

WORKING PAPER 6

The Rise of the Digital Labour Market: Characteristics and Implications for the Study of Education, Opportunity and Work

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Abstract

The study of education and work has typically focused on the role of the credential in shaping individual opportunities in the competition for jobs. Despite its pivotal role in understanding the link between education and work how the labour market operates in an increasingly digital context has remained under-researched. This article explains why the digital labour market is in urgent need of study, not only because of a decline in the perceived value of credentials, but also because rapid digital innovation is transforming how labour markets are structured and shape the competition for jobs. Digital tools give job seekers new ways of describing themselves and employers additional quantifiable data on candidates, in real-time and at low cost. We identify three dimensions of digital labour markets that distinguish them from earlier 'analogue' models – Information, Control and Engagement (ICE). We explain how changes in these dimensions contribute to a restructuring of the recruitment process, and outline some of the implications for current accounts of the education-work relationship and social inequalities.

Keywords: education and work | credentials | digital labour markets | recruitment | social mobility | HRTech

1. Introduction

The relationship between education and work has been widely studied, but there has been a surprising lack of research on the role of labour markets. Where the labour market has been in focus, most evident in studies of social mobility, it has been on credential competition as the 'currency of opportunity' in the competition for jobs. However, there have been increasing interest in the role of labour markets due to increasing evidence of social congestion (Brown 2013) and over-qualification (McGuinness, Bergin and Whelan 2018; Rothstein 2020:30-31). The global expansion of higher education has also added to concerns about grade inflation, fuelled by perceived failings of higher education to prepare students with the employability skills needed to find suitable employment (Souto-Otero 2021). Some companies, including industry leaders, such as Google, Apple, Ernst & Young or Hilton Hotels & Resorts (see Glassdoor 2020), have publicly downplayed the importance of credentials for their recruitment. All of this adds to confusion about the market value of educational credentials and how best to address inequalities in individual life-chances and increase opportunities for social mobility.

Most of the research literature across the social sciences, including economics, sociology and education, have used differences in credential performance and 'paper qualifications' to represent a hierarchical ordering of individual job prospects (see Brown and Souto-Otero 2020). However, as we move towards more digitalized labour markets, we need to ask how best to understand the role of the credential within changing labour market contexts, along with its implications for education, employability and the future of work.

We want to contribute to new debates by considering the development and implications of digital labour markets, where ongoing transformation has changed how job seekers and

employers engage in the recruitment process, compared to what we know about ‘analogic’ labour markets (non-digitalized recruitment).

This working paper argues that the digitalisation of the labour market, offer new sources of information on job candidates and new ways for people to present their ‘employability’ (Brown and Hesketh 2004) which further weaken the role of the credential in determining hiring outcomes. It examines how the hiring process is being transformed by new sources of *information*, shifts in the locus of *control*, and fundamental changes in the rules of *engagement* – which we term the I-C-E model of the labour market. Following this, we discuss wider methodological and theoretical implications related to these changes, as a contribution towards rethinking the education-work relationship.

2. Why we need to rethink the relationship between education and work in a digital context

We now spend more time online and create more digital data than ever before. Over half of the world’s population, and over 90 per cent in many developed countries, have access to the internet (World Bank 2021), and many spend a lot of time on it. Eighteen to 35 year olds in the USA spend the equivalent to a full working day a week on social media alone (Nielsen 2018). In relation to job search, Adecco (2019) estimates that today candidates spend, on average, three quarters of their job search time online, on websites and social media. Platforms include LinkedIn, Facebook jobs, Google Careers, Glassdoor, Twitter, amongst many others.

Tertiary education expansion and the declining costs of digital technologies incentivize the adoption of digital tools for recruitment. With the shift to mass higher education some employers receive otherwise unmanageable numbers of applications. Google receives millions of applications per year (Nisen 2014), Unilever received 250,000 applications for 800 new graduate positions (HireVue 2020). Companies need ways to deal with these volumes in a timely and affordable way, while maintaining the external legitimacy of their decisions – this is, not to be seen to select at random or in a biased way.

Moreover, as Van Esch and Black (2019:730) argue, people’s increasing online presence means that “if companies want to attract and recruit talent who increasingly spend their lives in digital space, they have to recruit in that digital space with digital technologies and tools”. Many companies have digitalized advertising, moving it online: in the UK, around half of employers use their website to advertise vacancies and a similar proportion use their social media, whereas 10 per cent use paid-for website or social media recruitment services, even though channels such as ‘word of mouth’ continue to be important (Winterbotham et al. 2020). Digitalisation of advertisement and application submission creates ideal conditions for job seekers to ‘spray and pray’, increasing applicant numbers and reinforcing the incentives for companies to use AI and machine learning software to review and rank CVs – part of the growing HRTech market.

This new context challenges existing theories of job competition and the role of credentials in determining labour market outcomes, primarily because there are new sources of information on which employers can make their hiring decisions. Since employers cannot directly observe individual productivity, capacity to learn, or professional networks, qualifications have been widely used as a proxy for skills, trainability, and social connections (Brown and Souto-Otero 2020).

A central question is how the shift to digital labour markets changes the ways employers collect and interpret information about candidates, and the role of credentials in that process. But this does not mean credentials have no value. In much of the labour market credentials continue to be important for recruitment but they are, increasingly, thresholds to achieve and

below which candidates are less likely to enter the competition, rather than being entry tickets to a commensurate job. As Jeff Weiner, LinkedIn CEO put it, the qualities that employers are seeking:

“are qualities that you don't necessarily pick up from a degree (...) Increasingly I hear this mantra: Skills, not degrees. It's not skills at the exclusion of degrees. It's just expanding our perspective to go beyond degrees” (quoted in Bariso 2017).

3. The digital labour market: Information, Control and Engagement (ICE)

This section introduces a framework for the analysis of the digital labour market. It is a conceptual model, and we acknowledge that there are different degrees of use of digital technologies in live recruitment processes.

3.1 Information

The digital labour market matching process is information intensive and offers the possibility to observe candidates in ways that were previously unimaginable. As such, a central trait of digital innovation is the transformation of signal transmission. In the digital labour market, there is an exponential increase in volume of data used in the hiring process. It is information rich, although this information may not be more accurate or fairly assessed than in analogic labour markets. There is, for example, some evidence of *different* types of deception but not in frequency in deception in LinkedIn and offline resumes (Guillory and Hancock 2012).

In analogic recruitment processes, the candidate constructs and communicates narratives around their credentials, career path, personal aims, connections, etc. which transmits primarily through limited text (a few pages of CV and covering letter) and “talk” during interviews. In digital labour markets these sources are still relevant, but the process expands to include others, such as social network sites, and new forms of observation. There is also observation in analogue recruitment, for example during interviews or through internships, but the digital labour market affords the ‘observant recruiter’ new opportunities to gaze information on candidates’ productive skills, trainability, and social networks, as well as personality. This consequently relaxes the need to rely on the credential.

Observation of skills and previous work is facilitated by digital technologies. The nature of the CV is altered: 3D CVs offer detailed information on applicant’ profiles and qualifications through meta-data supported by digital means. It has been claimed that standard, “Résumés will be displaced by constantly evolving representations of individual experiences, skills and aptitudes that exist purely in the digital realm. Innovative tools that use social media, big data and other technologies to give tremendous insight into individual job seekers will [be] the primary screening method.” (B. Myhal, former CEO of Nexthire – cited in Shidiqui 2016). Trainability can be observed through tasks to be performed online, through the review of data on work, education or leisure that are available through third party reports in social media or through applicants’ narratives on their juggling of simultaneous undertakings such as learning, work or hobbies (and applicant narratives on how stressed they are or how much they are “loving it”). While employers can infer something about an applicant’s social network from their CV (e.g. name, university attended), this cannot compete with the review of an applicant’s LinkedIn and other social media accounts. Some employers use cut-off points based on minimum number of connections, or the quality of those connections as part of the process: social media can be used to assess the social capital of job applicants, as Adecco (2014) has noted. Extensive data to infer personality traits is also available – an aspect that we will revisit.

An applicant may opt out from this online presence, but this can be costly. No information may lead to suspicion and exclusion: “the absence of online information may become as problematic as the presence of red flags” (this is, problematic information) (Berkelaar and

Harrison 2017:3). The focus on digital footprints also has large implications for mid-career and later life career changers, who may have ‘missed’ many opportunities to develop such footprints, as they progressed in the labour market. The above changes are enabled by the production – by the applicant and others around them – of new types of information. To be sure, employers can observe potential employees and their attributes in real time and in actual workplaces without digitalization. This is reflected in an increasing use of work experience linked to formal study, post-college or university internships, agency work, and other forms of ‘work trials’ (Maguire and Keep 2021), but these also require a selection process before deciding who obtains such positions, which moreover do not operate for the majority of posts.

3.2 Control shift

Digital labour markets not only increase the sources and volume of information used in the hiring process but also change the locus of control of the information *used* to judge the applicant (from the applicant to the employer), and its *processing* (from employers to machines). In analogic labour markets, applicants have a high degree of control over the information employers can access and the narrative they present. The information used for recruitment is highly curated and delimited: what is narrated and what is observed is often created or selected for the purposes of the recruitment process.

In digital labour markets there is a change in control of the information on the applicant used in the recruitment process, from the applicant to the employer. Changes are not just one way. Candidates also have access to new sources of information about employers provided by employees or previous candidates at their disposal (in platforms like Glassdoor), which can affect application decisions. However, the information that employers have is much expanded too, and can come directly from the applicant or be extracted by the recruiter, sometimes without the awareness of the candidate, using their digital footprints: Youtube or Tiktok videos recorded, social media posts on and from the individual, blogs, photos, previous company websites, etc.

These digital footprints are often not produced with the recruitment process in mind and can also include information produced by the applicants’ network. The nature of social involvement in recruitment changes. In analogue labour markets recruiters are limited to deciphering social cues from CVs and other information candidates may provide, for example through their dress codes, accent or poise. In digital labour markets employers can observe applicants’ narratives, but also what others say about the applicant or their experiences. Various materialities (e.g. objects, places, bodies and attires – the applicants’ and those of people around them – as observable in social media platforms like Facebook, for example), become visible and intersect with the recruitment process in unprecedented ways. Moreover “people have limited control over when, and in what order, their online information is presented” (Berkelaar and Harrison 2017). Less applicant control over the information that the employer can access about the applicant implies less control over signalling.

Digitalised recruitment also shifts control in information processing, and in some cases in decision-making. In algorithmic led recruitment parts of the process become automated, delegated from humans to machines, to become less time consuming and what is assumed to be more ‘accurate’. This underlines the importance of who writes, activates, and interprets the algorithms as HR staff lose control over parts of the process to AI developers. This market is dominated by companies like Oracle, but there are hundreds of HRTech solution providers. Some, like Taleo, automatically rank applicants comparing their resume to the job description (Shields 2018). While these systems automate the process and seek to make it consistent, this does not necessarily imply that they are free of bias, as discussed below.

The use of digital technologies enhances ‘commensuration’ (the application of common metrics and signifiers to different realities) in recruitment, for example in the automated search

for certain “keywords” in the CV. Vocabularies count. Applicants can also automate this work, with digital tools like Jobscan that ensure a match between the top keywords required by the job description and the applicants’ CV. Adecco (2020) advises job seekers:

“Most of the terms you have on your LinkedIn profile are searchable by other users, so adding relevant keywords to your profile can help recruiters find you. Start by optimizing your professional headline, which is the most highly indexed part of your profile, and then add keywords to the other sections of your profile to ensure that you are as visible as possible to potential employers in your industry” (Adecco 2020)

The emphasis on keywords raises questions of what is lost in the shift to digital labour markets. AI does not see people as entities, but as the sum of ‘signifying’ words and their connections.

3.3 Engagement

The digital labour market changes the nature of engagement for both hirers and job seekers, as it becomes increasingly boundaryless in time, geography and activity. There is no switching off or delimiting of recruitment ‘events’: digital technologies enable an examination of the past as well as the present; applicants’ control over the time dimension of the recruitment process becomes more difficult. The possibility to post personal profiles on employment sites also generates 24/7 competition, even with applicants who are *not* aware of the vacancy, as employers’ algorithms search through job seekers’ profiles for headhunting opportunities.

Digital labour markets make it viable to engage applicants from much further afield and large populations of non-active candidates. The role of geography is reconfigured as recruitment processes become more globalized – an aspect that may be more accentuated in the case of managerial and professional employment but extends its ramifications to other segments of the labour market too. Advertisements for job opportunities are published and consumed at near zero cost online. Applicants have access to a larger pool of jobs than ever before, globally, with ‘jobs matching your interest’ being sent to candidates’ inboxes around the world. The ‘candidates’ engagement in the process changes as the distinction between active and passive candidates no longer seems sufficient. Whilst in the past, a ‘passive’ job candidate shared its CV with a recruitment agency, now every internet user is a potential applicant: Facebook, Twitter or Instagram show job adverts to users whose profile could be matched to a job and who have not taken any steps to present themselves as job seekers. They are what we could call ‘dormant’ candidates. Some vendors specialize in finding such candidates gathering information from various websites and compiling an individual profile that is then incorporated into the recruiter applicant tracking system (ATS).

The process blurs the boundaries between what is work relevant and irrelevant, as access to data on the ‘self’ of candidates, including non-professional activities, that (some) recruiters may consider relevant to judge the candidate, is facilitated. This information is not only about candidates’ ability to do the job or fit with the organization, but also about their future behaviour and personal ‘being’. Employers often view the ‘digital self’ as a door to seeing the real ‘personality’ of applicants, which they consider a proxy for future job performance and motivation:

“the most commonly mentioned appealing aspect of an applicant’s social media profile was in fact the least tangible; 58 per cent of managers were more likely to hire if they ‘got a good feel for the candidate’s personality’ from their profile.” (Broughton et al. 2013:16).

About three quarters of employers consider social media profiles to be a ‘true reflection of a more complex reality, which, it can be said, is even more accurate than a static tailor-made CV’ (Adecco 2019), a reflection of the applicants’ true self. This reminds us, recruitment is not

only based on a technical match, but also on an ontological match (personality package), which can now be explored in new ways. Tools like 'DeepSense', scan social media profiles to infer personality features. IBM Watson 'Personality Insights' produces scores on the psychological profiles as well as the values of applicants based on linguistic analysis of digital communications. Facebook data has been used to infer 'dark' personality traits such as psychopathy and narcissism (Akhtar et al. 2018). It is important to note that digital tools are not only used at the top end of the labour market. Personality profiling based on social media data to score personality has been used to predict risk of bullying or bad attitude of babysitters, for example (Sánchez-Monedero and Dencick 2019).

The digital 'amplifies' the information about the 'self'. As personality profiling comes to rely more on digital data such as 'likes' or types of words used to infer personality, values, and intelligence, how individuals personally market themselves becomes a central component of their digital self. As a result of the above, the digital labour market requires continuous care and self-governance from individuals, a never-finished process of curation of materials through work on the 'digital self' to show job readiness, the construction of a unique brand of the digital self over time, not only when looking for a job. Tagging and un-tagging to highlight your added value and that of your network and avoid negative information are now part of the digital self, as Adecco (2020) notes:

"Review tags regularly: review the posts and photos you've been tagged in, and untag yourself from anything unflattering or controversial (...) When cleaning up your profiles, it's advisable to check older posts and activity, removing anything that could paint you in a negative or questionable light"

This requires specific sets of dispositions and skills. It also entails the expansion of one's network, and being strategic in that expansion including, when possible, industry leaders and experts in the field. This demands time and effort, keeping information up to date and consistent between platforms and trying to monitor how employers define ideal candidates and employees, to respond to changes in their approaches.

The digital labour market model does not apply to all jobs or job seekers. It is a model that is evolving across various aspects of the recruitment process, often co-existing with established labour market practices. It has more purchase in some locations, sectors and segments of the labour market, such as professional and managerial posts. But the direction of travel is towards an increasingly digital labour market. This raises the central question of how to reconceptualize the recruitment process.

4. How does the digital labour market change recruitment practices?

We need to think of new ways to study labour markets and how they relate to education and employment. Existing theories on the link between education and work have little to say about how the recruitment *process* works. Below we present an outline of the eight main stages of hiring in pre-digital labour markets (see also Mueller and Baum 2011; Thebe and Van der Waldt 2014). Not all jobs may include all these stages, but most will consist of multiple stages rather than single hiring 'decision', and the basis of that process are captured below.

- Needs analysis and definition of the job and desired applicant requirements
- Job description, formulation and communication (eg. advertisement, 'word of mouth')
- Applicant pool formation (active/ passive candidates)
- Screening of CVs and additional documentation
- Interviews and/ or tests
- Hiring decision (job offer/ rejection)
- Reference check for offers

- Negotiation (for offers) & feedback

Linked to these stages, there are sub-stages (decisions around timeframes to fill the position, and on how to carry out each stage). In the digital labour market, the recruitment process changes in fundamental ways: the stages of the recruitment process, and what happens within them changes and the dynamics of the process itself changes too. There are, thus, changes *in, within and across* the stages of recruitment.

4.1 Changes in stages

Digital recruitment alters the stages in the recruitment processes. The main elements of digital recruitment are outlined below – the main changes in the process are signalled in italics. These changes give greater power to employers in the pre-selection of candidates and their observation and expand the boundaries of the types of information that are used in recruitment, well beyond formal education credentials:

- Needs analysis and definition of the job/ desired applicant requirements
- Job description formulation
- *Pre-selection and communication (e.g. decision on where to advertise and to whom)*
- Creation of the applicant pool/ ocean (active/ passive candidates)
- *Passive and active screening – digital scoping*
- Interviews and/ or tests
- *Digital vetting*
- Hiring decision (job offer/ rejection)
- Reference check (for offers)
- Negotiation (for offers) & feedback

Changes in stages take place in three main ways. First, pre-selection becomes a more explicit stage. In digital labour markets recruiters pre-select by deciding *who will be exposed to their advertisements* in a more personalized way than before, as they have a high degree of control over the characteristics of those who will see their adverts. Facebook offered companies the possibility to target their job advertisements to users interested in a certain industry or living in a certain geographical area, having predefined age ranges, gender, ethnicity or connections to other companies, letting firms choose among 100+ attributes (Ali et al. 2019), and excluding those ‘eyeballs’ who do not fall into the predetermined parameters. Pre-selection on individual characteristics, may also occur unintentionally, however. Lambrecht and Tucker (2019) found that a STEM job ad they analysed was shown 20 per cent more frequently to males, because female ‘eyeballs’ are more expensive on the web (as a result of their role in household purchases), and the job advert algorithm they used took cost aspects into consideration when deciding who to show the advert to.

Second, while there are some parallels with employment agencies and headhunting in analogic labour markets, the examination of passive and dormant candidates is scaled up and facilitated by technology. Applications like Seekout can automatically create a shortlist of candidates from worldwide talent profiles available on the web or the firm’s own Applicant Tracking Systems (ATS), based on job descriptions.

Third, screening is based on extracted as well as received information. In analogic labour markets screening tends to rely on information received from the applicant. Digital technologies permit ‘active screening’ whereby recruiters extract information about the applicant through ‘digital scoping’ – also referred to sometimes as social media profiling - and ‘digital vetting’. Digital surveillance through scoping and vetting are one-way data extractions, in contrast to the greater exchange of information used in analogic processes – as our previous discussion of a ‘control shift’ makes clear.

Digital scoping aims to gather online information that applicants did not disclose in the selection process to assess their work ethic, values and personality. Information on qualifications, posts, comments about life or current employer, spelling mistakes, videos, 'likes' given and received, photographs, etc. are all part of this new data deluge. Such online inspection may come before or after interviews or tests. When it is ex-post it tends to have a more confirmatory than exploratory character, and becomes closer to 'digital vetting' - online explorations to verify claims made by an applicant. It can consist of the verification of candidates' current employer, qualifications, criminal or health record or credit rating, for example. It may complement or substitute previous forms of vetting, as online endorsements, feedback ratings from previous employers or customers and other forms of skills and personality altmetrics become the online version of the reference letter.

Sometimes digital scoping and digital vetting are present in the recruitment process even if they are not a formal part of it. As one recruiter reported to Kutlu (2018:29):

“Candidate’s academic background and experience are vital factors in hiring but I like observing their lives, especially extreme cases, it is a biological instinct. I stalk celebrities too”.

This is problematic given that job seekers expect to be considered according to an explicit and transparent recruitment process. Some legislators have begun to react against the most blatant strategies for digital scoping and vetting such as asking candidates to provide passwords or usernames or to send invitations to connect online to examine their profiles (Berkelaar and Harrison 2017:4).

The validity of some forms of digital scoping and vetting is contested, as workers can adapt their online behaviour to employers' preferences or create profiles exclusively for job-seeking. Moreover, people may simply behave differently online and offline, in leisure contexts and at work. Many applicants will be aware that algorithms are used in recruitment, but only some will know how to maximize their 'algo scores', leading to new sources of inequality. Algo scores themselves are moving targets, as they auto-correct according to location or over time. Chamorro-Premuzic et al. (2016) note how after the press publicized that liking Curly Fries in social media was a strong predictor of IQ, increases in such likes led to the downwards re-positioning the value of this signal.

4.2 Changes within stages

The digital labour market also brings about fundamental changes to what is done within stages in the hiring process: the tools employed, the data used and the ways they are analysed. Table 1 provides an overview of selected digital tools currently used at various stages in hiring.

Table 1: Digital tools in selected hiring stages

	Task for AI/ digital tool	Examples of Users	Examples of vendors
Job description	Contribute to job description optimization (reduce jargon, make descriptions more exciting, avoid indirect discrimination such as gender biases, etc.) to expand the pool of suitable candidates and protect the employer's reputation	Cisco, Atos, Nestle, American Express, Nvidia, Evernote	Textio or Three source
Advertiseme	Provide targeted job advertising	Newton, Netflix,	ClickIQ,

nt	optimization services to produce accurate recommendations for relevant candidates	Youtube	PandoLogic, Recruitz or Appcast
Applicant pool construction	Search in oceans of hundreds of millions of CVs from passive candidates scanning multiple databases such as LinkedIn, Glassdoors, GitHub, Healthgrades and social media profiles	Bank of America, Intel, e-Bay, Hilton, Nike, Accenture or Warner Bros.	Hiretual Pro, Ideal or Loxo
Screening	Reviews CVs to filter out or rank them. Aims to save time and costs, improve consistency and claims to avoid human biases associated with preconceptions and fatigue.	IBM, LinkedIn, Hilton, Goldman Sachs, Amazon	IBM Kenexa, Ideal, CVVIZ, Zoho Recruit, Talent Recruit, Talent Cube
Testing	Use AI-powered psychometric testing to provide more engaging tests to improve the candidate experience and candidate to hire ratio.	Unilever, PwC, Tesla, Boston Consulting Group	Arctic Shores, Pymetrics, Knack.
Interviewing	Video interviewing (synchronous or asynchronous) and video screening software to reduce interviews' costs, biases and time. Software analyses video to assess person-organisation and person-job fit. Aims to reduce bias/ discrimination.	Vodafone, Intel, Urban Outfitters, IBM, Hilton, Unilever, Salesforce, Zappier, Pinpoint, Ocado, Facebook	HireVue, Montage, Wepow, InterviewStream, My Interview.

Source: Based on information from Albert (2019) and vendor site reviews.

These tools modify what can be done within stages. As a result of online advertisement, for example, the job definition in an advert is no longer fixed. Companies have the opportunity to alter and customize job descriptions, emphasizing different aspects of the vacancy at different points in time, for different platforms or 'user profiles', to modify or expand the pool of applicants according to the profile of applicants that they are receiving (Yarger et al. 2019).

Digital interviews enable the analysis of verbal and non-verbal data for applicants' profiling or fit estimation (Köchling and Wehner 2020). Voice mining and pitch modulation patterns, text analytics and image analysis (e.g. facial expressions such as smiles or anxiety clues) are used for pattern comparison with 'high performers' in similar roles, emotion and personality profiling and prediction of personal traits such as capacity to cope with stressful situations.

Digital tests and games produce rich data to work-out fit with the employer or vacancy. Pymetrics presents itself as a test and games tool, based on neuroscience research, to assess applicants' cognitive ability, social and emotional traits. HireVue uses games to report on applicants' teamwork skills, willingness to learn new skills (learning quotients), problem solving, adaptability, communication, leadership, memory or attention (Sánchez-Monedero and Dencick 2019).

'Smart screening' rests on AI-driven candidate scoring. Some of the techniques for data analysis are not new, but the possibilities for their use and the scale of their implementation are: linguistic analysis has been used for a long time to infer talent, "but modern scraping tools and

publicly available text have made it applicable to large-scale profiling” (Chamorro-Premuzic, 2016:629). In the final stages of the process, rejection and feedback can be automated, offering suggestions for up-skilling or for new suitable positions to match the job seeker’s profile.

4.3 Changes across stages: flexing the hiring process

Digital technologies allow flexible modification of the sequencing of stages, and who is involved in recruitment. Assessment results from previous tests may be ready for analysis before screening, as vendors keep records of past performance. Personality profiling may be brought forward – before tests and interviews – through digital scoping. As such, employers “may come across personal information before professional information is seen, and that filter may have a different effect if seen before or after professional information is examined” (Berkelaar and Harrison 2017). Search algorithms determine what information is presented and in what order.

The transition between stages in the hiring process has become faster. HireVue (2020) claims to have accelerated Unilever’s recruitment process by 90 per cent. Fast response is attractive to both companies and applicants. Discussions about the use of 24/7 chatbots (such as Mya, Beamery or Humanly’s) for relationship management with candidates or automated scheduling for calls, tests or interviews (e.g. X.ai, Troops, Olono, AllyO) are often linked to arguments on the improvement of “candidates’ experience”.

From the previous discussions it is clear that who is involved in the recruitment process also changes with new technology solution vendor entering the recruitment space, together with social media platforms, for example. Friends and connections, have become part of the process through tagging, likes and communication activity, as already discussed.

4.4 Where do these changes lead? Effectiveness, biases and acceptability

Two central issues relate to the effectiveness of these new digital recruitment tools and their implications for fairness in recruitment. Claims of effectiveness such as those made by Van Esch and Black (2019:731) are contested by others who have pointed out various sources of bias (see Cowgill and Tucker 2020). For example, digital scoping and vetting exercises may come across data that recruiters are required to ignore (e.g. image, age, political views, relationship status or sexual preferences). The same information and its value or appropriateness can be viewed differently, depending on whether it is submitted in analogic or digital recruitment: adding a photograph to the CV or requiring one can be perceived as improper or be against the law, whereas ‘not including a photograph throughout your digital presence is portrayed as naïve and unprofessional’ by employers (Kutlu 2018:28). Baert (2018) notes how social media profile picture affects the likelihood of progression into the interview stage in selection processes.

Another source of bias is ‘confirmation bias’: as algorithms are fed with company data to identify relationships that predict performance, existing biases may be replicated. In spite of their veneer of objectivity, algorithms learn human biases. Data analyses can be a further source of bias: facial analysis techniques used in interview video analysis have been found to suffer from disparities in errors across gender and racial lines and may not infer emotions correctly, especially, cross-culturally (Raghanvan et al. 2020). But ‘flipping the bias’ is also possible: if previous biases led to selection only in the case of star applicants from minorities the algorithm will associate the factor discriminated against as a marker for high performers (Rambachan and Roth 2020).

A further issue is lack of transparency: how performance in a game, facial expressions or speech is AI judged and respectively weighted may not be easy to explain. Employers may

lose sight of how their recruitment is operating. Transparency may not only be difficult to achieve, but also insufficient to avoid biases, as the example by Lambrecht and Tucker (2019) in STEM recruitment mentioned earlier shows: a review of the algorithm would show that it aims to minimize costs for advertisers, but knowledge of online advertisement is needed to realize the consequences of this rule in terms of gender discrimination.

Vendors are responding to these sorts of concerns by evaluating their models for bias and transparency or providing software that removes personal information from applicants' profiles before human review. Some specifically present the reduction of biases as a selling point (Sánchez-Monedero et al. 2020). Confirmation biases such as those that led Amazon to scrap an AI recruiting tool that discriminated against women for software development jobs (Meyer 2018), for example, are being addressed through weighting of less represented populations to make up for under-representation (Edionwe 2017).

Digital tools may be seen as more useful for parts of the recruitment process (advertising, screening) than for others (final selection), and for some companies than for others (smaller companies who may look for a specific type of candidate and may not have enough data on past post-holders to feed the algorithm). They exclude those who do not have access to digital technologies. Recruitment may become more homogeneous and the selection of 'non-traditional' profiles less likely (Newman et al. 2020).

There are, thus, important questions of both fairness and efficiency in the use of digital tools for recruitment. Yarger et al. (2020) suggest that at the end of the day, digital tools do not need to be perfect but 'only' better than humans yet questions around "whether", "when" or "how" they are remain. Liem et al. (2018) note that personality inferences from video resumes are roughly as (in)valid as those from paper resumes, and the analysis of information from automated interviews and correlation of facial gestures with personality still need much improvement (Sánchez-Monedero et al. 2020). Psychological research provides evidence of the validity of human-led recruitment techniques (Chamorro-Premuzic et al. 2016), but also that algorithms that mine social media data tend to outperform humans' inferences on personality characteristics (Van de Ven et al. 2017). Moreover, most work relates to the predictive capacity of digital tools regarding personality or job interview performance; findings on their validity to predict actual job performance are scarce. On the whole, the jury is still out on the effectiveness of different digital tools for recruitment (Treweek and Briel 2020).

With regards to acceptability Oberst et al. (2020) found that recruiters prefer expert recommendations to those given by algorithms. Human decisions are often seen as fairer than those taken by algorithms in recruitment (Lee 2018) because algorithms are seen to lack human judgment and struggle with qualities that are difficult to quantify (see also Newman et al. 2020). Perceptions of fairness affect applicants' dispositions to apply for a job, accept an offer and ultimately the company's reputation and brand image.

Taking these and other considerations into account, recruiters and developers will make decisions on whether and how to use new technologies. Johnson and Gueutal (2011) describe how Microsoft mined data on the relationships between variables such as university attended, work experience and previous employers to target certain universities and companies for future hiring. Google employed a similar approach, to narrow down the universities it approached to those that provided their top talent. But Unilever used technology to target more universities. With AI, and making use of recruitment tools such as Facebook, WayUp and Muse, Unilever expanded its campus milkround from 840 to 2,600 universities, while reducing costs (Van Escah and Black 2019). Other approaches go further, not trying to use universities in the process. Some companies have used digital technologies to make recruitment more "skills based". Gas-Jumper provides, administers and assesses blind skills-based tests. In blind hiring skills testing is done early on, instead of CV examination. Applicants are anonymised, and the recruiter receives a ranking of applicants based on their performance,

without personally identifying information, to decide who to call for interview based on metrics (Yarger et al. 2020). This system is meant to help companies diversify their workforce and is a very different approach to that used by companies screening on personality, fit and digital scoping prior to interviews. Through “technical interviews” vendors like Interviewing.io, used by companies like Dropbox, Facebook or Coinbase to hire engineers, “track how candidates do in live, rigorous technical interviews and get you the best performers” (Interviewing.io 2021). The company provides university students with opportunities to practice technical interviews. Top performers then get to interview with employers. This aims to provide an alternative to campus fairs and reliance on ‘university attended’. The company reports more than 82% of their university candidates are from non-elite universities (Yarger et al. 2020). These different ways of approaching screening based on the possibilities offered by new technologies reflect different values and conceptions of employability and/or talent management. The rise of the digital labour market facilitates alternatives to credential-based accounts which require detailed investigation.

5. Conclusions

Social mobility and the role of education in the allocation of opportunity are high in the political agenda. In a context of increasing access and achievement in education, getting a better understanding of how labour markets structure life chances, and under what conditions, is vital. Research in these areas from an employers’ perspective is, however, limited and much of it shares questionable assumptions about the role of credentials in the labour market and has neglected the study of how the labour market operates. The assumption, central in existing theories on the link between education and work such as human capital, signalling or social reproduction theories (Becker 1964, Arrow 1973, Bourdieu and Boltanski 1978), is that the credential is a key differentiator in determining labour market outcomes (Brown and Souto-Otero 2020). Although, these accounts offer important insights, we need new concepts, ideas and debates focused on the changing relationship between education, work, and the labour market.

This working paper aims to make a start in this direction by considering the development and implications of digital labour markets. It outlines a new model for the study of digital labour markets, premised on changes in three dimensions relating to Information, Control, and Engagement. We argued that the digital labour market is characterized by more intense use of *Information* over which there is less applicant *control* in signalling, and new forms of job market *engagement*. These changes are largely enabled due to the production, by the applicant and others around them, of various types of digital data, which employers curate for their own purposes.

The I-C-E model has significant implications for the relationship between education and work, as it questions the primacy of credentials in recruitment. The digital labour market facilitates the detailed assessment of candidates well beyond academic performance, to include performance in varied forms of assessment, examination of their networks, psychological profile, past projects and work performances and areas of their everyday life previously outside the purview of hiring decisions. Out of school activities, including non-formal and informal education, experiential learning, and work experience, can now be documented in ways that they could not before. New credentials that compete in the space of formal qualifications emerge not only in terms of micro-credentials and badges, but also in terms of the records that vendors keep on individual assessments of performance, that can be used during different recruitment events, as part of a lifelong record individual employability.

Algorithms may simply replicate existing biases and reproduce existing inequalities, including in the value of educational credentials. But the digitalization of the labour market can also bring new spins on old inequalities, in ways that should be examined. The extent to which the digital assessment of speech patterns during selection process mirror, accentuate or mitigate

Bernstein's (1973) arguments on the role of speech codes in reproducing educational inequalities is a case in point. Inequalities of status between educational institutions and 'settings' can be reconfigured and made evident: the sight of a modest school or university (of their buildings, 'not of the right background' students, etc.) in an applicant's social media may evoke reactions from employers, who might otherwise have fewer elements for judgment of those institutions before the digitalization of everything.

However, this digital evidence can be used for different purposes: to give greater weight to the performance of those coming from such a school, or to exclude them from the process. The globalization of job competition and applicant pools may increase the importance of the international prestige and visibility of qualifications or individual institutions compared to their national standing, as these can diverge significantly at times. Less typical combinations of credentials, achievements and experiences may pay a penalty as algorithms used in HRtech may not pick up their value, because they do not conform to their identified patterns of the typical 'employable candidate'. We also noted how new areas for the study of labour market inequalities emerge, as individual skills around the construction of the 'digital self' become central to employment prospects. Key to these debates are the algorithms used in recruitment and their biases, which will have an increasingly important role in selection to jobs, but to date little researched.

However, we do not assume that companies engage in recruitment in a uniform way (standardization through technology) or with the same purposes, as technologies may be used to reproduce or challenge labour market inequalities, with different consequences in terms of social inclusion and exclusion. For example, some companies may use technology to reduce the range of educational institutions they engage with while others seek to use technology to expand them. This has fundamental implications for how educational and labour market inequalities are organized in relation to each other.

A central question raised by the digitalization of the labour market is how individuals should prepare for a different way of getting a job. The importance of the 'digital self' in recruitment, the meaning of being 'platform ready' at the time of 'algorithmic recruitment', and how such changes re-structure social relations and education should receive much greater attention from academics, HR professionals and policy analysts. This is likely to require methodological pluralism, including a central role for digital methods, the use of which remains in its infancy. Digital labour markets need to be understood in digital ways, to achieve both better data and better theories to understand the labour market (Bills and Brown 2011). The digital labour market has not only transformed the rules of the labour market for job seekers and employers, but also the possibilities that researchers have to understand it.

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