such as misuse of personal data (of both staff and students) for commercial purposes.

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[12] The *Supporting On-line Learning and Teaching* course is a week-long facilitated online course introducing staff to learning and teaching online and the Stirling approach. It is a simplified version, based on an earlier edition of *Blended and Online Learning and Teaching* to respond to the quick switch to teaching and learning online caused by the Coronavirus crisis.

4.2 Supporting students through difficult times

The 2020 Covid pandemic has forced university leaders, academics, technologists and support staff to consider practicalities of operating in a fully digital space. For many institutions, this was the first 'hands-on' full experience of moving towards a more digital university, and equally the same experience has been shared by many students, who might have been so far used to rather traditional delivery with digital engagement that was meant to only support their normal class-based and campus-based education. Switching to a fully on-line mode of study therefore required a substantial adjustment and a greater responsibility and engagement in learning. However, as students found themselves out of the campus, many lost the support from staff but also access to sufficient technology and infrastructure. Despite the ever-pervasive dominance of technology in our day-to-day lives, still not all students have equal and sufficient access to hardware and internet connection. Supporting students when they are unable to access those crucial services has been reported as the most difficult and often frustrating aspect of the epidemic, during which Scottish universities (unlike schools and colleges) were expected to operate as normal. Currently, additional initiatives to support students and their learning are being developed in the Scottish HEI sector, to include: greater access to digital resources (incl. e-textbooks), adjustment to assessment, more asynchronous and self-guided delivery of courses and all other supportive skills development workshops offered by the library, information centres and the student support services (to include videos on how to use VLE).

4.3 More collaborative ways of working

A sector wide solidarity has emerged during the epidemic. There are multiple examples of how employees (academic and non-academic staff) have created divisional and university digital platforms for sharing positive practices on how to better organise work, how to prepare materials/adjust assessment or how to plan forward. The same has been true in the wider sector, where colleagues from across different institutions eagerly share experience and support each other in finding best solutions to the crisis caused by the Covid-19. A general optimism is detected amongst academics in Scotland, who despite some concerns related to the substantial time investment needed for transition to the on-line teaching, see this as an unavoidable response to changing times. Many agree that reappraisal of existing practices and upskilling in digital skills for delivery of educational content is the worthwhile investment that has a potential to increase the quality of learning and student engagement.

5   Recommendations to address Key Points and Gaps in Policy Response

Within the European Union, the European Commission's Digital Economy Society Index (DESI) for 2018 shows that EU countries face deep digital development gap and therefore should invest fast to boost Europe's digital performance and meet the needs of the Digital Single Market. According to the index, the

similar disparity is seen in terms of digital skills. While Nordic countries and the U.K. have populations with notably advanced digital skills, almost half of all other Europeans still lack basic technical competences. As demonstrated in this report, the digital skills gaps across the UK and Scottish population are clear and more needs to happen to ensure that the employers have access to workers with skillsets matching the needs of labour market, on the one hand, and that the workers can fully utilise opportunities that offer better work and employment. A number of initiatives engaging stakeholders across different fields of work and learning should be therefore considered to address the current gaps in policy and practical response. This report proposes that approach for digital up-skilling is built on principles of inclusivity and life-long learning

5.1. Building digital capability inclusively through lifelong learning

Digital technologies are constantly evolving and becoming increasingly embedded into our lives and work. The future of work even more so is predicted to be greatly relaying on basic and specific digital skills but as Sections 2.3. and 2.4 discussed, the digital skills gap exists across the labour market and specifically in some new jobs across AI, Cyber-security and E-commerce. There is a concurrent need to up-skill people across their working lives in a range of digital skills. The UK and Scotland's industrial strategies pledge a strong commitment to support public, private and third sector organisations' delivery of digital skills training and to increase the digital capability. However, real actions need to follow such pledge if the UK's nations are to resolve challenges of global national and regional economic development, rapid advances in technology and an ageing population. More people of all ages must be given opportunities to upskill, retrain and develop the higher-level and digital skills that are matching the needs of employers. The currently reported gap in what skills employers need and what skills workers have is alarming and it suggests that more practically focused effective intervention need to happen.

As the world of work is dynamic and the changes that will impact the labour market in the future are unknown, ensuring a constant supply of digital and other skills is challenging but crucial. This is why the skills sector has to work closely with the industry to be able to respond to those needs timely and effectively. Short- and long-term focused strategies are needed, to addresses workers' lack of digital skills. The short-term strategies must include school/college/university- and work-based interventions that deliver digital training to address particular digital skills. Long-term orientation requires recognition for the life-long interventions that address different needs across people's careers and working lives, as well as changing needs of employers and the labour market.

Recommendation 1: Practically-focused effective interventions need to be designed and offered more widely to reach individuals from disadvantaged backgrounds and with low level of skills or qualifications

When building digital capability, particularly important is the issue of inclusivity. Even though digital inclusion has been increasingly present in the industrial and learning strategies, inequalities in learning persist. It seems that the current policies designed to improve digital skills in the UK are not currently

reaching all populations. In the UK, the adults who could most benefit from learning are often the least likely to do so including older and disabled people and those not living in private households (ONS 2019b). Those from lower socioeconomic groups, those with fewer years of initial education, and those furthest from the labour market also remain under-represented in learning. According to ONS Internet Access, Opinions and Lifestyle Survey (OPN), a lack of inclination (64%) and a lack of skills (20%) are frequently reported as reasons for not engaging with the digital world. This would suggest that an essential part of the education for digital skills may need to be the promotion of the life and work-related benefits these offer and helping to reduce barrier to engagement. Anxiety and apprehension might not be the barrier that describes the learning of digital skills only, as these are commonly experienced barriers in learning agenda more generally. However, the fact that people remain digitally excluded highlights the importance of ensuring that non-digital alternatives continue to be made available to enable everyone to participate fully in society and the labour market. Policy-makers, regulators and educators will need to play a fundamental role in helping those who are displaced or disadvantaged to repurpose their skills or retrain to acquire new skills.

Recommendation 2: *Varieties of* pathways *to digital up-skilling and re-training have to exist, which will include pathways that are based in either formal education setting, workplace or the community.*

For that reasons, a variety of pathways to up-skilling and re-training have to exist, which will include pathways that are based in either formal education setting, workplace or the community. There are many positive examples of digital up-skilling across those different sites across Scotland, some of which are presented in this report (Section 6), and some of which are the publically-funded adult education programmes. Importantly, some of those initiatives focus not just on learning but offer financial support towards skills training, thus eliminating one of the biggest barriers to continuous education. Some of such support is being offered by the Union Learning Fund administered by the Scottish Union Learning (trade unions' skills body in Scotland), or Individual Training Accounts (ITA) administered by Skills Development Scotland. All universities in Scotland enable publically-funded UG education for eligible students and multiple universities also offer bursaries, scholarships and awards that are available to local and international students and undergraduate and postgraduate levels. More flexible funding routes could be made available, especially for mature students and carer-changers to fully enable individuals to engage with learning throughout their lives, such as a "lifelong learning loan allowance" for adults without a degree suggested by a recent review of post-18 education in the UK (Hubble and Bolton, 2019). The Auger Review proposed a financial amount equivalent to four years' full-time undergraduate degree funding – up to £30,000 that could be used for vocational or academic courses from levels 4 to 6 at any stage of an adult's career for full and part-time students. The Scottish Government's commitment to supporting individuals deciding to study for a degree is clear, with currently fees being publically-funded and administered by SAAS. However, more could be done to make the university education more flexible and put in place mechanisms to ensure individuals can engage in continual/lifelong learning to remain employable in a market with an accelerating rate of technological change.

Recommendation 3: *The government and HEIs need to re-think how to make the delivery of university education fully flexible and fitting to lives of more learners who are otherwise unable to take advantage of largely publicly-funded university education at under-graduate level.*

More flexible study, enabling students to move between work and study across their lifetimes, will be a key in effective responding to the rapidly changing labour market. A recognition and support for more flexible and modular training, in addition to traditional part-time and full-time modes of study, should be considered and offered to the public. Despite an increased demand for lifelong learning, the provision of flexible adult education by UK higher education institutions has been declining in recent years (Tazzyman et al. 2019). With the decline of more flexible ways of studying that are fitting within peoples work and home responsibilities, adult learners have been withdrawing from university enrolment (Butcher 2020). While the call to close the digital skills gap highlights the need for more people to reskill and upskill, the current regulatory and funding systems are simply not designed to promote more flexible ways of learning (the Auger Review). The universities are an important partner in closing the skills gap, including the digital one. In order to make this happen a series of solutions need to be devised to make university studies more flexible and better support learners accessing less traditional pathways. Universities UK (UUK) and the Confederation of British Industry (CBI) are calling to initiate a longer-term change to the higher education system for example by introducing of a pilot scheme that would introduce and evaluate an integration of modular funding and shorter and more flexible courses (UUK 2018).

Recommendation 4: *Universities need to continue their commitment to the employability agenda making sure that they continue to best prepare students for life-long learning and employment*

In recent years, in response to criticisms from employers, HEIs declared commitment to and heavily invested in initiatives focused on developing employability and career skills of students to meet the demands required by business and industry (JISC 2015). This agenda includes digital skills sought after by employers in the digital economy as preparing graduates for employment, and increasingly for work, in a digital workplace has become an essential requirement for HEIs.

While some substantial progress has been made, yet only 41% of students feel that their courses adequately prepare them for the digital workplace, and only 69% thought that digital skills would be important for their career (JISC 2018). A recent QAA survey on graduate skills which explored the graduate skills through the lenses of equality and diversity, readiness for employment, and global perspective suggested that universities are doing well, but could do better (Swingler et al. 2019). Therefore, HEI need to better prepare individuals to meet future labour market needs by improving their labour market monitoring and fostering closer relationships with industry and employers. This is particularly important in the context of an ongoing change in business, society and the labour market. A greater collaboration with employers, industry and government is needed to help identify and deliver the skills of the future. This includes basic and specific digital skills, but also the 'soft' or 'transferable' skills and competences, and attributes such as creativity, communication, problem-solving, entrepreneurship and personal

resilience, which should be embedded into all HE courses. The focus on development of soft competencies, in addition to a more traditional, and in some disciplines often a sole focus on academic skills only, such as critical thinking and writing, will help to ensure university curricula are "future ready" and aligned with the needs of employers (WEF 2020).

5.2. Lessons from Covid-19

Recommendation 5: *While continuing to operationalise and implement digital up-skilling for the nation, a significant effort needs to be placed by the policy-makers, and especially HEI, to better understand challenges and unintended consequences digital learning and working poses.*

For almost all institutions and organisations, the Covid-19 pandemic has accelerated the speed of embedding digital ways of working. The pandemic forced so many employers and educators to work and deliver content remotely, learning quickly about solutions focused on short-term delivery of services. Therefore it can be said that the pandemic acted as a catalyst for quick upskilling and highlighted areas that will require a more systematic training. Despite the appetite for implementation of digital, on-line and virtual solutions, this will be an incremental process. Many organisations and institution, including the HEIs realised there are gaps to be addressed not only in the skills but also in the infrastructure, as the crisis has also highlighted the social and digital divides. The 2020 Covid-19 epidemic has highlighted that HEI needs to support both staff and students in acquisition of wider digital competencies and not just selected digital skills. However, at the same time as this speedy digital integration happens, many unintended consequences of learning and teaching, and indeed working, in digital realms are surfacing, such as personal data protection issues, cyber-security and ethicality of on-line surveillance practices. Only slowly these issues are getting recognised as challenging and potentially altering the nature of working lives and the university education. There is an urgent need to better understand challenges and unintended consequences digital learning and working poses. Universities and workplaces must swiftly and appropriately respond not just to the demand for digital skills but be able to also recognise complexities and potential consequences of being, living and working on-line that pose ethical and moral concerns.

6   Other Good practice identified regionally

6.1 New Digital Skills Collaborations and Partnerships

EIT Digital, the Europe-wide digital innovation and entrepreneurial education organisation, has opened a centre in Edinburgh in 2019. The centre is funded by Scottish Enterprise, Scottish Funding Council and EIT Digital, and hosted by the University of Edinburgh's Bayes Centre.

The 'Edinburgh Satellite' of EIT aims to fulfil the Scottish Government's five key goals: to deepen relationships with the EU, increase innovation and investment in R&D, increase university-industry knowledge exchange, develop skills needed by Scottish businesses, and promote skills and talent of people living and working in Scotland. EIT Digital is an organisation with an annual budget of €100m and investment focused on driving Europe's digital transformation by developing entrepreneurial digital skills and accelerating the market uptake of research-based digital technologies, particularly those focusing on Europe's strategic, societal challenges, which are: Digital Industry, Digital Finance, Digital Cities, Digital Wellbeing and Digital Tech. EIT Digital model is based on a pan-European ecosystem of over 200 top European corporations, SMEs, start-ups, universities and research institutes, where students, researchers, engineers, business developers and entrepreneurs who collaborate in an open innovation setting. the organisation has its presence in Amsterdam, Berlin, Braga, Budapest, Brussels, Eindhoven, Edinburgh, Helsinki, London, Madrid, Milano, Munich, Nice, Paris, Rennes, Stockholm, Trento, and San Francisco. The key stands of activities involve the EIT Digital Academy and skills development through blended model of learning aimed at different ages and levels of digital comprehension (a Master School, Doctoral School and Professional School.

The Edinburgh Satellite host a new Doctoral Training Centre, with a focus on Fintech, and Cyber Security via a new program supported by the Scottish Government's Cyber Resilience Unit and ScotlandIS, plus other areas of national strategic importance. Its students are supported by universities across Scotland. The partnership has recently led to funding of PhD project in Financial Technology Scholarship. This opportunity, funded by Actelligent and EIT Digital, aims to explore ways of improving the accuracy of stock price forecasts by using machine learning and big data analytics. (This post is currently advertised with a call placed on 2nd of July 2020 and programme to start in September 2020).

More information can be found on: https://www.eitdigital.eu and https://www.eitdigital.eu/about-us/locations/london-clc/edinburgh-satellite/

6.2 Ecommerce courses

The Institute of Ecommerce has partnered with the University of Strathclyde Business School to deliver the first Ecommerce course of its kind in the UK13. These courses are targeted at senior ecommerce managers and designed to close the skills gap which is currently preventing the growth of ecommerce in Scotland. They are considered as pioneering world class executive education with keynotes and guest speakers from the tech and ecommerce giants such as Amazon and Google. The first session of the pilot course took place in January 2020 and it was heavily oversubscribed suggesting there is a demand for developing this specific digital skill this new. The imitative is supported by Scottish Enterprise and Skills Development Scotland, and it is one of many considered by the newly formed Institute of Ecommerce,

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[13] https://www.sbs.strath.ac.uk/feeds/news.aspx?id=1997

which has been established by practitioners in order to capitalise on the economic opportunity which ecommerce represents to Scotland.

The UK has the 3rd largest ecommerce turnover in the world, sitting only behind China and the USA. It's worth £688 billion, this is the equivalent of German and French ecommerce combined and with 8% of the UK population. It is estimated that worldwide retail ecommerce will be worth over US$6 trillion by 2021. Scotland has the potential to generate around £55 billion in online sales. The institute aims to deliver support and training to thousands of Scottish businesses professionals over the next five years. The aim is to equip businesses in Scotland with the skills, techniques and tools to ensure greater productivity, wealth and increased exports. The emphasis is placed on delivering training that is practical, relevant and accessible, and which helps companies to grow. The programme is heavily featuring the peer learning, enabling practitioners to build useful training and share best practice and concerns.

Further specialist and beginners' courses are in development as well as a programme of ecommerce grassroots clubs already running in Glasgow and Stirling and soon due to be extended to Edinburgh and Aberdeen. More information on the Institute of Ecommerce can be found on: https://www.instituteecommerce.com

6.3 Digital Futures at Work Research Centre

The Digital Futures at Work Research Centre (Dig.IT) aims to advance our understanding of how digital technologies are reshaping work, impacting on employers, employees, job seekers and governments. It is led by both University of Sussex Business School and Leeds University Business School with partners from Aberdeen, Cambridge, Manchester and Monash Universities. It is funded by the Economic and Social Research Council (ESRC). Drawing resources from different academic fields of study, Dig.IT will provide an empirically innovative and international broad body of knowledge that will offer authoritative insights into the impact of digitalisation on the future of work.

Dig.IT will establish a Data Observatory on digital futures at work to promote findings through an interactive website, report on a series of methodological seminars and new experimental methods and deliver extensive outreach activities. It will act as a one-platform library of resources at the forefront of research on digital work and will establish itself as a focal point for decision-makers across the policy spectrum, connecting with industrial strategy, employment and welfare policy. It will also manage an Innovation Fund designed to fund novel research ideas, from across the academic community as they emerge over the life course of the centre.

More information can be found on: https://digit-research.org/innovation-fund/

6.4 Digital Unions and Scottish Union Learning Everyday Skills Programme

Trade unions recognise the increasing need for helping workers to develop their digital skills in the workplace. This is why digital skills have become an essential element of the Scottish Union Learning Everyday Skills programme. The programme is funded by the Scottish Government to deliver the digital skills project to further develop workplace learning opportunities around digital skills, encourage greater employer engagement, and subsequently lead to an overall increase in digital participation in Scotland, in line with Scottish Government strategy. In addition, the Union Learning Reps programme runs refreshing courses for working reps who already have digital skills and who feel confident to become champions or trainers for colleagues, internally supporting digital skills development in the workplace. Amongst the courses offered are web development and coding courses, and increasingly courses focused on developing understanding of cyber risks and threats, that help to equip worker to take appropriate measures to stay safe online.

More information about the Scottish Union Learning and the trade union movement's initiatives to support workers in their digital skills development can be found on: https://www.scottishunionlearning.com

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8 Appendices

Appendix 1 Expert Interviews

Name of organisation	Type of organisation	Expert's position	Interview date	Mode of interview (telephone, mail, etc.)
Scottish University	HEI	Lecturer in Economics	24.06.2020	Microsoft Teams + email exchanges
Scottish University	HEI	Academic Development Partner	25.06.2020	Microsoft Teams + email exchanges
Scottish University	HEI	Head of Information Services		Published brief
Scottish University	HEI	Director of HRM Programmes	June 2020	Informal conversations + emails
Scottish University	HEI	Senior Lecturer in Health	1.07.2020	Informal conversations + email
Various institutions, Scottish Academic Leadership Programme network	HEI	Academics and teaching technologists	January – August 2020	Zoom/Teams conversations
various	Unions	Learning reps	July	Informal conversations

Appendix 2 Digital Skills Type

Table 1: Baseline and Specific Digital Skills

Digital Skill Type	Digital Skill Cluster	Description	Common Occupations
Baseline	Productivity Software	Productivity software skills such as Word and Excel, Enterprise Resource Planning (ERP), Project Management Software, SAP	• Administrative Occupations • Customer Service
Specific	Software & Programming	Programming languages such as Java, SQL, and Python	• Programmers • Software Developers • Database Administrators
	Computer & Networking Support	Set up, support and manage computer systems and networks	• Network Administrators • Software Developers • IT User Support Technicians
	Data Analysis	Data analysis tools like R or Stata, Big Data, Data Science	• Management Consultants • Economists • Statisticians • Business Analysts
	Digital Design	Digital production, graphic design, online advertising Professionals skills	• Marketing Associate • Graphic Designers
	CRM	CRM software, such as Salesforce or Microsoft Dynamics	• Sales Professionals • Marketing Associate Professionals • Customer Services Managers
	Digital Marketing	Digital marketing technologies, such as social media platforms and analytics tools, such as Google Analytics	• Sales & Marketing Professionals • Marketing Associate Professionals • HR Officers
	Machining & Manufacturing Technology	Machining and engineering software and tools such as CNC machining and computer-aided design	• Machine Operators • Civil Engineers • Quality Control Planning Engineers

Table 2: Skill – Qualification Levels Match

Skill Level RQF	Levels included	Example qualifications
Low-Skill	Entry level, Level 1, Level 2	Entry level certificate, GCSE, Level 1/2 certificate, intermediate apprenticeship, Functional Skills28
Middle-Skill	Level 3, Level 4, Level 5	A level, Advanced Apprenticeship, Higher National Certificate (HNC), Higher National Diploma (HND)
High-Skill	Level 6, Level 7, Level 8	Degree Apprenticeship, Bachelor's Degree, Master's Degree, Postgraduate Degree, PhD

Source: Nania et al (2019). No Longer Optional: Employer Demand for Digital Skills

Digital Competency framework created by the European Commission includes five key dimensions with matching brief description. For more detail see: https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework

Five Dimensions of Digital Competency	
1. **Information and data literacy**	• Searching, evaluating, managing data, information and digital content
2. **Communication and collaboration**	• Interacting, sharing, engaging, collaborating through digital technologies • Managing digital identity
3. **Digital content creation**	• Developing digital content, programming • Understanding Copyright and licences
4. **Safety**	• Protecting devices, personal data and privacy and well-being
5. **Problem solving**	• Solving technical problems • Identifying needs and technological responses and digital competence gaps

Name of the Programme	Digital Skills and Knowledge
BSc Business Computing	developing IT solutions to support business needs
BSc Business Computing	design, build and analyse computer systems
BSc Data Science	data science and analytics
BSc Digital media	digital media management and production
BSc Software Development with Cyber Security	software development, advanced knowledge of AI and computer security
BSc Software Engineering	design and programming, developing complex systems
BSc Graduate Apprenticeship in Data Science	mathematical, computing and analytical skills, data science technologies
MSc Digital Media and Communication	digital media management and production
MSc Big Data	big data technology, advanced analytics and industrial and scientific applications
MSc Data Science for Business	data analytics for business applications
MSc Mathematics and Data Science	big data and analytics, data networks
MSc Artificial Intelligence	advanced analytics and machine learning
MSc Business Analytics	systems analysis, business models, quantitative methods and data science
MSc Financial Technology (FinTech)	computing technology, financial theory, ethical and regulatory constraints, and business skills
MSc Finance and Data Analytics	big data skills
MSc Marketing Analytics	systems analysis, quantitative methods and data science

Appendix 4 Digital Economy and Society Index 2020

The Digital Economy and Society Index (DESI) is a composite index published annually by the European Commission since 2014. It measures the progress made by EU Member States towards a digital economy and society, bringing together a set of relevant indicators. The DESI is composed of five principal policy areas, which group 37 indicators overall:

1 Connectivity	Fixed broadband take-up, fixed broadband coverage, mobile broadband and broadband prices
2 Human capital	Internet user skills and advanced skills
3 Use of internet	Citizens' use of internet services and online transactions
4 Integration of digital technology	Business digitisation and e-commerce
5 Digital public services	e-Government