Future of Work Strategic 'Think Piece' Report:

Prof Claire Wallace (Aberdeen) and Prof Jacqueline O'Reilly (Sussex)
14th June 2018

Executive summary

The emerging body of reports and studies on the future of work reflect a growing public appetite to inform us about the likely consequences of work in the digital age. Employers, employees, policy makers and citizens are frequently presented with a range of analysis from business thinkers, consultants and academics from the UK and internationally. These include optimistic, pessimistic and sceptical interpretations based on disparate knowledge and interpretation of the consequences of changes to work and employment in the digital era.

However, the digital transformation of work has received limited attention in terms of ESRC funding. There has not been a significant ESRC investment in the broader topic of work since the 1990s programme on the Future of Work (Nolan and Wood 2003). To date valuable ESRC research investments have focused on particular aspects of work such as training, education and skills. The ESRC could play a strategic role in supporting research in this area, co-ordinating different methodological approaches and linking them to stakeholder networks and other research councils' initiatives.[1] Such an investment could provide a distinctive and substantial intellectual contribution to international debates; it could inform government policy around the Industrial Strategy; and it could also contribute to building research capacity and methodological skills for current and future generations of researchers seeking to examine the changing world of work and its consequences in the digital age.

The report draws upon a number of sources: an extensive review of current academic, policymakers and think tank research outputs; dialogue from two ESRC stakeholder workshops; consultations with a wide number of businesses, policymakers, stakeholders and academics in the UK, Germany and the US; a systematic review of current ESRC funding on the topic of work; and a short summary of EU research funding priorities. It provides an overview of the current landscape identifying five research themes that need addressing, outlining gaps in our existing knowledge. It concludes by making recommendations for future ESRC research investment, building international and local synergies, and capacity building to inform a research agenda on the future of work.

Part 1 identifies five main research areas and questions:
1. How are digital technologies at work affecting skills, training and productivity?
2. What are the social and economic consequences of emerging new working practices, work places and business models for shared prosperity?
3. How do these transformations affect inequalities, in-work poverty, insecurity and inclusion?
4. How is job quality changing and what effects does it have on health and wellbeing?
5. What are the implications for life long work, resilience and sustainability?

While some discrete analysis of these themes is receiving eclectic attention, systematic analysis and the relationship between these questions has been under-researched in the UK in relation to the implications for the future of work. The ESRC should try to develop initiatives to build synergies proactively. This could involve interdisciplinary initiatives with the EPSRC, AHRC and collaboration with stakeholders. It involves developing new methods of data collection that would in turn require new forms of skills training for researchers. Whilst research might focus on the UK it is essential to maintain awareness of international dimensions if the UK is to remain at the forefront of research this field and to alert us to the range of policy options in managing this transition (Neufeind et al. 2018; Rubery et al. 2018).

---

[1] See also previous scoping reviews from Halford et al. (2016) and Yates et al. (2017).

Some of the current gaps, data and capacity building needs include:
1. Mapping the growth and experience of new working practices, work places and business models' demand for skills, and provision of job quality and job security in the digital age.
2. Identifying good quality quantitative and qualitative, longitudinal and internationally comparative data about the experiences of employers, employees, job seekers and those not engaged in the paid work. This could include Big Data methods combining existing surveys, social security and administrative data, establishment surveys, and new innovative and experimental methods.
3. Analysis of the consequences of digitisation for different groups of workers by ethnicity, gender, age, socio-economic background, migration status and other intersectionalities.
4. Building on comparative measures of job quality, productivity and social innovation to include social health in a digital culture and wellbeing over the life course.
5. Understanding the combinations and portfolios of different types of work across the life course in formal, established, and informal and gig economy work.
6. Understanding how employee voice can be incorporated into new business models.
7. Provide a broad, historical and theoretical contextualisation of work including caring, unpaid and voluntary work alongside employment on digital platforms and conventional firms.
8. Supporting the development of computational analytics for social research in the digital age from UG to PG level as well as for ECRs and established researchers.
9. Establish secondments and internships in government, businesses and NGOs.
10. Links to EPSRC and AHRC investments in doctoral programmes on the Digital Economy.

Part 2: identifies key opportunities for interdisciplinary, international research including partners beyond the research community

Investment to support interdisciplinary research from economic, sociology, psychology, law and business studies is essential in taking this research agenda forward, as well as creating incentives to work with those in software engineering, informatics and the humanities. Some evidence of this already existing with the EPSRC Digital Economy theme, but a stronger focus on the work dimension of these changes is required to make a significant contribution to our wider knowledge.

Encouraging exchange visits and collaborative projects with a significant number of UK businesses, policy makers and international organisations working on these issues could strengthen these links. A substantial body of non-academic organisations are very interested in this area and anticipating future change. These include government departments such as: BEIS, DWP, DMC, DoE and the Office of Students; legislative bodies such as the recent Lords Committee investigation on Artificial Intelligence AI (April 2018) and the European Parliament study on gig workers (Forde et al. 2017); business organisations such as the TUC, CIPD and the IOD; think tanks such as RSA, Policy Network and management consultants like Deloittes Digital, McKinseys and Accentura. Engagement with non-academic actors could also create opportunities for co-funding, collaboration and potential secondments and placements for a range of researchers at different career stages.

Part 3. Summary Recommendations for ESRC investment
1. Fund a programme of research enabling a range of large, medium and small sized projects including quantitative, qualitative and innovative methodological approaches. These should be informed by theoretical, internationally comparative and historically contextualised understandings of the implementation and consequences of technological change at work.
2. Facilitate international collaborations to support a significant data infrastructure for the wider research community.
3. Support capacity building through the development of substantive and methodological skills, and new data analytics, building on Q-Step investments for students, researchers and practitioners.
4. Engage stakeholders in co-production.

Part 1. An overview of the current landscape area

What is the current scope of research in this area?

Research on work and employment in the UK has a long and internationally respected tradition (Gallie 1978; Brown 1987: Halford et al. 2016). However, the advent of the so-called Fourth Industrial Revolution (Schwab 2017) presents a new set of challenges that are inadequately addressed by the current ESRC research-funding portfolio. A more comprehensive and systematic analysis of the extent and broader consequences of the digital transformation of workplaces, in both established organisations and the creation of new business models, are urgently required.

The advent of the so-called Fourth Industrial Revolution is claimed will lead to new kinds of work relations as jobs become automated with increasing use of Artificial Intelligence (AI), robotics and algorithmic management (Schwab 2017). Optimistic, pessimistic and sceptical interpretations abound of an increasingly fragmented, digitalised and flexible transformation of work across the globe (Neufeind et al. 2018). The impact of these changes on employment practices can be summarised in relation to five broad research themes:

1. How are digital technologies at work affecting skills, training and productivity?
2. What are the social and economic consequences of emerging new working practices, work places and business models for shared prosperity?
3. How do these transformations affect inequalities, in-work poverty, insecurity and inclusion?
4. How is job quality changing and what effects does it have on health and wellbeing?
5. What are the implications for life long work, resilience and sustainability?

This report provides an overview of the current research landscape around these five themes. It identifies substantive and methodological strengths and gaps in our knowledge. It focuses on data needs to support research development and capacity building to enable a transformational impact on understanding the changing future of work.

1. How are digital technologies at work affecting skills, training and productivity?

New skill needs not only affect younger workers entering the labour market for the first time (O'Reilly et al. 2018) but also older workers and those displaced by technological change (Lain 2016; BEIS 2017). They will all be increasingly expected to participate in new forms of life long learning, if they are to keep a foothold in employment or to make transitions into new sectors and occupations.

Both young and older job applicants increasingly need to develop digital skills to access jobs via Internet based application processes, as organisations use algorithmic management systems to sift through candidates. For some young people these applications can be quite challenging. In particular for less advantaged and poorly qualified young people, often associated with being Not in Education, Employment or Training (NEET) their access to digital technology and Wi-Fi networks are often dependent on the resources provided by their families or friends: if they do not have these supportive social networks they do not have reliable access to the labour market. Once they find work, organisations are increasingly using digital tools to schedule working time and shift allocations through Facebook and Whatsapp.

There has been a significant investment in the UK on apprenticeships and Trailblazers programs to support people who are not yet qualified to participate on apprenticeships. These will be young people who will work in traditional apprenticeship style manual labour occupations, but who will increasingly need to use a variety of digital technologies to manage their own workloads, especially if they become part of the growing number of the self-employed to manage their website, reviewers responses and customer communications. Government reforms to introduce Graduate Apprenticeships are part of a trend to increase the analytical dimension of these established forms of

training, but there is limited evaluation of the effectiveness of these programmes, or international comparisons for example with Scandinavian countries or Germany where similar trends in augmenting established apprenticeships with higher education courses are being introduced. The Apprenticeship Levy aimed at generating investment in these skills in the UK appears to be patchy, having limited initial success in encouraging firms to invest in skills (CIPD 2018c; DoE 2017).

Predicted changes in the future of work also give rise to a major concern on productivity growth in relation to skill requirements. However, technological advances do not seem to have had an impact on productivity growth (Soete 2018; BEIS 2017). Productivity gains are the main driver of higher wages and living standards. But the broken link between productivity and wages might be explained by the slow diffusion of technology and the lack of capacity or incentives for firms to invest.

A key challenge is how to stimulate investments and how the benefits of new digital technologies are actualised, distributed and reinvested in relation to changing skill needs and productivity improvements. Embedding institutions to provide digital training and skill acquisition will require effective collaboration between the social partners in business and the public sphere to identify policies that will work; research is needed to understand, evaluate and inform us about the effectiveness of changing processes at work.

2. What are the social and economic consequences of emerging new working practices, work places and business models for shared prosperity?

The social and economic consequences of new working practices are contested in relation to job loss and creation (Acemoglu et al. 2017; Autor 2015). Frey and Osborne (2017) suggest that fifty per cent of US jobs are vulnerable to some form of automation, whereas Arntz et al. (2016) estimate that this is more likely to be around nine per cent in OECD countries. Job losses resulting from automation and AI will disproportionately affect different occupations and industries including high status professions such as medicine, accountancy and the law. However, Autor (2014:130) argues that the anxiety around robots replacing humans is often over stated ignoring '*the strong complementarities that increase productivity, raise earnings and augment demand for skilled labour*'.

Labour displacement and productivity effects of AI on employment suggest that middle-level jobs requiring routine manual and cognitive skilled are most at risk. In the long run, initial labour displacement effects of jobs with routinised manual or cognitive skills, as in previous industrial revolutions, will be compensated for by the growth in non-routine jobs at the high and low end of the economy. One expected result is that women and ethnic minorities, in low skilled, low paid jobs are more likely to be affected, at least in the short term (Piasna and Drahokoupil 2017; WEF 2017).

There is a lot of discussion about AI, but very little good quality social science research that explains the diversity and implications of AI at work. The term AI is used very generically, but there is very little understanding of how this applies to various sectors and what its implications for work will be. Retail shopping is a good example of this. More people are employed in the retail sector through the digital transformation, but employment in high street shops is in decline. Shops and banks are increasingly announcing redundancies, and simultanously announcing new jobs in different parts of their organisations, if they don't become bankrupt. Changing patterns of consumption resulting from the use of AI in retailing is changing the face of employment in these sectors, but not receiving sufficient attention from social science research for its wider implications.

Algorithmic management is allowing closer surveillance of employees' performance and the harvesting of personal data. In addition, the case of Cambridge Analytica indicates the need to develop new forms of data regulation and ethical practices around individual and employee data to complement and evaluate the recent introduction of General Data Protection Regulation. Understanding how these computational analytical skills are being used by firms is only beginning to be investigated by social scientists (Angrave et al. 2016).

New platform working practices in the forms of 'crowdwork', 'clickworkers' and new types of self-employment are evident and highly visible in the public eye (Forde et al. 2017). These 'new' jobs frequently challenge the boundaries of existing employment law, social protection and taxation categories. High profile legal disputes such as Uber and Deliveroo illustrate the contested definitions of the boundaries between self-employment and worker status, with the onus of proof increasingly resting with the employer rather than the worker (Prassl 2015). The Taylor Review 2017 is one example of attempts to examine these developments in the UK. But this issue presents similar problems in many European jurisdictions with governments looking for new solutions to redefining social protection and employment status (Berg and De Stefano 2018). Further clarification of workers' rights to minimum wages, holiday entitlements and other benefits is also needed (Rubery et al. 2018). While some authors have suggested that a basic income policy could address these problems, Huws et al. (2018) point out that this raises a number of additional problems with regard to who should be entitled to these benefits, how immigration from outside Europe affects this policy, and whether it would encourage employers to withdraw their contributions to social welfare.

In terms of 'shared prosperity' new business models have the potential to exacerbate the concentration of capital in the hands of a few people and companies, changing the ownership of the means of production and raising the question about wealth redistribution and social mobility. As a result of accelerating innovation systems some successful firms can make use of extraordinary economies of scale and exceptional returns on capital (Brynjolfsson and McAfee 2014). These 'superstar firms' tend to have higher profit margins and lower shares of labour. A growing ecosystem of venture capital and private equity investors chasing 'unicorn' investments (software start ups achieving US$1 billion evaluation) are likely to have dire consequences for the increased commodification of labour in platform companies according to Zysman and Kenney (2018). Central to debates on inequality in the digital age is the notion that innovations in technology are driving growth and productivity in some areas at an exponential rate, but the benefits are not widely shared (Haskel and Westlake 2017). Policy choices on how the consequences of these technological changes are implemented and the consequences managed are political, subject to coalitions of actors at the local, sectoral, national and international level (Neufeind et al. 2018).

3. How do transformations affect inequalities, in-work poverty and insecurity?

The increased commodification of labour will affect particular groups of workers differently (Rubery et al. 2018). Conventional inequalities in terms of gender, age, ethnicity, and labour market stratification are potentially being reproduced in new forms; new divisions between regular and irregular workers, supplementary and secondary earners will also emerge as new forms of the employment contract are redefined on platforms, in the courts and in established organisations.

Evidence from the US and the World Economic Forum (WEF (2017) indicate that pay inequalities in terms of gender and ethnicity are also evident in the new digital economy (Ge et al. 2017; Howcroft and Rubery 2018). More recent recognition of how discrimination can be built unconsciously into algorithms is gaining attention in the USA (www.ajlunited.org), but there is little evidence of comparable research in the UK. An important dimension highlighted by research at the Joseph Rowntree Foundation is the issue of in-work poverty as wages fail to cover basic living costs. Job insecurity and lack of benefits and representation, highlighted by the Taylor Review (BEIS 2017), undermines working conditions, especially in new forms of digital, 'gig' and crowd work.

As social media and 'intangible capital' becomes ever more ubiquitous (Haskel and Westlake 2017), business models involving social networks and online reviews are producing phenomenal power for some 'super star' firms; but the potential empowerment for employees working in these networks is yet to be fully realised. New technologies offer innovative possibilities of income generation and new forms of 'self-employment' for those in dispersed, co-operative and sharing economy communities. Alongside these new forms of income generation are new forms of employee voice and organisation that have been channelled through social media channels. The Independent Workers Union in the

UK (https://iwgb.org.uk/how-we-began), union platforms for crowd workers in Europe (http://faircrowd.work), and business platforms providing employees' company reviews, like 'glassdoor' (www.glassdoor.co.uk) (Larkin 2015), are emerging as new channels of voice and organisation in the digital work economy. Conventional workers' organisations such as the TUC, the ETUC and American trade unions are keen to develop proactive responses to these developments in terms of recruitment, voice and action. Pioneering work has taken place in Germany in this respect (TUC 2017), but research in the UK in this area is in its infancy.

4. How is job quality changing and what effects does it have on health and wellbeing?

The quality of work has been a topic of much recent discussion by national and international bodies (Taylor Review 2017; The Work Foundation 2017; CIPD 2018a and b; New Economics Foundation 2017, OECD 2011, ILO 2016). Some of the academic debate in the UK has focused on measures and dimensions that need to be included in differentiating between 'good' and 'bad' quality jobs (White 2016; Findlay and Thompson 2017; Warhurst 2018; Felstead et al. 2018). Overall, while recognising that job creation is essential, they remind us that it is not a sufficient goal: job quality measured across a range of dimensions is vital to understand emerging forms of inequality. Europe aims to be home to quality work. Prior to the Global Financial Crisis developing flexible work pathways, strengthening legislation to protect workers and creating mechanisms for social dialogue were pathways to pursuing this agenda. A key issue was enabling women's participation in the labour market, increasing the employment rates of older workers, NEETs and other disadvantaged groups. Whilst there has been a lot of work in this area, the focus has been mainly on individual or specific groups' experiences of work rather than broader issues of health, wellbeing and the design of work (Wood et al. 2018), or an exploration of what Hobsbawn (2018) calls 'social health' in the digital era.

Contextualising the UK experience internationally (Hall and Soskice 2001, Gallie 2013), Britain is consistently something of a liberal outsider within Europe, although more typical of the Anglo-Saxon countries around the world. This has led the Taylor review to emphasise the importance of finding a British solution to work quality and the future of work. However, on most indicators of work quality in the EU the Nordic countries and the Netherlands do best, the Eastern and Southern countries do worst and the UK is somewhere in the middle (OECD, European Foundation for the Improvement of Living and Working Conditions).

What is clear is that since the economic crisis of 2008 the number of part-time jobs has increased and self-employment now characterises just over a quarter of all workers - not all of them voluntarily. The number of insecure and what used to be called "atypical" jobs have become more typical (Rubery et al. 2018). Although employment rates are at their highest the Taylor Review (2017) has called for the systematic monitoring of job quality. A number of indexes and dashboards have been proposed, some more narrowly focused upon wages and availability of work and others more broadly comprising indicators of fulfilment, often condensed into indicators of job satisfaction. There is no agreement on what counts as job quality and indicators tend to reflect the available data as much as theoretical orientations. The CIPD has developed a helpful framework bringing together a mosaic of various concepts with suggestions for how these could be measured drawing upon a cross-disciplinary review of the literature.

5. What are the implications for life long work, resilience and sustainability?

The research on life long work to date has tended to focus on older workers and their health problems (see Appendix 1). However, we should also include people at other stages of the life course since the de-standardisation of work and family transitions affects people at all phases of life and "resilience" at one phase could depend upon experiences at another (Moen 2016).

The numbers of older workers over 50 have been increasing steadily over the last decades and now make up the third largest group of workers.[2] Changing demographic trends such as the increase in later divorce and older people taking out mortgages for themselves, or to help children onto the housing ladder or through education, means that working longer may become a necessity. Given the rise in employment of those over 50 (and even over 65 with the end of compulsory retirement), new approaches and conceptualisations are needed for this group of workers. They are no longer to be viewed as moving towards retirement but rather in need of training, skills, careers advice and job re-design to fit their requirements.

Systematic reviews have suggested that there is little difference in the performance of older workers compared to younger ones, as some workplaces have become less physically challenging. Furthermore, they suggest that since people age in different ways some might be physically challenged, while others are not (New Economics Foundation 2017). More subjective and psychological aspects of aging become important. Digital communications offer new ways of integrating both able bodied and those that are more physically challenged. Nevertheless, older people who have not grown up immersed in digital communications might find this aspect of the digital revolution challenging and this can be a potential source of exclusion and alienation for some and embraced by others.

At the other end of the age spectrum, young people undergo extended routes through education, training, internships and temporary jobs interspersed with travel abroad or periods of un (or non) employment. There is growing concern about NEETS and increasing difficulty that low qualified young people find in entering the labour market. At the more privileged end, young people might change jobs, change careers, undertake new educational directions or pursue enthusiasms such as travel, activism, music or sport. Such pathways offer increasing individualisation and choice but less regular work. These activities may or may not lead to conventional careers but they do pose problems for conventional social security and welfare systems built upon the assumption of regular work and regular contributions over an extended period of working life (O'Reilly et al. 2018).

Family life has become likewise de-standardised, including reconstituted families and the dispersal of childbearing across the life course to include later starts, the recognition of civil partnerships etc. In this complicated set of transitions, single person households have grown at both ends of the life course as have non-family living arrangements with lodgers, housing communities, carers etc. (Daly 2005). There is greater recognition of diversity but it means that the integration of private and public working life takes more complex forms than in the past (Findlay and Thompson 2017). In the UK there has been a great deal of research on work and care (see Appendix 1) but the digitalisation of working practices brings new challenges to the 'over connected worker' 'pressed for time' as discussed by Wajcman (2015) and Hobsbawn (2018).

Examining the digital gender divide Howcroft and Rubery (2018) illustrate how persisting gender inequalities are perpetuated, and how emerging forms of employment reinforce women's role in social reproduction in new ways. They argue that we need to think about the consequences of these transformations in relation to structural changes in the growth and decline of particular sectors, changes to the nature and quality of work affected by patterns of displacement and recruitment, change to the employment relationship, and change to access to work over the period of childbirth and childrearing. Their policy recommendations focus on issues related to working-time flexibility, revisiting the societal value of care and 'caring jobs', and the regulation of new forms of employment.

---

[2] David Bell (2018) presentation at "A future that works for all" workshop Edinburgh

Where are there important gaps in the current research profile of this area and what data needs are there?

1. Identifying changing demand for skills in the Digital Age

There is a clear need to have new data that can inform us about changing skill needs in jobs affected by the digital transformation of work. The data required would include an employer and employee survey, Big Data methods to link with existing data and administrative data, as well as innovative and experimental qualitative methods to capture these employer, employee and job seekers experiences.

There have been a number of valuable ESRC investments in understanding changing skill needs through the LLAKES Centre (www.llakes.ac.uk) on learning, economic competitiveness and social cohesion. They focus on youth, inter-generational mobility, and civic values; learning, work and the economy; and education, inequality and social cohesion. The SKOPE Centre (www.skope.ox.ac.uk) founded in 1998-2018 examines the links between the acquisition and use of skills and knowledge, product market strategies and performance (measured in a variety of ways). The Skills and Employment Survey (SES) (https://esrc.ukri.org/research/our-research/skills-and-employment-survey-ses) was funded until 2014 in collaboration with UKCES to understand how working life has changed over time, building on previous surveys from 1986. A number of investments from the Department for Business, Innovation and Skills, and the Department for Education have funded the Centre for Vocational Education Research (http://cver.lse.ac.uk) in 2015 to understand the contribution of vocational education to individuals and the wider economy; the DoE has also funded the Employers Skills Survey (www.skillssurvey.co.uk). OECD (2016) publications in this field have largely drawn on data from the Survey of Adult Skills (PIACC) (www.oecd.org/skills/piaac). This very rich source of data could be further exploited to address some of the key themes and could be linked to gaps and suggestions identified in the following section.

2. Mapping the growth and experience of new working practices, work places and business models through new and innovative methods

There are a number of international surveys to capture dimensions of work in the gig economy (Forde et al. 2017; De Stefano 2016; Huws et al. 2017; Pew Research 2016) and on non-standard employment (ILO 2016). The European Commission has established an aggregate measure comparing country performance drawing on a range of existing data about infrastructure, human capital indicators, the use of digital tools amongst citizens, businesses and government (European Commission 2017). The OECD (2011) has also produced a guide to measuring the Information Society. The iLabour Project at Oxford (http://ilabour.oii.ox.ac.uk) provides an indicator, the Online Labor Index, to measure the supply and demand of online freelance labour across countries and occupations, funded by the European Research Council. The Leverhulme Centre for Intelligence (http://lcfi.ac.uk) is largely concerned with AI across a broader remit that does not focus on work per se.

These resources provide a useful context against which to understand trends in the growth of new forms of digital employment on platforms and the extent of digitalisation amongst the labour force, in business, government and society more generally, or trends in AI. Some of these sources also provide some very useful international benchmarks for developments in the UK. In the period of negotiating Brexit it is essential that these comparative indicators and data sources are sustained and developed if UK based researchers are to maintain their international position in this field. This comparative perspective will also be essential to inform government policy, in particular related to the Industrial Strategy about the relative progress, or lack of it.

Significant investments from the ESRC and other bodies have provided very valuable data resources and analysis but these investments have not focused on the impact of the digital transformation of employment. In contrast, for example, in Germany there has been a major investment in establishing

an employer/employee survey linked to social security data to map the effects of digitalisation on businesses and employment (Arnold et al. 2016) (www.iab.de/de/befragungen/zew_arbeitswelt.aspx). ESRC investment in replicating parts of this research programme could be very instructive to UK policy makers and the academic community on measuring the extent and effects of the digital transformation of work in the UK, as well as enabling cross-national comparisons with Germany, or potentially other countries where comparable data might exist. In addition a further updated round of the Workplace Employment Relations Survey, last conducted in 2011 (www.wers2011.info/), would allow a historical comparison on key dimensions that are closely rooted in the British tradition of employment research since the 1980s.

There are relatively few studies examining how new forms of employment in the digital economy reflect or reproduce existing inequalities and potentially exacerbate them to create new forms of insecurity (Gallie et al 2017). There is a need to understand who are the gig economy workers but also how they combine portfolios of work, how this relates to job quality and their resilience across the life course. This could involve good qualitative case study investigations in addition to surveys and the use of Big Data sources, or innovative data scraping methods from platform organisations.

There is a body of research in the United States that has used platform data to track the discrepancies between white and non-white providers and the incomes they have received for those services in different areas of particular cities (Ge et al. 2016). This has been very significant research in the context of United States. This data is much more difficult to access in the European context. Nevertheless, this is a very important and significantly under researched area that requires investigation in the UK and EU context with the involvement of platform businesses who have access to this data. This is a challenging area and it is often very difficult to obtain the data from these organisations. But this is also a very significant area in which these organisations could be encouraged to participate, to legitimise or improve their performance and address some of the pressing ethical issues about how organisations treat personal data and activity on these digital platforms. Such levels of co-production of research would be extremely innovative, engaging and address some of the concerns voiced in the UK Industrial Strategy.

3. Building on comparative measures of Job Quality to include health and wellbeing

Research has tended to focus upon institutional contexts and economic rewards or measurements of individual workers' satisfaction. Issues that have been neglected include the role of health and wellbeing. Here we can identify two aspects – the health and wellbeing provided by having a job rather than being out of work, but also the way in which workplaces can help to promote health and wellbeing or support people with problems. Gallie (2013) for example found that work had intensified following the Great Financial Crisis but also that workplaces were less secure – all intensifying employees' experience of stress. Yet work is very important for offering avenues to social inclusion and social networks that are known to be important for good mental health, addressing feelings of being disconnected, isolated or lonely. This suggests that we need to see the quality of work more broadly – not just in the case of employment alone. Work is an integral part of contemporary societies, a source of value and identity as well as a way of earning a living. The role of work in creating and sustaining communities, in encouraging regional development and in creating social cohesion needs to be understood more comprehensively within the nations of the UK, but also from a comparative international perspective.

A range of indicators and indexes of job quality are being developed in Europe. For example the Job Quality Index (JQI) from the European Trade Union Institute (www.etui.org/Topics/Labour-market-employment-social-policy/Job-quality-index-JQI) uses a number of sub-indices to measure wages, non-standard employment, working conditions, working time and work-life balance, training and interest representation between 2005-15. The OECD (www.oecd.org/statistics/job-quality.htm) provides comparative quantitative indicators over time for a range of dimensions related to earning, insecurity and job strain. However, none of these focus specifically new forms of employment

involving digital technologies and there is little attention to issues related for example to mental health, social health, connectedness, loneliness and wellbeing. As indications that job quality in the UK has generally declined, political initiatives to promote fair work have emerged, for example from the Scottish government and the newly established Institute for the Future of Work (www.ifow.org), amongst others. This is likely to be a key issue that will also affect dimensions of economic growth and productivity as well as experiences of social inclusion and wellbeing (Findlay and Thompson 2017).

4. Life long work, resilience and sustainability for the social organisation of labour using digital technologies

There is need for a "joined up" approach to work and employment that can make connections between different stages of the life course and different kinds of work and enterprise beyond conventional employment. Whilst conventional employment is well documented, the wider types of work and enterprise discussed in this Think Piece require additional information. Longitudinal and panel surveys can make an important contribution here but putting together data from surveys and administrative sources can help to provide a wider picture of working lives in the round. Digital technologies and data linkages provide opportunities for capturing these connections, but some of it can only make sense through qualitative approaches.

The role of older workers, their problems, their preferences and attitudes towards them will continue to be important in the future for understanding how people cope and thrive (or fail to) in the new digital environment and ways in which older and younger workers can contribute. But with the de-standardisation of the life course, these issues may affect people at other life stages too and we can no longer make assumptions about age-determinism. An important outcome of the discussion above is to find methods to incorporate the welfare/pensions contributions for non-standard careers, careers inside and outside of formal employment and digital workers.

What are the capacity building needs in this area?

In addition to generating new forms of data outlined above to address the questions identified in the five key research themes, there is a fundamental gap in the level of education being provided in British universities regarding new skills for work in the digital age. The Q-Step program was a significant ESRC investment to improve the quality of quantitative skills amongst UK graduates. It is necessary to review the continuation of this investment and augment it by adding courses like computational analytics for social research that are being taught at leading universities in the US (Salganik 2018), along side refinement of established qualitative and quantitative approaches that are targeted at this area of research. Building research capacity to examine data allowing comparisons across countries, economic sectors, regions and different social groups needs to be aimed at undergraduates, post-graduates and the wider research community across the career spectrum from early to established career researchers; it could also involve stakeholder communities. The provision of this training would also benefit from the inclusion of non-academic organisations in particular business, government and the third sector to understand how this data can inform decision-making.

This capacity building could be supported by a combination of different university courses together with secondments and internships comparable to those currently offered by the Cabinet Office Open Innovation Unit with government departments; additional secondments from businesses and relevant organisations such as the TUC could also be supported by ESRC investments and cross-funding. Institutions such as the Essex Summer School, NatCen and the Social Research Association have a good track record for offering these kinds of courses. New doctoral programmes such as that offered by the EPSRC could include relevant components of increasing capacity building.

These initiatives could also be linked with the EPSRC and AHRC investment in programmes for research on the Digital Economy. Capacity can be built up by the better integration of computer

scientists/engineers with social scientists and humanities scholars. Whilst these disciplines tend to operate in parallel, the developments in IT mean that both for methodological and substantive reasons there could be some creative synergies across disciplines. There were some good examples (as well as less good ones) in the Digital Economy Programme, which is now ending. Although it seldom addressed the idea of "economy" as such, other interdisciplinary collaborations, sometimes stimulated by sandpits were fruitful and innovative.

However, data and methodological skills are not enough on their own. Better data is no use without better ideas and concepts to formulate the right questions, find the right tools, understand and communicate the results (Halford and Savage 2017). Capacity building initiatives need to go hand in hand with investment enabling the development and dialogue around theoretical approaches and concepts to understand the new labour processes and configurations of the labour market. There is clearly a need to rethink concepts such as insecurity as well as develop new ones (Gallie and Felstead 2017). Furthermore, syntheses of work and labour dynamics are still needed that historically contextualise the current period (Findlay and Thompson 2017).

Part 2. Key opportunities and future directions

What are the opportunities for interdisciplinary research in this area?

There are many opportunities to encourage economists, sociologists, psychologists, lawyers and business studies scholars to work together on these issues, as well as creating incentives to work with those in software engineering and informatics and the humanities. Some evidence of this already exists with the EPSRC Digital Economy theme but this is now ending and we require a stronger focus on the work dimension of these changes. The ESRC would be in a position to create workshops and sandpits to encourage interdisciplinary working, especially making bridges to computer and other scientists.

There are a number of important ways in which interdisciplinary research in this area needs to be encouraged. At present considerable attention from economists has been focused on estimating job effects from the impact of digital technologies; Yates et al. (2017) suggest that examining the experience of 'being in the digital age' has been dominated by sociologists, although a large number of economists have also focused on the labour market consequences of digitalisation. The RCUK investment in the Digital Economy initiated in 2008 involved a cross council partnership (AHRC, ESRC and Innovate UK) led by the Engineering and Physical Sciences Research Council (EPSRC) around themes of trust, identity, privacy and security; digital business models; the Internet of Things for services; and content creation and consumption. There are a number of ESRC Centres that are relevant here including The Centre for Economic Performance, the Centre for Competitive Advantage in a Global Economy and the Centre for Macroeconomics, but their funding will end by 2020 (see Appendix).

What are the opportunities for international research perspectives in this area?

Encouraging international perspectives to examine these issues is essential. There are a number of opportunities for international research, some of which have been indicated previously.

First, there is already a large body of existing international data that could be mined further to examine some of these issues situating the UK in relation to developments in other countries both within and outside the EU. This is still rather underdeveloped and could be supported by some targeted calls around these themes. This is important in highlighting how countries and sectors are developing at different rates. It is valuable in identifying new areas of research to account for these successes, failures and differences that can be used to inform UK policy developments.

Second, apart from some of the sources cited previously, where it is essential that the UK continues to provide data to international organisations, further opportunities could include looking at the work of the European Foundation for the Improvement of Living and Working conditions that regularly conduct the European Working Conditions Survey. It would be important to maintain a contribution of UK data to this comparative survey that might be threatened by the consequences of the Brexit negotiations and the period that followed.

Further collaborations need to maintained and could be develop with the EU More Years Better Lives Programme, the Future of Manufacturing in Europe and Digital Age. The OECD has a large programme on the Future of Work and OECD: Going Digital. Pew Research (Washington) has a large programme on Work and Employment and the Digital Divide. Management consultants like Deloittes Digital, McKinseys and Accentura are also very engaged in these debates and research; the World Economic Forum and the EU Digital Economy and Society Index would be important to consult as agenda setting organisations to encourage potentially jointly badged international collaborations.

Comparison of Britain with other liberal market economies can help to provide examples from largely comparable countries such as the US, Canada, Australia. Encouraging comparative programmes to understand the different rates of developments and diffusion of digital technology at work in Asia and the very under researched areas of the Gulf states, or parts of Africa for example, would be very valuable and innovative.

Encouraging exchange visits and collaborative projects could strengthen these international links. An open access data repository with resources on digital work could also be very useful for both scholars in the UK as well as those from abroad and for those with less easy access to a range of research resources.

What is the potential for impact beyond the research community?

It is clear from the number of reports and reviews written by different organisations that there is tremendous interest in the future of work. The large numbers of attendees at the ESRC workshops attest to this. Some of the organisations in the UK who would welcome collaboration and/or potentially provide co-funding including the Scottish and Welsh Governments, the DWP, BEIS, DCMS, the TUC and the CIPD. The ESRC could play a significant role in bringing these organisations and researchers together.

The What Works Centres have been important for making these connections through the What Works Local Economic Growth and the What Works Wellbeing Centres. Integrated secondments or placements with some of these organisations, business partners and other stakeholders would be an important contribution to the co-production of relevant impactful research in this field.

What might be the opportunities for co-funding or collaborating with other partners in this area?

There are a number of organisations including government bodies, businesses, consultancies, think tanks and NGOs currently developing research programmes around the Future of Work that have been mentioned previously. In the UK: The Scottish Government Fair Work Commission, The Work Foundation, the TUC, The New Economics Foundation, CIPD (HR Professionals); the RSA; Carnegie UK; JRF; BEIS; the Future of Work Institute and Business in the Community. At an international level the European Foundation for the Improvement of Living and Working Conditions, the OECD, the ILO and Pew Research all have programmes running in this area.

Within the UK research landscape an obvious collaborator would be the AHRC where there is a programme on Digital Transformations and the EPSRC which funds research for example on new

business models and platforms as part of its Digital Economy programme; however, the human dimensions is often missing from this EPSRC programme, especially related to employment.

The ESRC can help to make connections across these different public and private sector organisations. Pump priming money and networking events, including sandpits can be a way of brain storming and bringing about research innovations using a variety of actors that would not necessarily otherwise communicate. As part of the UKRI an important aspect would be networking across research councils to ensure the issues raised in this report are reflected elsewhere. The What Works Centres are a way of publicising research that can be useful for the general public or particular groups.

Where might the ESRC focus its funding to make a distinctive contribution to developing the research profile of this area?

The ESRC could play a key role in co-ordinating and bringing together interested parties in understanding the future of work, including academics, government, business and NGOs. It could further make resources available to generate a significant data infrastructure that could be widely used across the research community. The ESRC can help to train researchers and build capacity as well as developing cross-Council programmes and initiatives. By tailoring calls for proposals, the ESRC can help to fill the gaps in knowledge that identified in this report. Through initiatives such as the What Works Centres it can help to make sure that the messages get through to wider audiences.

Part 3. Summary Recommendations

The Think piece has outlined research under five main themes and suggested data and research gaps under each of them along with capacity building investments. Although there have been investments in areas related to the future of work, there has not been a specific focus on employment for several decades, and no significant investment to examine the challenges posed by the future digital transformation of work and employment.

Investment in new data sources and exploitation of existing ones, developing new methods of analysis and building upon the long traditions of social science research in this field is a key priority. In particular ensuring that this research investment promotes international comparative approaches will be essential to retain the high status and contribution of British social science to these pertinent international debates.

The need for systematic, empirically informed, and comprehensive source of data is essential. This needs to be complemented with rigourous analysis of trends in work and employment to understand how the digital transformation of work is affecting established organisaitions as well as generating new forms of employment and business models.

In summary, the ESRC should:

1. Develop and fund a programme of research enabling a range of large, medium and small sized projects. This should support quantitative, qualitative and innovative methodological approaches. These should be informed by a theoretical, internationally comparative and historically contextualised understandings of the implementation and consequences of technological change at work. This could be done through research programmes, calls for Centre applications or targeted calls more generally. Some of these could also be announced in collaboration with the EPSRC and the AHRC and encourage the engagement of co-production with relevant stakeholders.
2. Facilitate international collaborations to support a significant data infrastructure for the wider research community. The ESRC should ensure international impact and partnerships for UK projects by encouraging internationally comparative research. The EU framework programmes have provided a focus for European research that has helped to target research at the problems facing European societies. Problems such as youth unemployment, migration and the integration of family and work have benefited from this focus. The social and economic consequences of the digital transformation is about to be launched.
3. Support capacity building through the development of substantive and methodological skills, and new data analytic skills, building on Q-Step investments. This should feed into undergraduate and postgraduate courses. It could also include a community of researchers across the career hierarchy, along with practitioners.
4. Engage stakeholders in co-production. The ESRC should create links between researchers and stakeholders in the public, private and non-profit sector, building on the extensive interest already shown in the future of work and work quality.

References

Acemoglu, D. and P. Restrepo (2017) 'The Race Between Man and Machine: Implications of Technology for Growth, Factor Shares and Employment', unpublished.

Angrave, D., Charlwood, A., Kirkpatrick, I., Lawrence, M. and Stuart, M. (2016) 'HR Analytics: Why HR is set to fail the Big Data challenge' Human Resource Management Journal, 26(1):1-11.

Arnold, D., S. Butschek, D. Müller and S. Steffes (2016) '*Digitalisierung am Arbeitsplatz: Aktuelle Ergebnisse einer Betriebs- und Beschäftigtenbefragung*',(Digitalisation at work: Results of a company and employee survey) Forschungsbericht im Auftrag des Bundesministeriums für Arbeit und Soziales und des Instituts für Arbeitsmarkt- und Berufsforschung, Berlin. http://www.bmas.de/SharedDocs/Downloads/DE/PDF-Publikationen/a875-monitor-digitalisierung-am-arbeitsplatz.pdf?__blob=publicationFile&v=2

Arntz, M., T. Gregory and U. Zierahn (2016) *The Risk of Automation for Jobs in OECD Countries: a Comparative Analysis*, Social, Employment and Migration Working Paper 189, Paris: OECD.

Autor, D. (2015) 'Why Are There Still So Many Jobs? The History and Future of Workplace Automation', *Journal of Economic Perspectives*, 29(3): 3–30.

Autor, D. (2014) 'Polanyi's Paradox and the Shape of Employment Growth', *NBER Working Paper No. 20485.*

BEIS (2017) *Industrial Strategy White Paper* https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future

Berg, J. and V. de Stefano (2018) 'Employment and regulation for clickworkers' in Neufeind, M., J. O'Reilly and F. Ranft (eds.) *Work in the Digital Age: Challenges of the Fourth Industrial Revolution* (London: Rowman and Littlefield) pp.175-184

Brown, R. (1987) 'Editorial Introduction' *Work, Employment and Society* 1(1):1-6.

Brynjolfsson, E., and A. McAfee (2014) *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. New York: W. W. Norton & Company.

CIPD, (2018a) *UK Working Lives. In Search of Job Quality.* London: Chartered Institute for Personnel and Development.

CIPD (2018b) *Understanding and Measuring Job Quality. Research Report Part 2. Indicators of Job Quality.* London: Chartered Institute for Personnel and Development.

CIPD (2018c) *Assessing the early impact of the apprenticeship levy – employers' perspective.* London: Chartered Institute for Personnel and Development. https://www.cipd.co.uk/Images/assessing-the-early-impact-of-the-apprenticeship-levy_2017-employers-perspective_tcm18-36580.pdf

Daly, M. (2005) Changing family life in Europe: significance for state and society. *European Societies,* **7**(3): 379-398.

DoE (2017) *Apprenticeships evaluation 2017: employers Research report* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/659710/Apprenticeships_evaluation_2017_employers.pdf

De Stefano, V. (2016) *The Rise of the 'Just-In-Time Workforce': On-Demand Work, Crowdwork and Labour Protection in the 'Gig-Economy'*, Geneva: International Labour Office. http://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---travail/documents/publication/wcms_443267.pdf;

European Commission (2017) The Digital Economy and Society Index (DESI), https://ec.europa.eu/digital-single-market/en/desi.

Felstead, A., Gallie, D., Green, F. and Henseke, G (2018) 'What are the best measures of good work? Three Principles for measurement selection.' http://www.cardiff.ac.uk/__data/assets/word_doc/0007/1198609/Best_Measures_Advisory_Felstead_et_al.docx

Findlay, P. and Thompson, P. (2017) 'Contemporary Work: its meaning and demands.' *Journal of Industrial Relations,* 59(2): 122-138.

Forde, C., M. Stuart, S. Joyce, L. Oliver, D. Valizade, G. Alberti, K. Hardy, V. Trappmann, C. Umney, and C. Carson (2017) *The Social Protection of Workers in the Collaborative Economy*, Report for European Parliament Employment and Social Affairs Committee, December 2017.

http://www.europarl.europa.eu/RegData/etudes/STUD/2017/614184/IPOL_STU(2017)61418 4_EN.pdf

Frey, C. B. and M. A. Osborne (2017), 'The Future of Employment: How Susceptible are Jobs to Computerization?' *Technological Forecasting and Social Change*, 114(C): 254–280.

Gallie, D. (2013) (ed) *Economic Crisis, Quality of Work and Social Integration. The European Experience.* Oxford: Oxford University Press.

Gallie, D., Felstead, A., Green, F. and Inanc, H. (2017) 'The hidden face of job insecurity.' *Work, Employment and Society,* 31(1), pp. 36-53.

Gallie, D. (1978) *In search of the new working class: Automation and social integration within the capitalist enterprise.* Cambridge: Cambridge University Press.

Ge, Y., C. R. Knittel, D. MacKenzie and S. Zoepf (2016), 'Racial and Gender Discrimination in Transportation Network Companies', *NBER Working Paper* 22776.

Halford, S. and Savage, M., 2017. Speaking Sociologically with Big Data: Symphonic Social Science and the Future for Big Data Research. *Sociology,* **51**(6), pp. 1132-1148.

Halford, S., Hudson, M., Leonard, P., Parry, J. and Taylor, R. (2016) 'The New Dynamics of Work: A Scoping Study.' http://workfutures.southampton.ac.uk/wp-content/uploads/sites/188/2013/08/2016-NewDynamicsOfWork.pdf

Hall, P. and Soskice, D., eds, (2001) *Varieties of Capitalism. The institutional foundations of Comparative Advantage.* Oxford: Oxford University Press.

Haskel, J., and S. Westlake (2017) *Capitalism Without Capital: The Rise of the Intangible Economy.* Princeton: Princeton University Press.

Hobsbawn, J. (2018) *Fully Connected: Social Health in an Age of Overload.* London: Bloomsbury Business

Howcroft, D. and J. Rubery (2018) 'Gender equality prospects and the fourth industrial revolution' in Neufeind, M., J. O'Reilly and F. Ranft (eds.) *Work in the Digital Age: Challenges of the Fourth Industrial Revolution* (London: Rowman and Littlefield) pp. 63-74.

Huws, U., N. H. Spencer, D. S. Syrdal and K. Holts (2017) *Work in the European Gig Economy: Research Results from the UK, Sweden, Germany, Austria, the Netherlands, Switzerland and Italy,* Brussels and Hatfield: European Foundation for Progressive Studies, UNI Europa and University of Hertfordshire, http://www.feps-europe.eu/assets/9d13a6d2-5973-4131-b9c8-3ca5100f92d4/work-in-the-european-gig-full-report-pppdf.pdf;

ILO (2016) *Non-standard Employment Around the world: Understanding Challenges, Shaping Prospects,* Geneva: International Labour Office, http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_534326.pdf.

Lain, D. (2016) *Reconstructing Retirement: Work and Welfare in the UK and USA* (Bristol: Policy Press)

Larkin, T. (2015) 'Why you shouldn't ignore Glassdoor' HR Magazine Sept 7th, http://www.hrmagazine.co.uk/article-details/why-you-shouldnt-ignore-glassdoor

Moen, P. (2016) 'Work over the gendered life-course.' In: M. Shanahan, J. Mortimer and M. Kirkpatrick Johnson, eds, *Handbook of the Life Course.* Switzerland: Springer.

Neufeind, M., J. O'Reilly and F. Ranft (2018) (eds.) *Work in the Digital Age: Challenges of the Fourth Industrial Revolution* (London: Rowman and Littlefield).

New Economics Foundation (2017) *Well-being at Work. A Review of the Literature.* London: NEF.

Nolan, P. and S. Wood (2003) 'Mapping the Future of Work' *British Journal of Industrial Relations* 41(2):165-174

O'Reilly, J., Leschke, J., Ortlieb, R., Seeleib-Kaiser, M. and Villa, P. (2018) (eds.) *Youth Labour in Transition: Inequalities, Mobility and Policies in Europe* (New York: Oxford University Press).

OECD (2011) *Measuring the Information Society* http://www.oecd.org/sti/sci-tech/oecdguidetomeasuringtheinformationsociety2011.htm

OECD (2016) 'Skills for a Digital World', Policy Brief on The Future of Work, OECD Publishing, Paris. https://www.oecd.org/els/emp/Skills-for-a-Digital-World.pdf

Pew Research Centre (2016) http://www.pewinternet.org/2016/11/17/gig-work-online-selling-and-home-sharing;

Piasna, A. and Drahokoupil, J. (2017) 'Gender Inequalities in the New World of Work' *Transfer: European Review of Labour and Research*, Vol. 23(3), DOI: 10.1177/1024258917713839,

Prassl, J. (2015) *The Concept of the Employer*, Oxford: Oxford University Press.

Rubery, J., Grimshaw, D., Keizer, A. and Johnson M. (2018) Challenges and Contradictions in the 'Normalising' of Precarious Work' *Work, Employment and Society* 32(3): 509-527.

Salganik, M.J. (2018) *Bit By Bit: Social Research in the Digital Age.* NJ: Princeton University Press.

Schwab, K. (2018) *Shaping the Fourth Industrial Revolution*, Geneva: World Economic Forum.

Soete, L. (2018) 'Destructive creation: explaining the productivity paradox in the digital age' in Neufeind, M., J. O'Reilly and F. Ranft (2018) (eds.) *Work in the Digital Age: Challenges of the Fourth Industrial Revolution* (London: Rowman and Littlefield) pp.29-46.

TUC (2017) *Shaping Our Digital Future.* London: Trade Union Congress.

WEF (2017) *Accelerating Gender Parity in the Fourth Industrial Revolution: An Agenda for Leaders to Shape the Future of Education, Gender and Work*, 2017 http://www3.weforum.org/docs/WEF_EGW_White_Paper_Gender_Parity_4IR.pdf

The Work Foundation (2017) *The Commission on Good Work.* London: The Work Foundation.

White, D. (2016) *Work and Wellbeing - Discussion Paper.* UK: Carnegie Trust.

Wood, S. K. Daniels, and C. Ogbonnaya (2018) 'Use of Work–Nonwork Supports and Employee Well-Being: The Mediating Roles of Job Demands, Job Control, Supportive Management and Work–Nonwork Conflict', *International Journal of Human Resource Management* published online

Yates S., B. Wessels, L. Robson, P. Hepburn, S. Crone, G. Jones, A. Zhangana, M. Pidd, A, Light, C.Taylor, L. Townsend, V. Weerakkody, M. Whitty (2017) *Summary Final Report: ESRC Scoping review on Ways of being in digital age.* Accessed November 22nd 2017 https://waysofbeingdigital.com

Zysman, J. and M. Kenney (2018) 'Entrepreneurial finance in the era of intelligent tools and digital platforms: implications and consequences for work' in Neufeind, M., J. O'Reilly and F. Ranft (2018) (eds.) *Work in the Digital Age: Challenges of the Fourth Industrial Revolution* (London: Rowman and Littlefield) pp. 47-62.

Wajcman, J. (2015) *Pressed for Time.* Chicago: Chicago University Press.

Appendix 1

Systematic Review of existing ESRC investments

Out of 842 funded grants there were 44 projects addressing work. The main source was the ESRC list of funded projects made available by the data sharing agreement, but we also included an analysis of the UKRI Research Gateway including all projects funded since 2015.
We excluded funding for studentships, research seminar series and projects that had no UK element (mostly ones to do with GCRF or DFID for example). We also excluded projects that included the word work but were not about work as such (e.g. new directions in social work). The remaining projects were sorted into categories based on a reading of the title and abstract. Unfunded projects were not included because the data sharing agreement did not come through in time to enable us to analyse them.

The first category was that of **digital work/IT** related projects and there were only 3 that fell clearly into this theme. This was rather surprising given that it is a major element in the future of work and in our own research review. A scrutiny of EPSRC projects as published on the UKRI Research Gateway indicates that there were a number of projects from that research council relating to digital communications, new business models etc. However, they were concerned more with the technology of communications and not so much with the impact or human dimensions. Only one project (about technical change and the replacement of jobs with robots) seemed to relate to future challenges. The area of digital work and IT would therefore constitute a significant gap in ESRC research funding.

The second category relates to **migration issues**. The four projects funded under this category considered the work of asylum seekers and EU migrants in the UK as well as work exploitation and geographical dimensions. An issue which has been neglected here is the role of remote workers who may or may not be in the UK, but who work for UK companies using IT communications. An example would be web-designers and IT workers in Russia or Romania who are working for British companies. This kind of globalised, distributed work might also relate to the first category above since it is the jobs that migrate rather than the people.

The issue of **wellbeing and job quality** was touched on by 5 projects. Two of these were major surveys and cohort studies that are presumably on-going. Others related to specific aspects of job quality such as learning, legal regulations or a-typical employment. It would seem that this is also a gap in ESRC funding because there is no general project about the quality of work and wellbeing. However, we should note that the European Foundation for the Improvement of Living and Working Conditions as well as the OECD have been doing a work in this area internationally and that also includes the UK.

The topic of **working and caring** includes the largest number of projects. This has clearly been a major focus of research in the UK. Of the 10 projects funded in this area, the main focus has been on couples and the division of labour and upon the relationship between work and parenting. The role of carers and caring is a focus of 5 of these projects and many of them are linked to life course issues and studies or to health.

There is some overlap with the next category, that of **lifelong working** where 2 of the 8 projects mention health and one is concerned with the intergenerational transmission of worklessness and another with social inequalities.   A number of the projects are concerned with how to deal with older workers, extending working lives or active aging. Lifelong working therefore mainly refers to older workers and represents the second largest category of ESRC funding on work.
There was only one project about **new business models** – although EPSRC have funded projects on this theme. This is clearly a lack in terms of social science perspectives.

The next category includes projects relating **to transport and/or planning** issues. Two of the 4 are about commuting specifically and the rest about transport more generally.

Under **economics** we have included wider economic issues where there are 6 projects to be found. A strong theme is productivity, but also industrial strategy. Two of the projects are about specific sectors (metal firms and industrial regions). Innovation is a theme in two of them. We should note that there were many other economics projects and here we have selected only those relating most obviously to work.

Under the theme of **youth** there was only one project that was about NEETS and this was a comparative one including several countries. This was a rather surprising gap given the focus on youth in European projects (see our separate review).

The miscellaneous category included a project on **social mobility** – a topic which has been a key theme in British social science in the past. However, we should note that a number of other projects were concerned with social inequalities under different themes.

Therefore, although lifelong working and working/ caring issues have been well covered by recent ESRC funding, the role of digital communications and their impact on work or mobility are under-explored.

Summary of ESRC funded projects

Digital Work/ IT	The working practices, regulation and safety of internet-based sex work in the UK	Technical change: employment and inequality. A spatial analysis of house and plant data (how jobs being replaced by robots)	Gender, Skilled migration and IT in UK and India	
New Business Models	New business models and innovation			
Economics	Innovation and productivity for different groups of workers	Infrastructure and industrial strategy	UK foundry and metal firms	Skills and management practices for uneven firm productivity
	Business innovation dynamics and infrastructure	Manufacturing renaissance in industrial regions		
Wellbeing/ job quality	Work, learning and wellbeing	Legal regulation of unacceptable forms of work (global)	Modelling and measuring a-typical employment	Skills and employment survey
	Cross cohort research programme: employment, health and wellbeing			

Working and Caring	What makes dual career couples work? A longitudinal and mixed methods analysis	Parental nonstandard work schedules in the UK: implications for children's and parent's health	Couples balancing work and care – impact of universal credit	Life course causes and consequences of caring: how do work and family histories influence caring and health
	Innovation Fellowship – enhancing organisational effectiveness by modernising support for working carers	Extending our understanding of informal care provision in mid life in the UK using the NCDS	Changing patterns of parental time use and their implications for parental wellbeing	Home sense: Analysing the domestic division of labour using digital devices
	Maximising support for working carers	Life course causes and consequences of caring. How do work family histories of informal care affect health and wellbeing?		
Lifelong working	Tackling health inequalities and extending working lives THRIVE	Policies for longer lives. Health and care responsibilities	FACTAGE – Fairer active ageing for Europe	Intergenerational worklessness in international context: the role of labour markets, welfare systems and education
	Transitions and mobilities. Girls growing up in Britain 1954-76	Life course and family dynamics in China and UK	The impact of interventions and policies on prolonging working life in good health	EXTEND – social inequalities and extending working lives of an ageing workforce (cross national)
Youth	Understanding NEETS. Individual and institutional determinants of youth inactivity in France, Germany, Japan, NL and the UK			
Migration issues	Asylum, welfare and work in the age of austerity	Modern slavery- meaning and measurement	Migration and the North-South Divide	Honeypot Britain. The lived experiences of working as an EU migrant in the UK

Transport/ planning	Transportation and the socio-spatial dimensions of travel to work flows	Does commuting affect health and wellbeing?	Commuting and wellbeing	Social and economic implications of transport sharing and automation
	Working in whose interests? Spatial planning and the future of public sector professional labor			
Miscellane ous	Breaking class ceilings. Social mobility into British Elite occupations			

Centre for Economic Performance (http://cep.lse.ac.uk) established in 1990 with funding until September 2020 studies the determinants of economic performance at the level of the company, the nation and the global economy by focusing on the major links between globalisation, technology and institutions (above all the educational system and the labour market) and their impact on productivity, inequality, employment, stability and wellbeing.

Centre for Competitive Advantage in the Global Economy (https://warwick.ac.uk/fac/soc/economics/research/centres/cage) established in 2010 with funding until 2020 examines how markets, institutions and public policies interact to create and sustain competitive advantage in a changing global economy, how such advantage evolves over time and how it influences growth deprivation and wellbeing in both the short and the long run.

Centre for Macroeconomics (http://www.centreformacroeconomics.ac.uk) with funding until 2017 examined unemployment, fiscal austerity, financial markets, shifts in the world economy and the development of new methodologies.

What Works Centre for Local Economic Growth
https://esrc.ukri.org/research/our-research/what-works-centre-for-local-economic-growth/
This centre is funded until 2019 and makes the connections between employment, infrastructure such as transport, housing etc. together with technology in fostering economic development. There are lessons here for the wider implications of employment for local devlepment.

What Works Wellbeing Centre
https://whatworkswellbeing.org/. This centre has been important in connecting psychological, social and community levels of wellbeing and their has been a focus recently on the role of work in fostering wellbeing (see the recent report on Work, Learning and Wellbeing). The Centre can be a source of promulgating new perspectives and making connections between work and other aspects of wellbeing.

Summary of EU research investments in Horizon 2020 related to the future of work

Projects funded by the European Commission are published on CORDIS - Community Research and Development Information System. An initial keyword search of the topic of 'employment' generated 7866 mentions of all projects funded between 2014 to April 2018. A list of H2020 projects can be downloaded from https://data.europa.eu/euodp/en/data/dataset/cordisH2020projects and a list of project by topics is available from https://data.europa.eu/euodp/en/data/dataset/cordisref-data
The project and organisation dataset was last extracted in April 2018. While it is beyond the remit of this 'think piece' to provide a systematic review of these projects, the main themes relevant to the area of the future of work that have recently been funded in the past five years included:

    Working and caring
    Health, Wellbeing and Job quality
    Older workers and life long working
    Youth Unemployment
    Migration
    Digital Work

The topics of gender equality, aging and public policies have been well covered in previous funding rounds. Further investment in gender equality has been allocated under the Science with and for Societies funding programme largely focused on implementing gender equality plans.

Priorities of the Juncker Commission:
The Juncker Commission took office in November 2014 led by President Juncker who defined 10 priorities to guide their work during their time in office.

While Europe 2020 remains, the emphasis has very much shifted on these priorities, and they will increasingly appear in Horizon 2020 work programmes.

There is no individual priority on research and innovation. However, several priorities are of relevance and will impact on Horizon 2020 work programmes including:

• A New Boost for Jobs, Growth and Investment
• A Connected Digital Single Market
• A Resilient Energy Union with a Forward-Looking Climate Change Policy

Some example of current calls under 'Societal Challenges', 'Industrial Leadership' and 'Transformations' include:
The Digital transformation in Health and Care
Digitising and transforming European industry and services
Trusted digital solutions and Cybersecurity in Health and Care
Digital Security
Transformative impact of disruptive technologies in public services
The impact of technological transformations on children and youth
Using big data approaches in research innovation policy making