

Foundations of Criminal Liability in the Context of Digital Transformation: A Comparative Study

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Abstract:

Criminal liability has historically rested on the idea of a human actor who bears the consequences of voluntary conduct. The digital revolution driven by artificial intelligence has altered this premise. Intelligent systems can now affect individuals and societies without direct human intervention. New forms of crime involving these entities therefore challenge traditional legal systems. Such offences require a sound understanding of emerging technologies and how they operate. Traditional frameworks have shown clear limits when conduct is generated by self-learning systems. Legislation must consequently remain flexible and responsive to rapid technological change. It must also maintain a fair balance between innovation and legal responsibility.

Keywords: artificial intelligence crimes; criminal liability; electronic legal personality; criminal responsibility; proof through digital evidence; comparative legislation.

Introduction:

Modern technology, a product of the Fourth Industrial Revolution, has produced unprecedented scientific achievements. Artificial intelligence applications are among its most significant outcomes¹. These applications have renewed debate in criminal legal scholarship because they pose new challenges to legal thought, especially criminal law. Scholars have examined several questions concerning who should bear criminal liability for digital offences involving the acts and errors of intelligent systems. These offences may be committed independently and without direct human intervention².

Most legal systems accept that criminal liability arises only when a person possesses awareness and free will. The person must understand the nature of the act and perform it voluntarily, without external compulsion. Rapid advances in cognitive technologies have disrupted this human-centred model.

¹See Sabrin Jaber Muhammad, 'The Problem of Applying Criminal Liability to Artificial Intelligence Crimes,' Journal of Legal and Economic Research 8, no. 1 (2025), p. 85 [in Arabic].

²Roumaissa Kahoul, 'Difficulties in Applying Criminal Liability Rules to Artificial Intelligence Crimes,' Journal of Emir Abdelkader University of Islamic Sciences 39, no. 2 (2025), p. 266 [in Arabic].

Intelligent systems rely on deep-learning algorithms and may make decisions through continuous data analysis without direct human input. Their relative autonomy makes legal attribution difficult, particularly when their decisions cause serious harm. Examples include traffic accidents involving autonomous vehicles and incorrect decisions by medical AI systems that cause severe injury. These cases present the legal system with a difficult question: who should be held responsible?

There is no clear and comprehensive legal framework governing intelligent systems and the criminal liability arising from their use. The absence of defined standards for allocating responsibility among programmers, manufacturers, owners, and the AI entity itself further complicates the legal landscape. Traditional rules based on direct criminal intent or human negligence are ill-equipped to address conduct generated by self-learning systems. Criminal accountability therefore becomes difficult³. This leads to the central research question: To what extent can current systems of criminal liability address the legal problems associated with offences committed through artificial intelligence?

This study addresses a growing legal vacuum. The problem has become more urgent as AI applications expand without clear rules governing their use. Western legal scholarship has examined this issue, but legislative intervention remains necessary. A coherent legal regime must define how AI technologies are to be regulated and how crimes arising from their use should be addressed.

The study examines the legal dimensions of AI systems and evaluates whether existing legislative frameworks can regulate these complex technologies. It identifies gaps in laws designed for a clearly identifiable human actor. It also proposes a new framework, or amendments to existing rules, that would balance the benefits of intelligent systems with the protection of individual and collective rights.

The study adopts descriptive, analytical, and comparative methods. It analyses existing laws on criminal liability and artificial intelligence and assesses their effectiveness in addressing unlawful conduct generated by intelligent systems. It also compares the approaches of several states that have taken an early lead in this field. This comparison helps identify legal gaps and supports suitable recommendations.

The study is divided into two parts:

Part One: The problem of attributing criminal liability between human actors and intelligent systems.

Part Two: Reconstructing the rules of criminal attribution in response to artificial intelligence.

Part One: The Problem of Attributing Criminal Liability Between Human Actors and Intelligent Systems

Traditional crime has acquired new technical forms. Advanced technologies, artificial intelligence, and digital information are now used to plan and execute offences and erase their traces. The resulting problem is not limited to criminalisation, punishment, classification, or the definition of legal elements. The deeper difficulty lies in monitoring and investigation, complex detection and seizure procedures, and the risks involved in collecting evidence⁴. Traditional legal systems therefore face serious challenges. These offences require detailed knowledge of the technologies and their operation.

³See Ayman Khalid Fadel Al-Halahla, 'Artificial Intelligence and Crime: Legal Frameworks for Criminal Liability in the Digital Age,' *International Journal of Law and Business*, no. 57 (April-May 2025), Business Law Research Laboratory, Hassan I University, Settat, Morocco, p. 70 [in Arabic].

⁴See Muhammad Fahmi Talba, *Computers and Artificial Intelligence* (Alexandria: Modern Egyptian Office Press), p. 38 [in Arabic].

Identifying the offender in AI-related crime is especially difficult because several parties may bear responsibility. They include the manufacturer, the programmer, the owner or user, and the AI entity itself. This creates legal and ethical questions about how such offences should be addressed and how liability should be assigned. The following discussion outlines these issues.

Section One: The Absence of Criminal Intent in the Conduct of Intelligent Systems

An offence does not consist of a material element alone. Attributing the physical act to a person is insufficient to establish criminal liability. A further element with psychological characteristics is required. This is the mental element, which connects the offender's outward conduct with the offender's internal state. It takes one of two forms:

First: Criminal Intent

Criminal intent is the principal mental element required to establish an offence under traditional criminal law. Criminal liability requires attribution of the act to its author and of the result to that act. The theories of equivalence of causes and adequate causation are used to connect conduct with its result. This reasoning presupposes that the actor has free will and the capacity for discernment or understanding. These qualities are traditionally associated with a natural person, since only a human being is regarded as capable of bearing such responsibility. Applying this model to artificial intelligence is difficult. The legal characterisation of the act is complicated by the absence of direct human volition. Traditional criminal intent cannot readily be applied when the actor is a machine governed by software or a program operating on previously entered knowledge.⁵ Where an AI-related offence can be traced to a manufacturer, programmer, or user, the mental element may nevertheless be established. The offender is then a human being who knowingly and intentionally uses an AI system, such as a robot or an autonomous vehicle, to bring about the prohibited conduct and its result⁶.

Second: Intentional Fault

Intentional fault arises when the offender knowingly and willingly engages in conduct contrary to law but does not intend the resulting harm. Fault is assessed by comparing the offender's conduct with that of an ordinary person in the same circumstances. It may result from negligence, lack of caution, recklessness, or failure to comply with legal rules⁷. Unintentional fault by an AI entity would presuppose awareness, understanding, and freedom of choice. Recognising these qualities would effectively treat the entity as a natural person and remove the central legal difficulty. In other words, unintentional liability presupposes a capacity for intentional responsibility. Where the fault lies with the operator, programmer, or user, the ordinary rules governing natural persons apply. Where the fault arises from the AI application itself, the same unresolved question remains⁸.

Section Two: Legal Debate over the Parties Liable for Artificial Intelligence Crimes

Criminal liability is the legal consequence of an offence recognised by law. It requires the offender to bear the penalty imposed by criminal rules. Artificial intelligence may involve several participants, including the producing company, the owner or user, and the beneficiary of the technology. Determining liability for AI-related offences is therefore one of the most complex issues in modern law. The relative autonomy of these systems raises fundamental questions about the party responsible

⁵See Muhammad Abbas Hammoudi Hussein Al-Zubaidi and Noor Qais Muhammad Shaheen, 'The Crisis of Criminal Legislation in Addressing Artificial Intelligence Crimes: An Analytical Study,' special issue, Al-Zaytoonah University of Jordan Journal for Legal Studies (2024), p. 29 [in Arabic].

⁶See Maryam Abd al-Wahab, previously cited, p. 685 [in Arabic].

⁷See the same reference, p. 686 [in Arabic].

⁸See Al-Zubaidi and Shaheen, previously cited, pp. 29-30 [in Arabic].

for their conduct⁹. At times, the system may appear to be the perpetrator. At other times, it serves merely as the instrument of the offence¹⁰. Should responsibility fall on the developer, the user, or the system itself?

First: Criminal Liability of the Artificial Intelligence Designer

The criminal liability of an AI system's manufacturer is a central issue when the system engages in conduct constituting an offence. The manufacturer is a principal contributor to the system's creation, whether it produces the entire system or only some of its components. It initially controls the programming and design of the operating system. Its legal position must therefore be examined whenever the machine commits prohibited conduct. A manufacturer may attempt to avoid liability through terms in the user agreement signed by the owner. Such terms may assign sole liability to the owner for crimes committed through the AI program and exempt the manufacturer. The position differs when an offence results from manufacturing defects or negligent maintenance. Such failures may cause the device to leave its normal operating path or become uncontrollable. A manufacturer must comply with defined standards when developing AI programs¹¹. These standards must ensure safety and security if control over the technology is lost. As AI systems become increasingly autonomous, the manufacturer may bear criminal liability for failure to meet those duties. Legislation should therefore impose binding manufacturing requirements and provide penalties for non-compliance. The severity of the penalty should reflect both the offence committed by the technology and the manufacturer's failure to observe the applicable controls¹².

Second: Criminal Liability of the Owner or User of Artificial Intelligence

The owner or user of AI technology may bear criminal liability for a robot's conduct where the offence results from its use. Manufacturers and programmers often warn owners and users of foreseeable risks in order to limit their own liability for unlawful acts committed through the technology¹³. Human curiosity may lead users to tamper with AI systems and employ them to commit offences. For example, the owner or user of an intelligent vehicle may disable automated control while retaining the system's voice guidance. The user then assumes control of the vehicle. If the program issues a warning intended to prevent an accident and the user disregards it, the user alone may bear criminal liability. Liability may also be shared by the manufacturer, programmer, owner, or user when the offence results from their direct acts. A programmer may configure an AI program to steal bank-account data, after which the owner or user deploys it for that purpose. An owner may also alter the operating commands of an autonomous vehicle with the assistance of a specialist. If this is done to commit an offence and shift responsibility to the manufacturer or the vehicle, liability is shared by the owner and the person who changed the commands. These cases fall within the rules on criminal

⁹See Al-Halahla, previously cited, p. 64 [in Arabic].

¹⁰See Mourad Ben Aouda Haskar, 'The Problem of Applying Criminal Liability Rules to Artificial Intelligence Crimes,' *Journal of Rights and Human Sciences* 15, no. 1 (2022), p. 188 [in Arabic].

¹¹See Abd al-Razzaq Ahmad Muhammad Al-Miri, *Criminal Liability for Artificial Intelligence Crimes*, 1st ed. (Berlin: Arab Democratic Center for Strategic, Political and Economic Studies, 2024), p. 57 [in Arabic].

¹²See Maryam Abd al-Wahab, 'Criminal Liability for Artificial Intelligence Crimes,' *Journal of Law and Environmental Sciences* 2, no. 2 (2023), p. 690 [in Arabic].

¹³See Muhammad Ali Abu Ali, *Criminal Liability for Harm Caused by Artificial Intelligence*, master's study in criminal law, 1st ed. (Cairo: Dar Al-Nahda Al-Arabiya for Publishing and Distribution, 2024), p. 177 [in Arabic].

participation¹⁴. Article 42 of the Algerian Penal Code identifies acts of this kind¹⁵. Some scholars argue¹⁶ that the owner bears presumed liability for offences committed through an AI system in the owner's possession. The owner must then prove the contrary. Under this view, liability is based on the assumption of risk.

Third: Criminal Liability of Artificial Intelligence Itself

Whether artificial intelligence may be held criminally liable for autonomous conduct has generated extensive debate. The question arises where the system commits an offence without a programming error or external intervention. The prevailing view currently rejects criminal liability for robots or AI systems. They are treated as innocent intermediaries that cannot be prosecuted. A system is an invented machine that operates according to its programming. It may malfunction or suffer a technical failure, and an offender may use it as an instrument of crime. Traditional criminal law recognises the liability of natural persons and, in some cases, legal persons such as companies when an offence is committed for their benefit and on their behalf. AI entities cannot presently be held criminally liable because they lack criminal capacity. They cannot exercise understanding, discernment, or freedom of choice, which form the basis of liability for a legally responsible natural person¹⁷. Article 74 of the Algerian Penal Code provides that 'no penalty shall be imposed on a person who was insane at the time of the offence ...'. Article 48 of the same Code states that 'no penalty shall be imposed on a person compelled to commit an offence by a force that could not be resisted'. Algerian legislation therefore treats insanity, coercion, and minority as circumstances that negate freedom of choice and preclude criminal liability. Under current law, a criminal penalty cannot be imposed on an AI system. A court may, however, order the confiscation of the AI entity used to commit the offence. Another proposed model is liability based on the natural and probable consequences of conduct. It assumes close involvement by programmers or users in the entity's daily activities, but no intention to commit an offence through it¹⁸.

Section Three: The Effectiveness of International and Arab Legislation in Addressing Artificial Intelligence Crimes

Rapid technological change driven by artificial intelligence requires a departure from conventional legislative policy. Rules governing robots have become an urgent necessity. They are needed to protect victims, parties involved with AI technologies, and society as a whole. Many Arab states have embraced the civilian use of robots in hospitals, roads, airports, and other public and service settings¹⁹. This openness has created legal challenges as reliance on AI technologies increases. Traditional rules, particularly criminal provisions, have proved inadequate. This section therefore reviews leading international, comparative, and Arab legislative approaches.

¹⁴See Reem Khalfan Saeed Rashid Al-Kindi, 'The Personal Scope of Criminal Liability for Artificial Intelligence Errors,' master's thesis, College of Law, University of Sharjah, p. 4 [in Arabic].

¹⁵Ordinance No. 66-156 of 18 Safar 1386, corresponding to 8 June 1966, promulgating the Algerian Penal Code, as amended, Official Gazette of the People's Democratic Republic of Algeria, no. 49 (1966) [in Arabic].

¹⁶See Yahya Ibrahim Dahshan, 'Criminal Liability for Artificial Intelligence Crimes,' Sharia and Law Journal, no. 82 (April 2020), p. 29 [in Arabic].

¹⁷See Muhammad Najib Hamed Atiya Dbeisha, 'Criminal Liability Arising from Artificial Intelligence Crimes: A Comparative Foundational Study,' Eighth International Scientific Conference, Technology and Law, special issue, Spirit of Laws Journal, Faculty of Law, Tanta University, pp. 2305-2306 [in Arabic].

¹⁸See Muhammad Ali Abu Ali, previously cited, p. 128 [in Arabic].

¹⁹See Somaya Muhammad Saeed Mahmoud, 'Legal Challenges of Artificial Intelligence: The Robot as a Model,' Journal of Legal and Economic Sciences, Faculty of Law, Ain Shams University (2024), p. 13 [in Arabic].

First: United States Legislation

The United States follows a flexible approach that promotes technological innovation while limiting legislative intervention. Lawmakers give strong priority to personal-data protection but also provide companies with broad freedom to develop AI technologies. This flexibility encourages innovation and accelerates development, especially in advanced sectors such as finance and healthcare. Yet limited oversight may allow some technologies to be used unlawfully or in ways that harm individuals. The model remains effective in stimulating innovation. It nevertheless raises continuing questions about whether the legal system can adequately address abuse and errors caused by improper use of AI technologies²⁰.

Second: European Legislation

Europe adopted the Artificial Intelligence Act as a comprehensive framework intended to balance technological innovation with the protection of fundamental rights. The Act is rigorous and adopts an advanced regulatory approach. It classifies intelligent systems by risk level, including low, medium, and high risk. Earlier discussions in this field often referred to Asimov's Laws, also known as the Three Laws of Robotics. These principles influenced later regulatory thinking. One important development was the European Union's 2018 initiative to formulate ethical guidelines for artificial intelligence²¹.

The relevant principles include:

* **The principle of truthfulness:** users must receive accurate information so that they can make sound and appropriate decisions.

* **The principle of fairness:** AI systems must be developed in accordance with the 1948 Universal Declaration of Human Rights.

* The principles of non-discrimination, accountability, and trust.

The European AI Act places particular emphasis on high-risk systems, including those used in medicine and the justice system. In the medical context, AI systems must undergo strict testing before they are approved for diagnosis. This reduces diagnostic errors and protects patients' rights. It also strengthens public confidence in the use of technology in healthcare. Developers must disclose relevant information about the algorithms used to ensure transparency and compliance with ethical standards. Serious penalties may be imposed for breaches of safety requirements or misuse of intelligent systems²².

The European Parliament has also proposed that Member States recognise a 'human representative responsible for the robot'. This person may be the manufacturer, operator, owner, or user. Civil liability would depend on the degree of harm and the representative's actual control over the robot²³.

Third: Arab Legislation

The United Arab Emirates was the first Arab state to give particular attention to artificial intelligence. It was also among the first countries worldwide to invest in AI across vital sectors. Examples include the automated Dubai Metro, described as the world's longest fully automated and safe metro network. The UAE also aims for robotic officers to constitute 25% of its police force by²⁴ 2030. These efforts

²⁰See Al-Halahla, previously cited, p. 81 [in Arabic].

²¹See Al-Zubaidi and Shaheen, previously cited, p. 27 [in Arabic].

²²See Al-Halahla, previously cited, p. 81 [in Arabic].

²³See Al-Zubaidi and Shaheen, 'The Crisis of Criminal Legislation in Addressing Artificial Intelligence Crimes: An Analytical Study,' special issue, Al-Zaytoonah University of Jordan Journal for Legal Studies (2024), p. 27 [in Arabic].

²⁴See Somaya Muhammad Saeed Mahmoud, previously cited, pp. 11 and 14 [in Arabic].

reflect its ambition to become a global centre for AI development. It also plans to rely fully on AI for services and data analysis by 2031. As a leading state in this field, the UAE adopted guidelines informed by earlier international initiatives, including those of the European Union and the United Nations. The guidelines include the following:

1- Fairness and transparency in AI systems. Data received by a system should represent the target group whenever possible. AI algorithms should not be biased, and effective measures must limit bias. The fairness of decisions made by these systems should also be demonstrable.

2- The AI system itself should not be held accountable. Responsibility should be divided among the user, developer, and designer. Developers should make further efforts to reduce risks inherent in AI systems. They should also provide mechanisms that allow users to challenge important decisions.

3- AI systems must be safe and serve humanity. They must not be capable of harming, alienating, or misleading people. This requires the following:

- AI systems must be developed objectively. Their purpose should be to provide services and information that support important decisions, not manipulation or deception.
- States should avoid arms races involving lethal autonomous weapons.
- States should cooperate in applying the safety standards imposed on AI systems.

4- AI systems must benefit humanity and remain consistent with human values in the short and long term and at the global level. Accordingly:

- Human safety and security must be the highest priority when any AI system is designed, whether the person is an operator or a user. Failures must also be recorded and monitored.
- AI systems must remain open to verification and capable of being controlled.
- User safety and privacy must be protected when AI systems are deactivated. Due care is especially necessary during the manufacture of systems that directly affect human lives.
- Individuals must be able to disable such systems or reverse their decisions²⁵.

The United Arab Emirates has made notable progress in keeping pace with global developments, although its regulatory experience remains at an early stage. Arab lawmakers can draw on this approach and other comparative models. Their experience may support an integrated legal framework that balances technological innovation with the protection of fundamental rights while respecting the social and cultural characteristics of Arab societies.

Part Two: Reconstructing the Rules of Criminal Attribution in Response to Artificial Intelligence

Artificial intelligence crimes belong to the near future, although some have already emerged. Their forms continue to multiply as technological development accelerates. Humanity is entering a new stage that requires a framework capable of addressing the distinctive features of this technology. Current legislation has not adequately regulated the resulting problems or protected the affected parties. An effective framework must rest on a realistic understanding of how AI is used. It must also consider its effects on human and social behaviour and on the interests that deserve legal protection. As this technology develops, debate will extend beyond whether criminal liability for AI conduct can arise and whether its conditions are satisfied. It will also concern understanding, discernment, and the treatment of concepts that remain unfamiliar to criminal law. Legal scholarship and legislation have been hesitant to recognise them. If AI were granted legal personality for its offences, the system of

²⁵See Al-Zubaidi and Shaheen, previously cited, p. 28 [in Arabic].

applicable penalties would require reconsideration. Physical penalties, financial sanctions, and modern alternatives to punishment may not suit technologies with a distinct nature and set of characteristics²⁶. An inadequate legal framework allows AI to operate without sufficient oversight. This may cause unintended violations of individual rights or threaten public safety and security. Legislation must protect society without obstructing innovation and technological development. The following sections briefly address these issues.

Section One: Granting Limited Legal Personality to Intelligent Systems

Traditional legal systems face increasing difficulty when addressing errors generated by artificial intelligence. Calls to recognise some form of legal personality for AI systems have therefore intensified. Supporters and opponents each advance distinct arguments. Yet no clear legal framework currently determines

whether an intelligent entity may receive legal personality. The current European approach is the only one described as expressly contemplating such recognition. It reflects a broader movement to reconsider the legal rules governing intelligent machines. For more than a decade, these systems have increasingly been distinguished from the traditional legal concept of a thing. A different status may therefore anticipate future technological developments.

In its 2017 recommendations on civil-law rules for robotics, the European Parliament proposed a status of electronic persons for autonomous robots responsible for damage they cause. This personality might apply to robots that make independent decisions or interact autonomously with third parties. The recommendations also contemplated a specific long-term legal status for robots as applications of AI. At least the most sophisticated autonomous robots could then be treated as electronic persons²⁷. The proposed European civil-law framework for robotics further indicated that an independent legal personality might eventually be recognised when a robot can make decisions independently of its user. It also suggested legal safeguards for any future grant of personality. Each machine would receive an electronic identity containing a digital sequence, a name, and an identification number. It would also contain a secure 'black box' holding all information about the robot and an insurance certificate covering damage caused by it. These proposals suggest that autonomous legal personality may become possible if new generations of robots can think, learn, and decide without human intervention²⁸.

If artificial intelligence is granted legal personality, a corresponding penalty must be possible. A penalty presupposes responsibility, and responsibility in turn depends on legal personality. Law must respond promptly to social and technological change. Saudi Arabia took an early symbolic step by granting citizenship to the robot Sophia in 2017. Japan likewise granted official Tokyo residency and the legal status of a seven-year-old boy to an AI-powered online program²⁹. This proposal does not seek to equate intelligent systems with natural or legal persons. It seeks only to grant a form of personality that permits responsibility under a legal regime. Such a regime should promote justice and protect persons harmed by AI conduct. Legal personality for AI should therefore rest on defined legal grounds, including the following:

²⁶See Saida Bouznoun, 'Artificial Intelligence Entities in Criminal-Law Thought,' *Al-Mi'yar* 28, no. 4 (2024), pp. 583-584 [in Arabic].

²⁷See Muhammad Ali Abu Ali, previously cited, p. 74 [in Arabic].

²⁸See the same reference, p. 72 [in Arabic].

²⁹Simon Chesterman, 'Artificial Intelligence and the Limits of Legal Personality,' Law Working Paper, National University of Singapore (2020), p. 3.

- Intelligent systems must remain under continuous supervision by specialised bodies that ensure compliance with legal and ethical standards. Strict penalties should apply to developers or operators who violate the rules.³⁰

- Intelligent systems that make decisions through data analysis without direct human intervention have the strongest claim to legal personality. Medical robots used in surgery are one example because their algorithms may make critical decisions in real time.

- Intelligent systems must directly affect individual rights and lives. Examples include systems used in the financial sector to provide investment recommendations or manage client assets³¹.

In our view, AI could receive an exceptional legal personality modelled on that granted to legal persons. This would help regulate the legal consequences of its acts and decisions. Its application would require precision and strict oversight to maintain a flexible balance between sanctions and innovation.

Section Two: The Need for New Legislation to Reflect the Nature of Intelligent Systems

The absence of a clear legislative framework for artificial intelligence creates legal gaps that impede justice. Unnecessary new laws or amendments that do not fit existing rules may produce legislative inflation. This occurs when numerous criminal provisions address the same subject and disrupt the coherent operation of criminal law. Reliance on AI is increasing, while entirely new offences have reshaped concepts of crime and legal responsibility in the digital age. Examples include the use of self-learning systems in cyberattacks and the exploitation of technical vulnerabilities in AI. An innovative legal framework is therefore required to assign responsibility for such conduct.

The harms caused by intelligent systems should be criminalised and punished only to the extent necessary to achieve justice and protect affected parties. Legislatures should avoid excessive criminalisation and punishment. They must also consider the benefits these technologies provide to humanity. New provisions should balance technological innovation with legal and ethical principles. This does not prevent the legislature from using sufficiently general language to cover conduct that may emerge as protected interests evolve. The rules should remain flexible enough to address future innovations and new harmful uses of AI while preserving fundamental legal values³².

The absence of a precise and comprehensive legal definition of artificial intelligence is another major obstacle to specialised legislation. National law should define the scope of AI systems by reference to their uses, including industrial, medical, and judicial applications, and to their degree of independence from human intervention. A sound definition can reduce legal gaps. It can also clarify relationships among developers, operators, and end users, redefine their responsibilities, strengthen transparency, and support rigorous oversight. National definitions should draw on international standards but be adapted to the domestic legal environment. This approach would promote international cooperation and reduce legislative differences that may hinder innovation or effective enforcement³³. Legislative solutions should also draw on the experience of states that have taken an early lead in this field. Their laws offer an important point of reference. The greater challenge lies in practical implementation. International cooperation and continuous legal reform are needed to keep pace with rapid technological change.

³⁰Maximilian Koenig, 'AI Governance and Shared Accountability,' *European Law Journal* 29 (2023).

³¹European Commission, 'Artificial Intelligence Act Overview,' <https://ec.europa.eu/digital-strategy/ai-act>.

³²See Al-Zubaidi and Shaheen, previously cited, p. 32 [in Arabic].

³³See Al-Halahla, previously cited, pp. 67-68 [in Arabic].

Section Three: Forms of Punishment for Offences Committed by Artificial Intelligence Entities

The capacity of AI technologies to develop autonomously has increased their freedom of action and decision-making independence. Once granted electronic legal personality, they could be held criminally accountable for offences committed through a will independent of the persons who manufactured, programmed, or used them³⁴. If legislation recognises a new form of legal personality, the penalties imposed on these technologies must reflect their nature and the principle of personal punishment. Where an AI entity commits a criminal act without human intervention, a prospect that may become realistic in the future, a penalty could be imposed directly on it. Algerian and comparative legislation provide sanctions of varying severity, but existing penalties do not correspond to the nature of these entities³⁵. New sanctions suited to electronic personality would therefore be required. They could include the following:

- **Suspension, destruction, or dissolution:** this sanction could apply to a physical or algorithmic AI entity that poses a threat to public security and has been conclusively found responsible. It would terminate the entity's existence in the same way that dissolution terminates a legal person. It may also be compared to the death penalty imposed on a natural person.

- **Financial fine:** legislative recognition of an AI entity as a legal person would require an independent financial estate. A fine could then be paid to the public treasury from that estate.

- **Confiscation:** this is a sanction that deprives the entity of rights or operational freedom. Where specific software components can be separated, the entity may also be reprogrammed. Reprogramming would function as rehabilitation adapted to its nature³⁶. One example would be the withdrawal of an autonomous vehicle's driving licence³⁷.

Where an AI-related offence is attributed to a manufacturer, user, or owner, the applicable penalties are those prescribed for natural or legal persons under the criminal law of each state. Offences committed autonomously by AI entities would require penalties tailored to their distinctive nature. Such penalties remain a subject of research and legal exploration.

Conclusion:

Artificial intelligence is no longer merely a technical tool. It has reshaped the concepts of crime and criminal liability in the digital age. Traditional laws have proved inadequate in addressing problems created by intelligent systems. A new legal regime is needed to balance innovation with the protection of rights and to ensure sustainable justice. This task requires international cooperation among legislators, technical experts, and other relevant actors. The study reaches the following recommendations:

- 1- The criminal-law framework should be updated to ensure an effective response to emerging technology-related offences. Technical experts should participate in the drafting process.
- 2- Intelligent systems should be granted a form of electronic legal personality comparable, where appropriate, to that of natural persons. This would facilitate independent criminal accountability.
- 3- The responsibilities of producers, users, and other participants in AI-related offences should be clearly defined.

³⁴See Abdelkader Bezza and Driss Bakhouya, 'Legal Characterisation of Crimes Committed by Artificial Intelligence Entities,' *Journal of Legal and Political Studies* 10, no. 2 (June 2024), p. 54 [in Arabic].

³⁵See Al-Zubaidi and Shaheen, previously cited, p. 32 [in Arabic].

³⁶See Al-Zubaidi and Shaheen, previously cited, p. 35 [in Arabic].

³⁷See Bezza and Bakhouya, previously cited, p. 34 [in Arabic].

4- The Ministry of the Interior should establish a dedicated unit for combating AI-related crime and protecting information security. Its purpose would be to strengthen digital security and address emerging technology-related offences.

5- Legal and ethical standards must govern the manufacture, programming, and use of AI machines and software. Specialised supervisory bodies should monitor compliance.

6- Public awareness should be strengthened through seminars and scientific conferences. These events should explain the risks associated with technology and promote informed vigilance.

7- Law-enforcement officers and judges should receive specialised training on complex digital evidence. Dedicated technical investigation units should assist them in understanding and evaluating such evidence.

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