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AI INTEGRATION AND ECONOMIC DIVIDES: ANALYZING GLOBAL AI STRATEGIES

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Abstract: This study investigates the impact of socio-economic factors on national AI strategies in India, Bangladesh, Germany, UAE, Egypt, and the USA through quantitative content analysis. The analysis explores the correlation between GDP per capita, the share of manufacturing, and the frequency of risk-related terms in AI strategy documents. It is found that wealthier nations emphasize AI risks more, correlating with deeper technological integration into their societal structures. Conversely, the emphasis on AI risks shows a weak correlation with the share of manufacturing, indicating broader AI impacts in service-oriented sectors. Lower-middle-income countries appear more optimistic, focusing on AI's economic benefits. The study underscores the need for balanced AI strategies that promote innovation while ensuring worker well-being, advocating for adaptive governance frameworks that enhance workplace safety and efficiency.
Keywords: AI strategies, occupational safety, AI governance, technological development

1. INTRODUCTION

The ongoing integration of Artificial Intelligence (AI) within industrial settings has prompted a global evaluation of how disruptive cognitive technologies can also impact the dynamics of workplace safety (Peres et al., 2020; Ivković et al. 2024; Kuzior et al. 2024).

The deployment of AI in the working environment is undoubtedly an occasion. Technologies like addictive manufacturing revolutionize the productivity of the manufacturing process (Deja et al., 2023; Saniuk et al. 2024) and smart systems enhance the energy efficiency of the buildings by combining smart energy management systems (Gualandri and Kuzior, 2023), IoT, and renewable energies (Abbasi et al., 2023).

However, AI systems increasingly perform complex tasks and they might constitute a risk in terms of physical and psychological safety mainly because the introduction of cognitive technologies can alter job roles and influence worker satisfaction and security (Nazareno and Schiff, 2021).

In sectors such as construction and heavy industries, AI implementation has high upside potential in enhancing workplace safety via proactive safety measures (Cebulla et al., 2023). AI-driven monitoring systems for construction safety represent the potential of AI to mitigate risks such as falls, one of the most common accidents in the construction industry (Bigham et al., 2019). Generally, predictive analytics powered by neural networks have shown potential in forecasting work-related injuries and preventing incidents before they occur (Ivaz et al., 2021), potentially transforming traditional approaches to occupational safety in complex industrial environments.

On the downside, in the service sectors, the increasing AI capabilities create uncertainties regarding job stability and future employment prospects (Howard, 2019), impacting mental health (Giuntella et al., 2023) even before the layoffs take place.

The potential risks and opportunities of AI-enhanced work environments are both significant, with some scholars raising concerns about the adequacy of current regulatory frameworks to protect workers (Todolí-Signes, 2021). Facing the complex occupational effects of AI integration in the workplace, the national AI strategies proposed and implemented in the last few years are influenced by the government's approach to country-specific socio-economic indicators such as economic prosperity and productive structure, often with broader development agendas.

AI National strategies have been analyzed through the sociological lenses of the narratives and imaginaries (Bareis and Katzenbach, 2022), the mapping of investment plans, the relation with ethics and innovation (Sloane, 2022), the role of the state (Djeffal et al., 2022) and social responsibility (Saveliev et al., 2020), which are all elements involved in the broader work safety framework.

As these strategies can dictate how safety regulations are framed and implemented across industries understanding these narratives is crucial for anticipating how AI will affect occupational safety in a global scenario characterized by widely different economic settings, with strict regulations emerging in critical areas like the EU (Roy et al., 2021)

Considering the abovementioned factors, the study set out to explore the influence of the socio-economic context on the risk or opportunity-oriented attitude to the AI implementation displayed in national AI strategies, via a quantitative content analysis based on assessing the presence of certain words or concepts to deduce themes and patterns in the textual data.

Furthermore, when a risk/opportunity ratio is explored, the analysis proceeds to correlate the tendency to attribute risk or opportunities to the ratio between manufacturing and services in the economy and the level of income in terms of GDP per capita.

2. METHODOLOGY OF RESEARCH

To quantitatively assess the orientation towards risks or opportunities associated with AI implementation in the national AI policy documents, specific keywords indicative of 'risk' and 'opportunity' were identified to conduct a targeted frequency analysis.

The 'risk '- related keywords include terms that signify potential negative outcomes or concerns directly associated with the implementation or consequences of AI technologies focusing on these aspects: jobs being replaced by AI technologies, risks of handling personal or sensitive data by AI systems, safety hazards due to AI systems' decision-making that might affect human safety.

The 'opportunity '- related keywords encompassed terms that highlight potential positive impacts or benefits that AI technologies might bring in connection to: jobs created as a

direct result of AI implementation, efficiency gains, skill development, and potential for career progression.

Table 1. Word frequency in AI strategies classified per category

Category	Keywords
Risk	hazard, risk, compliance, regulation, law, unemployment, surveillance, challenge, safety, control, cybersecurity, threat, vulnerability, harm, security
Opportunity	career, transformation, growth, hiring, innovation, improvement, development, research, engagement, training, reskilling, knowledge, opportunity, enhance, benefit

The frequency of each keyword was counted in each national AI policy document using Voyant Tools, an open-source, web-based application for performing text analysis (Gregory et al., 2022). This process involved a systematic review of the text, identifying and recording each occurrence of the designated 'risk' and 'opportunity' keywords. The counts for each keyword were compiled into a dataset, with separate columns for 'risk' and 'opportunity' word frequencies. The final dataset included the total count of 'risk' and 'opportunity' keywords for each country, alongside their respective economic context, which allowed for a comprehensive analysis of how different nations frame the narrative around AI within their policy documents. To quantitatively assess the balance between perceived risks and opportunities as discussed in the AI policy documents, a Risk vs. Opportunity ratio was calculated for each country.

This ratio was defined as the percentage of total mentions that are attributed to 'risk', formulated mathematically as follows:

$$\text{Risk vs. Opportunity Ratio} = \left(\frac{\text{Risk}}{\text{Risk}+\text{Opportunity}}\right) \times 100\% \quad (1)$$

This formula provides a normalized measure of the emphasis on risk relative to the combined discourse on risk and opportunity, facilitating comparisons across countries with differing lengths of policy documents.

To quantitatively assess the relationship between the emphasis on risks versus opportunities within national AI policies and the economic reliance on manufacturing across various countries, a Pearson correlation coefficient (rr) was calculated. This statistical measure was chosen to determine the strength and direction of the linear relationship between the two variables across the dataset.

$$r = \frac{n(\sum R_i M_i) - (\sum R_i)(\sum M_i)}{\sqrt{\left[n\sum R_i^2 - (\sum R_i)^2\right]\left[n\sum M_i^2 - (\sum M_i)^2\right]}} \quad (2)$$

R_i denotes the "Risk vs. Opportunity ratio" for the country, representing the proportion of risk-related discourse relative to the total discourse on risks and opportunities within AI policy documents.

Selection of Documents

The current study uses quantitative analysis to extract some quantitative information about our set of documents and the vocabulary employed, such as term frequencies and terms' relevance. To conduct the analysis, a set of documents based on the national strategies available from 2018 to 2023 was selected, with the following criteria: documents had to be officially labeled and published through official government websites as AI

strategy documents, the national AI laws considered had to be written originally in English and they should give a balanced representation of the global arena in terms of income and economic composition. The dataset for the analysis was compiled from national AI policies across six countries: USA (National Artificial Intelligence Research and Development Strategic Plan, 2023), India (National Strategy for Artificial Intelligence India, 2018), UAE (UAE National Strategy for Artificial Intelligence 2031, 2018), Germany (Artificial Intelligence Strategy, 2018), Egypt (Egypt Artificial Intelligence Strategy, 2019) and Bangladesh (National strategy for artificial intelligence of Bangladesh, 2019). A list of the documents collected and analyzed can be found in Table 2.

Table 2. Overview of Documents Analyzed

Country	Year	Title	Pages
Bangladesh	2019	National strategy for artificial intelligence in Bangladesh	53
Egypt	2019	Egypt's National Artificial Intelligence Strategy	74
Germany	2018	Artificial intelligence strategy	45
India	2018	National strategy for artificial intelligence	114
UAE	2018	UAE National Strategy for Artificial Intelligence	47
USA	2023	National Artificial Intelligence Research and Development Strategic Plan 2023 Update	47

These countries were categorized based on income status as either high-income or lower-middle-income. Additionally, data on the percentage share of manufacturing within each country's economy was included to explore its relationship with the AI policy orientation.
Data on the economic indicators: income level and manufacturing share of GDP, were also collected from reliable sources like the World Bank database to further contextualize the findings.
The data set encompasses six countries, representing a range of economic statuses and industrial structures. The variables considered in the analysis include:

- Risk-related Words in AI Strategy (%): Measures the frequency of risk-related terminology within the strategic AI documents, reflecting the emphasis on risk in AI policy.
- % Share of Manufacturing in the Economy: Indicates the proportion of the country’s GDP that originates from the manufacturing sector.
- GDP per Capita (in dollars): Serves as a proxy for the economic wealth and development level of the country.

To explore the relationships among the variables, Pearson correlation coefficients were calculated. This method was selected due to its efficacy in measuring the degree of linear relationship between variables. The correlation analysis aimed to discern: the relationship between the percentage of risk-related words in AI strategies and the share of manufacturing and the relationship between the percentage of risk-related words in AI strategies and GDP per capita.

Correlation Coefficient (r) Values Interpretation:

- $|r| < 0.3$: Weak correlation
- $0.3 \leq |r| < 0.7$: Moderate correlation
- $|r| \geq 0.7$: Strong correlation

3. RESULTS

The tendency to characterize AI adoption more in perilous terms rather than as an opportunity is represented in Figure 1.

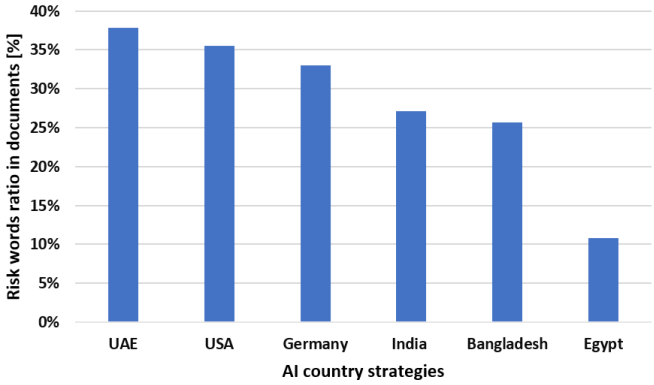

Fig. 1. "Risk vs. Opportunity ratio" proportion of risk-related discourse relative to the total discourse on risks and opportunities.

Figures 2 and 3 indicate the total mentions of “risk” and “opportunity” related words in all AI national strategies.

What is noticeable is that strictly work-related words like unemployment, reskilling, hiring, and career tend to be more represented in the opportunity discourse, however, they are comparatively low in respect to broader and all-encompassing terminology related to these concepts. Further qualitative context analysis needs to be performed to assess the relevance of occupational themes in the broader context of national AI strategies.

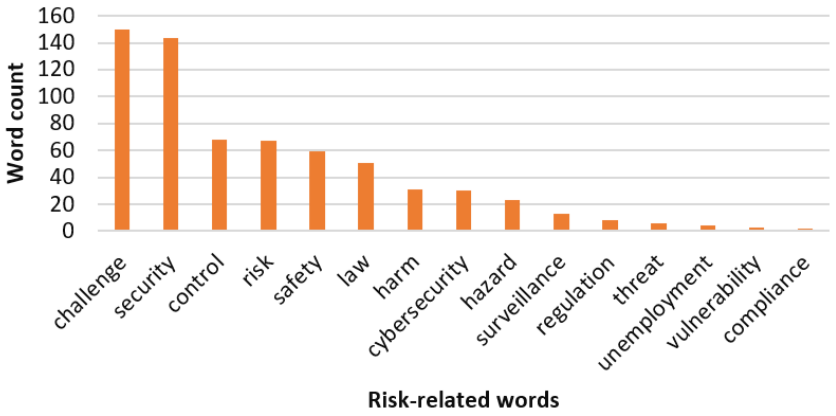

Fig. 2. Risk-related words relative to the total discourse.

Source: own elaboration based on quantitative analysis via Voyant Tools

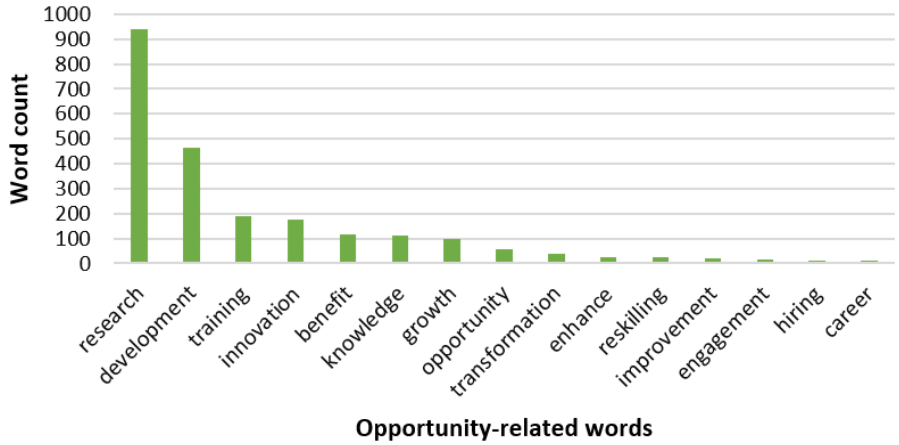

Fig. 3. Opportunity-related words relative to the total discourse. Source: own elaboration based on quantitative analysis via Voyant Tools

Table 3. Conversely displays the statistical data related to the economic conditions.

	Risk-related words in AI strategy	% share of manufacturing in the economy	GDP per capita in dollars
UAE	37.8	51.50	53708.0
USA	35.5	17.90	76329.6
Germany	33	26.90	48718.0
India	27.1	25.70	2410.9
Bangladesh	25.7	21.80	2688.3
Egypt	10.8	32.70	4295.4
Correlation		0.140	0.760

Risk-related words in AI Strategy and Income: the correlation coefficient is approximately 0,760. This indicates a strong positive relationship, suggesting that countries mentioning risk more frequently in their AI strategies tend to have higher income levels.

Risk-related words in AI Strategy and % Share of Manufacturing: the correlation is very weak, around 0.140. This low correlation suggests that the frequency of risk-related words in AI strategies does not have a significant linear relationship with the proportion of the economy dedicated to manufacturing.

4. DISCUSSION AND CONCLUSION

The results of this paper have analyzed the correlation between socioeconomic indicators and the frequency of risk-related terms in national AI strategy documents.

Findings indicate that wealthier nations tend to emphasize the risks associated with AI more extensively within their policy frameworks than low-income countries. Such correlation suggests that, the deeper the technology is integrated into the economic and societal structure, the more alertness about potential adverse impacts is raised in public opinion, and the scientific community, and, as a consequence, AI risks are addressed in governmental plans. Additionally, the analysis reveals a weak correlation between the share of manufacturing in a country's economy and the emphasis on AI risks, confirming that the new wave of AI focused on generative AI and machine learning methods impacts

service-oriented economies. On the other hand, lower-middle-income countries adopt a more optimistic view of AI implementation, more willing to use technological development to propel economic development. Notwithstanding the relatively limited sample of AI strategies, this work aims to offer valuable insights into the approaches to occupational safety in different socio-economic and political environments.

A robust framework for AI governance is essential to ensure that technological advancements do not compromise worker well-being or societal welfare. Such frameworks should be adaptable and inclusive, designed to meet diverse needs and address potential vulnerabilities across various industrial sectors as highlighted by Fobel and Kuzior (2019).

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