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IA en las cadenas de suministro:
la libertad de la esclavitud revisada

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Summary: Introduction. 1. The right to freedom from slavery today. 2. Modern slavery in global supply chains. 3. AI for uncovering modern slavery and safeguarding the right to freedom from slavery. 3.1. AI and human rights. 3.2. Advancing supply chain transparency with AI. New ways to tackle modern slavery. 4. Critical aspects and final remarks. References.

Abstract: This paper addresses the link between Artificial Intelligence (AI) and the human and fundamental right to freedom from slavery: in particular, we focus on the modern slavery in global supply chains and the possibility to use AI to identify it. We analyze the slavery and its modern version, situate the AI within the human rights debate and argue that we should not only focus on how AI can violate and infringe the human rights, but also explore how AI could be useful in identifying violations and helping to combat them. We emphasize the need for inclusive datasets and stakeholder oversight and argue in support of AI to enhance transparency of international supply chains while cautioning against biases. We conclude by outlining the importance of responsible AI deployment and making a case for more regulatory efforts to protect the fundamental human right to freedom from slavery in supply chain operations.

Resumen: El presente trabajo trata el tema de la Inteligencia Artificial (IA) y el derecho humano y fundamental a la libertad de la esclavitud. En particular, enfocamos la esclavitud moderna en las cadenas internacionales de suministros y la posibilidad de utilizar la IA para detectarla. Analizamos la esclavitud y su versión moderna, situamos la IA dentro del debate sobre Derechos Humanos, y tratamos la idea de que ver la IA solo como una herramienta de la violación de Derechos Humanos es limitativo y que hay que explorar más como la IA podría ser útil para identificar las violaciones de los derechos humanos y para ayudarnos a combatirlas. Para lograrlo necesitamos los datos más inclusivos y la supervisión humana, y sostenemos, sin perder de vista el problema de sesgos, que la IA podría ayudar a incrementar la transparencia en las cadenas internacionales de suministros. Concluimos con la importancia del desarrollo de la IA responsable y la necesidad de más esfuerzo regulatorio para proteger este derecho en dichas cadenas.

Introduction

Human rights and artificial intelligence (AI) have come into clash on variety of aspects: more often than not, the AI was a tool to curtail the rights of individuals and vulnerable social groups depriving them of the little they could rely upon in terms of equal treatment, civil freedoms, social benefits, or other entitlements (among many, FRA 2022; Greiman 2021; Quintavalla and Temperman 2023).

This work addresses one of the human and fundamental rights[1] that have seldom been linked to the AI, although the situation is probably about to change. The right to freedom from slavery has been a part of our history and development as society, but was not that often related to AI. To make up for this gap and add to the existing debate, this paper focuses on modern slavery within international supply chains of everyday products, such as those of Nespresso, Starbucks, or Apple, and asks how AI can be useful to detect and combat it. We want to show that while AI poses threats to fundamental rights, it can also serve as a powerful tool for defending them. Our review of literature and analysis of the existing options for leveraging AI in the fight against modern slavery (such as AI-based due diligence monitoring using Blockchain and digital identity systems to uncover labour conditions and treatment of workers or integrating AI into automated surveillance of supply chains) supports the conclusion that a regulatory action alongside technical advancements is the right way forward. We also argue that addressing challenges of opacity and lack of transparency, human oversight, shortage of best practices and further issues are all crucial for deploying AI effectively in combating modern slavery within international supply chains.

Indeed, although the recent EU Artificial Intelligence Act (AI Act 2024)[2], the first regulation of AI in the world, addresses various issues related to fundamental rights-compliant development, deployment, and use of AI systems, including General Purpose AI (GPAI), it falls short in

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[1] Although the authors are aware of the conceptual differences between human rights (Universal Declaration of Human Rights) and fundamental rights (EU Charter of Fundamental Rights), for the purposes of this paper these two terms will be used interchangeably, giving preference to the concept of fundamental rights whenever possible.

[2] We also use the definition of AI from AI Act: "a machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments" (art. 3).

fully addressing some of the fundamental rights, particularly the right to freedom from slavery. Given the EU's global influence in setting technology-related regulations (Bradford 2020), proactive measures are essential to safeguard this human right not only within the EU, but also globally. Therefore, the reference to the EU is not accidental: we believe the EU has the potential to lead the use of AI in fighting modern slavery and be an example to follow for other countries.

To properly address the topic and explain the ideas that we shortly have sketched above, the paper is organized as follows: we start with the introduction of the freedom from slavery as a human right and address the contemporary relevance of this right as a pressing human rights issue. Then we contextualize it within the contemporary production model, that is, we explain the link that exists between modern slavery and international supply chains. Then we move to explain what AI has to do with this: after briefly introducing the variety of discussions on AI and human rights, usually focusing on the threats of AI to them, we then address the possibility of using AI to prevent and identify the freedom from slavery violations that take place in the international supply chains, focusing on slavery related to work and employment conditions. Then we address critical aspects that emerged in our research and finish with conclusive remarks.

1. **The right to freedom from slavery today**

Slavery has been a part of human history probably from its beginning (Everett and Keegan 1997; Rogers 2019; Haslam 2020)[3]. If we focus on the XX century only, freedom from slavery was first recognized in The International Agreement for the Suppression of the White Slave Traffic (1904) (United Nations 2024b) and following treaties, and took a more specific form in the 1926 Slavery Convention which defined slavery as "the status or condition of a person over whom any or all of the powers attaching to the right of ownership are exercised" (United Nations 2024a). This characterization is fully supported by the Bellagio-Harvard Guidelines on the Legal Parameters of Slavery, under which the idea of control over a person by another is a key element to the definition (Allain 2012). Nonetheless, it should be

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[3] One of the characters of the novel "Trust" by Hernan Diaz puts it as follows: "All throughout the history, the origin of capital was slavery. Look at this country and the modern world. Without slaves no cotton; without cotton, no industry; without industry, no finance capital. The original unnameable sin" (Diaz 2023, 299-300).

noted that the academic discussion on the definition of slavery is still ongoing; this persistent debate demonstrates the problems and inadequacies within the definitions provided by international treaties (Heys 2023).

The right to freedom from slavery became a part of the Universal Declaration of Human Rights (1948) and afterward was included in many other international and regional treaties. The latest of them is the Protocol to Prevent, Suppress and Punish Trafficking of Persons, Especially Women and Children (United Nations 2000). All these initiatives show that the international community took the question of slavery seriously and addressed it globally[4]. However, addressing does not mean solving. This is where this paper comes into play: is there a way to use AI for that purpose? Could AI be useful in fighting these practices of annihilation of human dignity and suppression of fundamental human freedom to make decisions on his or her life and future?

These questions will be explored in the following sections of this paper. For the time being, what matters is to highlight the need to address slavery not as a human tragedy of the past, that we have overcome and left behind. Sadly, this is not the case. Even today, certain forms of slavery persist, and shockingly, some of them are completely legal. Consider, for instance, the first section of the Thirteenth Amendment of the United States' Constitution, through which slavery can be imposed as a penalty for criminal offenses[5]. Whereas this provision is still in force at Federal level, it was only at the beginning of the XXI century that some States have banned this exception by amending their own Constitutions. Hence, it currently remains as a mostly valid legal consequence[6].

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[4] *Cfr.* some noteworthy international provisions: Article 6.c of the Charter of the International Military Tribunal (1945), Articles 1 and 7 of the Supplementary Convention on the Abolition of Slavery the Slave Trade, and Institutions and Practices Similar to Slavery (1956), Article 8 of the International Convention on Civil and Political Rights (1966), Article 7 of the Rome Statute of the International Criminal Court (1998), Article 11 of the International Convention on the Protection of the Rights of All Migrant Workers and Members of their Families (1990), Article 3 of the Worst Forms of Child Labour Convention (1999), or Article 1 of the P029 Forced Labour Convention Protocol (2014). Some of these instruments are widely accepted, with up to 94% of countries (out of 193 countries) having ratified their content in the case of the 1999 Worst Forms of Child Labour Convention (Landman 2020, 307-310).

[5] "Neither slavery nor involuntary servitude, except as a punishment for crime whereof the party shall have been duly convicted, shall exist within the United States, or any place subject to their jurisdiction". U.S. Const. amend. XIII, § 1.

[6] It is noteworthy that among the founding NATO nations, the United States had the highest incarceration rate in 2021, with an alarming rate of 664 prisoners per

Moreover, according to the International Labor Organization (ILO) (2022), in 2021 there have been 50 million of modern slaves, that is, people who were trapped in forced labor or forced marriage.

Indeed, the concept of slavery has changed: the chains and whips –typical attributes of common imaginary of slavery of the XIX century– have been substituted by less evident but not less powerful tools of oppression of the most vulnerable ones, who, just as in the past, are exploited, sold, and treated as goods, but not as human beings.

The 1990s brought into being a new term to encompass all the novel (or not accounted for before) practices that constitute a contemporary approach towards the understanding of the phenomenon of slavery. "Modern slavery" is an umbrella term that covers the forced labor and forced marriage, child labor, domestic servitude, bond labor, organ harvesting, trafficking in persons, and sexual exploitation (Nicholson, Dang and Trodd 2018). In this paper, practices related to labor, which according to the ILO generate the largest number of (modern) slaves in the world, will be the main focus.

2. **Modern slavery in global supply chains**

This article focuses not on modern slavery as such, but on modern slavery in supply chains, that is, in this "set of upstream and downstream entities who work either directly or indirectly with the firm" (Melnyk et al. 2013). Within the international supply chains, modern slavery has multiple underlying causes. These range from poverty to racial discrimination, from corruption and criminality to inadequate laws, from unregulated business practices to societal cultural norms (Han et al. 2022, 4-5). Modern slavery has sometimes been disguised or rationalized as part of a cultural practice and life-or-death necessity of poor families who simply do not have alternatives but to rely on the work of children. For instance, India had almost 8 million children working in 2023, although it is making advancements to reduce it. This is to say, although what we qualify as modern slavery practice, in some countries is a question of survival, these practices are not acceptable for whatever reason they persist.

The supply chains that we focus on are international and involve big and powerful companies that outsource many of their functions to

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100,000 population (the United Kingdom ranked second on the list, with 129 prisoners per 100,000 inhabitants). Vid. https://www.prisonpolicy.org/global/ 202.html.

the poor countries where the labour is cheap, and workers are vulnerable. Furthermore, labour-related rights in these contexts are also absent or unenforceable (Han et al. 2022, 7). Indeed, Gold et al. (2015, 485-494) explain that the international supply chains exploit cheap human resources, driven by global inequality and hierarchical social relations to produce goods for the global market. While cost reduction is a common goal in supply chains, in cases of slave labour, the bulk of profits are retained by "slaveholders" or businesses, and little to nothing reaches the lowest levels of the chain. The origin of slave-made commodities is concealed from the public eye, and the workers do not know or are too vulnerable to claim higher wages as well as healthy and dignified work conditions. Slave-made commodities become, therefore, mixed with other goods at subsequent supply chain tiers, such as exporters or wholesalers, before reaching consumers. These consumers are often not aware, or even prefer not to be aware, of how the products they buy have been produced. Consequently, slave labour remains largely hidden or deliberately ignored by the industrialized world.

Different abuses related to supply chain management have been brought into the light regardless the sector or industry, be it raw materials, consumer ready goods, minery, agriculture, or other sectors. For instance, and among many, the 2016 report of the International Trade Union Confederation (Howard 2016) showed the estimated hidden workforce of many of widely known companies, such as Apple, Carrefour, Nestlé, Nike, Siemens, Samsung and many others. This is to say that many of the goods and products we use every day, starting with an iPhone and finishing with a cup of hot chocolate, from the running shoes to the TV set, from food to washing machine might have been done by modern slaves.

Indeed, identifying and addressing the existence of modern slavery within the international supply chains is a complicated and challenging issue. Due to the intricate and often hidden nature of modern slavery within supply chains, it is difficult to accurately estimate the global number of individuals affected by it, as well as to appropriately tackle this rapidly expanding global problem (Meehan and Pinnington 2021, 77). Further issues ensue from the strategies to combat and stop these practices: needless to say, making big and powerful companies comply with human rights is an ongoing challenge, but not an already achieved result (United Nations 2011).

The EU is working on the legislative proposal that would prohibit the products made with forced labor on the EU market (Legislative Observatory 2022): the precedents of similar legislative initiatives have

been already included into legislative frameworks of the UK (Modern Slavery Act 2015), Australia (Modern Slavery Act 2018) and Canada (Fighting Against Forced Labour and Child Labour in Supply Chains Act 2024), among many others.

However, despite nearly a decade since the implementation of the first actual regulatory framework, the measures provided to combat modern slavery have proven to be ineffective. Consider, for instance, the UK Modern Slavery Act (2015). Section 54 of the UK Modern Slavery Act requires that companies with a business presence in the UK and an annual turnover of at least £36 million to present an annual statement on modern slavery and human trafficking (UK Government Home Office 2017). This and similar obligations are meant to outline the actions organizations have to undertake to prevent modern slavery in their business operations and international supply chains. The companies are obliged to provide details about the company's structure, business operations, and supply chains, along with policies, due diligence processes, and risk assessments related to slavery and human trafficking. They must elucidate on the effectiveness of measures taken to prevent such practices, and describe the training available to their staff, among other measures. The company's statement must be approved by the appropriate governing body and signed. Additionally, if the organization has a website, the statement must be published there, with a link on the homepage, otherwise, it must provide a copy of this statement to anyone who submits a written request. The duties outlined in the Act can be enforced by the Secretary of State through civil proceedings. Similar provisions regarding modern slavery identification and prevention can be found in the other Acts mentioned above.

Regardless of these efforts, the problem is that it remains problematic to combat modern slavery by solely promoting accountability in the public sphere through disclosure. Indeed, the UK Act –but this is not the problem of the UK Act alone– does not set forth specific reporting standards, nor does it impose penalties for non-compliance. Moreover, as long as a report is published, the company will have complied, even if it does not undertake any actions against modern slavery, therefore falling short in addressing the problem (LeBaron and Rühmkorf 2017, 20).

Furthermore, the regulation has not effectively curtailed modern slavery practices in supply chains also because influential stakeholders with vested interests often exert pressure on vulnerable workers to conceal modern slavery offenses (Yawar and Seuring 2017, 621-643). Additionally, conducting rigorous due diligence across global supply chains is a complex, time-consuming, and expensive endeavor

(MacCarthy et al. 2022, 4), which the affected countries themselves nor local communities can afford. These challenges currently contribute to the persistence of modern slavery despite regulatory efforts (Mantouvalou 2018, 1017-1045; Tambe and Tambay 2020, 22).

To be sure, the companies might argue that they are not in a situation to challenge the national legal frameworks that permit these practices, and their presence offers employment where otherwise the people would starve or live even worse than they live working for the big international corporations. This is also true: yet the corporations need to act and not to close their eyes. The right way to proceed is not to continue these practices, but to work to improve the employment conditions and support the local communities by addressing specific issues and problems, such as accommodation, transportation, food, education and healthcare. As stated by Dante Pesce, the chairman of the United Nations Working Group on Business and Human Rights (Eco-Business 2018), "You [company] are, at very least, complicit if you fail to act".

3. **AI for uncovering modern slavery and safeguarding the right to freedom from slavery**

The discussion so far shows that the right of freedom from slavery remains necessary to defend; its infringements and violations are elusive, concealed, and difficult to identify. It is, therefore, hard to fight. This lack of visibility is inherent to violations of other human rights as well, such as enforced disappearances and extrajudicial killings, *e.g.*, in Mexico with over 100,000 people reported missing (United Nations 2022). Criminal groups allegedly scheme with authorities to abduct or kill individuals, while governments often fail to properly investigate cases or provide justice for victims' families. These factors ultimately allow the violations to continue unchecked and hidden. Hence, all human rights violations are difficult to investigate and bring to the light.

This is why we turn to AI: can AI be useful in this? Indeed, according to Landman (2020, 329-330), techniques, such as computational science and AI –already being used to detect and quantify several human rights violations– could be equally applicable to shedding light on modern slavery as described in the following section[7].

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[7] In this regard, an initiative worth mentioning is the Human Rights Data Analysis Group (HRDAG), which has developed a Machine Learning-based tool to calculate the deaths during Syrian conflict (2011-2014), to identify where the mass graves in Mexico

But before discussing the uses of AI to identify modern slavery-aligned practices in the supply chains, we first need to situate AI within the debate on the human rights and identify what is missing in it and how addressing the modern slavery problem might push forward a change within this debate.

3.1. *AI and human rights*

The research on the impact of AI on human rights is extensive (among many, Mantelero 2022; Aizenberg and van der Hoeven 2020; European Council 2023; Jones 2023). The human rights and fundamental rights that the literature discussed and continues discussing mostly are the right to privacy and personal data protection, the right to freedom from discrimination and bias and the right to equality, the right to fair trial and other procedural rights, freedom of expression, right to healthcare and essential services, rights related to intellectual property and authorship and others.

Having said that, it is also true that not all human rights have been subject to the same attention: for example, the amount of academic literature on the threats of AI to privacy and personal data protection is many times superior to that of other rights, such as right to education, and, for the purposes of this paper, also to the right to freedom from slavery.

The question is why the freedom of slavery is not a "popular" topic for human rights scholars who work on AI. We do not know the reasons, yet we suggest that this is probably due to the lack of knowledge about AI's possibilities in this sense. Also, the lack of interest by the companies that develop AI to invest in something that might bring into the light the seriousness of the problem that they themselves have caused, could play a significant role, should their AI be based on supply chains in the first place. This is just a hypothesis that to be sure needs to be proven: however, with this work we want to contribute to bringing this possibility on the table and arguing that there should be more discussion and analysis of how to use AI in reducing and hopefully eliminating the problem of modern slavery in the world.

This work indirectly addresses one of the currently widely spread narratives on the AI. This is also proven by the aforementioned

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are situated and to establish the patterns of discourse of human rights violators (Landman 2020).

literature overview: the AI is seen as a threat to human rights and as a tool to reduce humans to entities who are easy to manipulate. From this point of view, they exist to generate the data necessary to train AI systems, to buy and use services or to be processed as packages or goods in the warehouse. And this is indeed the case, as many cases of AI uses have shown. Yet the AI is not only that and should not be only that: the idea that this work defends is also related to the fact that seeing AI as a threat only is reductive. We should also start seeing AI as an opportunity: a way to use the AI in improving the situation of the most vulnerable people and to use AI for the benefit of humans and not just for the benefit of (big technological) companies.

3.2. *Advancing supply chain transparency with AI. New ways to tackle modern slavery*

To gain a deeper understanding of how AI can improve the detection of modern slavery within supply chains, it is important to examine the existing practices used for conducting them through audits.

The methods for evaluating modern slavery within international supply chains differ from conventional approaches used in regular supply chain audits. Brintrup et al. (2023, 4681) describe traditional supply chain surveillance as a "manual, and at times an opportunistic process, informed by expert knowledge and limited data. The process would involve scrutiny, validation and judgements made by a variety of supply chain professionals. For example, if a supplier's relations with competitors were of interest, the buyer might directly query the supplier or monitor industrial news sources. At other times, surveillance might be tacit. Procurement officers might collate historical data on supplier performance periodically to assist in future supplier selection. Both of these involve a degree of subjectivity and tacit human knowledge". Hence, modern slavery, as a distinct issue, requires dedicated and targeted attention to be properly addressed (Lund-Thomsen 2008, 1005; New 2015, 697; Gold et al. 2015, 10, 14).

Traditional methods for identifying these risks regularly involve customer surveys, accreditation processes, manual mapping, and monitoring of suppliers, as well as third-party auditing services (Brintrup et al. 2023, 4675). Whilst conducting any of these procedures within global international supply chains, auditors should focus on identifying specific indicators that suggest modern slavery practices might be involved. Such indicators are, for instance, the threat of physical harm

to individuals, restriction of movement, debt bondage, withholding wages, retaining passports, or the threat of denunciation to the authorities. Additional complications arise from the limited research available on this specific question and the fact that such indicators of modern slavery can be hazardous for auditors or inspectors to report, often constituting a risk to their own lives (Crane 2013, 49; Stevenson and Cole 2018, 83; Bodendorf et al. 2022, 2050-2053).

Moreover, the criminal nature of modern slavery acts committed against others, coupled with the possible severe repercussions for those involved if exposed, conveys that conventional detection and remediation practices, typically effective for other types of offenses, are often inadequate or inappropriate for addressing modern slavery. This means that, in general, regular international supply chain management practices have limited effectiveness when addressing illegal activities that are actively concealed (Gold et al. 2015, 8; Stevenson and Cole 2018, 82).

Despite the diversity in measurement strategies, Landman (2020, 330; Landman and Kersten 2016, 127) stresses that some "common themes" emerge in the process of assessing said risks, namely:

(i)   All modern slavery measurement methods rely on raw data sources.
(ii) A coding or counting process transforms raw information into quantitative data, expressing different categories and dimensions of slavery.
(iii) Analytical techniques produce descriptive statistics or more complex analyses that combine or compare data across categories, variables, and dimensions.
(iv) These methods generate outputs that may improve our understanding of modern slavery, including the quantification of the total number of instances or occurrences of modern slavery risks in a given supply chain at a specific point in time (prevalence counts), explanations of such patterns, and predictions or estimates of risks of modern slavery.

Bearing the above in mind it comes as no surprise that the idea to see whether AI could offer a way forward has emerged. As of today, most of the burden of preventing, addressing, and ultimately resolving the issue of modern slavery falls on companies. Consequently, Brintrup et al. (2023, 4675) observed that several recent studies suggest that Supply Chain Digitalization (SCD) could provide companies with additional approaches to enhance existing methods for addressing visibility issues.

As posed by several studies, digital technologies offer substantial benefits throughout supply chain management stages in general. Theoretically, they improve demand responsiveness and capacity flexibility, helping to identify how events causing disruptions in production, sale, or distribution of products affect supply chain performance and can lead to changes in supply chain structural design and planning parameters in response to said disruptions. According to the scientific literature, technologies like big data analytics and track and trace significantly enhance data coordination and supply chain visibility for simulating and implementing recovery strategies. These findings underscore digitalization's critical role in advancing supply chain resilience and responsiveness to disruptions (Ivanov et al. 2019, 829).

Even though the use of AI is, in fact, not strictly necessary for analyzing digital data –whether derived from supply chain audits or otherwise– it could certainly offer performance enhancements compared to other methods when dealing with unstructured, large-scale digital data.

AI-powered tools are therefore being developed to aid companies in combating forced labour and other forms of modern slavery within their international supply chains. These tools leverage advanced technologies such as natural language processing, computer vision, and decision intelligence to analyze data and detect, *e.g.*, indicators of trafficking or forced labour (Li 2016, 98–99, Weinberg et al. 2020) ultimately progressing towards freedom from slavery. AI tools may also contribute to creating more transparent supply chains by analyzing large datasets from various sources to identify potential signs of modern slavery practices. The outcomes presented by this approach theoretically allow companies to take swift action to prevent and address any activity that could be related to modern slavery: that is to say, the companies have means not only to deal with concrete cases of slavery, but also identify border-line situations or conditions which could eventually lead to slavery-based relationships.

Examples of such technology involve AI-powered due diligence technology platforms like GRAT[8] or FRDM[9], which are designed to map complex supply chains and help identify and mitigate forced labour, slave labour, and human trafficking in them, possibly enabling companies to meet higher standards for anti-modern slavery legislation and human rights due diligence requirements (Nersessian and

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[8] See https://counterforcedlabor.com/grat/
[9] See https://www.frdm.co/how-frdm-works

Pachamanova 2022, 2-46). In addition to that, these platforms also educate, create more awareness and also help the companies to track their advancements in dealing with these problems: besides identifying risks of forced labour, these systems also track progress of how these risks are being dealt with and provide with support and assistance in finding the most appropriate solution.

Indeed, the adoption of AI tools has emerged as a way to combat modern slavery: should companies choose to explore it, they have a possibility to boost their existing slavery prohibition due diligence processes using this technology, for instance, along with blockchain technology to record modern slavery in the supply chain offenses publicly and transparently (Tambe and Tambay 2020). As a result, prompt action could be taken based on the accurate outputs generated by the enhanced auditing process. Despite the importance of explainability in algorithmic results –subsequently addressed in this section– practitioners often prioritize accuracy over explainability. There are, however, significant differences in this preference across various industrial sectors and application areas (Brintrup et al. 2023, 4674).

After a thorough literature review on this issue, Han et el. (2022, 16) found that scientific studies conducted on the use of digital technologies –such as AI, cloud computing, and biometric identification– specifically aiming to reduce modern slavery risks within supply chains, currently do not address how these technologies achieve this objective. This suggests that their ability to boost supply chain transparency is not necessarily well-understood, nor has it been unequivocally demonstrated. Nevertheless, in the context of Industry 4.0, these advanced digital tools hold promise as potential solutions for combating modern slavery, even though further research is needed to assess their effectiveness and associated challenges and eventually identify where these technologies fall short to achieve their objectives.

As a part of the challenges mentioned above, it is crucial to recognize risks associated with supply chain digitalization and AI powered surveillance in general, and with modern slavery practices in particular. Among many, a rising concern regarding AI systems' ability to comply with individuals' privacy are among the most prominent issues. It should be noted that EU companies have to comply with the Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (GDPR). For example, in accordance with article 13 GDPR, where personal data relating to a data subject are collected from the data subject, auditors or companies,

using AI tools, should inform the data subject of the existence of automated decision-making, as well as meaningful information about the logic involved, as well as the significance and the envisaged consequences of such processing for the data subject. This conflicts directly with the so-called *black box* effect of AI algorithms.

To be sure, privacy and personal data protection legislation differs and there is no harmonized approach to it outside the EU: yet, as already mentioned before, in this case, as well as in other cases, the EU's approach or the so called "Brussels effect" (Bradford 2020) could be a starting point in terms of understanding and treating personal information of the workers.

Further issue is related to biases: regarding the data that the algorithm used to detect modern slavery in supply chains is based on, there could be several biases influencing its decision-making process. Said biases may arise from several sources, namely: (i) data imbalance, such as overrepresentation, or underrepresentation of certain phenomena in the datasets; (ii) incorrect input data, such as extracting data from sources that may not be sufficiently reliable like *mock reports* where suppliers only appear to be doing the right things on audit day; (iii) irrelevant reports where companies disclose certain types of unrelated information, including supply chain membership, labour policies, environmental impact, and social information; (iv) social media posts, or the news (Stevenson and Cole 2018, 85).

Furthermore, many AI algorithms make use of "black box" methods, which pose interpretation difficulties, making it problematical to understand the reasoning behind specific outcomes or predictions (among many, Pascuale 2025; O'Neil 2017; Koivisto 2021; Brkan and Bonnet 2019; Veale and Brass 2019). These could lead AI systems to analyse data preferring some outcomes over others. For example, if the data is skewed towards certain regions or sectors, the model may underestimate risks in other areas; an algorithm may associate certain worker demographics with higher modern slavery risks, even if that correlation is driven by systemic inequalities rather than actual risk factors. All of these factors certainly highlight the need for human oversight to help mitigate risks (Brintrup et al. 2023, 4681-4685). Yet, even the most attentive and professional human oversight clashes with the aforementioned lack of transparency and explainability, two factors that complicate the process of making any corrections to possible algorithmic errors or biases in the modern slavery risk assessment. In addition to that, other factors, such as publicity, transparency, traceability, explainability, and auditability of these algorithms are essential to prevent the violation of fundamental rights, including

equality, privacy or the right to non-discrimination (Iturmendi 2023, 266-269).

4. **Critical aspects and final remarks**

In this article we have briefly described the phenomenon of the modern slavery and situated it within the international supply chains of multinational businesses. We have also described the importance to change the perspective on AI: it can be used to identify these illegal practices. We have also warned that while AI holds promise in enhancing transparency and risk assessment in supply chains, it also carries risks of bias and perpetuating existing inequalities if not designed and deployed carefully.

To be sure, we are not suggesting that the AI alone will make the slavery disappear. Far from that: what we claim is that there are ways to make the AI useful to help us fighting against those who submit human beings to unbearable torture and depravation of human dignity. We argue that the AI is part of a solution, but not a solution in itself.

Furthermore, we are also aware that what AI can do is to identify the illegal practices, but cannot actually stop them: further steps have to be taken by those in charge as knowledge slavery-friendly practices alone do not affect these practices. Knowledge is just the first step and further procedures have to be created to effectively stop them and prevent them from being re-established.

As identified in this paper, there is an additional problem related to the source of AI: as usual, AI is generated mainly by the private sector. We should foster and support the development of such systems by public or non-profit sectors. Indeed, if we want to identify those companies that do not comply with the regulations, that knowingly and consciously have built their international supply chains on abuses and that generate profits for the detriment of human rights and freedoms, we should rely on free and independent (open source) AI systems and platforms.

This need for independent technologies fits within a wider framework of needs related to stability and resilience of democratic states vis-a-vis large technological companies. Upholding and safeguarding fundamental and human rights, including the right to freedom from slavery, is a core responsibility of governments. Private sector involvement in combating modern slavery could be influenced by corporate interests, market dynamics, and financial motivations. This might lead to selective prioritization of certain aspects of anti-slavery

efforts that align with business goals, potentially overlooking broader systemic issues or marginalized groups. When this responsibility is largely delegated to private entities, it can shift accountability away from democratic institutions that are designed to represent and protect the interests of citizens. If the fight against modern slavery becomes privatized, human rights, including freedom from slavery, may be treated as commodities, subject to market forces rather than inherent rights that every individual possesses as a human being.

On a tangentially related note, most AI advancements aimed at promoting freedom from slavery are designed to ensure compliance with current regulatory standards. Consequently, if legal frameworks evolve to better safeguard human rights, innovation will likely align with these updated standards. The focus on compliance with current regulatory standards reflects the practical approach of AI developers and organizations working in the anti-modern slavery area. By prioritizing adherence to existing legal frameworks, AI technologies are only designed to address immediate needs and meet specific requirements related to detecting and preventing modern slavery. This is not to imply that current developments addressed in this study are inherently negative, but rather to emphasize the need for additional actions and interventions to address modern slavery and protect vulnerable individuals.

Another essential aspect to keep in mind in using AI for international supply chain control, is that the mechanisms for accountability and oversight are critical. The reviewed literature suggests that transparency in AI systems operations and reliability on the results are crucial, if we want to shift the perception of AI from a threat to an opportunity.

To be sure, the use of AI in fighting the modern slavery should not compromise other human rights, such as right to privacy or protection from personal data abuse. Nor should it turn into unregulated mass surveillance and data harvesting from developing countries. Ethical frameworks should be discussed and aligned between different countries and cultures, prioritizing the most beneficial choices for the most vulnerable when balancing these values.

As a mere (yet powerful!) tool in this endeavour, AI can help aggregate and analyse data to support modern slavery risk assessment. Though literature on this topic is scarce, the most relevant studies agree on this. However, it requires accompaniment, monitoring and joint management overseen by diverse stakeholders, such as businesses, governments, civil society organizations, and worker representatives, with governments assuming a bigger role and leading

this fight. This oversight ensures inclusive and representative datasets and reliable outcomes of AI systems, which can help reduce modern slavery.

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