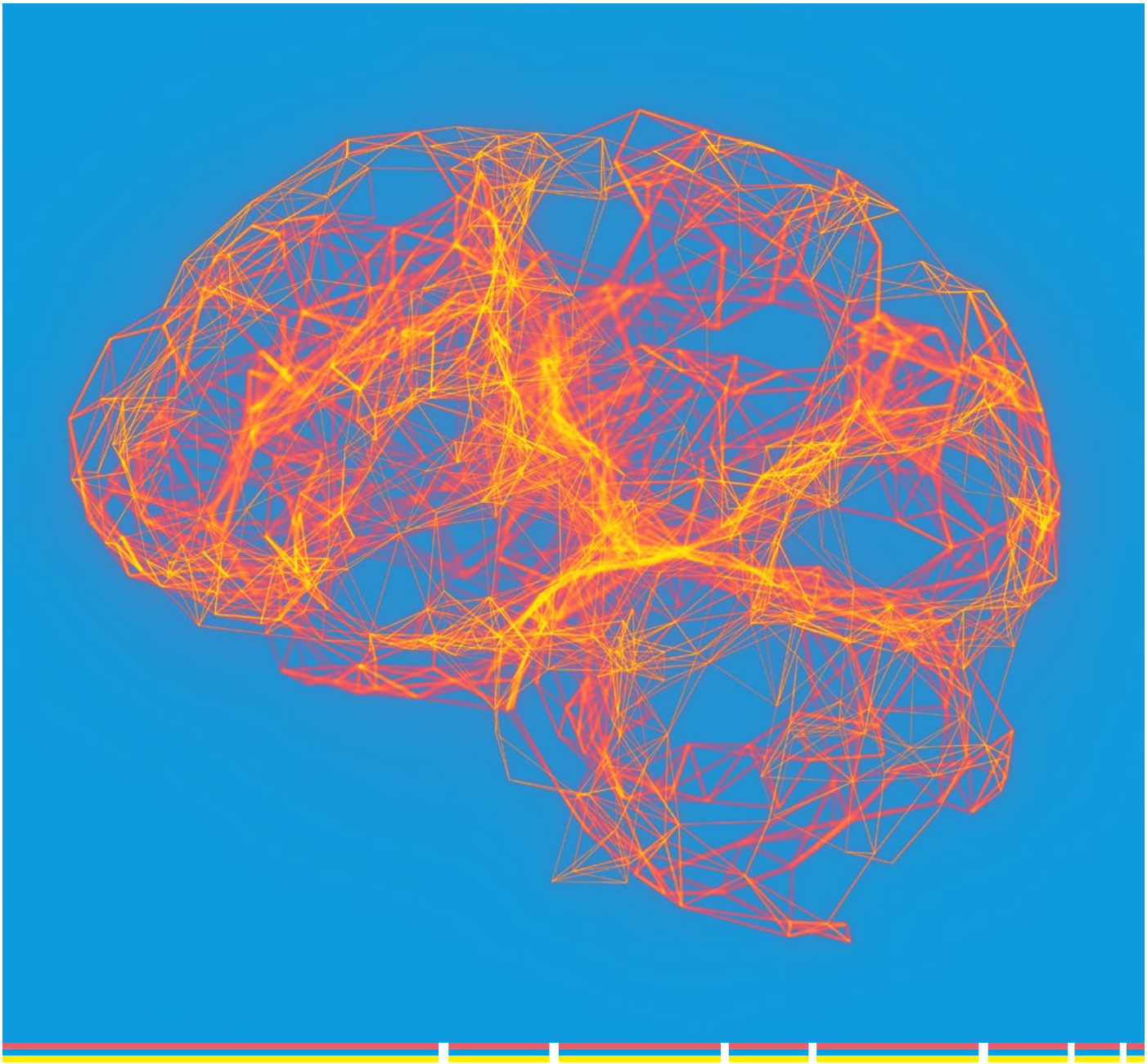
CRSE
*Centre for Research on Self-Employment



THE IMPACT OF ARTIFICIAL INTELLIGENCE ON SELF-EMPLOYMENT

A think piece

ABOUT THE AUTHOR

Terri L. Griffith (BA UC Berkeley, MS & PhD Carnegie Mellon University) is a Professor of Management & Entrepreneurship at Santa Clara University's School of Business. She works with organisations from start-ups to the Fortune 100 as they build out the future of work.

Chester Spell (BIE, PhD Georgia Institute of Technology) is Professor of Management at Rutgers University. His research focuses on how employers and the changing nature of work affect behavioural and population health. Some of his research also asks how policy can respond, especially to disadvantaged groups.

Katerina Bezrukova (BS, MS & PhD Moscow University in Russia, Postdoc, The Wharton School, University of Pennsylvania) is Associate Professor at the School of Management, University at Buffalo. She quantifies human behaviour to predict group faultlines and performance and advises people how to survive and excel when they are in the minority in organisations.

Athena Floro, Santa Clara University, provided critical research assistance.

CRSE

The CRSE is the leading international think tank working to improve the understanding of the self-employment sector and its impact on the economy. We deliver leading edge, robust and multidisciplinary research in collaboration with academics from around the world who are at the forefront of self-employment studies.

Key to the CRSE's work is promoting the knowledge acquired through our research and providing comprehensive analysis into the sector to inform public policy and add value to practitioners. This is achieved through strong collaboration with a network of academics and experts in the field, alongside a dedicated steering committee who exist to set the agenda for future research.

CONTENTS

INTRODUCTION

Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, notes that we are on the leading edge of the fourth industrial revolution, one "characterised by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres."[1] This transition brings us new ways of working, new tools with which to do the work, and new expectations about the role of people in organisations.

Increases in self-employment, freelancing, and project-based work are happening in tandem with an explosion of available data and the machine intelligence to turn that data into knowledge and action. The World Economic Forum, the US National Science Foundation,[2] and scholars at the Oxford Martin School,[3] all note that these shifts are often enabled by exponential improvements in technology - meaning we must respond quickly. Data and tools advance faster than organisational designs.[4] These trends can be a curse on the self-employed if they are passive about work design and training as their knowledge and tools may become obsolete. Alternatively, these fast changes may be a benefit if proactive self-employed workers are the best available source of agile, up-to-date skills and tools in the market.

The focus of this report is on artificial intelligence (AI) and the self-employed. It is hard to put a strict definition on artificial intelligence and its related fields, but we can give a basic framework using the boundaries noted in Figure 1: AI is a broad class of tools including hardware and software robots and intelligent devices. Within AI are applications of machine learning where the programs are "trained" on vast sets of data, rather than programmed with specific rules by people. Deep learning, where the AI teaches itself, is of increasing importance and power. AI's application to work spans everything from the back office to client identification, contact, and invoicing. From colourising movies, fraud detection, marketing lead generation, trip planning based on traffic conditions, foreign language translation, to depositing checks, AI is changing how we all work.

Following guidance from the UK Office for National Statistics,[5] we define a self-employed person as someone who runs their business for themselves and takes responsibility for its success or failure. "Self-employment can be in the form of a sole trader, a partnership (two or more people who run a business) or an owner of a limited liability company (also responsible for running the business)." We will specifically note in our conclusions where the data or focus are the self-employed in general, the solo self-employed (those without employees), or the group sometimes referred to as freelancers - self-employed people taking on project or contract-based work.

This report takes the view that the self-employed are uniquely at risk from shifts triggered by AI and other resource-intensive automation technologies. We come to this conclusion given we find little, though some, government training support related to the use of AI. We also expect that corporate training is unlikely to be offered to the self-employed (though corporate training budgets continue to increase[6]) as it could trigger an "employee" classification related to employment rights.[7] To the extent that artificial intelligence tools are priced for corporate versus individual purchase, this may also negatively affect the self-employed. On the other hand, the more market power the self-employed have through their knowledge and technical resources, the better. Some self-employed will have unique valuable skills or specialised tools tuned to their expertise. For them, where the growth of AI requires specialisation, the most expert self-employed may be privileged by increases in AI at work.

[1]https://www.foreignaffairs.com/articles/2015-12-12/fourth-industrial-revolution
[2]https://www.nsf.gov/crssprgm/nano/reports/2016-1003_ICA_Workshop_Final_Report_2016.pdf
[3]https://www.oxfordmartin.ox.ac.uk/downloads/reports/Citi_GPS_Technology_Work_2.pdf
[4]https://www.mitpressjournals.org/doi/abs/10.1162/003465303772815736
[5]https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/trendsinselfemploymentintheuk/2001to2015
[6]https://www.td.org/magazines/td-magazine/learning-investment-and-hours-are-on-the-rise
[7]https://www.nidirect.gov.uk/articles/employment-status

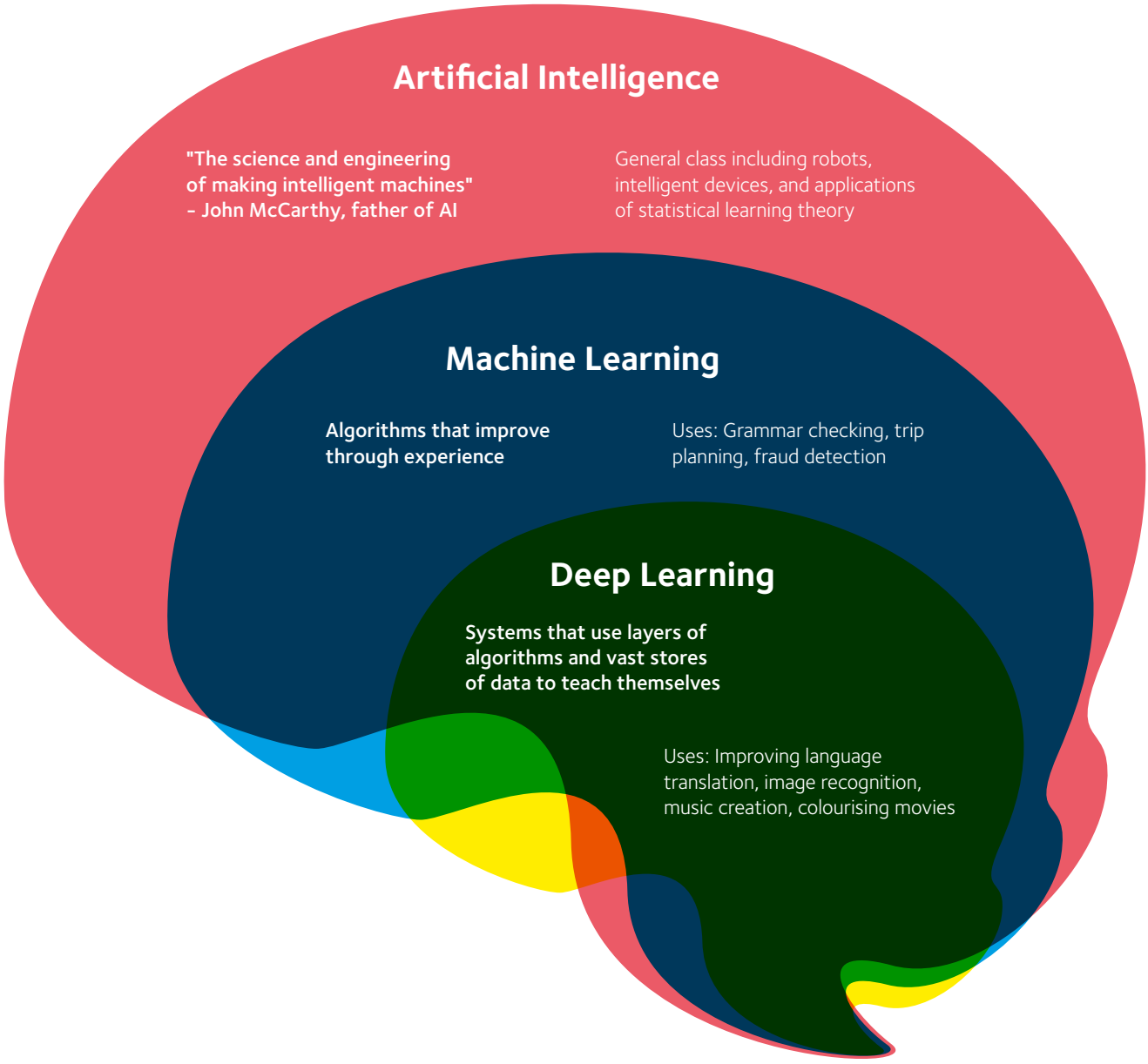


Figure 1: Framework for understanding artificial intelligence, machine learning and deep learning

Concepts drawn from https://www.ibm.com/developerworks/library/cc-beginner-guide-machine-learning-ai-cognitive/index.html

WHAT DO WE KNOW ABOUT AI AND THE SELF-EMPLOYED?

Self-employment is increasing at a steady rate and AI investment is exploding. It is clear that the self-employed will be dealing with the implications of AI as investment turns into new tools and viable ways of automating different tasks.

The analysis below draws on UK and US data, while also looking to policy directions globally. Self-employment is of popular, corporate, and academic interest in both countries and the data suggests significant economic impact. The UK tracks self-employed workers quarterly via the Labour Force Survey (LFS). Fifteen per cent of the UK workforce was self-employed for at least some of their work in 2017.[8] US data is harder to track as the Department of Labour didn't measure self-employment between 2006 and 2016, and the 2017 data only captures self-employment when it is the main job.[9]

Adding to the context, we see worldwide AI investment and financing growing at a staggering rate: from 4.5bn USD to 39.2bn USD in just five years.[10]

We need to understand the implications of these effects (steady growth in self-employment and dramatic growth in AI investment) and how they may connect. While it is likely to take years for the early stage AI investments to bear fruit, the scale of growth is a signal of likely changes ahead.

The ultimate effect of AI on job change and displacement for the self-employed will follow from changes we make now: How occupations shift to work with AI, whether tasks are redesigned to be more amenable to robotic work, etc. In September of 2017, Toronto hosted the first Economics of AI conference.[11] Using data from prior technological innovations, economist James Bessen writes, "while AI might not create overall unemployment in the near future, it will likely eliminate jobs in some occupations while creating new jobs in others. The need to retrain and transition workers to new occupations, sometimes in new locations, might be highly disruptive even though the total employment rate remains high."[12] From their paper at the same conference, economists Anton Korinek and Joseph E. Stiglitz (Winner of the 2001 Nobel Memorial Prize in Economic Sciences) state: "Although we agree that most AI-related innovations are likely to be complementary to at least some jobs – e.g. the ones applying AI to solve problems – we believe that taking a broader perspective, progress in AI is more likely to substitute for human labour, or even to replace workers outright."[13]

The arguments above point to a variety of lenses to apply to the question of how AI affects the self-employed. In the sections below, we consider institutional support, occupations where tasks may be most affected, and the roles played by the self-employed who work within organisations. As noted in the early stage economic work sited above, all workers are likely to need new knowledge and approaches to their work. There are opportunities for the self-employed to gain more knowledge and adjust to their future AI-augmented occupations, either on their own or with support of government or professional associations. Our focus question, then, is how the self-employed are positioned for these changes.

EVIDENCE-BASED PERSPECTIVES

There is no large-scale focused research that brings together issues of AI and self-employment. Therefore, we explored research on all forms of self-employment, AI and work, as well as scanning for focused assessments of AI as a tool for the self-employed.

As a starting point we evaluate the impact of AI on self-employment by combining data from the UK (especially the Centre for Research on Self-Employment), the US Occupational Information Network (O*NET), and peer-reviewed research by Frey and Osborne. This is the first time this data has been integrated in this way. The following section describes our assessment with a focus on whether the self-employed are uniquely at risk of developments in AI. We hope this serves as a catalyst for policy makers and scholars to heighten the focus on AI and the self-employed.

[8] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/trendsinselfemploymentintheuk/2018-02-07
[9] https://www.bls.gov/news.release/pdf/conemp.pdf
[10] https://www-statista-com.libproxy.scu.edu/statistics/941137/ai-investment-and-funding-worldwide/
[11] Economics of Artificial Intelligence, forthcoming from University of Chicago Press. http://www.nber.org/chapters/c14005
[12] Bessen, J. (2018). AI and Jobs: the role of demand. In Economics of Artificial Intelligence. University of Chicago Press.
[13] Korinek, A., & Stiglitz, J. E. (2018). Artificial Intelligence and Its Implications for Income Distribution and Unemployment. In Economics of Artificial Intelligence. University of Chicago Press.

Lowest paid self-employed most at risk of computerisation

By combining Frey and Osborne's probabilities for occupations (in general, not just those likely to be held by the self-employed) to be computerised (i.e. replaced by automation)[14] with the CRSE assessment of the number of solo self-employed in high, mid, and low pay occupations,[15] we find that the lowest paid and most populous categories of solo self-employed are at highest risk for computerisation. Sales, agricultural workers, drivers, and construction fall into this category. The derivation of these probabilities is offered below. High pay occupations are generally not seen as at risk of computerisation, with bookkeeping being the exception.

Figure 2 summarises these results. It focuses on the 27 solo self-employed occupations and their pay categories noted in the prior CRSE research (excluding the category of "other"). These occupations range from the most populous categories of solo self-employed work, construction (619,000), to least populous, manufacturing managers (20,000).

To create their probability estimates for computerisation, Frey and Osborne evaluated 702 occupation descriptions available in the US Occupational Information Network[17] (O*NET) – a database of occupations and the underlying tasks of the work. Frey and Osborne assumed three "roadblocks" to the computerisation of jobs, things that at least in the near term make computerisation of an occupation less likely. These are the extent to which perception and manipulation, creative intelligence, and social intelligence are key to the occupation. They then used human expert analysis as a basis to train a machine learning algorithm - and we do note the irony - to calculate the probability that a particular occupation could be computerised in the next decade or so.

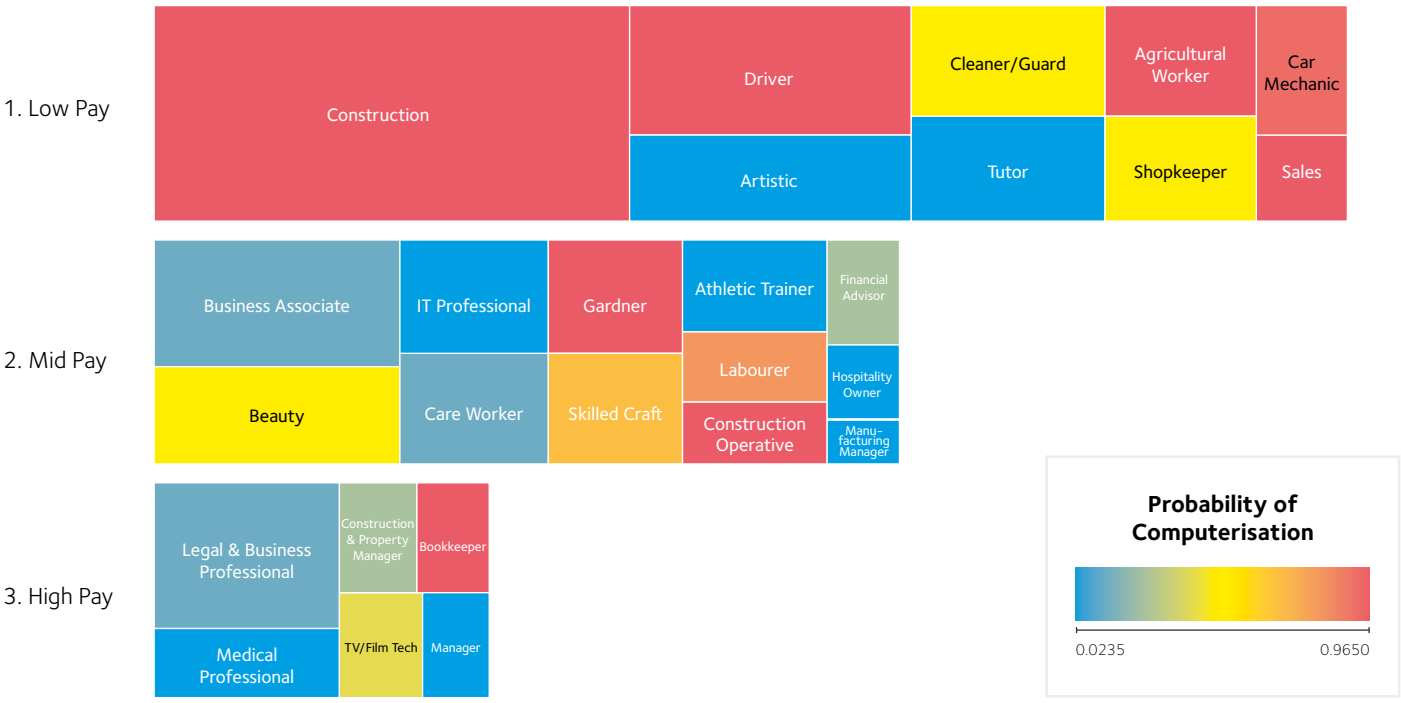


Figure 2: Relative size of Solo Self-Employment Segment by Probability (colour) that Occupation will be Computerised

[14]Frey, C. B., & Osborne, M. A. (2017). The future of employment: how susceptible are jobs to computerisation? Technological Forecasting and Social Change, 114, 254-280. Note that this data is not specific to self-employment.
[15]Centre for Research on Self-Employment, Institute for Employment Studies (2017) The True Diversity of Self-Employment. London, UK.
[16]Underlying data sourced from CRSE: The True Diversity of Self-Employment and Frey & Osborne 2017
[17]https://www.onetonline.org/

We appreciate their nuanced view that while the ratings are based on the present form of an occupation, there is also additional risk that the approach to the work can also be changed. For example, traditional on-site construction requires careful manipulation and so could be difficult to computerise. However, construction strategies can change to make use of prefabricated materials to reduce variability and make construction more amenable to machine assembly (and we assume automation is used in the prefabrication as well). Were that strategic change to happen, construction occupations might have an even higher probability of displacement than the noted probability.

A similar argument can be made for protecting occupations against computerisation. Strategic changes to work, for example, the creation of labour enhancements like exo-skeletons supported by AI manipulators,[18] could enhance the value of a construction worker's contribution. The combination of human/machine efforts and their applicability to innovation might offer value far beyond that of prefabrication and mechanisation.

Current use of automation statistically tied to probability of later computerisation only for the most at-risk occupations

The data suggests that when automation is in use in occupations with higher overall risk of computerisation, it is indicative of a slippery slope toward displacement – using automation now may mean those occupations are more easily automated overall. Such occupations include construction trades, sales and bookkeeping. For those occupations less at risk (those requiring capabilities more difficult to automate such as legal and business professionals, managers, IT professionals, or financial advisors), technology is perhaps being used to augment work, rather than replace the worker – there is no correlation between level of automation in these occupations and probability of computerisation. We came to this assessment by dividing the 27 occupations into those with 60 per cent or more probability of computerisation and those with 59 per cent or less. Level of current use of automation in the occupation was statistically significantly tied to probability of computerisation in the high-risk occupations, but not the lower risk ones.

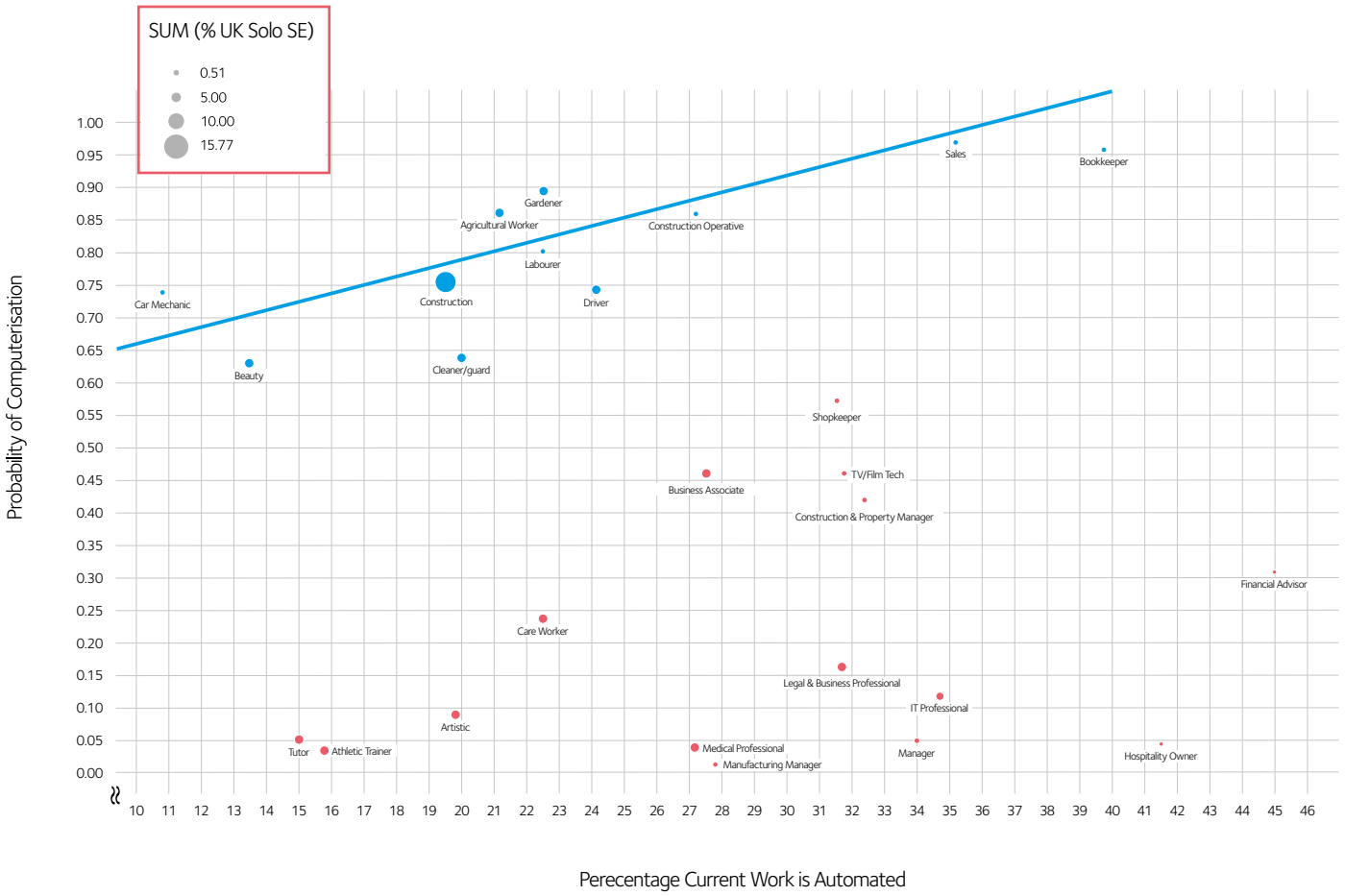


Figure 3: Differential Relationship of Automation (Size of market indicates relative size of UK self-employed population)

[18]https://www.inverse.com/article/41960-wearable-exoskeletons-built-in-a-i-to-meld-human-machine

Figure 3 maps the occupations by current use of automation and predicted computerisation and is an interesting starting point for future research. As noted above, economists and others hypothesise that AI will replace some tasks in some occupations and other occupations entirely. Some tasks will be augmented, allowing lower skilled workers to do more, or higher skilled workers to take on entirely new tasks.[19] This analysis offers a preliminary perspective on which occupations held by the self-employed are likely to fall into which category of outcome.

Applying these results to the most recent Labour Force Survey data (Oct-Dec 2018)[20], construction roles are most concerning (20% of the UK self-employed at risk), while those in professional, scientific & technical activities (12% of the UK self-employed) may offer examples of automation opportunity. Reskilling is a general refrain for at-risk occupations, though as we note above, business strategies more focused on augmentation are possible, even if they have yet to take hold. For occupations like those in the professional, scientific, and technical arenas, augmentation use cases for AI need to be top of mind.

Self-employed at risk because of lower institutional support

AI will change many occupations. In the simplest view, one where technology is applied without consideration of human outcomes or rethinking human roles, the self-employed most at risk to computerisation are also the least paid (Figure 2). The self-employed more generally are perhaps uniquely at risk given their lack of deep financial resources (vis-a-vis corporate employees) or clear institutional support.

Government or other small business resources that could support the self-employed, as they look to engage with new tools or upgrade their expertise, may be available but hard to identify. While "Business and self-employed" is a browsing category on the gov.uk site[21] for UK government services and information, the term self-employed rarely appears within specific programs and so may be overlooked by the self-employed. Our examination of a variety of the entries under "Finance and Support for Your Business,"[22] for example, found no mention of the self-employed being eligible, though many resources are available for entities with zero to nine employees; programs for digital growth[23] or digital innovation[24] speak to "entrepreneurs," "businesses," and "companies."

The extent that artificial intelligence tools are priced for corporate versus individual purchase may also negatively affect the self-employed if they do not have the financial resources to gain these tools or build them on their own.

Educational foundations also seem out of step with the growth of self-employed careers. The GCSE business curriculum[25] offers appropriate material, but only to those students self-identifying an interest in business. We also note that the current business curriculum does not include discussions of self-employed workers either as an option for the student or as stakeholders more generally. AI is beneficial to the self-employed to the extent it supports their business strategy, yet without solid business understanding, the self-employed may not be in a position to make this evaluation. Though the National Careers Service lists some introductory courses in AI, we do not see classes or other educational support for leveraging AI into daily work. Employing organisations are unlikely sources of training as offering training to contractors might trigger an "employee" classification related to employment rights.[26]

The self-employed may find it more difficult than other workers to engage with AI and institutional support systems are not yet integrating issues of self-employment and AI. For example, while there is recent government attention on AI in work as evidenced by a House of Lords Select Committee and the related Government response,[27] the work has no mention of the special issues of the self-employed. Similarly, recent reports on self-employment and the gig economy only mention technology as an enabler of flexible work.[28] Where there is institutional support for either education or technology implementation, it does not explicitly mention the self-employed.

Self-employed are likely to be working in teams, though perhaps with less support than employees - teamwork is protective against computerisation

Our own research on groups and teams, telecommuting, and familiarity with the evolution of self-employment,[29] made us curious about how much teamwork affects the self-employed. The O*NET data shows teamwork for self-employed occupations ranging from "important" (a rating of 50 by expert job analysts) to "extremely important" (nearing a rating of 100). Hospitality owners scored the highest (95), while sales occupations scored the lowest (56.5). This focus on teamwork is also supported by a search of the global Upwork freelancer platform. There, over 80% of the job postings mention the word "team" in our recent search.

[19] For example, Economics of Artificial Intelligence, forthcoming from University of Chicago Press. https://papers.nber.org/books/agra-1
[20] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/employeesandselfemployedbyindustryemp14
[21] https://www.gov.uk/browse/business
[22] https://www.gov.uk/business-finance-support
[23] https://www.gov.uk/business-finance-support/digital-growth-manchester
[24] https://www.gov.uk/business-finance-support/digital-innovation-programme-tees-valley
[25] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/485407/Business_GCSE.pdf
[26] https://www.nidirect.gov.uk/articles/employment-status
[27] https://www.gov.uk/government/publications/ai-in-the-uk-ready-willing-and-able-government-response-to-the-select-committee-report
[28] https://publications.parliament.uk/pa/cm201719/cmselect/cmworpen/644/644.pdf
[29] Bezrukova, K., Spell, C. S., Caldwell, D., & Burger, J. M. (2016). A multilevel perspective on faultlines: Differentiating the effects between group-and organizational-level faultlines. Journal of Applied Psychology, 101(1), 86. Griffith, T. L. (2012). Technology and teams: The next ten years. In Looking back, moving forward: A review of group and team-based research (pp. 245-278). Emerald Group Publishing Limited. Griffith, T. L., Nordbäck, E. S., Sawyer, J. E., & Rice, R. E. (2018). Field study of complements to supervisory leadership in more and less flexible work settings. Journal of Organization Design, 7(1), 10.

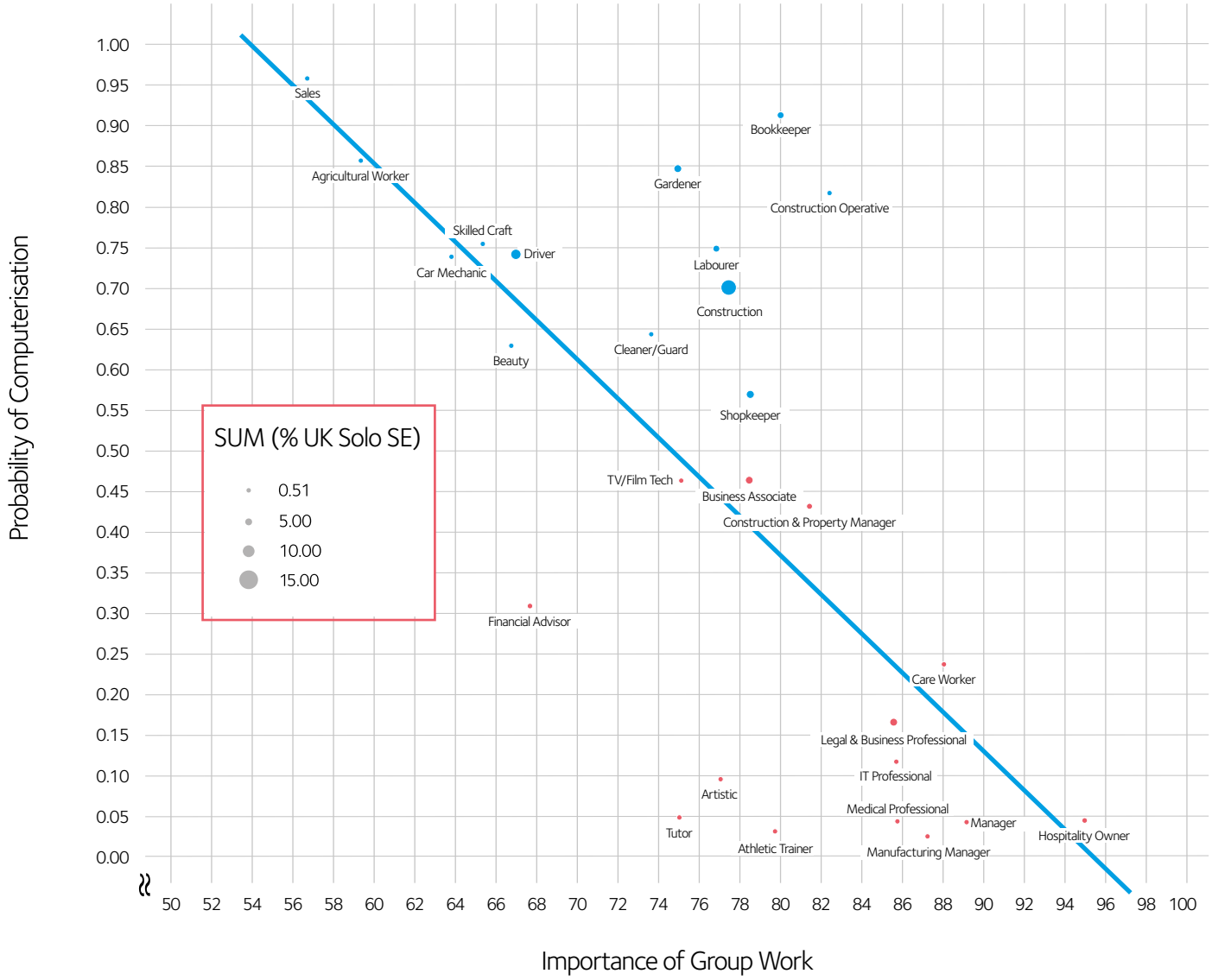


Figure 4: Importance of Group Work by Probability of Computerisation and Size of Segment

Figure 4 illustrates these results along with the probabilities for computerisation for self-employed occupations, showing another important relationship. Frey and Osborne suggest that occupations requiring social intelligence (social perceptiveness, negotiation, and persuasion) are more difficult to computerise (and thus have lower probabilities for computerisation). In Figure 4, we see this relationship played out in terms of working with others – jobs with greater focus on working with others are correlated with smaller probabilities of computerisation.

Professional and managerial work, as well as roles more focused on the most social aspects of service (care giver, hospitality owner) leverage social skills to an extent that is unlikely to be computerised in the near term.

Teamwork, like some automation, is an opportunity to leverage individual contributions if effectively applied. However, we do not find guidance for the self-employed related to teamwork or automation. While corporate employees may participate in training on effective team leadership and team building, this training is unlikely to extend to self-employed contributors given employment classification issues noted earlier. If the self-employed are able to participate in team training, it may be less effective to the extent that they participate in a rolling set of teams rather than more stable ones. Transactive memory (knowing who knows what, who has what information, and how to best coordinate) can be developed when teams train together, but is often disrupted with team member changes.[30] The self-employed may benefit from approaches sometimes studied in virtual teams, for example, practices related to swift trust[31] and/or collaborative tools that support knowledge transfer.[32]

[30]For a review, please see Argote, L., & Ren, Y. (2012). Transactive memory systems: A microfoundation of dynamic capabilities. Journal of Management Studies, 49(8), 1375-1382.
[31]Crisp, C. B., & Jarvenpaa, S. L. (2013). Swift trust in global virtual teams: Trusting beliefs and normative actions. Journal of Personnel Psychology, 12(1), 45-56.
[32]Lewis, K., & Herndon, B. (2011). Transactive memory systems: Current issues and future research directions. Organization Science, 22(5), 1254-1265.

NEW PERSPECTIVE FOR HOW THE SELF-EMPLOYED CAN RESPOND TO AI: TEAMS, TECHNOLOGY AND POWER

The results of our analysis highlight the importance of teams and technology in the work of the self-employed. The more powerful the self-employed are through their knowledge and technical resources, the more likely they will be in position to augment their work with technology, rather than be replaced by technology. In this section, we offer a research-based framework to guide the support of the self-employed as they work in teams and leverage technology.

As we think about both the implementation of AI and the role of the self-employed as members of teams, policy needs to recognise that AI has implications not only on the individual level (employability and the threat of redundancy), but also on relationships among people and groups. Team faultlines are one way of understanding these relationships.

Faultlines in teams and their significance in the work of self-employed

Because so much work by the self-employed, like work in general, is done in teams, it is useful to consider what research might tell us about the role of group composition, structure and resources (i.e. AI) for the self-employed and what they encounter when working in teams. Especially relevant here is the research stream on how the mix of people or resources in a team can create faultlines: splits or fractures in teams.[33] First conceptualised in the late 1990s, faultlines are hypothetical dividing lines that split a group into homogeneous subgroups based on group members' alignment along one or more attributes. This relatively new research area has application to the question of AI and the self-employed since there is a faultline, or natural division, between the self-employed and other staff members by definition. In modelling the question of how the self-employed can respond to AI from a faultlines perspective, we can better understand how the self-employed can leverage their knowledge and skills, at least under some conditions, to manage these divisions and even reach across them to protect, maintain and possibly advance their place in the workforce.

Specifically, the role of faultlines could potentially be important for self-employed status when there is a difference in access to technology, like when the organisation owns the AI and full-time employees have access, but self-employed members of the team do not.[34] Different levels of expertise or resources, given the power they may offer, can also play a role. Such imbalances can put the sub teams into conflict. Such faultlines may lay dormant until triggered by differential treatment, insult, or humiliating action, or when some team members have more contact with the supervisor than others.[35] People often think of faultlines as harmful to a team, but the story is not consistently negative. They can be disruptive in a positive way by bringing innovation and creativity and providing pockets of social support, especially critical in competitive environments.

The impact of faultlines on the self-employed in the context of AI

A key implication may be that the divide between those who have resources (i.e. AI) and those who do not increases perceptions of inequality, leading to competition between subgroups. The effects on the self-employed, then, stem partly from their positions in teams and who owns tools, such as AI (the self-employed or an organisation). If the AI is owned/controlled by the self-employed, this may create a more level playing field allowing the self-employed to counteract the power traditionally held by the organisation. The self-employed are more protected against computerisation of their role when they have more essential resources (expertise and/or technology) and thus possess more leverage in the team. For example, if the self-employed are in the role of independent consultants that have unique expertise in a particular AI software, they have expertise in power via the software expertise that others in the organisation do not possess. In addition to expertise and ownership of AI tools, another factor is the work itself; to the extent that the work is interdependent and requires a team to overcome divides, the less likely technology will displace self-employed workers.

In Table 1, we outline possible implications and risks given faultlines based on expert status and technical resource power for the self-employed. There are three conditions (listed across the top of the table) that are relevant here. First, if a group of self-employed are working with a similar team of other self-employed, there is no faultline or division with respect to AI resources. In the second condition (middle column in Table 1), if there is a power differential between self-employed with relatively little power working with full-time employees of an organisation, AI will put the self-employed at little risk if they control the AI (our earlier example of consultants). AI will put the self-employed at high risk if the organisation controls the AI (i.e. a shift to driverless car technology where the self-employed are currently the vehicle operators). Finally, in the right column of Table 1, the self-employed are working as experts with full time employees of an organisation.

[33]Research on faultlines began with Lau, D. C., & Murnighan, J. K. (1998). Demographic diversity and faultlines: The compositional dynamics of organizational groups. Academy of Management Review, 23(2), 325-340. A recent review: Thatcher, S. M., & Patel, P. C. (2012). Group faultlines: A review, integration, and guide to future research. Journal of Management, 38(4), 969-1009.

[34]Discussion of resource-based faultlines: Carton, A. M., & Cummings, J. N. (2013). The impact of subgroup type and subgroup configurational properties on work team performance. Journal of Applied Psychology, 98, 732.)

[35]Chrobot-Mason, D., Ruderman, M. N., Weber, T. J., & Ernst, C. 2009. The challenge of leading on unstable ground: Triggers that activate social identity faultlines. Human Relations, 62(11): 1763–1794.

Table 1: Impacts on Work and Computerisation for the Self-Employed Working in Teams

	Self-Employed Working with Team of Other Self-Employed	**Self-Employed with Little Power Working with Employees of Organisation**	**Self-Employed Working as an Expert with Employees of Organisation**
No AI	Group with no faultline: No risk to self-employed	Self-employed faultline, leverage on organisational side: No AI, self-employed at low risk	Self-employed faultline, leverage on expert/ self-employed side: Self-employed at low risk
AI Controlled by Self-Employed	Group with no faultline: No risk to self-employed	Self-employed faultline, leverage to self-employed: Self-employed at moderate risk	Self-employed faultline, more leverage to self-employed: Self-employed at low risk
AI Controlled by Organisation		Self-employed faultline, leverage on organisation's side: Self-employed at high risk	Self-employed faultline, expert power counterbalanced by AI on the organisation's side: Self-employed at moderate risk

If the self-employed control the AI, there is low risk and the potential for beneficial outcomes for self-employed due to not easily imitated expertise. As an example, independent contractors who can perform maintenance and repair operations on robots may be a growth area associated with expanding AI in some industries. There is moderate risk to the self-employed only when the organisation controls the AI (i.e. when self-employed are contractors operating a technology but the organisation owns the software and can potentially train its employees to use it). In summary, the table depicts knowledge (who has expertise) and ownership (who has control) in predicting how self-employed groups might experience risk due to AI when they work with groups of full-time employees. If the AI is owned or controlled by the self-employed, the risk of job loss could be mitigated as this could add a premium and counteract the power held by the organisation.

CONCLUSION

We started with general questions around how automation and computerisation affect jobs held by the self-employed. Our analysis suggests that automation and computerisation pose a job security risk at least to some occupations in the self-employment sector. Chief among the reasons for these risks would be related to access and/or power over resources (or lack of access) related to AI technology. If the self-employed lack control over AI or expertise to use the technology, the risk of job loss will be elevated. Social factors may mitigate these risks. Work, for example, that is interdependent and requires employees to work together, negotiate and make decisions is less likely to be made redundant as these attributes are more difficult for AI to imitate. Other jobs and occupations may see expansion or substantially changed job design. For example, accountants may see more emphasis on management and consulting (and less on manipulating numbers and other mundane tasks) as AI comes to do more routine calculations. Attorneys also may see some functions diminish in importance, such as searching through court records, but more time spent on trial-related issues, consultation, or other areas. Technical jobs such as maintenance for robots and distribution of hardware for AI may see significant growth. The possibility of expansion of certain skilled occupations reminds one of the growth of IT positions decades ago, where support and maintenance of computers became much more needed.

Overall, by encouraging innovation and broad expertise transfer, the self-employed will gain resource and expertise power, and thus, some protection from the harmful effects of automation. The self-employed will have greater avenues to mitigate job loss or redundancy due to the integration of AI to the extent that they are aware of the issues, continue to develop knowledge related to the changing landscape, and where there is applied research to support them. In the sections below we highlight some of the particular opportunities. Overall, jobs that require creativity, work in interdependent teams or which AI itself depends upon would be least at risk, with the self-employed in jobs that can be routinised or where technical expertise resides elsewhere being at especially high risk.

Awareness

Create public awareness programs to highlight the basic opportunities and risks of AI and other automation to support early adopters and generate wider interest. Awareness could be supported through funded talks at professional associations and other communities of practice and leveraging efforts related to "Good work: The Taylor review of modern working practices"[36] or the House of Lords document "AI in the UK: Ready, willing and able?"[37]

Develop policies to encourage AI designers to share when and how AI is in use, and to the extent possible, to make the processes interpretable and transparent – this can help maintain awareness of technical advances.

Formalised learning platforms such as the National Careers Service should be updated and maintained to ensure that the job profiles and skills checks integrate shifting skills and tools - both for the use of AI and capabilities required when taking on the job as a self-employed person.

Education

Update and extend formal learning platforms such as the National Careers Service to ensure that the job profiles and skills checks integrate shifting skills and tools - both for the use of AI and capabilities required when taking on jobs as a self-employed person.

Establish materials about the integration of AI and self-employment in curriculum standards so that early and lifelong learning can succeed in the new work environment. In practice this could include creating opportunities for educators/teachers around technology implementation, as well as additional funding into the development of relevant lessons plans and teaching materials.

Adjust curriculum standards to recognise that even the solo self-employed work in teams and need access to evidence-based training on effective teamwork using technology. Greater awareness and expertise for the self-employed may create balance in team expertise where the self-employed work with traditional employees in organisations.

Further research

Support applied research specific to the integration of AI in work, and specifically for the self-employed. It is crucial to focus on long-term efforts, as such research will take multiple years and needs to begin now to have evidence-based recommendations as the prevalence of AI increases.

[36]https://www.gov.uk/government/publications/good-work-the-taylor-review-of-modern-working-practices
[37]https://publications.parliament.uk/pa/ld201719/ldselect/ldai/100/100.pdf

crse.co.uk