

MECHANISMS FOR INCREASING THE EFFICIENCY OF HUMAN CAPITAL IN THE LABOUR MARKET THROUGH THE USE OF ARTIFICIAL INTELLIGENCE

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Abstract

This study examined the mechanisms through which artificial intelligence enhanced the efficiency of human capital in the labour market. Drawing on international reports, empirical research findings, and labour market statistics from Uzbekistan, the study evaluated the contribution of artificial intelligence to labour productivity, workforce reskilling, skills development, job matching, and labour market forecasting. The findings demonstrated that the effective application of artificial intelligence supported higher human capital efficiency, strengthened labour market competencies, and improved employment quality. The analysis also highlighted the importance of integrating AI-based approaches into workforce development and labour market institutions. The study provided practical implications for improving human capital policies and promoting sustainable labour market development.

Keywords: human capital, artificial intelligence, labour market, labour productivity, reskilling, digital skills, employment, workforce competencies.

Annotatsiya

Mazkur tadqiqotda sun'iy intellektning mehnat bozorida inson kapitali samaradorligini oshirish mexanizmlari ilmiy jihatdan tahlil qilindi. Xalqaro tashkilotlar hisobotlari, empirik tadqiqotlar va O'zbekiston mehnat bozori bo'yicha statistik ma'lumotlar asosida sun'iy intellektning mehnat unumdorligi, kasbiy ko'nikmalarni rivojlantirish, qayta tayyorlash, bandlikni muvofiqlashtirish hamda malaka ehtiyojlarini prognozlashdagi roli baholandi. Tahlil natijalari sun'iy intellekt texnologiyalaridan oqilona foydalanish inson kapitalining samaradorligini oshirish, mehnat bozori talablariga mos kompetensiyalarni shakllantirish va bandlik sifatini yaxshilashga xizmat qilishini ko'rsatdi. Tadqiqot natijalari inson kapitalini rivojlantirish siyosatini takomillashtirish hamda mehnat bozori institutlari samaradorligini oshirish uchun amaliy ahamiyat kasb etdi.

Kalit so'zlar: inson kapitali, sun'iy intellekt, mehnat bozori, mehnat unumdorligi, qayta tayyorlash, raqamli ko'nikmalar, bandlik, malaka.

Аннотация

В исследовании были проанализированы механизмы повышения эффективности человеческого капитала на рынке труда с использованием технологий искусственного интеллекта. На основе материалов международных организаций, результатов эмпирических исследований и статистических данных по рынку труда Узбекистана была оценена роль искусственного интеллекта в повышении производительности труда, развитии профессиональных компетенций, переподготовке кадров, совершенствовании механизмов занятости и прогнозировании потребности в навыках. Полученные результаты

показали, что рациональное применение технологий искусственного интеллекта способствовало повышению эффективности человеческого капитала, развитию востребованных компетенций и улучшению качества занятости. Исследование сформировало практические рекомендации по совершенствованию политики развития человеческого капитала и рынка труда.

Ключевые слова: человеческий капитал, искусственный интеллект, рынок труда, производительность труда, переподготовка кадров, цифровые навыки, занятость, компетенции.

INTRODUCTION

Globally, human capital - the knowledge, skills, competencies and health embodied in people - is increasingly recognised as the decisive factor of production and the principal source of long-run competitiveness. In a knowledge-driven economy, the efficiency with which human capital is formed, allocated and used in the labour market determines productivity growth and inclusive prosperity. The rapid diffusion of artificial intelligence (AI) as a general-purpose technology is now reshaping the very mechanisms through which that efficiency is achieved. Investment in generative AI has grown roughly eightfold since the launch of large-language-model chat assistants in late 2022, and AI has become the single most impactful driver of change in the labour market [1];[2].

The scale of the transformation is striking. The World Economic Forum projects that, between 2025 and 2030, technological, economic, demographic and green-transition trends will create about 170 million new jobs and displace about 92 million - a net increase of roughly 78 million, but a structural churn equivalent to 22 per cent of all formal jobs [2]. AI and information-processing technologies alone are expected to create around 11 million jobs and displace some 9 million [1]. Employers anticipate that 39 per cent of workers' core skills will change by 2030, and 63 per cent identify skills gaps as the principal barrier to transformation; on current trends, 59 of every 100 workers will require reskilling or upskilling by 2030, of whom roughly one in nine is unlikely to receive it [2];[3].

Crucially, AI does not merely displace or create jobs; it changes how work is done and how human capital generates value. A landmark field experiment covering 5,172 customer-support agents found that access to a generative-AI assistant raised productivity - issues resolved per hour - by fourteen to fifteen per cent on average, with much larger gains of thirty to thirty-five per cent for less-experienced and lower-skilled workers, while top performers gained little [4]. The OECD reports comparable gains of five to over twenty-five per cent across customer support, software development and consulting, again concentrated among lower-skilled workers - a "democratisation of skills" that allows AI to disseminate the tacit knowledge of experts down the experience curve [5]. These findings reframe AI as a mechanism for raising the efficiency of human capital, not simply a substitute for it.

For Uzbekistan, the stakes are high and specific. The country has a young, fast-growing population - more than sixty per cent under the age of thirty, with around 700,000 young people entering the labour market each year and the working-age

population projected to rise by ten million by 2050. Although the unemployment rate fell to 4.9 per cent in the third quarter of 2025, around 760,000 people remain registered job-seekers and informal employment is estimated at about 40 per cent of the workforce [6]; [7]. Higher-education coverage among 18-23-year-olds rose dramatically from 8.3 per cent in 2017 to 47.7 per cent in 2024/25, yet analysts highlight a persistent “skills problem”: a mismatch between the competencies produced by the education system and those demanded by a rapidly modernising economy [7]. In this setting, mechanisms that raise the efficiency of human capital are not optional refinements but central to converting a demographic dividend into productive employment.

LITERATURE REVIEW

Human capital has long been recognized as one of the primary drivers of economic growth, labour productivity, and sustainable development. Contemporary economic theory increasingly emphasizes that the value of human capital depends not only on educational attainment but also on the effective utilization of workers' knowledge and skills within the labour market. Recent technological advances have positioned artificial intelligence (AI) as an important factor influencing labour productivity, workforce development, and skill formation. The Future of Jobs Report 2025 identifies AI as one of the leading technologies reshaping labour demand, accelerating changes in occupational structures, and increasing the need for continuous reskilling and upskilling of employees [2].

Recent empirical studies have demonstrated that AI contributes to higher labour productivity by supporting workers in knowledge-intensive tasks rather than replacing human capabilities. Brynjolfsson, Li and Raymond reported that generative AI significantly increased employee productivity, with the greatest improvements observed among less-experienced workers. Their findings suggested that AI facilitates knowledge transfer, reduces learning time, and improves task performance through real-time decision support [4]. Similar conclusions were presented by the OECD, which found that generative AI improved productivity across customer services, software development, and professional consulting while contributing to broader access to advanced knowledge and expertise [5].

The relationship between AI and human capital has also been examined from the perspective of lifelong learning and workforce adaptability. The World Economic Forum emphasized that rapid technological change requires continuous investment in reskilling and upskilling, as a substantial share of existing competencies is expected to change during the coming decade. According to its analysis, AI-powered adaptive learning systems enable more efficient acquisition of new competencies, reduce training costs, and improve access to lifelong learning opportunities [2]; [3].

Another important research direction concerns the application of AI in labour-market matching and workforce planning. AI-based analytical tools have been shown to improve the alignment between labour demand and labour supply by identifying emerging skill requirements, forecasting occupational changes, and supporting evidence-based employment policies. These technologies contribute to reducing

information asymmetry in labour markets and increasing the efficiency of workforce allocation [1]; [10].

Studies focusing on developing economies indicate that the effectiveness of AI depends on the availability of digital infrastructure, institutional capacity, reliable labour-market data, and digital competencies among workers. International organizations have noted that successful AI adoption requires coordinated investments in education, digital skills, and institutional reforms to ensure that technological progress complements rather than substitutes human capital [11]; [15]; [16].

Although previous studies have comprehensively examined the effects of AI on productivity, skills development, and labour-market transformation, limited attention has been devoted to integrating these findings into a unified framework explaining the mechanisms through which AI enhances human capital efficiency, particularly in emerging labour markets. Therefore, this study contributes to the existing literature by systematizing the principal AI-driven mechanisms affecting human capital efficiency and evaluating their applicability within the context of Uzbekistan's labour market.

METHODOLOGY

This study employed a qualitative analytical approach supported by secondary data analysis to investigate the mechanisms through which artificial intelligence improves the efficiency of human capital in the labour market. The research was based on reports published by the World Economic Forum, OECD, World Bank, International Labour Organization, the Statistics Agency of the Republic of Uzbekistan, and relevant national policy documents, together with findings from peer-reviewed empirical studies on generative artificial intelligence and labour productivity. Comparative and systematic analysis methods were applied to identify the principal channels through which AI influences workforce performance, skills development, labour-market matching, and productivity growth. The identified mechanisms were classified into six analytical categories and evaluated according to their documented effectiveness, practical applicability, and relevance to Uzbekistan's labour-market conditions. The synthesized evidence provided a comprehensive methodological basis for assessing AI-driven improvements in human capital efficiency and for formulating evidence-based recommendations for labour-market development.

ANALYSIS AND RESULTS

Uzbekistan's labour market combines strong demographic potential with a pronounced skills challenge. Robust economic growth - 6.5 per cent of GDP in 2024 - has not yet translated demographic advantage into sufficient high-quality employment, and the central constraint is increasingly the supply of market-ready skills rather than capital [7]. Table 1 summarises the principal indicators and policy instruments that define this context.

This profile - abundant young labour, high informality, rapidly expanding but partly misaligned education, and an explicit reform agenda - makes the efficiency, rather than merely the quantity, of human capital the decisive policy variable, and defines the relevance of the AI mechanisms analysed below.

Table 1.
Selected labour-market and human-capital indicators of Uzbekistan¹

Indicator	Value	Unit	Source
Unemployment rate	4.9	%	[6]
Registered job seekers	760,000	persons	[6]
Annual labour market entrants	700,000	persons/year	[6],[8]
Population under 30	>60	%	[6],[8]
Informal employment	40	% of total employment	[7]
Higher education enrolment (18-23 years)	47.7	%	[7]
Labour Market Development Strategy (PF-4947)	2022-2026	implementation period	[9]
Vocational education reform (PQ-316)	250	investment million USD	[7]
Youth to be trained	600,000	persons	[7]

Synthesising the international evidence yields six distinct mechanisms through which AI raises the efficiency of human capital. Figure 1 sets the macro context - the scale of labour-market churn to 2030 - while Figure 2 illustrates the central micro-mechanism: the heterogeneous productivity gains from AI assistance.

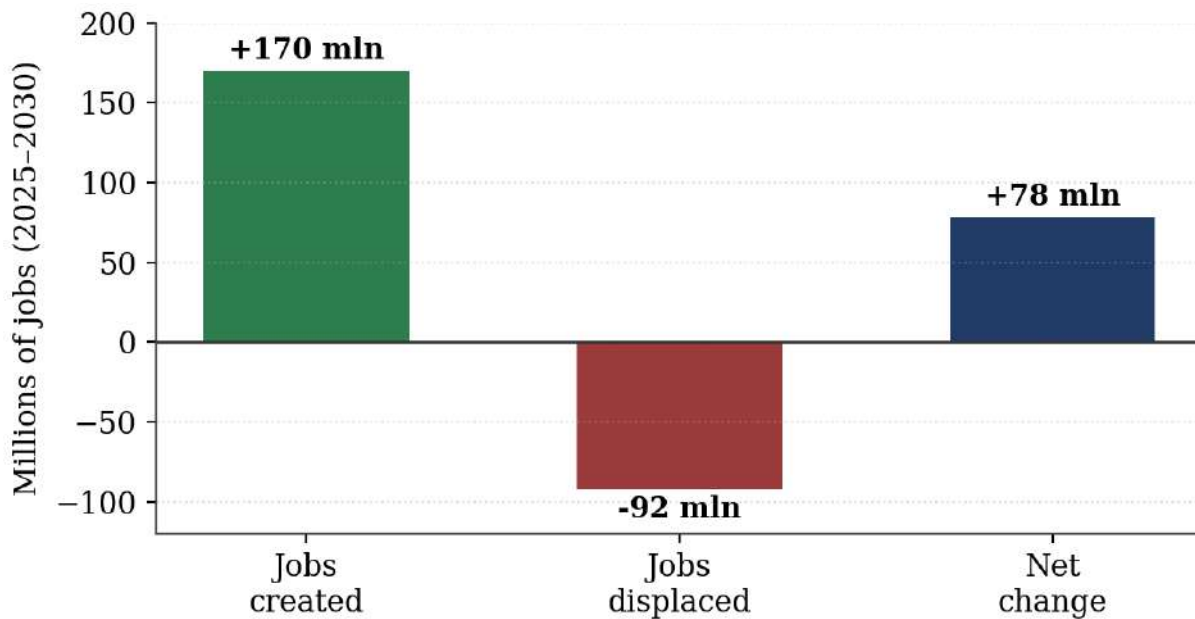


Figure 1. Projected global labour-market churn by 2030²

¹ Source: Compiled by the author based on the cited sources.

² Compiled by the author from WEF Future of Jobs Report 2025 [2].

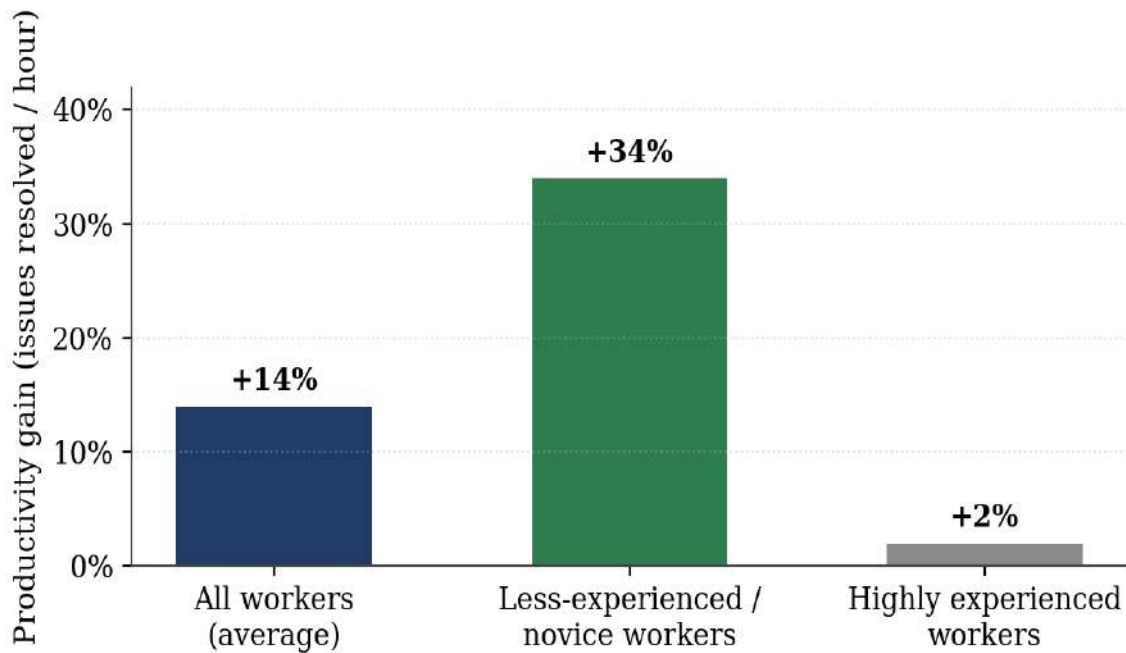


Figure 2. Productivity gains from generative-AI assistance, by worker experience level¹

Mechanism 1 - Productivity augmentation. As an “intelligent co-pilot,” AI augments workers in real time, raising output per worker. Field evidence documents average gains of fourteen to fifteen per cent in customer support, and five to over twenty-five per cent across knowledge tasks such as writing, coding and consulting [4; 5]. This directly increases the value generated per unit of human capital.

Mechanism 2 - Democratisation of skills and accelerated on-the-job learning. Because gains accrue disproportionately to less-experienced workers (thirty to thirty-five per cent versus near-zero for experts), AI compresses the experience curve: it transfers the tacit knowledge of high performers to novices and supports learning and language fluency on the job [4]. For an economy with a large entry-level cohort, this is a powerful equaliser. Mechanism 3 - Reskilling and upskilling at scale. AI-powered adaptive learning platforms personalise training, lower its cost and expand access, helping to address the projected change in 39 per cent of core skills; globally, only 0.5 per cent of GDP is invested in adult lifelong learning, and closing this gap could add an estimated USD 6.5 trillion to GDP by 2030 [2; 3].

Mechanism 4 - Improved labour-market matching. AI-based job-matching and skills-based hiring reduce search frictions and information asymmetries, connecting workers to suitable vacancies more quickly - a function increasingly delivered through national digital platforms. Mechanism 5 - Workforce-skills anticipation. Machine-learning analysis of labour-market data improves the forecasting of emerging skill demand, enabling education and training systems to anticipate rather than lag change. Mechanism 6 - Human-AI task reallocation. By automating routine, well-defined tasks,

¹ Compiled by the author from field-experimental evidence [4]; [5]

AI frees workers to concentrate on higher-value cognitive, creative and interpersonal activities, shifting the composition of human capital toward skills that are complementary to, rather than substitutable by, machines. Table 2 systematises these mechanisms.

Table 2.

Mechanisms by which AI increases the efficiency of human capital¹

Mechanism	Description	Documented Impact	Relevance to Uzbekistan
Productivity enhancement	AI supports employees in completing tasks more efficiently and improving work quality.	Productivity increases by 14–15% on average and up to 25% in knowledge-intensive tasks [4],[5].	High; particularly relevant for services and the ICT sector.
Skills development	AI facilitates knowledge transfer and supports learning for less-experienced workers.	Productivity of less-experienced workers improves by 30–35% [4].	Very high; beneficial for the country's young workforce.
Reskilling and upskilling	AI enables personalized and cost-effective training.	Helps address the 39% change in core skill requirements [2],[3].	Very high; supports reducing skills mismatches.
Labour market matching	AI improves job matching based on workers' skills and employers' needs.	Faster and more accurate job matching.	High; strengthens digital employment services.
Skills forecasting	AI predicts future labour market skill demands.	Supports better alignment between education and labour market needs.	High; useful for vocational and higher education planning.
Human–AI task reallocation	AI automates routine tasks, allowing workers to focus on higher-value activities.	Promotes a shift toward higher-value and complementary skills [10].	Medium–high; contributes to changes in job content and work organization.

The same evidence that documents large gains also shows that outcomes are not automatic. Whether AI augments or substitutes human capital depends on the design of the human-AI workflow: when AI mainly substitutes for worker effort it can de-skill, whereas well-designed augmentation builds capability [10]. Realised aggregate effects remain modest and uneven - concentrated in larger, more digitalised firms - and diffusion across firms and sectors is a prerequisite for broad-based gains [11]. Distributional risks are concentrated at entry-level pathways: analyses suggest a meaningful share of entry-level work hours is automatable, with early signs of disruption for junior roles. For Uzbekistan, with its large young cohort, this implies that the augmentation mechanisms must be actively steered - through workflow design, AI literacy and complementary skills - so that AI strengthens rather than erodes the human-capital base.

¹ Source: Compiled by the author based on the cited sources.

The taxonomy indicates that AI offers Uzbekistan a coherent set of instruments for converting its demographic dividend into productive human capital - provided the mechanisms are matched to the country's structural features and supported by adequate enabling conditions.

Matching mechanisms to the skills problem. The highest-value mechanisms for Uzbekistan are those that address its specific constraints. Skills democratisation (Mechanism 2) and reskilling at scale (Mechanism 3) directly target the education-market mismatch and the large entry-level cohort, allowing AI to accelerate skill formation where it is most needed. Improved matching (Mechanism 4) and skills anticipation (Mechanism 5) reinforce ongoing vocational-education reform - the hub-and-spoke skills centres and employer-linked curricula introduced under PQ-316 - by aligning training with real labour demand and connecting workers to jobs through digital platforms. Productivity augmentation (Mechanism 1) raises output across the fast-growing services and IT sectors that increasingly drive employment.

Enabling conditions. International evidence is unambiguous that AI mechanisms deliver only where enabling conditions exist: reliable digital infrastructure, high-quality and accessible labour-market data, widespread AI and digital literacy, and institutional bridges between education and employers. Uzbekistan's principal gaps are precisely here - the gap between rapidly expanding education and market-ready skills, high informality that limits the reach of formal programmes, and interregional disparities in infrastructure [7]. Embedding AI literacy and digital skills into curricula, expanding the EduImkon financing model, and strengthening education-employer feedback loops are therefore prerequisites rather than complements.

Managing risks and avoiding a skills divide. Because outcomes depend on workflow design, policy must steer AI toward augmentation: prioritising human-AI complementarity, protecting and redesigning entry-level pathways, and ensuring that the productivity dividend is broadly shared rather than captured by a few digitalised firms or urban centres. The risk of a labour-market divide - between workers and regions with AI access and those without - is real and, given Uzbekistan's interregional disparities, must be actively managed through inclusive access to AI tools and training. Equally, raising women's participation on par with men could lift national income by an estimated 29 per cent, and AI-enabled flexible and remote work can support this inclusion [6].

Taken together, these considerations argue for a coordinated, mechanism-based strategy rather than isolated pilots. Uzbekistan is comparatively well-positioned: it combines a strong demographic base, rapid economic growth, an explicit labour-market and vocational-reform agenda, and a national digitalisation programme. The decisive task is to embed the six mechanisms deliberately into human-capital policy - building the data, infrastructure and AI-literacy foundations, designing for augmentation, and prioritising the democratisation, reskilling, matching and anticipation mechanisms where the structural payoff is greatest.

CONCLUSION AND SUGGESTIONS

Artificial intelligence is transforming not only the quantity of jobs but the mechanisms by which human capital generates value in the labour market. The international evidence shows that AI can materially raise human-capital efficiency - augmenting productivity by fourteen to fifteen per cent on average and by thirty to thirty-five per cent for less-experienced workers, democratising skills, accelerating reskilling, improving matching, anticipating skill demand, and reallocating tasks toward higher-value human work. For Uzbekistan, whose young and fast-growing workforce faces a pronounced skills mismatch and high informality, these mechanisms offer a realistic path to converting demographic potential into productive employment.

The article therefore recommends a context-sensitive package for Uzbekistan: (1) prioritise the skills-democratisation and reskilling mechanisms through AI-powered adaptive learning embedded in vocational and higher education; (2) deploy AI for labour-market matching and skills anticipation to align training with demand and reduce search frictions; (3) build the enabling foundations - digital infrastructure, open labour-market data, and widespread AI literacy; (4) design human-AI workflows for augmentation rather than substitution, protecting and redesigning entry-level pathways; and (5) guard against a labour-market divide between leading and lagging workers and regions, while leveraging AI-enabled flexible work to raise women's participation. The scientific contribution of the study is its systematisation of AI's effects into a coherent mechanism taxonomy linked to the structural features of a young, reform-driven emerging labour market, providing a practical foundation for future country-specific research and for human-capital policy design.

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