

DOI <https://doi.org/10.30525/978-9934-26-597-6-53>

COBOTS AS A TOOL FOR TECHNOLOGICAL SUBSTITUTION LABOR: ECONOMIC AND SOCIO-POLITICAL ASPECTS (UKRAINE)

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Abstract

The article explores the feasibility of using collaborative robots (cobots) as a tool for labor substitution in the context of Ukraine's workforce shortage caused by the war. It examines the benefits and risks of rebuilding the country's industry in the post-war period on new technological foundations using collaborative robots. The study assesses the potential of cobotization as a tool for technological labor substitution amid Ukraine's workforce deficit and the urgent need for post-war industrial recovery. Key considerations include the role of cobots in addressing labor shortages, enhancing productivity, and balancing economic modernization with social and technical challenges.

Keywords: collaborative robots; workforce; technological substitution labor; workforce deficit; Ukraine

1 Introduction

The war unleashed by Russia in Ukraine has exacerbated pre-existing negative trends in the country's labor market, historically shaped by the demographic aging of the workforce. Ukraine is currently facing significant wartime challenges, notably mass labor migration from the conflict, casualties, destruction of production infrastructure, and economic stagnation. The post-war recovery of the nation's industrial potential, amid a severe workforce deficit, necessitates innovative approaches to reorganizing production processes.

One promising direction in this context is the implementation of collaborative robots (cobots) – a technology that merges human ingenuity with the efficiency, power, and precision of automated systems. The aim of this study is to substantiate the strategic role of cobots in rebuilding Ukraine's

industrial sector on advanced technological foundations, ensuring resilience and competitiveness in the post-war era.

2 Overview

Ukraine's national labor market in the pre-war period was characterized by negative trends in the natural dynamics of the workforce. In 2021, the largest segments being the 40-49 age group (27.1%) and the 50-59 age group (22.1%) characterized the workforce structure. Younger cohorts, specifically those aged 25-29 (10.5%) and 30-34 (14.1%), constituted smaller proportions. (Fig. 1) [1].

The wartime labor migration, civilian and military casualties, conscription, destruction of production and civilian infrastructure, and occupation of Ukrainian territories have led to a contraction of the labor market. The most acute challenge for the country is the workforce shortage. This issue poses a long-term negative impact on the economy and demands comprehensive strategies to address it, including repatriating migrants, stimulating birth rates, and increasing labor productivity.

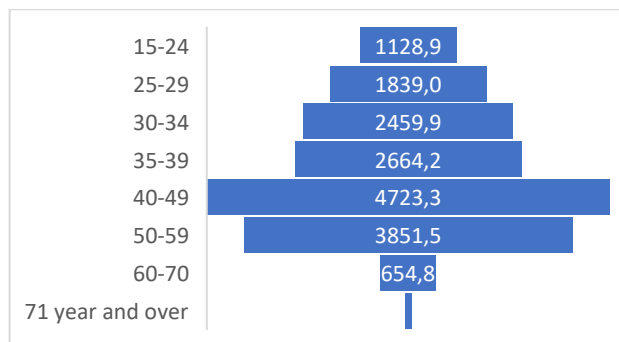


Figure 1. Ukraine's Labor Force in 2021 (Thousands) by Age Group

The post-war recovery of Ukraine's industry will entail industrial sectors restructuring facing labor shortages due to casualties and wartime migration. The use of cobots during this recovery phase, aimed at mitigating workforce deficits, offers several advantages.

Firstly, their deployment will reduce labor shortages through technological substitution. *Secondly*, cobots can perform production tasks in hazardous working conditions, enhancing workplace safety and reducing

occupational injuries. However, cobotization requires additional investments in training personnel with specialized skills to interact with cobots.

Thirdly, their flexible integration into production environments allows implementation in both existing facilities and new enterprises. *Fourthly*, cobots increase production volumes and shorten production cycles due to their precision, speed, and ability to operate continuously, while simultaneously improving product quality by minimizing manufacturing defects.

Overall, leveraging cobots for post-war recovery will drive technological advancement in Ukraine's industry, enhance production resilience, and reduce dependence on the human factor.

The use of cobots, despite their numerous advantages, also entails *specific risks* that must be considered when developing a strategy for Ukraine's post-war industrial recovery. Initial costs for purchasing, installing, maintaining cobots, and training personnel require substantial investment. While these costs are moderate compared to implementing traditional industrial robots, they may still pose a significant barrier to modernizing industrial businesses—particularly small and medium-sized enterprises (SMEs)—amid post-war reconstruction challenges.

Cobot adoption is further constrained by technical limitations, such as payload capacity and the complexity of integrating them into existing production processes. In Ukraine's unstable external environment, a critical risk lies in their vulnerability to cyberattacks, which could disrupt production, cause data loss, or even result in physical damage. Widespread cobot implementation necessitates resolving ethical concerns, including accountability for automated systems' actions, their potential to exacerbate social inequality, and long-term impacts on the national labor market.

Strategic directions for minimizing the identified risks include investing in personnel training, ensuring cybersecurity, developing clear occupational safety protocols, and addressing the socio-economic consequences of automation.

3 Conclusions

The use of cobots during Ukraine's post-war industrial recovery requires a thorough analysis of their benefits and potential risks, the development of coordinated strategies for industrial revival, digital and industrial security, human capital development, and social policy. This will enable the formation of a comprehensive approach to addressing the complex challenges of rebuilding the economy in the post-war period.

Acknowledgments

This article was prepared as part of the research project "Ensuring the Post-War Industrial Recovery of Ukraine with Workforce" (State Registration No. 0121U003622).

The author expresses gratitude to Associate Professor Iryna Ivanova for her assistance with the English translation.

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