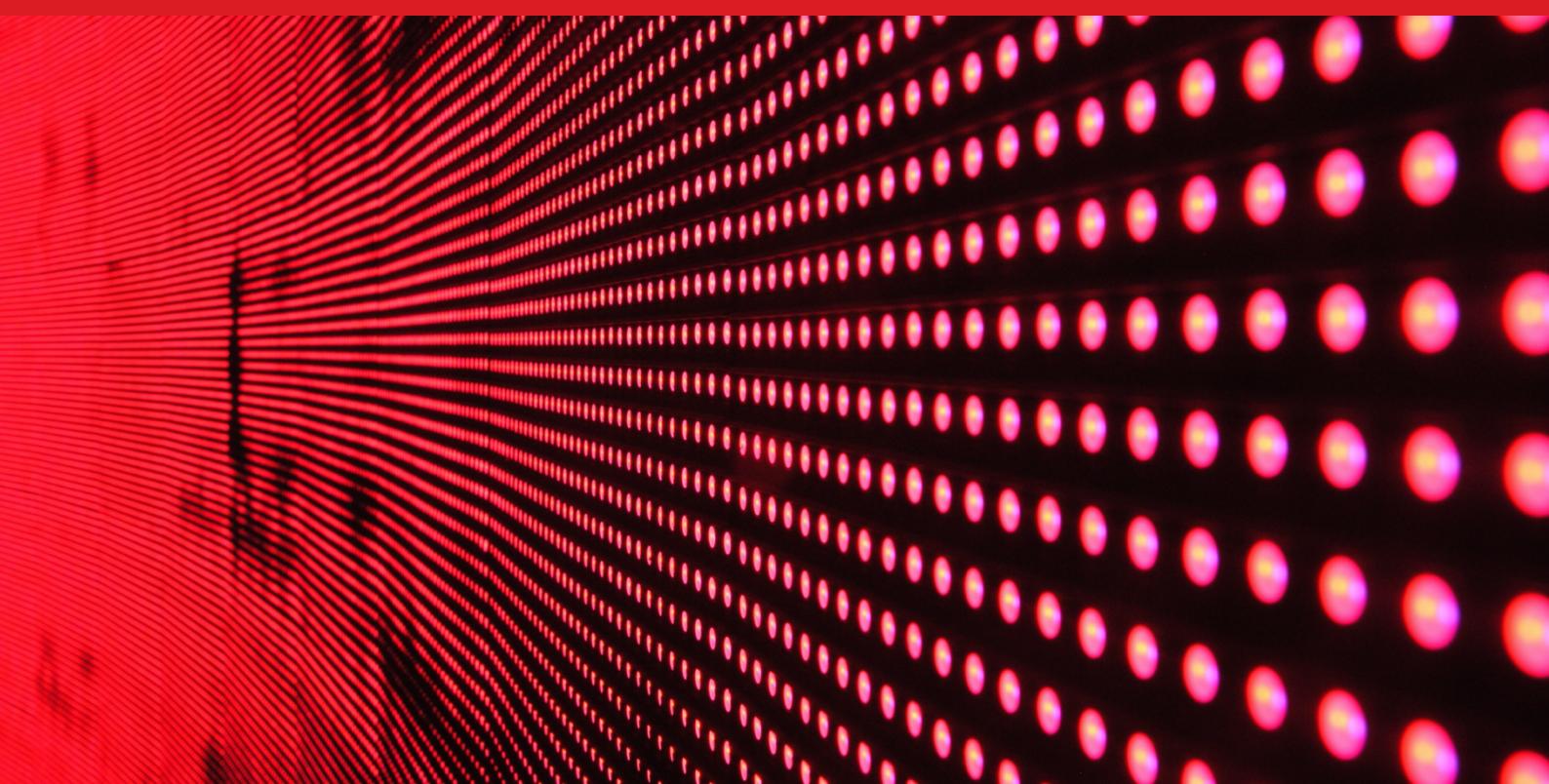


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Digital talent: Mapping the demand for digital skills in Tunisia

White Paper Series



About this project

This white paper series is part of an accompanying research project implemented by Einstein Center Digital Future (ECDF), funded by the Federal Ministry of Economic Cooperation and Development (BMZ), and commissioned to the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, as part of the Special Initiative on Training and Job Creation – “Invest for Jobs” through the GIZ flagship program the Digital Transformation Center Tunisia.

The Digital Transformation Center Tunisia aims to support a variety of Tunisia’s current digital priorities, from assisting Tunisian startups and facilitating the transformation of Tunisia’s industrial companies towards Industry 4.0 to operationalizing the Tunisian digital transformation strategies for all relevant stakeholders, including rural communities and civil society.

For more information on the project, please visit www.digital-maghreb.org.

For more information on the Digital Transformation Center Tunisia, please visit <https://www.giz.de/en/worldwide/86916.html>.

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The GIZ is the German development agency that provides services in the field of international development cooperation. GIZ mainly implements technical cooperation projects of the Federal Ministry of Economic Cooperation and Development (BMZ), its main commissioning party.

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Digital Talent: Mapping the demand for digital skills in Tunisia

I – Introduction

Tunisia has experienced high unemployment over the past years. The overall unemployment rate stands at 17% and is even higher for university graduates at around 30% (National Institute of Statistics, 2021). While there are likely multiple causes driving this, a likely factor is the existence of a mismatch between the demand by employers and the skills supplied by Tunisian job seekers (Assaad et al., 2018). This explanation is supported by evidence from the World Bank Enterprise Survey, which finds that 34.8% of Tunisian firms identify an inadequately educated workforce as a major constraint – a substantially higher rate than across other countries (20.5%; The World Bank, 2020).

Digital skills have been identified as an area that potentially suffers from this labor market mismatch in North Africa (AUC & OECD, 2021). Indeed, in a nation-wide survey, Tunisian firms named technical and digital skills as by far the most important competency when filling job posts (IACE, 2019). To understand this potential skills mismatch, this article investigates the specific digital skills that are currently in demand in the Tunisian labor market using a novel dataset. We collect data from the largest Tunisian online job platform through web crawling between May 2020 and May

2021, obtaining a sample of 59,254 online job ads.

To the best of our knowledge, this paper is the first to examine the demand for digital skills in North Africa using data from online job advertisements. It is also the first study using online job ads data in a middle-income country, as previous literature has focused on online job ads in high-income countries (e.g., Deming & Kahn, 2018; Deming & Noray, 2020). We find that 42% of job ads require some digital skills. The category of skills mentioned most often in our dataset is “programming,” which appears in 16% of all job ads. Moreover, we find that digital skills go hand in hand with a series of non-digital competencies, such as cognitive and social skills. This analysis helps identify potential skills gaps, direct students and jobseekers towards employable roles, and support educational and labor market policy more generally. Policymakers may benefit from learning about the demand for digital skills in Tunisia. In fact, the Tunisian government has already proven interest in promoting the digital sector and creating high-quality jobs as it has established a ministry especially dedicated to ICT and the digital transformation (MTCEN).

II - Data and method

1) Collecting online job ads and extracting digital skills

We collect job ads data from the largest job portal available in Tunisia: **OptionCarriere.tn**.¹ Using web crawling we gather online job ads over the period from May 2020 to May 2021, obtaining 280,865 raw ads. For our analysis, we concentrate on French-language ads only (which constitute 92% of the total) and remove duplicates. This yields a set of 59,254 unique job ads.

We identify digital skills that appear in our ads, following an approach developed by Djumalieva and Sleeman (2018b). We first identify 59 digital skills in our data ranging from software or programming languages (e.g., “Python,” “PHP,” “HTML”), digital marketing skills (e.g., “SEO,” or Search Engine Optimization, the process of optimizing traffic to websites) to broader digital skills (e.g., “e-commerce”). These 59 skills constitute our starting set from which we identify a larger number of skills. To do so, in a second step, we employ a **Word Embeddings Model** to identify synonymous skills (Jurafsky & Martin, 2020). This is a machine learning model that turns words from a corpus of text into vectors; these vectors can be used to find other words that share a number of characteristics, such as appearing in similar contexts. We train our model on the text of all of our ads and use it to identify skills similar to our starting set of 59 skills; in each case, the resulting skills are manually checked to ensure they are digital skills.² Using this method, we identify over five hundred additional digital skills, resulting in a total of 603. (Details of the method used can be found in the Online Appendix).

2) Grouping digital skills into categories

To improve our analysis, we group the identified digital skills into eight broader categories. To do so, we adapt a taxonomy developed by Djumalieva and Sleeman (2018a). The resulting eight categories are as follow:

- **“Programming”** includes skills related to web development (e.g., HTML, CSS, PHP), app development (e.g., Apache Cordova, Flutter, iOS development) and software development (e.g., Java, software engineering, C++);
- **“Technical support and IT”** includes IT support (e.g., VLAN, antivirus), IT security (e.g., firewalling, Fortinet), system administration (e.g., PowerShell, Linux), servers and middleware (e.g., Hibernate, SoapUI, server administration) and networks (e.g., WLAN, MPLS);
- **“Office software”** includes common IT software (e.g., the Microsoft suite) as well as general office digital tools (e.g., emailing, computer tools);
- **“Graphic design and digital content creation”** combines graphic and digital design (e.g., Adobe, Illustrator, Photoshop) and digital content creation (e.g., blogs, optimized digital contents),

¹ OptionCarriere.tn aggregates job ads from a number of smaller job portals in Tunisia. We selected this job portal because of the large number of available job ads for Tunisia, and to avoid duplicate entry issues (as ads

reposted on several job portals can vary in non-systematic ways, which could lead to double counting).

² Specifically, we use three definitions of digital skills from ESCO, the OECD and UNESCO (see Online Appendix for more details).

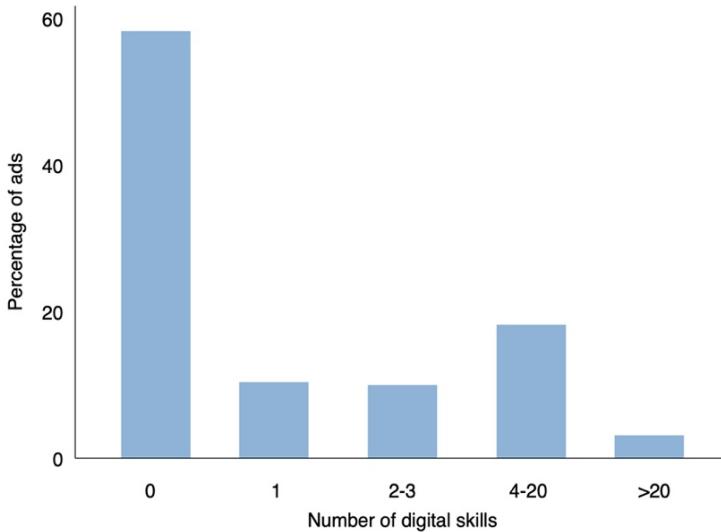


Figure 1: Number of digital skills mentioned per job ad

Note: The figure presents the distribution of ads by the number of digital skills they mention, using all ads in our data ($N = 59,254$).

as well as web content management (e.g., newsletter, web banners);

- “**Data science and data engineering**” brings together methods and software related to data science (e.g., Python, Big Data) and data engineering (e.g., Azure, AWS, cloud computing);
- “**Digital marketing**” is comprised of tools for digital marketing (e.g., Google Analytics, Google Ads), web content optimization (e.g., Search Engine Optimization / SEO) and general digital marketing keywords (e.g., e-marketing, Netlinking campaigns);
- “**Data and business analysis**” includes data analysis skills (e.g., Power BI, data visualization) and business analysis (e.g., CRM, Microsoft Dynamics);
- “**Machine learning and AI**” brings together keywords from both of these related fields (e.g., random forests, PyTorch for machine learning; Deep Learning for AI).

A small number of general terms are left uncategorized as “other”. As in the original taxonomy, the categories are not mutually

exclusive. The reason is that there are skills that span a variety of uses; for instance, “SQL” – a language used to manage databases – is related to both data engineering and programming as well as technical support and IT.

Additionally, we identify nine non-digital skill categories in the data. To do so, we adapt the taxonomy used by Deming and Noray (2020).³ These are:

- “**Social**” such as communication and teamwork skills;
- “**Cognitive**” such as thinking or analyzing;
- “**Character**” includes skills such as ‘detail-oriented’, ‘self-motivated’ or ‘organized’;
- “**Management**” such as ‘supervising’ or ‘leadership’ skills;
- “**Creativity**” includes ‘creative’ and its variations (‘creative spirit’, ‘creativity’);
- “**Writing**” includes writing and editing skills;
- “**Finance**” skills such as budgeting, accounting and general finance skills;
- “**Business systems**” includes business skills such as Six Sigma, business intelligence, KPIs;

³ Details of all keywords used to identify each non-digital category are presented in the Online Appendix.

| Category | Count | Rate | Rate – digital ads only |
|---|-------|------|-------------------------|
| Programming | 9,526 | 16% | 39% |
| Data science and data engineering | 5,714 | 10% | 23% |
| Technical support and IT | 5,443 | 9% | 22% |
| Office software | 5,410 | 9% | 22% |
| Graphic design and digital content creation | 4,696 | 8% | 19% |
| Digital marketing | 3,795 | 6% | 15% |
| Data and business analysis | 2,681 | 5% | 11% |
| Machine learning and AI | 770 | 1% | 3% |

Table 1: Distribution of job ads across digital skills categories

Note: The count column presents the absolute number of ads that mention at least one skill in the relevant category. The rate column corresponds to the percentage of ads mentioning at least one skill from the relevant category (i.e., the count divided by the total number of ads, N = 59,254). The ‘Rate–digital ads only’ reports the percentage of ads mentioning any skill in that category over the total number of ads mentioning any digital skill (N = 24,718).

- “Customer service” includes a number of client-related skills, such as ‘sales’ or ‘patience’.

III - Results

In this section, we present the results of our analysis – looking at the prevalence of digital skills as well as their association with non-digital skills.

1) Over four in ten online ads mention at least one digital skill

We begin by coding ads by the number of digital skills they mention. We find that 42% of all ads include at least one digital skill. Among those that mention at least one digital skill, ads include an average of 6.9 digital skills; three quarters mention at least two skills. Figure 1 shows the distribution of number of digital skills mentioned per job ad.

We next consider the demand for digital skills by category. We assign an ad to a category if

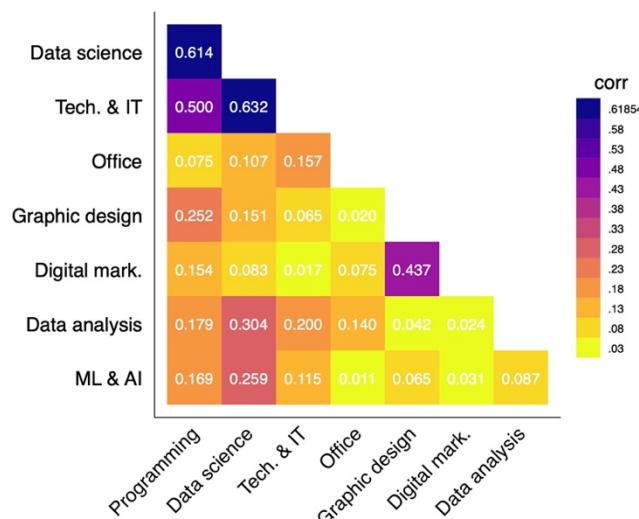


Figure 2: Correlations between digital skills

Note: The figure shows the bivariate correlations between categories of digital skills. Digital skills category names are abbreviated but follow the same order as in Table 1 above. All bivariate correlations are statistically significant at the 1% level. The colors represent the strength of the correlation, from high (dark magenta) to low (yellow). N = 59,254.

it mentions at least one of the skills in that category. Table 1 reports the count of ads in each category, as well as the rate as a percentage of all ads (59,254). The category “programming” has the highest count in our categories, being mentioned in 16% of all ads. The “office software” category appears in 9% of all ads. While the number for “office software” might appear low, this could indicate that this type of skills is sufficiently common in certain job categories as to be assumed by employers (and therefore not mentioned in job ads), as has been previously suggested (Lamb et al., 2019). For comparison, in their job ads data from the U.S., Deming and Noray (2020) find that office software skills were mentioned in 8.8% of all ads in the year 2007; by 2019, that number had increased to 12%.⁴

Figure 2 presents the correlations for each pair of digital skills. Most correlations are relatively small; among the strongest are the

“data science and data engineering” category and the “programming” and “technical support and IT,” as well as between “digital marketing” and “graphic design and digital content creation.”

2) Digital skills tend to appear alongside cognitive, social and writing skills

We now look at the interaction between digital and non-digital skills. We investigate what non-digital skills tend to appear together with digital skills, exploring differences by category. As with digital skills, we code ads as related to a non-digital category if they mention at least one of the keywords in that category. Table 3 presents – for each digital skills category – the share of ads that also mention at least one keyword of each non-digital skills category. For instance, 68% of ads mentioning programming skills also mentioned at least one “social” skill.

| Digital skills categories | Non-digital skills categories | | | | | | | | |
|-----------------------------------|-------------------------------|-----------|------------------|-----------|---------|---------|------------|------|------------------|
| | Social | Character | Customer service | Cognitive | Finance | Writing | Creativity | Mgmt | Business systems |
| Programming | 68% | 57% | 42% | 53% | 6% | 18% | 9% | 7% | 4% |
| Tech support & IT | 72% | 60% | 47% | 56% | 6% | 21% | 6% | 7% | 6% |
| Data science & engineering | 74% | 63% | 45% | 61% | 6% | 23% | 8% | 6% | 6% |
| Office software | 82% | 57% | 47% | 48% | 19% | 20% | 6% | 6% | 3% |
| Graphic design & content creation | 72% | 50% | 33% | 45% | 2% | 23% | 30% | 2% | 2% |
| Digital marketing | 81% | 53% | 47% | 53% | 3% | 29% | 25% | 5% | 6% |
| Data & business analysis | 77% | 61% | 51% | 66% | 19% | 24% | 8% | 10% | 6% |
| ML & AI | 78% | 54% | 35% | 63% | 7% | 28% | 20% | 7% | 6% |
| All digital ads | 70% | 48% | 41% | 45% | 10% | 16% | 10% | 6% | 3% |
| All ads (including non-digital) | 48% | 31% | 31% | 28% | 10% | 8% | 5% | 4% | 2% |

Table 2: Share of ads mentioning non-digital skills by digital skills categories

Note: This table presents the shares of ads in each digital skills category also mentioning non-digital skills (by category). It uses all job ads in our data ($N = 59,254$). See text for a description of the categories. “All digital ads” refers to all ads that mention at least one digital skill from any of the digital skills categories. Digital skills category names (column 1) are abbreviated but follow the same order as above. mgmt = management.

⁴ Tables in the Online Appendix (Deming & Noray, 2020).

We find that digital and non-digital skills tend to go hand in hand. For ads mentioning any digital skill, the shares also mentioning non-digital skills is also higher than for the overall sample (with the exception of the finance category). Moreover, the strength of the connection between digital and non-digital skills varies by category. The share of ads mentioning “cognitive,” “social,” “writing” and “character” skills is higher than in the rest of the sample across all digital categories. Note that this is not the case for other non-digital skills, such as “finance” or “management,” where the difference with the overall sample is smaller or even negative. For instance, almost all digital skills categories have lower shares of ads mentioning “finance” skills (e.g., “digital marketing”— 3%), compared to the overall sample (10%).

3) Over half of all ads mentioning digital skills are concentrated in the capital region

The geographic distribution of our dataset points to a concentration of online job ads in the capital, Tunis (Figure 3 below). The share of ads from Tunis (43%) is significantly higher than what we would expect given the capital’s share of the population (14%, National Institute of Statistics, 2014); this difference is even larger when we focus on job ads mentioning at least one digital skill (52%). If we compare job ads in our data to another source of job vacancies – the job offers received by the national employment agency (ANETI) – we see that Tunis stands out for its higher share of online job ads, but not for the share of ANETI vacancies (National Institute of Statistics, 2019b).

IV - Discussion

Thus far, we have quantified the demand for digital skills in Tunisia based on our dataset of job ads. In this section, we discuss the implications for the Tunisian labor market and take the representativeness of our data into consideration.

Findings and their implications

Our first contribution is to document the prevalence of digital skills in a significant portion of job ads (42%). In absolute terms, we find that 24,718 out of 59,254 ads mention at least one digital skill. If we exclude our two broad and transversal categories (“office software,” which includes the “Microsoft Office” suite, and “other,” which includes general skills such as “computer skills”), the figure is 16,049. With the number of unemployed Tunisians standing at 676,600 at the end of 2020 (National Institute of Statistics, 2021), there is a clear mismatch between the demand for jobs and the supply of jobs in Tunisia. There are simply more unemployed Tunisians than jobs currently in supply for them as we and other sources⁵ find. Nevertheless, it is important that the open positions that are provided by companies can be adequately filled by suitable applicants. Therefore, the mismatch induced by unsuitable skill sets of applicants should be mitigated by promoting digital skills that are frequently demanded.

Our second set of findings relates to the type of digital skills mentioned in job ads. We find a significant number of ads mentioning relatively advanced digital skills. For instance, if we combine all ads mentioning skills related to the “programming,” “data science and data engineering,” “technical support and IT” and “machine learning and AI” categories, we find 11,727 ads in our data, or 20% of all ads. This finding is considerable

⁵ A nationally representative survey of medium and large enterprises conducted by IACE estimated that, in 2019, there were 47,026 vacancies in the country (IACE, 2019). In the same year, the employment

bureaus run by the Tunisian National Employment Agency (ANETI) received 87,701 job offers requests from employers across all sectors (National Institute of Statistics, 2019b).

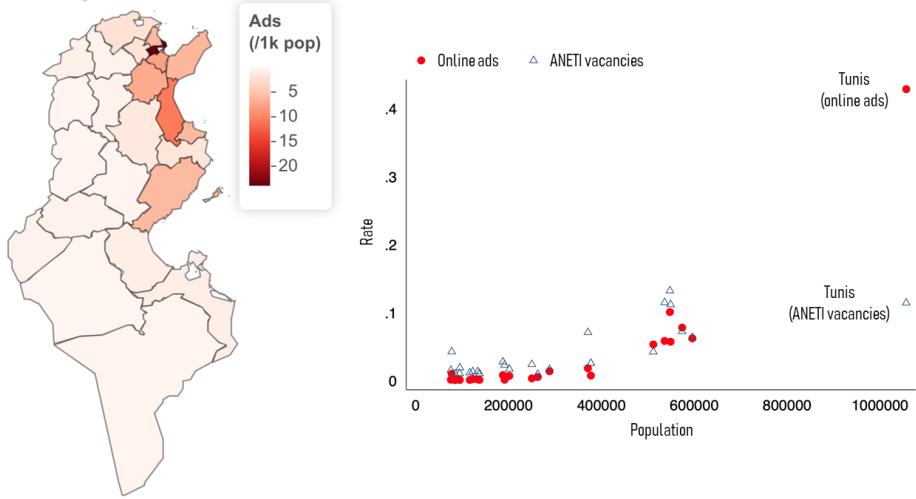


Figure 3: Geographic locations of online ads. Ads (per 1,000 inhabitants) by governorate (left) and comparison between population and shares of online ads and ANETI vacancies (right)

Note: The figure on the left presents the distribution of ads (per 1,000 inhabitants) by Tunisian governorate (N=59,254). The figure on the right shows the relationship between population by governorate and the rate of online ads as a percentage of all ads (red dots). The blue triangles represent shares of job ads received by the Tunisian National Employment Agency – ANETI in 2019 (National Institute of Statistics, 2019b) also at the governorate level. All population figures from the last census (National Institute of Statistics, 2014).

when compared to the total number of (formal) jobs in the ICT sector, which in 2019 stood at 31,264 (National Institute of Statistics, 2019a). While the ICT sector has been growing steadily in Tunisia, averaging 8.4% employment growth over the 2010–2019 period (National Institute of Statistics, 2019a), the relatively large number of job ads mentioning programming and other ICT-related skills could indicate a wider spread of these skills across sectors. We also find an association between digital and non-digital skills. These findings are in line with previous research, which highlights the connection between social and cognitive skills (Deming, 2017; Deming & Kahn, 2018). It follows that the Tunisian labor market may benefit from promoting digital skills together with social skills.

Representativeness of the dataset

To contextualize these figures in the Tunisian labor market, it is important to consider the extent to which our dataset covers job ads in Tunisia. Naturally, not all job ads are advertised online, a concern raised by prior job ads literature (Davis et al., 2013;

Hershbein & Kahn, 2018). A nation-wide survey of medium and large Tunisian businesses in 2019 found that only 31.5% of firms filled non-managerial roles through job ads (online and/or offline), against 44.3% choosing local employment agencies (IACE, 2019). In light of these facts, the absolute figures presented in this paper likely underestimate the total number of job ads requiring digital skills, as we cannot exclude that job offers not included in our dataset also mention digital skills.

Despite this, we believe that our dataset is likely to capture a sizable share of digital jobs in Tunisia. Previous research has shown that online job ads tend to overrepresent high-skilled and STEM occupations (Carnevale et al., 2014). These more high-skilled occupations are generally associated with a higher demand for digital skills, as suggested for example by BGT data (Nania et al., 2019; O’Kane et al., 2020). Moreover, surveys of employers show that firms in the ICT sector are more likely to fill positions through job ads, compared to the overall enterprise population (IACE, 2019). This implies that our

online job ads dataset is more representative for the digital skills labor market than it is for the total labor market.

Our dataset can be used to establish estimates for the absolute number of Tunisian jobs requiring digital skills, as well as their share of all job offers in the country. Since digital jobs are more likely to be advertised online, we believe that the dataset gives us a good understanding of the overall demand for digital skills in Tunisia; even with the limitation that we are not able to get a complete picture of the Tunisian labor market. We now have a better picture of the geographical distribution of digital jobs, the demand for different types of digital skills and the non-digital skills demanded alongside digital skills. Moreover, we have shown that online job ads data is a valuable data source in Tunisia. This paper should therefore serve as a starting point for further analyses utilizing this data in North Africa. As we have shown earlier, this type of data collected in high income countries is already in popular use. With the above-mentioned caveats regarding representativeness, online job ads likewise contain valuable information for middle-income countries.

IV - Conclusion

In this paper, we use a novel dataset of online job ads from Tunisia to study the demand for digital skills in the Tunisian labor market. We collect data from the largest jobs' portal in the country over the period of May 2020 to May 2021, obtaining 59,254 unique jobs advertisements. Following an approach developed by Djumalieva and Sleeman (2018b), we identify 603 digital skills in our data. We classify them in eight digital skills categories, ranging from "office software" to "machine learning and AI." We find that 42% of all ads mention at least one digital skill; the digital skills category appearing in the highest number of job ads is "programming," which is mentioned in 16% of all ads and includes skills related to web, software and app

development. Moreover, we examine the co-occurrence between our digital skill categories and nine non-digital skill categories used by Deming and Noray (2020). We find that ads mentioning digital skills also tend to mention non-digital skills at a higher rate than the other job ads, and in particular the categories for "cognitive," "social," "writing" and "character" skills.

While job ads provide a useful novel approach to studying the demand for digital skills, there are also a number of limitations. Because they likely only represent a portion of all job ads, it is important to consider whether job ads posted online differ systematically from other job ads. We find that ads in our dataset are more concentrated in the capital area compared to job requests received by the National Employment Agency, even after accounting for the larger population of the capital. Nevertheless, our dataset is helpful in providing lower bounds for the total number of ads requiring digital skills; moreover, if job ads containing digital skills are indeed more likely to be posted online, our analysis of the associations between digital and non-digital skills are also likely to be more representative of digital jobs.

Future research could expand this analysis by matching data from job ads to further data sources. Two promising avenues, following Deming and Kahn (2018), include: matching data to firm-level indicators, which would allow for an estimation of the connection between skill requirements and firm performance; and matching job ads to data on employment and wage growth by location and sector. A further avenue for research on the role of digital skills in the Tunisian labor market would involve expanding the analysis to include the supply of these skills.

References

- Assaad, R., Ghazouani, S., & Krafft, C. (2018). The Composition of Labor Supply and Unemployment in Tunisia. In The Tunisian Labor Market in an Era of Transition.
- Atalay, E., Phongthiengham, P., Sotelo, S., & Tannenbaum, D. (2018). New technologies and the labor market. *Journal of Monetary Economics*, 97, 48–67.
<https://doi.org/10.1016/j.jmoneco.2018.05.008>
- AUC, & OECD. (2021). Africa's Development Dynamics 2021: Digital Transformation for Quality Jobs.
- BGT. (2021). Frequently Asked Questions.
<https://www.burning-glass.com/about/faq/>
- Carnevale, A. P., Jayasunder, T., & Repnikov, D. (2014). Understanding Online Jobs Data: A Technical Report.
- Davis, S. J., Faberman, R. J., & Haltiwanger, J. C. (2013). The Establishment-Level Behavior of Vacancies and Hiring. *Quarterly Journal of Economics*, 128(2), 581–622.
- Deming, D. J. (2017). The growing importance of social skills in the labor market. *Quarterly Journal of Economics*, 132(4), 1593–1640. <https://doi.org/10.1093/qje/qjx022>
- Deming, D. J., & Kahn, L. B. (2018). Skill requirements across firms and labor markets: Evidence from job postings for professionals. *Journal of Labor Economics*, 36(S1), S337–S369. <https://doi.org/10.1086/694106>
- Deming, D. J., & Noray, K. (2020). Earnings dynamics, changing job skills, and stem careers. *Quarterly Journal of Economics*, 135(4), 1965–2005.
<https://doi.org/10.1093/qje/qjaa021>
- Djumalieva, J., & Sleeman, C. (2018a). An Open and Data-driven Taxonomy of Skills Extracted from Online Job Adverts. Developing Skills in a Changing World of Work, August, 425–454. <https://doi.org/10.5771/9783957103154-425>
- Djumalieva, J., & Sleeman, C. (2018b). Which digital skills do you really need? Exploring employer demand for digital skills and occupation growth prospects. Nesta, 1–10.
https://media.nesta.org.uk/documents/Which_digital_skills_do_you_really_need.pdf
- Hershbein, B., & Kahn, L. B. (2018). Do recessions accelerate routine-biased technological change? evidence from vacancy postings. *American Economic Review*, 108(7), 1737–1772. <https://doi.org/10.1257/aer.20161570>
- IACE. (2019). Rapport National de l'Emploi.
- ILO. (2018). Women and men in the informal economy: a statistical picture (third edition). Internation Labor Office.
- Jurafsky, D., & Martin, J. H. (2020). Speech and language processing.
- Lamb, C., Vu, V., & Willoughby, R. (2019). Digital, Defined: Understanding the demand for digital skills in Canada.
- Nania, J., Bonella, H., Restuccia, D., & Taska, B. (2019). No Longer Optional: Employer Demand for Digital Skills (Issue June).
<https://www.gov.uk/government/publications/current-and-future-demand-for-digital-skills-in-the-workplace>
- National Institute of Statistics. (2014). Census 2014.
- National Institute of Statistics. (2019a). Employed population and distribution of employed population by industry 2010-2019.
- National Institute of Statistics. (2019b). Employment agency statistics, job offers received.
- National Institute of Statistics. (2021). Unemployment rate and higher education graduates unemployment rate 2006-2021.
- O'Kane, L., Narasimhan, R., Nania, J., & Bledi Taska. (2020). Digitalization in the German Labor Market: Analyzing Demand for Digital Skills in Job Vacancies.
<https://www.bertelsmann-stiftung.de/en/publications/publication/did/digitalization-in-the-german-labor-market-en>
- The World Bank. (2020). Enterprise Surveys.

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