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Adapting to Change

The Potential Impact of Technology and Demography on the Saudi Labour Market

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Executive Summary

Technological advancements have long been a source of concern for workers, igniting ongoing debates about their impact on employment and job security. In a landmark study, Frey & Osborne [1] estimated that nearly half of US jobs were at risk of automation, with lower-wage and lower-education occupations being more susceptible. Building on their estimates of automation probability, this study aims to explore the effects of technological advancements on the Saudi labour market. It seeks to address two key questions: To what extent are different groups of workers in the Saudi labour market vulnerable to potential automation, and what policy pathways could mitigate these vulnerabilities?

The findings indicate that, while several groups of workers in Saudi Arabia have largely been shielded from technological changes due to specific policy choices and the nature of economic development post-Vision 2030, the data also reveals that Saudi and non-Saudi workers face varying degrees of exposure to automation. Saudi males, who are generally more educated and predominantly employed in management and technical occupations, are the least susceptible to automation. In contrast, a significant proportion of Saudi females, who have benefited from nationalisation policies, work in administrative and clerical positions, which are at higher risk. Non-Saudi workers, particularly females, are more concentrated in low-skill occupations, with more than half are vulnerable to job substitution due to technological change.

While government initiatives have successfully boosted employment among citizens, they may have overlooked the enhancement of job productivity through technology. Instead, the focus has been on labour-intensive sectors like public administration, hospitality, and retail. This approach, along with a preference for hiring low-cost, low-skilled expatriates, has resulted in a decline in labour productivity levels. Policy decisions often involve trade-offs.

Given the skill-biased nature of technological change, it is anticipated that the demand for skilled labour, particularly in sectors like information technologies, engineering, and advanced manufacturing, will grow. This development could adversely affect some categories of workers in routine, low-skill jobs. To mitigate the adverse effects of skill-biased technological change (SBTC) in the future, there will need to be continuous investment in education and vocational training, along with an increase in educational performance.

These challenges present to policymakers an opportunity to examine the interplay more closely between human capital development, labour, and technology. They also offer a chance to consider potential corrective measures, while supporting those more vulnerable to technological change. Beyond enhancing the current labour market and skills ecosystems—which include labour market information, education and vocational training, and stakeholder alignment—lower educational performance may suggest the need to explore alternative and complementary training to augment the existing skill set of national citizens. In this context, initiatives like SkillsFuture in Singapore may offer valuable lessons.

Introduction

Throughout history, technological change has increased labour productivity and job numbers, but it has also sparked worker anxieties. Recent studies predict automation could lead to massive job losses, inequality, and social disruption [2] [3] [4]. However, while technology alters job types and reshapes required skills, its impact is more nuanced and context-specific than often suggested—especially in Saudi Arabia. The dual nature of its labour market, along with recent policies and economic priorities, has made Saudi Arabia less vulnerable to job substitution due to automation. This paper examines how different worker groups in the Saudi labour market are exposed to technological change. While some groups may be vulnerable in the Kingdom's case, data suggests mass unemployment scenarios might not be as dire as it is often predicted in other countries.

Data and methodology

The paper analyses worker numbers using the Saudi Labour Force Survey (SLFS), which provides detailed data on demographics, employment status, education, and occupations for 5.6 million employed Saudis and 8.4 million non-Saudis—a broader coverage than administrative data. To assess the likelihood of jobs being automated, industry and occupational estimates from Frey and Osborne are utilised, encompassing 702 varied occupations classified under the 2010 Standard Occupational Classification (SOC) system [5]. These roles are categorised into two groups: fully automatable and non-automatable. A limitation is that the SLFS only offers aggregated ISCO-08 occupational data at the 1-digit level, restricting the list to ten broad occupations and allowing only a general view. However, since occupational tasks do not vary greatly across countries—an engineer, lawyer, or domestic worker performs similar tasks worldwide—this provides some level of comparability. The goal is to use these broad estimates to discern vulnerability to automation across different groups of workers, whether Saudi or non-Saudi, male or female.

Table 1. Main occupational groups by degree of risk of automation, England (2017)

Managers	**31%**	**24% - 42%**
Professionals	25%	18%-32%
Technicians and associate professionals	38%	28% - 50%
Clerical support workers	56%	47% - 62%
Service and sales workers	52%	32% -64%
Skilled agricultural, forestry, and fishery workers	51%	52% - 59%
Craft and related trades workers	54%	64%-65%
Plant and machine operators, and assemblers	61%	52%-69%
Elementary occupations	64%	56%-73%
Undefined	-	-

Source: Frey and Osborne, 2017. Estimates for the category "undefined" were not available.

Research findings

About 47 percent of jobs in Saudi Arabia could be exposed to some degrees of automation, a similar level to the United States. However, given current labour distribution in Saudi Arabia, we find different degrees of exposure to automation across sectors. Figure 1 shows a view of how the concentrations of workers across main occupations. The charts show the percentage distribution of within each group. The Y axis represents the skill level of each occupational groups (1 for low-skill and 4 for high-skill). The X axis represents the probability of automation.

A large proportion of Saudi males (33 percent) work in managerial and specialist roles mostly in sectors such as public administration and finance, occupations often requiring advanced cognitive skills, which are less susceptible to automation (Fig. 1.A). These positions involve complex decision-making and strategic planning, skills that are highly valued in a knowledge-based economy. The level of exposure to automation for managerial positions is estimated at 31 percent on average, with positions such as chief executives and senior officials at 24 percent. These roles often necessitate significant human interaction and emotional intelligence, which also reduce the risk of automation. Another third of Saudi males is working in lower-skill occupation such as sales and service, and clerical jobs, which are more susceptible to automation due to the repetitive and routine nature of the tasks involved. Clerical jobs often involve data entry, documentation, and administrative support tasks can be effectively performed by advanced software programmes. Similarly, sales and service occupations may experience increased automation through AI-driven customer service platforms and automated retail systems. However, while industries might automate specific logistical and planning functions, roles that require a high level of human interaction, such as tour guides, entertainers, and hospitality managers, may be less prone to automation.

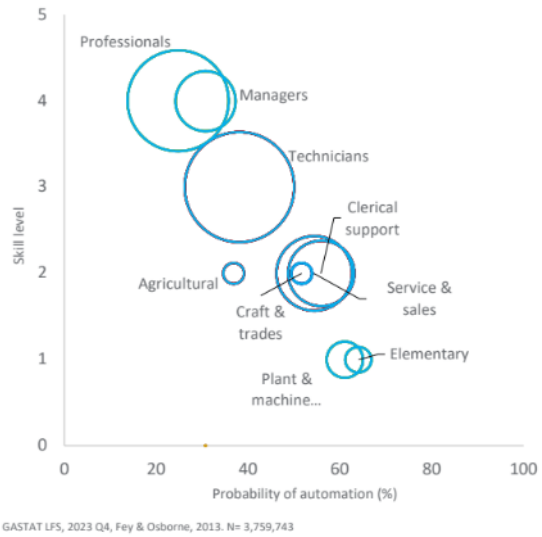
The employment landscape for Saudi women remains predominantly concentrated in sectors characterised by routine-based tasks, rendering these positions highly vulnerable to automation. Despite

advancements due to increasing levels of higher education among Saudi women, a substantial proportion of the workforce is still employed in administrative and clerical roles (30 percent). Over half of these roles are at risk of being automated, as they primarily involve repetitive and routine tasks that can be effectively managed by advanced software and AI technologies (Fig 1.B). A significant portion of Saudi females are employed in the education and healthcare sectors, which together comprise 34 percent of their employment. These sectors necessitate complex cognitive and interpersonal skills that are less susceptible to automation. Professions such as teaching and medical practice require critical thinking, problem-solving abilities, and emotional intelligence, making them more resistant to technological disruption. These occupations exhibit relatively lower exposure to automation, with rates of 20 percent and 25 percent, respectively.

Figures 1.C and 1.D further highlight the distinct segmentation between Saudi and non-Saudi workers. A significant 66 percent of non-Saudi males are concentrated in lower-skilled occupations. Primary sectors like construction—which employs the largest proportion of non-Saudi males—show a high susceptibility to automation at 62 percent. Occupations involving heavy machinery operation (61 percent), masonry (54 percent), and carpentry (63 percent) are also at risk due to technological advancements. Non-Saudi workers predominantly engage in crafts, trades, and plant and machinery operations (54 percent), with many also employed in sales and service roles (52 percent), increasing their risk of being affected by automation.

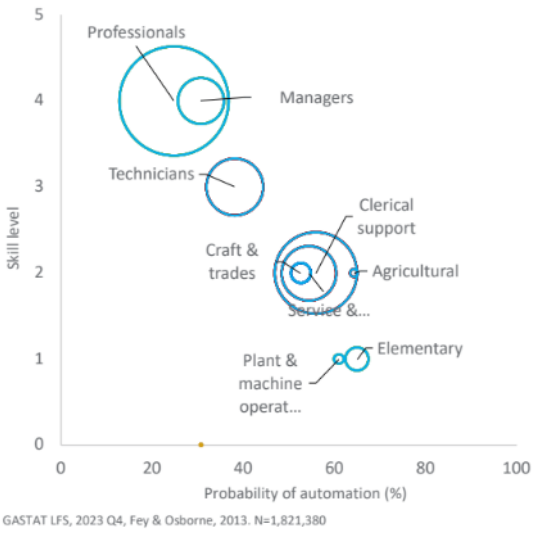
Figure 1. Occupations with a higher probability of automation, Saudi Arabia

A. Saudi male



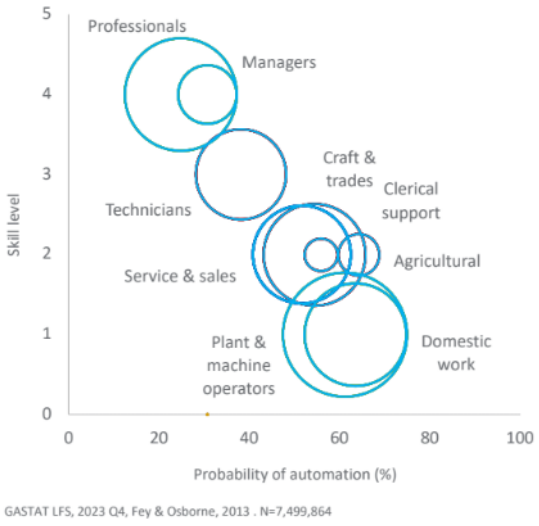
GASTAT LFS, 2023 Q4, Fey & Osborne, 2013. N= 3,759,743

B. Saudi female



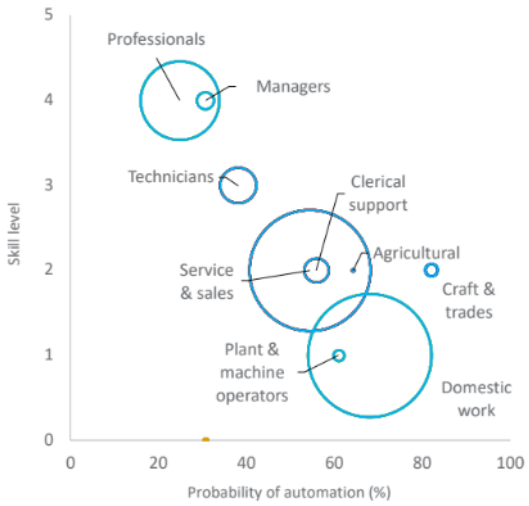
GASTAT LFS, 2023 Q4, Fey & Osborne, 2013. N=1,821,380

C. Non-Saudi male



GASTAT LFS, 2023 Q4, Fey & Osborne, 2013 . N=7,499,864

D. Non-Saudi female



GASTAT LFS, 2023 Q4, Fey & Osborne, 2013. N=871,051

Among all groups analysed, non-Saudi females are the most vulnerable to automation, with 80 percent of their workforce classified as lower-skill workers. Jobs within these categories have a probability of 54 percent to 82 percent of being automated. These individuals are primarily employed in domestic roles, such as servants or house cleaners, which face a higher exposure to automation at an average rate of 68 percent.

Policy Recommendations

While these challenges provide an opportunity to examine more closely the dynamics between human capital development, labour and technology, they also offer an occasion to reflect on potential corrective measures which could help improve conditions for learning and the mitigation of skill mismatches. Indeed, future workers will need to be prepared for a career, not just a job, and have the ability for life-long learning to adapt and upgrade their skills to ever-changing environments.

1. Dealing with asymmetrical information

Many young job seekers lack enough knowledge about jobs and labour market trends to make informed decisions early on. The asymmetry of labour market information—arising from limited access to and difficulty interpreting future labour demand—leads to inefficient human capital allocation and exacerbates mismatches in the Saudi labour market. Instead of intervening when students are about to enter the workforce, a better strategy is to act earlier. By exposing students to a wider range of career choices before they graduate from secondary school, they can make more informed decisions about their future fields, leading to better labour market outcomes.

2. Making education more of an investment than a consumption good

In the Saudi context, education is heavily subsidised, which often leads it to be viewed more as a consumption good rather than an investment in human capital. This perspective can significantly influence how individuals approach learning. When education is heavily subsidised, it may be appreciated more for its immediate experiential benefits—such as the enjoyment of learning and the social aspects of attending school—rather than for its potential to enhance future earning potential and career opportunities. This mindset can result in suboptimal decisions regarding education and training, with less emphasis on high-demand fields or those that provide practical job market skills.

3. Aligning stakeholders

A robust skill development strategy is crucial for creating a workforce that can thrive in a dynamic global economy. This strategy requires collaboration among educational institutions, labour market authorities, businesses, and individuals. Integrating inputs from private sector stakeholders is vital, as it allows governments to guide educational and vocational programmes more effectively, aligning them with industry needs. This synergy not only enhances curriculum relevance but also ensures that training is practical and applicable in real-world scenarios.

4. Making safety nets more dynamic and inclusive

In addition to educational reforms, there must be a concerted effort to develop social safety nets and redistribution mechanisms to assist those affected by technological displacement. However, for these programmes to be effective, they must act as a trampoline, helping labour market participants regain a foothold in the job market. As skills can erode rapidly, it is crucial that the unemployed do not remain idle and immediately join training programmes, enabling them to reintegrate into the labour market more quickly.

5. Improving education and training

Early childhood education (ECE) is crucial for laying the foundation for lifelong learning and upskilling. Developing this foundation from pre-elementary through primary and secondary levels equips students with learning skills that make them flexible, adaptable, and resilient to future technological changes. Improving participation in technical and vocational training programmes in Saudi Arabia requires alleviating the societal stigmatisation of these careers. Despite ambitious government efforts, participation remains below expectations. Enhancing synergy between training institutions and private firms can lead to more aligned curricula, and firms could offer on-the-job apprenticeship programmes in collaboration. Positive developments include the WAAD skill programme by the Saudi Ministry of Human Resources and Social Development and Singapore's SkillsFuture initiative.

6. Alternative and complementary training

Attitudes towards training are shifting, with micro-credentials and short, targeted technical and vocational programmes increasingly seen as better alternatives to formal education [6] [7]. The rapid pace of technological change has driven more students to seek efficient ways to enhance their skills. Online courses, virtual classrooms, and digital resources make education more inclusive, allowing individuals to learn at their own pace and schedules. Upskilling and reskilling initiatives should be continuously

updated to reflect the latest industry trends and technological advancements. A balanced approach is crucial, emphasising both knowledge-intensive skills and "softer" skills like effective communication, teamwork, creative problem-solving, socialisation, and adaptability to fast-changing situations.

Endnotes

1 **Frey, C.B / Osborne, M.A. 2013: The Future of Employment: How Susceptible Are Jobs to Computerisation?, in:** https://www.oxfordmartin.ox.ac.uk/downloads/academic/future-of-employment.pdf [01.09.2013].

2 **World Economic Forum 2023: The Future of Jobs Report 2023, in:** https://www.weforum.org/publications/the-future-of-jobs-report-2023/ **[30.04.2023].**

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6 **Cote, S. 2024: Navigating Tomorrow: Mastering Skills in a Dynamic Global Labor Market, in:** https://globallabormarketconference.com/research-and-whitepaper/navigating-tomorrow-mastering-skills-in-a-dynamic-global-labor-market **[09.12.2024].**

7 **Thompson, M.C. / Almoaibed, H. 2023: Better Jobs Tomorrow: The Appeal and Increasing Relevance of Alternative Credentials in Saudi Arabia, in:** https://www.kfcris.com/pdf/7e763338da1071f285b5e309c26509a46437a861cd81e.pdf **[04.2023].**

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