Internet of Things

Journal homepage: www.elsevier.com/locate/iot

Research article

It’s time for Artificial Intelligence Governance

Suada Hadzovic *, Lejla Becirspahic, Sasa Mrdovic

Faculty of Electrical Engineering, Zmaja od Bosne bb, Sarajevo, 71000, Bosnia and Herzegovina

ARTICLE INFO

Keywords:

Artificial Intelligence
Internet of Things
Governance
Regulatory Framework
AI Strategy
Analytical Hierarchy Method
Regulatory Impact Assessment

ABSTRACT

Advances in Internet of Things and Artificial Intelligence have transformed society with the potential to foster the prosperity of human beings and improving societal welfare. However, at the same time, there are concerns about their potential negative impact. In this regard, it is of utmost importance to establish a regulatory framework for IoT and AI that will ensure that human rights and fundamental freedoms are respected, promoted, and protected.

In this sense, the goal of this article is to propose the Artificial Intelligence and the Internet of Things governance model. To achieve a better regulation concept, for the Regulatory Impact Assessment we used the Analytical Hierarchy Process (AHP) method.

1. Introduction

Traditional regulatory frameworks are complex and fragmented, with a slow response to changes, with an overlap of competences between institutions, while certain topics are not covered because there are legal gaps.

Initiatives to manage artificial intelligence (AI) are increasing, both because of striving to exploit the enormous benefits that AI can bring, as well as to protect against the unpredictable and potentially dangerous side of AI that can lead to adverse consequences of unimaginable proportions. AI has also become the subject of strategic competition race of most powerful countries.

The United Nations (UN) call for a global, multidisciplinary conversation on AI governance so that the benefits of AI for all of humanity are maximized and the risks contained and reduced. To address the issue of international governance of AI, the UN established the Advisory Body on AI in October 2023. The AI Advisory Body has released an interim report, with a final report expected in the summer of 2024 ahead of the Future Summit in September 2024.

In April 2021, the European Commission proposed the AI Act, which represents the first comprehensive regulatory framework for AI in the world. After long negotiations, in March 2024, the agreed final text of the AI Act was adopted, which contains 808 amendments compared to the initial draft, which is an indicator of the complexity of the issue. At the heart of the AI Act are security requirements that companies must meet before placing AI products on the market. The EU AI Act is expected to repeat the success of the EU General Data Protection Regulation (GDPR), which has become the world "gold standard" for data protection.

As the existence of an efficient and adequate regulatory framework is one of the prerequisites for the development of Internet of Things (IoT) and AI for the benefit of the individual and society, our research is focused on making contributions that will be helpful primary to policymakers and regulatory authorities, as well as industry and society.

IoT and AI Governance is challenging since IoT and AI as building blocks of the digital ecosystem are intertwined, involving numerous participants, spanning different sectors, with expected and unexpected consequences. As digitization is driven by the increased and faster connectivity of people and things, and the digitization of societies and economies continuously creates record amounts of data, the IoT is increasingly present on its own or as a data source for AI. Due to the convergence of IoT and AI-infused infrastructure, society and economy, laws related to electronic communications, security, data protection and privacy, consumer protection, and many other sectoral laws are applicable. Therefore, it is necessary to form the governance framework in such a way as to avoid overlaps and not to leave areas that are not covered by the legislation.

The contribution of formation of an effective framework for the governance of advanced technologies, such as IoT and AI acts in the direction of strengthening digital equality and thereby reducing the existing digital gap. Developing countries may miss the opportunity for progress if they are late in creating a proactive regulatory environment and developing a national AI strategy that will create the preconditions for exploiting the potential of new technologies.

To achieve ‘‘better regulation’’ concept, it is necessary to carry out a Regulatory Impact Assessment (RIA) implementation, to identify the approach that should bring the greatest benefit to society.

* Corresponding author.
E-mail address: A (A).

The methodologies used for RIA implementation include least cost analysis, cost-effectiveness analysis, cost-benefit analysis and multi-criteria analysis. Multi-criteria analysis can be suitable to the transformative technologies such as AI and IoT considering that these technologies need multi-criteria decision making.

There are several methods of multi-criteria decision making. The Analytical Hierarchy Process (AHP) is a method characterized by the flexibility in changing parameters, and low mathematical complexity and sensitivity. Recent data shows that AHP is the main and most cited multi-criteria method.

This paper aims to answer several questions relevant to AI and IoT governance. Why countries need a national AI strategy and regulatory framework for AI and IoT? How countries can initiate their development? What steps should be taken? What are the building blocks of a national AI strategy? Which EU and global legislation and recommendations are the most relevant? How to identify relevant actors?

Trying to answer the above questions, we used two research methods. Firstly, we used a desk research method to gather information by analysing and synthesizing existing literature. Then we conducted the regulatory impact assessment (RIA) using the Analytical Hierarchy Process (AHP) method. This part of research using the AHP method was conducted in two phases. First phase is based on data gathered from civil servants of developing countries during AI training organized by Ministry of Science and ICT in Republic of Korea in October 2022. Second phase is based on data gathered from participants in the regional digital forum in Bosnia and Herzegovina in October 2023.

This paper is organized in following ways. Section 2 presents an overview of existing literature. Section 3 presents the research method by introduction of Regulatory Impact Assessment (RIA) and Analytical Hierarchy Process (AHP) as a chosen multi-criteria analysis method. From the concept of governance and presenting the digital governance gap in Section 4 is given a review of AI governance aimed to close the digital divide. Section 5 is dedicated to the identification of AI actors and AI lifecycle phases. Section 6 deals with relevant AI legislation in EU, recommendations and other documents. Section 8 presents the procedure and results of the multi-criteria analysis carried out using the AHP method in October 2022, determining AI Strategy option based on responses of regulatory experts from developing countries. Section 9 presents the procedure and results of the multi-criteria analysis carried out using the AHP method in October 2023, determining AI regulatory option based on responses of Bosnia and Herzegovina (BiH) regional digital forum participants. Section 10 presents AI and IoT Governance model development phases and an AI and IoT Governance model proposal. Section 10 gives conclusion.

2. Overview of the existing literature

In parallel with the increase in the number of initiatives for policies and regulation of AI governance, there are raising number of studies on AI governance.

Authors in [1] tried to identify trends in the AI ethics and governance conversation by examining 88 ethics documents published from 2016 to 2019. Authors found six types of motivation, such as social responsibility, competitive advantage, strategic planning, and strategic intervention, to signal social responsibility and to signal leadership. It is concluded that several characteristics might suggest that document is more likely to achieve its purposes, such as Engagement with Law and Governance, Specificity, Reach, Enforceability and Monitoring, Iteration, and Follow-Up.

The study [2] reveals the hurdles in formulating a cohesive global policy for AI regulation. As a response, the discussion proposes a model advocating for a collaborative network which blends government with industry expertise with aim to establish adaptive, responsive regulations able to evolve with technological advancement. Dynamic environment calls for a proactive and nuanced approach to regulation with imperative to safeguard public interest. The regulatory model should be adaptable and robust to address the complexities and uncertainties of AI advancement. Collaborative efforts of policymakers, civil society, technologists, and the public is needed.

The goal of the study [3] is to start discussion about governance of AI, by AI, and for both AI and humans. It is emphasized that humanity governs AI by different ways, which include Regulation, Standards, Self-regulation, Research, Education and awareness, and Collaboration. Some of the ways that humanity could govern AI include: Pre-emptive regulation, Alignment with human values, Certification and licensing, International cooperation, Public participation, and Encouraging the development of responsible AI. Some key considerations in domain of how humanity should govern AI include: Prioritizing safety and security, Ensuring transparency and explainability, Aligning human values and ethical principles, Involving all stakeholders, and Continuously evaluating and adapting.

Authors in the study [4] stressed a coordination problem in AI governance, proposing the establishment of an international governance coordination committee and an international congress for governance of AI and robotics.

Aspects of creating a new regulatory or other body with the authority to oversee AI, and how the said regulatory body could be designed to respond to existing challenges, are discussed in the paper [5]. In paper [6], the need for 25 officers in institutions for the implementation of the AI Act is estimated. Focus of the paper [7] is on how various institutional bodies will implement and enforce the new EU AI Act, additionally proposing a normative governance model.

Based on a detailed analysis of 34 national strategies, the paper [8] provides a report on AI possibilities, roles of the public sector and national investment plans in capacity-building initiatives to increase AI capabilities. The analysis of national AI strategies in the paper [9] concluded that two resources - technology and human resources provide insight into the achievements of national AI strategies, and based on this, countries were measured and compared in achieving their goals. The aim of the authors in the paper [10] is to present an assessment of AI readiness in order to help in the development and identification of the main pillars of the

national AI strategy. The paper [11] grouped AI strategies into eight areas: scientific research; development of AI talents; skills and the future of work; industrialization of AI technologies; ethical AI standards; data and digital infrastructure; AI in government, Inclusion and social well-being.

RIA is framed in the paper [12] as reasoning that connects various types of knowledge to inferences about the future. In the paper [13] is highlighted the importance of behavioural analysis in RIA. RIA for AI Governance conducted in the European Union [14] and United Kingdom [15], are comprehensive documents based on extensive costs calculation.

There are many multi-criteria decision analysis methods differing by the complexity of the algorithms. A survey of multi-criteria decision analysis methods and concepts is present in the paper [16] where a list of 60 different methods is used for investigating the prevalence of using these methods in different research articles. Accordingly, the AHP method is the main and most cited multi-criteria method during 2012 -2022 based on the conducted research.

Application of the AHP method is present in various fields, starting from architecture, forestry, automotive industry, etc. [17], [18], [19], [20], [21], [22], [23], [24] and [25] which is an indication of the flexibility of the method.

To the best of our knowledge, this paper is the first one who present the AI and IoT governance model development where the AHP method has been applied within the RIA. Probably the closest to this research is the paper [26] where the authors used the AHP to analyse costs and benefits as stages of RIA. Based on results of AHP analysis for costs and benefits, the most likely food policy priority in Indonesia was selected.

As AHP implementation is based on the experience and knowledges of AHP questionnaire respondents, we applied this method by acquiring responses from people with necessary knowledge level. Concerning that the AHP questionnaires respondents are from developing countries, presented research results are particularly interesting to developing countries.

This article complements listed and other related literature. Our research is focused on national AI strategy, and AI and IoT regulatory framework development. The results were obtained based on the conducted RIA by use of AHP method as the chosen method. Additionally, identification of key legislative documents and recommendations, AI lifecycle phases, AI actors including supervisory bodies is done. The AI and IoT governance model development is presented in phases from initiation, model development, model implementation, monitoring, and evaluation.

3. Research Method

3.1. Regulatory Impact Assessment

Regulatory Impact Assessment (RIA) is a systematic approach to critically evaluate the positive and negative effects of proposed and existing regulations and non-regulatory alternatives. It is a basic instrument of regulatory management that helps to base decisions on adopting or changing laws and regulations on facts and evidence [27].

By promoting the concept of "better regulation", the European Commission is promoting the use of the RIA method.

During the research, the regulatory impact assessment method (RIA - Regulatory Impact Assessment) was used, which is characterized by a systematic, structured analysis based on evidence of the future impacts of the proposed regulatory measure in relation to possible alternatives. The goal of this method is to ensure that initiatives and activities bring effective solutions, thereby increasing the benefits brought by regulation and reducing negative impacts.

Implementation of the RIA method is procedurally and methodologically challenging and consists of: (1) problem definition, (2) identification of alternative regulatory options, (3) data collection, (4) evaluation of alternative options, (5) identification of the chosen alternative option, and (6) monitoring and evaluation.

One of the key challenges in conducting RIA is the choice of the most appropriate methodology for impact assessment and comparison of alternative regulatory options, such as [27]:

- Least cost analysis
- Cost-effectiveness analysis (CEA - Cost-effectiveness analysis)
- Cost-benefit analysis (CBA - Cost-benefit analysis)
- Multi-criteria analysis (MCA - Multi-criteria analysis)

Considering the nature of the problem, a multi-criteria analysis of policy options was chosen, considering the regulatory criteria that should be analyzed when adopting new technology and adopting regulations for that technology, such as investment in new technologies, infrastructure accessibility, security, ethical issues, etc.

3.1. Analytical Hierarchy Process (AHP)

The AHP method is one of the most famous and in recent years the most used methods for multi-criteria decision-making, which was developed in the 1972s by Thomas L. Saaty, and its popularity stems from the fact that it is very close to the way an individual solves complex problems, breaking them down into simpler components: objective, criteria, and alternatives [28].

The AHP method is carried out by comparing in pairs, where the priority that one option has in relation to the other is expressed by descriptive values, using the Saaty scale [28] that ranks the relationship between the two options being compared, as shown in the table 1.

Participants are asked to determine the relative priorities of each element by comparing them in pairs, with respect to each element using Saaty's nine-number intensity scale (1, 2, ... 9).

Table 1. Saaty's relative importance scale

Intensity of importance	Definition	Explanation
1	Equal importance	A and B contribute equally to the objective
3	Moderate importance of one over another	Slightly favor A over B
5	Essential importance	Strongly favor A over B
7	Demonstrated importance	Element A is favored very strongly over B
9	Absolute importance	The evidence favoring element over A over B is of the highest possible order of importance
2, 4, 6, 8	Intermediate values between the two adjacent judgments	When compromise is needed. For example, 4 can be used for the intermediate value between 3 and 5
1/3, 1/4, /5, 1/6, 1/7, /8, 1/9	These values represent the opposite of the reciprocal whole numbers. For example, if "9" means that x is much more important than y, "1/9" means that x is much less important than y.	
1 – Equal importance, 3 – Moderate importance of one over another, 5 – Essential importance, 7 – Demonstrated importance, 9 – Absolute importance		

The AHP method allows checking the consistency of estimates when comparing in pairs. Using the consistency index CI = (λmax – n) /(n - 1) the consistency ratio CR = CI/RI is calculated, where RI is the random consistency index (consistency index for matrices of order n of randomly generated comparisons in pairs).

λmax is the maximum value of the matrix A, and n is the number of rows of the matrix.

The difference λ max – n, is used in measuring the consistency of estimates, and the smaller the difference, the more consistent the estimate.

CI = (λ max – n) /(n - 1)

CR = CI/RI, where RI is the random consistency index [28] taken from Table 2.

Table 2. The Random Consistency Index

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

If the CR value is ≤ 0.10, the assessment value is acceptable, and in other cases it is necessary to investigate the reasons for the unacceptably high inconsistency of assessments.

4. AI Governance for closing the digital divide

4.1. Concept of Governance

There is no unique definition of governance. UNDP defines governance *as "the exercise of political, economic and administrative authority in the management of a country's affairs at all levels. Governance comprises the complex mechanisms, processes and institutions through which citizens and groups articulate their interests, mediate their differences and exercise their legal rights and obligations. Good governance has many attributes. It is participatory, transparent and accountable. It is effective in making the best use of resources and is equitable. And it promotes the rule of law*.'' [29].

Additionally, UNDP underlines ''*The goal of governance initiatives should be to develop capacities that are needed to realise development that gives priority to the poor, advances women, sustains the environment and creates needed opportunities for employment and other livelihoods."* [29].

The concept of governance is old as human civilization. Author in [30] presents the historical evolution of the term ''governance'' from being synonymous with government into a broader and complex term. Governance can be used in various contexts, such as corporate governance, global governance, national governance, local governance, good governance and modern governance.

Simply, ''governance'' is the process of decision making and the process by which decisions are implemented or not. Good governance is characterized as accountable, transparent, responsive, effective and efficient, participatory, consensus oriented, equitable and inclusive and follows the rule of law [31]. This critical role of good governance in promoting sustainable development globally is discussed in [32].

4.2. Governance Gap

The digital world is currently a world of division and inequality, a trend that has become increasingly apparent over the years. Many populations have been left on the edge of the digital revolution.

Digital technologies have advanced dramatically and are the main drivers of wealth and economic power, but they are increasingly concentrated in a few countries and platforms. Massive investment in technology has not resulted in shared prosperity,

exacerbating global inequalities. All these divisions are exacerbated by a huge governance gap, where new technologies lack basic regulation, and public institutions struggle to find an effective response to these challenges. An illustration of the divided digital world, shown by the UN, is given in Figure 1. [33]

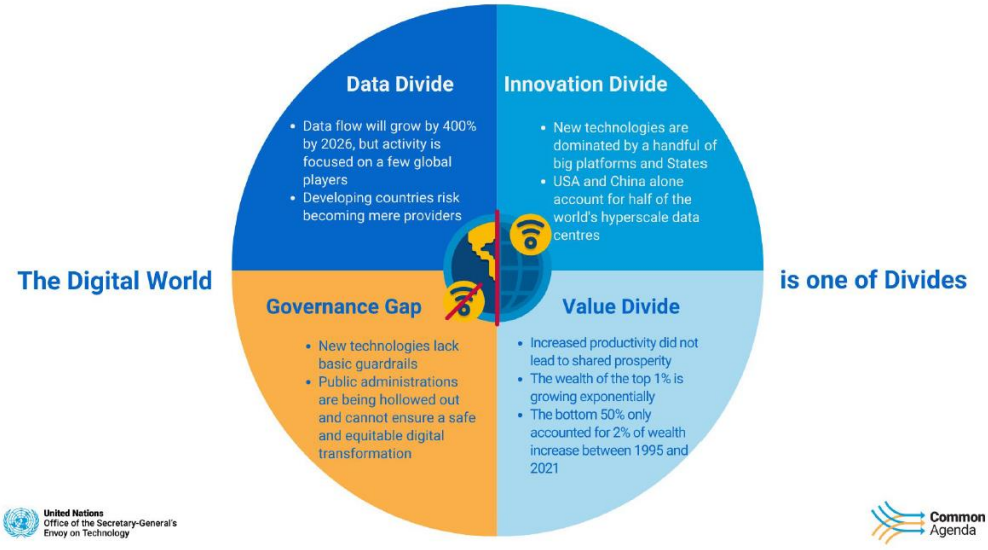


Fig. 1. The Digital World is one of Divides

The UN General Assembly recognized AI potential to accelerate and enable progress towards reaching the SDG by adopting the first global resolution on AI on 21 March 2024. Resolution A/78/L.49 on "Seizing the opportunities of safe, secure and trustworthy artificial intelligence systems for sustainable development" emphasizes that safe and reliable AI systems have the potential to accelerate progress towards achieving sustainable development goals. They are characterized by being human-centered, reliable, explainable, ethical, inclusive, with full respect, promotion and protection of human rights and international law, privacy protection, oriented towards sustainable development, and responsible. It must be respected throughout the life cycle including the phases: pre-design, engineering, development, evaluation, testing, implementation, use, sale, procurement, system operation and withdrawal [34]. The adoption of this UN resolution sets a commitment to closing the digital divide within and between nations and using this technology to advance common priorities around sustainable development.

4.3. AI Governance

According to conducted research in [35], AI governance introduction is a relatively recent phenomenon, as in 2016 no company and only one country i.e. the United States had released official documents explicitly governing AI. A growing number of AI-focused guides, frameworks and principles have started since 2016 when the Cambridge Analytica scandal occurred showing the harms of misused AI. The examined documents vary greatly in formality and format, but the convergence is evident over time at the level of principle. AI governance principles include Fairness, Accountability, Transparency/explainability, Ethics/human-centricity, Safety/security, and Privacy. Other AI governance principles also appear, in particular: Sustainability, Professional responsibility of developers and Technical competence.

The UN invites for the construction of a common framework for AI, and for the purpose of support, the UN AI Advisory Body was formed and recommendations on AI ethics were developed by the UN body.

The Interim report of the UN AI Advisory Body [36] states the following principles:

1. AI should be governed inclusively, by all and for the benefit of all
2. AI must be governed in the public interest
3. AI governance should be built in step with data governance and the promotion of data commons
4. AI governance must be universal, networked and rooted in multistakeholder collaboration
5. AI governance should be anchored in the UN Charter, International Human Rights Law, and other agreed international commitments such as the Sustainable Development Goals

5. AI lifecycle phases and AI actors

5.1. Ethical principles

In the Ethical Guidelines for Trusted Artificial Intelligence published in 2018 [37], by the independent high-level expert group on artificial intelligence (AI HLEG) established by the European Commission, four ethical principles are highlighted, which must be respected when developing, introducing and uses of AI systems:

- Respect for human autonomy.
- Prevention of damage.
- Fairness.
- Explainability.

These principles are translated into seven requirements for reliable AI, shown in Figure 2, which should be implemented and evaluated during the life cycle of the AI system [37]:

- Human agency and surveillance including fundamental rights, human agency and human surveillance
- Technical resilience and security including attack resistance and security, backup plan and overall security, accuracy, reliability, and repeatability
- Privacy and data management including respect for privacy, data quality and integrity and access to data
- Transparency including traceability, explainability and communication
- Diversity, non-discrimination, and equity including avoidance of unfair bias, accessibility and universal design and participation.
- Societal and environmental well-being including sustainability and environmental friendliness, social performance, society and democracy
- Accountability including verifiability, mitigation and reporting, trade-offs, and legal protection.

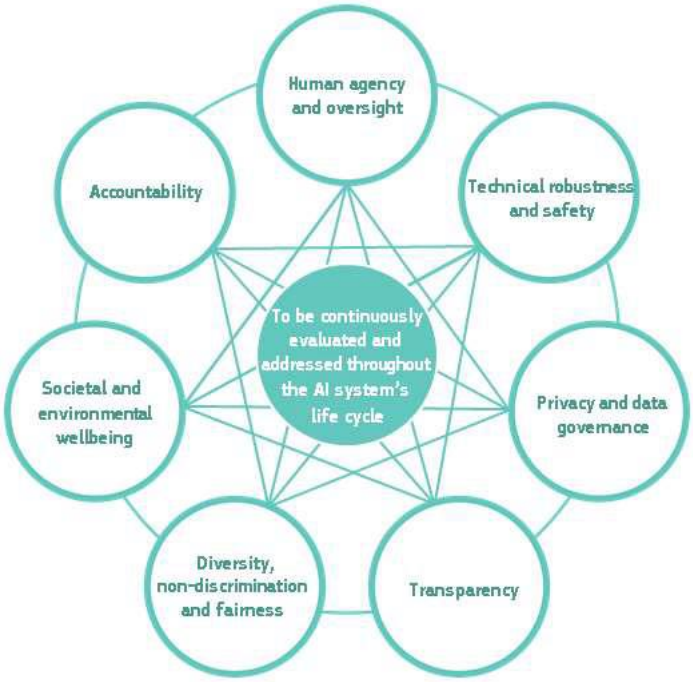


Fig. 2. Seven elements interrelationship

These requirements are applicable to numerous participants, such as:

- Developers
- Deployers
- End-users and a broader society

5.2. AI system life cycle from OECD and NIST perspective

To support policymakers, regulators, legislators and others to characterize AI systems deployed in specific contexts, the Organization for Economic Co-operation and Development (OECD) has developed a framework for assessing AI systems from a policy perspective. OECD framework is presented in Figure 3. [38]:

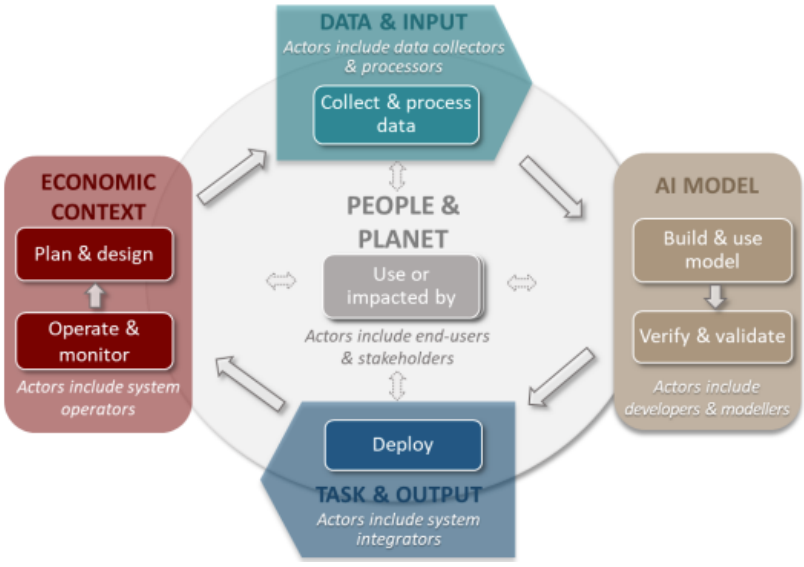


Fig. 3. OECD Framework for AI systems clasification

There are several views of the AI life cycle, and from the aspect of AI system governance, the inclusion of testing, evaluation, verification, and validation processes during the life cycle is crucial, as it is presented in Figure 4. [39], by US National institute of Standards and Technology (NIST) based on the modification of the life cycle framework presented by the Organization for Economic Co-operation and Development (OECD).

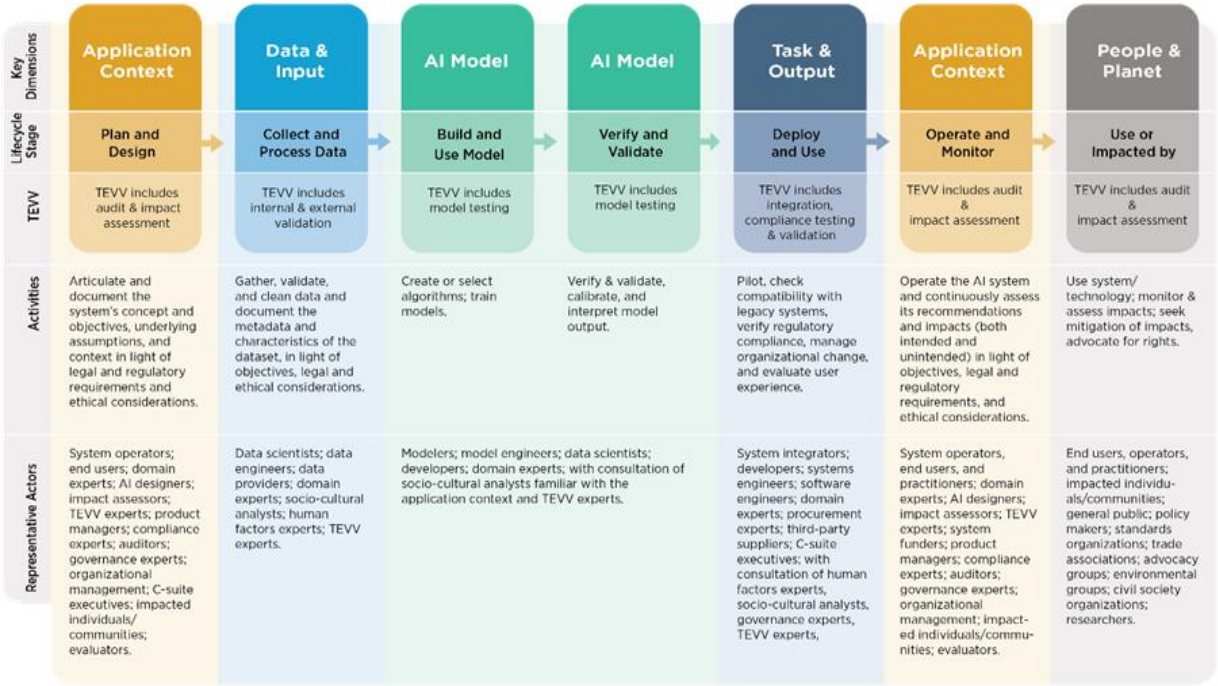


Fig. 4. AI system life cycle phases

The life cycle of an AI system is like the life cycle of traditional products and includes the traditional phases: Design, Development, Implementation, Operation and Monitoring, and Retirement. The two intermediate phases are: Verification and validation and Re-evaluation in which, as with any other product, it is decided whether it is necessary to return to the previous phase to harmonize the characteristics with the desired and re-commissioning or, otherwise, withdrawal from use.

The conclusion of the conducted research is that the basic differences in the life cycle of traditional products and AI systems are related to the aspect of data, security, ethical issues, and regulatory compliance in each phase of the life cycle. Additional aspects include multi-disciplinarity, number of participants, intertwining, dynamics, and unpredictability. Answering these aspects is the basis of effective AI governance. From a governance perspective, interesting AI participants identified by NIST are: Socio-cultural

analysts, diversity, equity, inclusion and accessibility experts, members of vulnerable groups, human factors experts, legal and privacy management experts, and socio- cultural and contextual factors associated with the implementation setting.

The AI participants identified in the ISO/IEC22989 standard from a governance perspective are AI Auditor, AI Evaluator, Policy Maker and Regulator [40]. However, they are only related to the process of verification and validation and re-evaluation, where the AI evaluator and AI auditor are also present in the work and monitoring phase. That is, we observe that these participants were not identified in the initial phase and the design and development phase, nor in the withdrawal phase.

5.3. AI actors and AI system life cycle identification

Based on the research, we proposed an AI model that includes the standard life cycle stages characteristic of any other product, with the difference being reflected in the AI participants.

In contrast to the analyzed approaches, in addition to the already identified participants, our conclusion is that it is necessary to include AI evaluators and AI auditors in all phases of the life cycle and given that assessments are needed at the very beginning, as well as during the design and development of the model, because from the entire process, its changes or withdrawal depends on it. Also, with the withdrawal of AI systems from use, impact assessments are needed, primarily from the ecological aspect, the protection of human health and life, and other aspects. In this regard, specific AI participants from the aspect of internal management are AI evaluators, domain experts, AI auditor - regulatory expert, AI Ethics expert, AI Security Specialist, AI data protection officer.

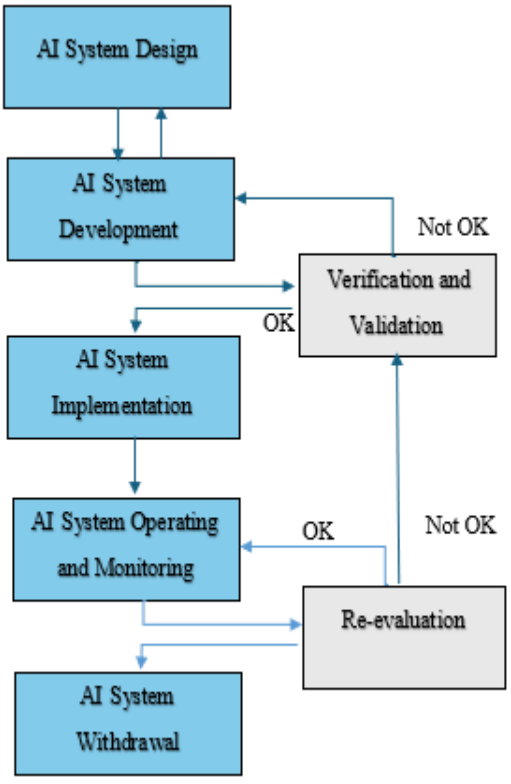
AI systems will be integrated in all areas of human life. Due to the application of AI in numerous sectors and the numerous principles that should be respected that will be part of the regulatory framework, ethical guidelines, standards, and other relevant recommendations, from the very beginning experts should be hired who will be familiar with regulation, ethical guidelines, security and domain expertise. That is why it is necessary to include: an Ethics expert, Data protection officer, Security specialist, AI auditor who will monitor compliance with the AI Act and other regulations.

The approach presented by OECD, NIST and ISO/IEC22989 shows the complexity of the AI life cycle characterized by large number of participants. From the governance aspect, the inclusion of testing, evaluation, verification, and validation processes during the life cycle, as shown in the NIST modification of the OECD framework, is crucial. From the detailed list of AI participants identified by NIST, we single out the participants from the AI governance aspect:

- Socio-cultural analysts, experts in the field of diversity, equality, inclusion and accessibility, members of vulnerable groups, experts in human factors
- Legal and privacy management experts and experts in socio-cultural and contextual factors related to the implementation setting.

ISO/IEC22989 presented the participants by stages of the AI life cycle, in which the AI Auditor, AI Evaluator, Policy Maker and Regulator were identified. However, they are only related to the process of verification and validation and re-evaluation, where the AI evaluator and AI auditor are also present in the work and monitoring phase. This means that these participants are not identified in the initial phase and the design and development phase, nor in the withdrawal phase.

Our proposed AI model is presented in Figure 5. and implies the inclusion of AI evaluators and AI auditors in all phases of the life cycle, considering that assessments are needed at the very beginning, as well as during the design and development of the model, because the entire process, its changes or withdrawal depends on it. Also, with the withdrawal of AI systems from use, impact assessments from environmental and other aspects are required. The AI auditor should monitor compliance with the AI Act and other relevant standards, policies, and legal requirements. An ethical expert is also necessary from the very beginning who will monitor compliance with the Ethical Guidelines. An AI security specialist is also essential throughout the lifecycle. Considering the GDPR provisions, if the underlying activities consist of the processing of sensitive personal data on a large scale or in a form where the data processing has a far-reaching impact on the rights of the data subject, it is necessary to involve a Data Protection Officer (DPO). If there are no legal obligations, companies can assign the role of DPO on a voluntary basis. An internal employee can be appointed as an internal DPO or an external DPO who must provide expertise in data protection law and information security. The Privacy Impact Assessment (PIA) or Data Protection Impact Assessment (DPIA) instrument was introduced by Article 35 of the GDPR [41].



AI Actors

• AI developers (AI Prompt Engineer, Generative Design Specialist, AI Content Reviewer/Content Auditor, AI Trainer)
• Data experts
• AI system integrator
• Data provider
• AI platform provider
• Provider of AI products or services
• Data provider
• Domain experts
• AI evaluators dealing with the performance of AI systems
• AI maintenance expert
• AI customer
• AI end user
• Entities under the influence of AI systems
• AI system impact evaluators
• Management – management
• Procurement

Verification and validation and re-validation

Internal evaluation - the whole life cycle
• AI evaluators dealing with the performance of AI systems
• Domain experts
• AI security specialist
• AI Ethics Expert
• AI Data Protection Officer
• AI auditors who deal with determining compliance with relevant standards, policies and legal requirements.

External evaluation before implementation and during operation
• Regulator
• Policy maker

Fig. 5. AI system life cycle phases and AI actors

6. AI relevant legislation

IoT and AI should be considered from different aspects, which means that the preparation of the rules should cover a wide range, from the protection of end users, liability obligations and compensation for possible damages, security, regulations related to electronic communications, privacy, data protection, copyright, protection workers, the environment, and many others. Relevant legislation must be applicable for the future without limiting technological development.

The UN formed the UN AI Advisory Body, which prepared an Interim Report in which the principles to be followed in the formation of new artificial intelligence governance institutions were identified.

Human rights protection and ethics are of priority, with existing international human rights instruments still applicable, and numerous ethical guidelines available that can be applied, such as those prepared by UNESCO.

The EU is an example of setting global standards in this area, starting with the GDPR, which has become the "gold standard" for data protection in the world. This success will most likely be repeated with the AI Act, whose draft from 2021 was finally agreed upon in March 2024 after long negotiations and is the first law of its kind in the world [42].

The legislative framework in the EU is an example of proactive one with a set of laws covering a wide range of areas applicable to AI and IoT. The set includes legislation related to data, electronic communications, cyber security, online platforms, and consumer protection. In this regard, we can highlight some of relevant documents as:

Human Rights Protection and AI Ethics

- UN Universal Declaration of Human Rights (UDHR)
- UN Guiding Principles on Business and Human Rights

- European Convention on Human Rights
- Charter of Fundamental Rights of the European Union
- UNESCO Recommendation on the Ethics of Artificial Intelligence

AI Related Legislative

- COM (2021)206 Proposal for a Regulation laying down harmonized rules on artificial Intelligence (Artificial Intelligence Act)
- COM/2022/496 Proposal for a Directive on adapting non-contractual civil liability rules to artificial intelligence (AI Liability Directive)

Data Related Legislative

- General Data Protection Regulation 2018/1725 (GDPR)
- Directive 2002/58/EC on privacy and electronic communications
- COM/2017/010 Proposal for a Regulation on Privacy and Electronic Communications
- Regulation (EU) 2018/1807 on a framework for the free flow of non-personal data in the EU
- Directive (EU) 2019/1024 on open data and the re-use of public sector information (recast)
- Regulation (EU) 2022/868 on European data governance (Data Governance Act)
- Regulation (EU) 2023/2854 on harmonised rules on fair access to and use of data (Data Act)

Electronic Communications

- Directive (EU) 2018/1972 establishing the European Electronic Communications Code

Cybersecurity Legislation

- Regulation (EU) 2019/881 on ENISA (the European Union Agency for Cybersecurity) and on information and communications technology cybersecurity certification (Cybersecurity Act)
- COM (2022)454 Proposal for a Regulation on horizontal cybersecurity requirements for products with digital elements
- Directive (EU) 2022/2555 on measures for a high common level of cybersecurity across the Union (NIS 2 Directive)

Consumer Protection Legislative

- Directive 2019/2161 as regards the better enforcement and modernisation of Union consumer protection rules (Omnibus Directive)
- Directive 2019/771 on certain aspects concerning contracts for the sale of goods (Sales of Goods Directive)
- Directive 2019/770 on certain aspects concerning contracts for the supply of digital content and digital services
- COM/2021/346 Proposal for a Regulation on general product safety
- COM/2022/495 Proposal for a Directive on liability for defective products
- Regulation (EU) 2019/1020 on market surveillance and compliance of products

Online Platforms Legislative

- Regulation 2019/1150 on promoting fairness and transparency for business users of online intermediation services (Platform to Business Regulation)
- Directive 2000/31/EC on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market ('Directive on electronic commerce')
- Regulation (EU) 2022/1925 on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and (EU) 2020/1828 (Digital Markets Act)
- Regulation (EU) 2022/2065 on a Single Market for Digital Services and amending Directive 2000/31/EC (Digital Services Act)

8. National AI Strategy

In October 2022, research was implemented using the AHP method. The research resulted in obtaining quantitative data through a questionnaire consisting of 28 pairwise comparisons of a total of eight indicators that represent the common areas of AI strategies listed in [11].

The policy announcements of AI strategy worldwide can be categorized into eight areas of public policy [11].

- Scientific Research
- AI Talent Development
- Skills and the Future of Work
- Industrialization of AI Technologies
- Ethical AI Standards
- Data and Digital Infrastructure
- AI in the Government
- Inclusion and Social Well-Being

Determining AI Strategy problem is structured as presented in Figure 6.

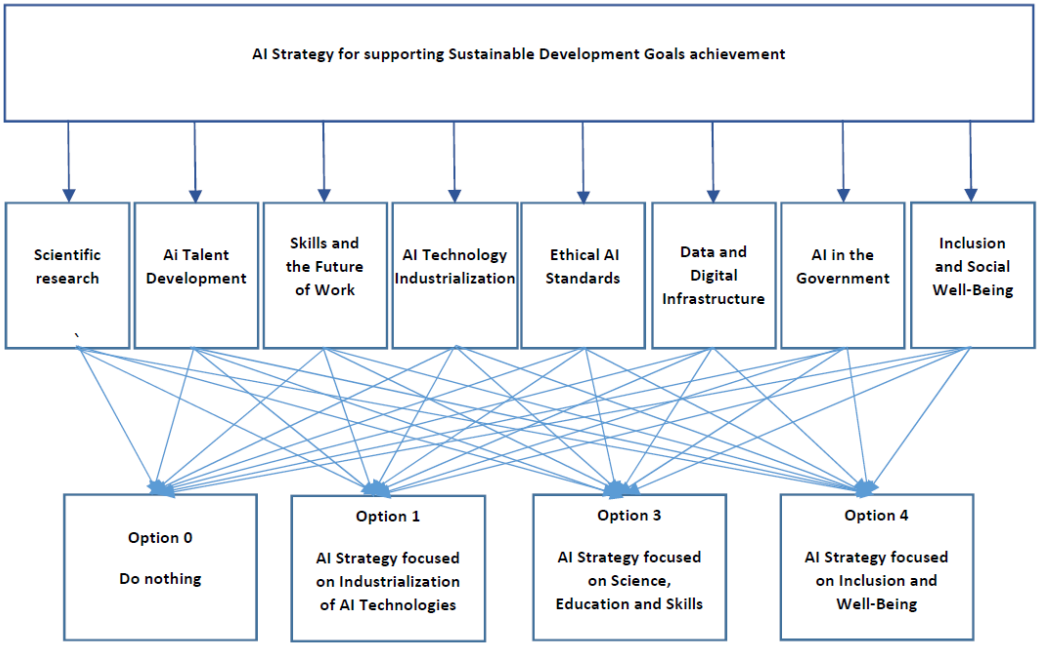


Fig. 6. AI Strategy problem structuring

After the completed questionnaires were collected, in which 8 criteria were compared, using Satty's rating scale, Table 3 was created. In Table 3, the answers from the questionnaire are summarized in the first column, the value of the arithmetic mean is entered in the second column by dividing the sum of the answers by 10, and the reciprocal value of the second column is entered in the third column, in order to form a matrix.

Table 3. Sum of collected responses

	How DOMINANT is A compared to B?		Sum	Sum /10	1/ (Sum /10)
	A	B			
	Inclusion and Social Well-Being	AI Talent Development	17.96	1.80	0.56
	Inclusion and Social Well-Being	Skills and the Future of Work	13.85	1.38	0.72
	Inclusion and Social Well-Being	Industrialization of AI Technologies	16.81	1.68	0.60
	Inclusion and Social Well-Being	Ethical AI Standards	15.03	1.50	0.67
	Inclusion and Social Well-Being	Data and Digital Infrastructure	20.76	2.08	0.48
	Inclusion and Social Well-Being	AI in the Government	13.56	1.36	0.74
	Inclusion and Social Well-Being	Scientific Research	7.82	0.78	1.28
	AI Talent Development	Skills and the Future of Work	14.79	1.48	0.68
	AI Talent Development	Industrialization of AI Technologies	16.81	1.68	0.59
	AI Talent Development	Ethical AI Standards	20.31	2.03	0.49
	AI Talent Development	Data and Digital Infrastructure	7.08	0.71	1.41
	AI Talent Development	AI in the Government	16.97	1.70	0.59
	AI Talent Development	Scientific Research	5.85	0.59	1.71
	Skills and the Future of Work	Industrialization of AI Technologies	28.44	2.84	0.35
	Skills and the Future of Work	Ethical AI Standards	12.31	1.23	0.81
	Skills and the Future of Work	Data and Digital Infrastructure	16.06	1.61	0.62
	Skills and the Future of Work	AI in the Government	10.10	1.01	0.99
	Skills and the Future of Work	Scientific Research	10.31	1.03	0.97
	Industrialization of AI Technologies	Ethical AI Standards	11.47	1.15	0.87
	Industrialization of AI Technologies	Data and Digital Infrastructure	6.84	0.68	1.46
	Industrialization of AI Technologies	AI in the Government	18.92	1.89	0.53
	Industrialization of AI Technologies	Scientific Research	11.85	1.19	0.84
	Ethical AI Standards	Data and Digital Infrastructure	25.42	2.54	0.39
	Ethical AI Standards	AI in the Government	19.03	1.90	0.53
	Ethical AI Standards	Scientific Research	17.95	1.80	0.56
	Data and Digital Infrastructure	AI in the Government	21.57	2.16	0.46
	Data and Digital Infrastructure	Scientific Research	7.93	0.79	1.26
	AI in the Government	Scientific Research	9.73	0.97	1.03

Based on the questionnaire, a reciprocal matrix is formed by filling in the values from the last and penultimate columns of the questionnaire. The initial matrix A = (aij) of size 8 × 8, where aij for i = 1, 2...8 and j = 1, 2,...8 is the element of the matrix in the i-th row and j-th column is shown in table 4. At the same time, the sum of the columns is calculated so that the matrix can be normalized.

Initial Matrix A

Table 4. Initial Matrix A

A	Crit.1	Crit.2	Crit.3	Crit.4	Crit.5	Crit.6	Crit.7	Crit.8
Crit. 1.	1.00	1.80	1.38	1.68	1.50	2.08	1.36	0.78
Crit. 2.	0.56	1.00	1.48	1.68	2.03	0.71	1.70	0.59
Crit. 3.	0.72	0.68	1.00	2.84	1.23	1.61	1.01	1.03
Crit. 4.	0.60	0.59	0.35	1.00	1.15	0.68	1.89	1.19
Crit. 5.	0.67	0.49	0.81	0.87	1.00	2.54	1.90	1.80
Crit. 6.	0.48	1.41	0.62	1.46	0.39	1.00	2.16	0.79
Crit. 7.	0.74	0.59	0.99	0.53	0.53	0.46	1.00	0.97
Crit. 8.	1.28	1.71	0.97	0.84	0.56	1.26	0.88	1.00
Sum:	6.04	8.27	7.61	10.91	8.39	10.34	11.89	8.14

From the initial matrix A, by dividing the elements of the matrix by the sum, a normalized matrix is obtained (eg a21 = 0.56, if we divide this value by the sum of the elements of the first column, we get 0.56/6.04 = 0.09).

Normalized matrix B = Initial matrix A /sum of columns of matrix A

Based on the normalized matrix, the weight of the criteria is calculated using the arithmetic mean of the sum of the elements of the rows of the matrix (e.g. Sum: 0.17 + 0.22 + 0.18 + 0.15 + 0.18 + 0.20 + 0.11 + 0.10 = 1.31. then the arithmetic mean is calculated as 1.31 /8 = 0.16 and it represents the weight of the criteria). The values representing the weight of the criteria form the last column of the matrix presented in Table 5.

Table 5. Normalized Matrix B

B	Crit.1	Crit.2	Crit.3	Crit.4	Crit.5	Crit.6	Crit.7	Crit.8	Sum	Sum/8
Crit. 1.	0.17	0.22	0.18	0.15	0.18	0.20	0.11	0.10	1.3087	0.1636
Crit. 2.	0.09	0.12	0.19	0.15	0.24	0.07	0.14	0.07	1.0868	0.1358
Crit. 3.	0.12	0.08	0.13	0.26	0.15	0.16	0.08	0.13	1.1071	0.1384
Crit. 4.	0.10	0.07	0.05	0.09	0.14	0.07	0.16	0.15	0.8159	0.1020
Crit. 5.	0.11	0.06	0.11	0.08	0.12	0.25	0.16	0.22	1.1019	0.1377
Crit. 6.	0.08	0.17	0.08	0.13	0.05	0.10	0.18	0.10	0.8886	0.1111
Crit. 7.	0.12	0.07	0.13	0.05	0.06	0.04	0.08	0.12	0.6828	0.0853
Crit. 8.	0.21	0.21	0.13	0.08	0.07	0.12	0.07	0.12	1.0082	0.1260

Matrix C = Initial matrix A criteria weights*

A consistency check is then calculated to check whether the calculated values are correct or not. The values of the initial matrix A are multiplied by the calculated weight of the criteria and matrix C is obtained.

By adding the values of the elements of each row, a weighted value of the sum is obtained. (e.g. in the first row the sum is 0.16 + 0.29 + 0.23 + 0.27 + 0.25 + 0.34 + 0.22 + 0.13 = 1.89). This value is divided by the weight of the criteria from matrix B and the value of the ratio is obtained (During the calculation, the values are rounded to two decimal places, but in the table the last rows are shown with four decimal places for accuracy, e.g. if you divide 1.89/0.16 = 11.81, but if are presented to four decimal places, the exact value is 1.8938/0.1636 = 11.5768 or 11.57). Matrix C is shown in Table 6.

Table 6. Matrix C

C	Crit.1	Crit.2	Crit.3	Crit.4	Crit.5	Crit.6	Crit.7	Crit.8	Ponder	Weight	Rate
Crit. 1.	0.16	0.29	0.23	0.27	0.25	0.34	0.22	0.13	1.8938	0.1636	11.5768
Crit. 2.	0.08	0.14	0.20	0.23	0.28	0.10	0.23	0.08	1.3229	0.1358	9.7383
Crit. 3.	0.10	0.09	0.14	0.39	0.17	0.22	0.14	0.14	1.4007	0.1384	10.1209
Crit. 4.	0.06	0.06	0.04	0.10	0.12	0.07	0.19	0.12	0.7598	0.1020	7.4500
Crit. 5.	0.09	0.07	0.11	0.12	0.14	0.35	0.26	0.25	1.3887	0.1377	10.0823
Crit. 6.	0.05	0.16	0.07	0.16	0.04	0.11	0.24	0.09	0.9242	0.1111	8.3205
Crit. 7.	0.06	0.05	0.08	0.04	0.04	0.04	0.09	0.08	0.4954	0.0853	5.8049
Crit. 8.	0.16	0.22	0.12	0.11	0.07	0.16	0.11	0.13	1.0707	0.1260	8.4964
Sum											71.5902

Checking the consistency of the solution

We calculate the consistency ratio CR according to the formula CR = CI/RI.

Consistency index CI = (λmax – n) /(n - 1)

λmax is the maximum value of the matrix A, and n is the number of rows of the matrix.

λmax is obtained by the arithmetic mean of the ratio, i.e. values of elements from the last column of matrix C (ie 11.57 + 9.74 + 10.12 + 7.45 + 10.08 + 8.32 + 5.80 + 8.50 = 71.59), which in the case of 8 rows of the matrix finally amounts to λmax = 71.59/8 = 8.95.

CI = (8.95 – 8)/ (8-1) = 0.95/7 = 0.14

The random consistency index according to Satty's table, for the case n = 8, is RI= 1.41.

Taking into account the CI and RI values, the assessment of the relative importance (weight) of the criteria (alternatives) is CR = 0.14/1.41 = 0.099, which is considered acceptable.

Given that CR = 0.099, the calculated values are correct, and it follows that the most significant criterion is 1, Inclusion and social well-being, according to the highest value in the last column in Table 6. According to the values of the last column from table 7.4, we can show the importance of criteria in Table 7.

Table 7. Criteria Importance Ranking

	Criteria	Rate	Importance
	Inclusion and Social Well-Being	11.58	**1**
	AI Talent Development	9.74	4
	Skills and the Future of Work	10.12	3
	Industrialization of AI Technologies	7.45	7
	Ethical AI Standards	10.08	**2**
	Data and Digital Infrastructure	8.32	6
	AI in the Government	5.80	8
	Scientific Research	8.50	5

According to these results, when creating a national AI strategy, the highest priority according to civil servants from developing countries is given to activities aimed at inclusion and social well-being

Determination of the most significant alternative

It is necessary to create a matrix for the alternatives that would be compared with each other, so first each criterion is compared with all the alternatives.

In case of alternatives, the values of the columns in the matrix are filled in according to the principle of giving a rating of 0.1, 0.2; 0.3 and 0.4 (the sum is 1), according to the assessment to what extent a certain criterion is related to the alternative.

Let's take an example of an assessment: Inclusion and social well-being. The highest value of 0.4 is assigned to Alternative 4 because it implies a solution with a focus on social good; 0.3 is given to Alternative 3 a solution with a focus on science, education and skills; 0.2 is given to Alternative 2 focusing on the industrialization of AI technologies and 0.1 is given to Alternative 1.

Similarly, assessments were made for other criteria, as shown in Table 8.

Table 8. The most significant alternative assessment

Criteria	Criteria Weight	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Inclusion and Social Well-Being	0.1636	0.10	0.20	0.30	0.40
AI Talent Development	0.1358	0.10	0.20	0.40	0.30
Skills and the Future of Work	0.1384	0.10	0.30	0.40	0.20
Industrialization of AI Technologies	0.1020	0.10	0.40	0.30	0.20
Ethical AI Standards	0.1377	0.10	0.30	0.20	0.40
Data and Digital Infrastructure	0.1111	0.10	0.30	0.20	0.40
AI in the Government	0.0853	0.10	0.20	0.30	0.40
Scientific Research	0.1260	0.10	0.20	0.40	0.30

Then the weight and alternatives are multiplied, as shown in Table 9. According to the mentioned alternatives, a matrix was created for the alternatives in order to compare them with each other, and each criterion is compared with all the alternatives.

In order to get the final result, the values in each row are added together.

Alternative 4 has the highest value of the sum of values and according to the implemented AHP method, it is the best choice.

Table 9. Matrix of alternatives determination

Criteria	Weight* Alternative 1	Weight* Alternative 2	Weight* Alternative 3	Weight* Alternative 4
Inclusion and Social Well-Being	0.0164	0.0327	0.0491	0.0654
AI Talent Development	0.0136	0.0272	0.0543	0.0407
Skills and the Future of Work	0.0138	0.0415	0.0554	0.0277
Industrialization of AI Technologies	0.0102	0.0408	0.0306	0.0204
Ethical AI Standards	0.0138	0.0413	0.0275	0.0551
Data and Digital Infrastructure	0.0111	0.0333	0.0222	0.0444
AI in the Government	0.0085	0.0171	0.0256	0.0341
Scientific Research	0.0126	0.0252	0.0504	0.0378
Sum	0.1000	0.2591	0.3151	0.3257

According to these results, when creating a national AI strategy, according to the opinion of civil servants from developing countries, the option of creating an AI strategy with a focus on inclusion and social well-being is preferred, as shown in table 10.

Table 10. Alternatives Ranking

Criteria	Priorities	Ranking
Alternative 1 – Do nothing	0.1000	4
Alternative 2 – AI Strategy focused on Industrialization of AI Technologies	0.2591	3
Alternative 3 – AI Strategy focused on Science, Education and Skills	0.3151	2
Alternative 3 – AI Strategy focused on Inclusion and Well-Being	0.3257	1

Based on the multi-criteria analysis conducted using the AHP method, the AI strategy was selected based on the responses collected from civil servants from developing countries. According to the results obtained during the creation of the national AI strategy, according to the opinion of civil servants from developing countries, the option of creating an AI strategy with a focus on inclusion and social well-being is preferred, which is also applicable for BiH as a developing country.

Main goal: National AI Strategy with a focus on inclusion and social well-being. The special objectives of the national AI Strategy, in order of importance, are: Inclusion and social well-being; Ethical AI standards, Development of AI skills and the future of work; Encouraging the development of AI talent; Science and research; Data and digital infrastructure; Industrialization of AI technologies and AI in government.

9. AI and IoT Regulatory Framework

In the period from 04.10. - 05.10.2023. The Sixth Digital Summit of the Western Balkans was held in Sarajevo, the largest regional digital event on cooperation in the field of digital transformation, hosted by the Ministry of Communications and Transport of Bosnia and Herzegovina. On that occasion, expert research was conducted using the Analytical Hierarchy Process (AHP) method.

In the group of 24 respondents, civil servants, representatives of civil society, academia and industry were included, who are assumed to be familiar with advanced technologies, taking into account their participation in the Summit.

We present the structuring of the problem of creating a regulatory solution with a schematic representation in Figure 7.
The problem of creating a regulatory solution is broken down into the following elements below.
The goal is to select priorities when determining the regulatory solution.

The eight criteria taken into account are as follows:

- Investing in AI research, high-speed networks and computing resources
- Protection of personal data and privacy
- Establishment of AI ethical guidelines by the business
- Adopting an AI strategy and an AI regulatory framework
- Raising awareness of AI benefits and dangers
- Banning potentially dangerous AI and monitoring AI development
- Free development of the AI market without new AI regulation
- Gradual AI regulation in accordance with the development of the AI market

Four options for regulatory action were presented according to the document of the regulatory impact assessment conducted in the European Union [14] and United Kingdom [15]. Alternatives to the regulatory approach that have been considered are:

- Option 0 – Do nothing
- Option 1 – Principle of doing the minimum
- Option 2 – Delegate the task to existing regulators with an obligation to respect the principles, supported by central AI regulatory functions
- Option 3 – Centralized AI regulator with setting new legal requirements for AI systems (do the maximum)

We present the structuring of the problem of creating a regulatory solution with a schematic representation in Figure 7.

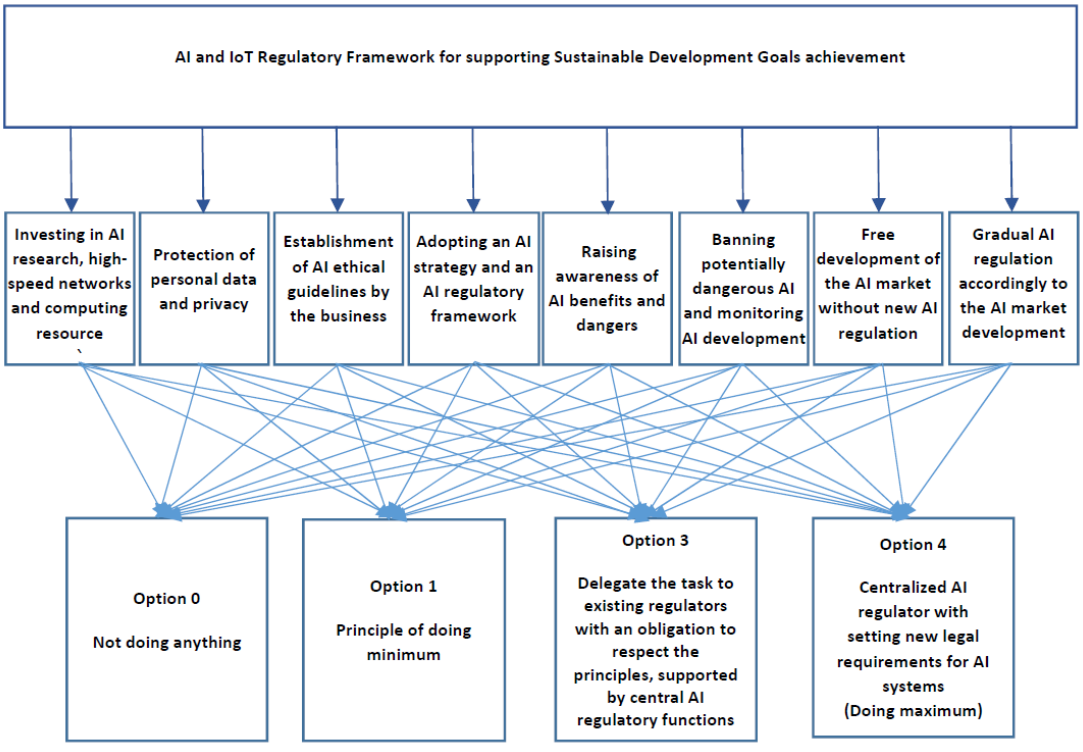


Fig. 7. AI Regulatory Framework problem structuring

Due to the fact that the calculation could not achieve the necessary consistency of the solution on several occasions, a detailed analysis of the 24 questionnaires took into account 19 questionnaires, while 5 questionnaires were rejected (with the conclusion that the questionnaires were filled out randomly without thinking and concentration).

After the completed questionnaires were collected, in which 8 criteria were compared, using Satty's rating scale [30], Table 11. was created. In Table 11. are summarized the answers from the questionnaire in the first column, the value of the arithmetic mean is

written in the second column by dividing the sum of the answers by 9, and the reciprocal value of the second column is written in the third column, in order to form a matrix.

Table 11. Sum of collected responses

How DOMINANT is A compared to B?				
A	B	Sum	Sum /10	1/ (Sum /10)
Investing in AI research, high-speed networks and computing resource	Protection of personal data and privacy	17.94	0.94	1.06
Investing in AI research, high-speed networks and computing resource	Establishment of AI ethical guidelines by the business	22.72	1.20	0.84
Investing in AI research, high-speed networks and computing resource	Adopting an AI strategy and an AI regulatory framework	27.38	1.44	0.69
Investing in AI research, high-speed networks and computing resource	Raising awareness of AI benefits and dangers	19.48	1.03	0.98
Investing in AI research, high-speed networks and computing resource	Banning potentially dangerous AI and monitoring AI development	14.57	0.77	1.30
Investing in AI research, high-speed networks and computing resource	Free development of the AI market without new AI regulation	46.37	2.44	0.41
Investing in AI research, high-speed networks and computing resource	Gradual AI regulation accordingly to the AI market development	22.13	1.16	0.86
Protection of personal data and privacy	Establishment of AI ethical guidelines by the business	29.38	1.55	0.65
Protection of personal data and privacy	Adopting an AI strategy and an AI regulatory framework	21.54	1.13	0.88
Protection of personal data and privacy	Raising awareness of AI benefits and dangers	31.90	1.68	0.60
Protection of personal data and privacy	Banning potentially dangerous AI and monitoring AI development	28.72	1.51	0.66
Protection of personal data and privacy	Free development of the AI market without new AI regulation	50.19	2.64	0.38
Protection of personal data and privacy	Gradual AI regulation accordingly to the AI market development	36.89	1.94	0.52
Establishment of AI ethical guidelines by the business	Adopting an AI strategy and an AI regulatory framework	12.35	0.65	1.54
Establishment of AI ethical guidelines by the business	Raising awareness of AI benefits and dangers	21.38	1.13	0.89
Establishment of AI ethical guidelines by the business	Banning potentially dangerous AI and monitoring AI development	11.65	0.61	1.63
Establishment of AI ethical guidelines by the business	Free development of the AI market without new AI regulation	26.37	1.39	0.72
Establishment of AI ethical guidelines by the business	Gradual AI regulation accordingly to the AI market development	29.20	1.54	0.65
Adopting an AI strategy and an AI regulatory framework	Raising awareness of AI benefits and dangers	38.73	2.04	0.49
Adopting an AI strategy and an AI regulatory framework	Banning potentially dangerous AI and monitoring AI development	24.44	1.29	0.78
Adopting an AI strategy and an AI regulatory framework	Free development of the AI market without new AI regulation	37.17	1.96	0.51
Adopting an AI strategy and an AI regulatory framework	Gradual AI regulation accordingly to the AI market development	32.14	1.69	0.59
Raising awareness of AI benefits and dangers	Banning potentially dangerous AI and monitoring AI development	13.25	0.70	1.43
Raising awareness of AI benefits and dangers	Free development of the AI market without new AI regulation	43.44	2.29	0.44
Raising awareness of AI benefits and dangers	Gradual AI regulation accordingly to the AI market development	24.72	1.30	0.77
Banning potentially dangerous AI and monitoring AI development	Free development of the AI market without new AI regulation	48.86	2.57	0.39
Banning potentially dangerous AI and monitoring AI development	Gradual AI regulation accordingly to the AI market development	49.47	2.60	0.38
Free development of the AI market without new AI regulation	Gradual AI regulation accordingly to the AI market development	22.10	1.16	0.86

Initial matrix A

Based on the questionnaire, a reciprocal matrix is formed by filling in the values from the last and penultimate columns of the questionnaire. The initial matrix A = (aij) of size 8 × 8, where aij for i = 1, 2...8 and j = 1, 2,...8 is the element of the matrix in the i-th row and j-th column is shown in Table 12. At the same time, the sum of the columns is calculated so that the matrix can be normalized.

Table 12. Initial Matrix A

A	Crit.1	Crit.2	Crit.3	Crit.4	Crit.5	Crit.6	Crit.7	Crit.8
Crit. 1.	1.00	0.94	1.20	1.44	1.03	0.77	2.44	1.16
Crit. 2.	1.06	1.00	1.55	1.13	1.68	1.51	2.64	1.94
Crit. 3.	0.84	0.65	1.00	0.65	1.13	0.61	1.39	1.54
Crit. 4.	0.69	0.88	1.54	1.00	2.04	1.29	1.96	1.69
Crit. 5.	0.98	0.60	0.89	0.49	1.00	0.70	2.29	1.30
Crit. 6.	1.30	0.66	1.63	0.78	1.43	1.00	2.57	2.60
Crit. 7.	0.41	0.38	0.72	0.44	0.44	0.39	1.00	1.16
Crit. 8.	0.86	0.52	0.65	0.59	0.77	0.38	0.88	1.00
Sum:	7.14	5.62	9.17	6.52	9.51	6.65	15.16	12.40

Normalized matrix B

From the initial matrix A, a normalized matrix is obtained by dividing the matrix elements by the sum (eg: a21 = 1.06, if we divide this value by the sum of the elements of the first column, we get 1.06/7.14 = 0.15).

From the normalized matrix, the weight of the criteria is calculated using the arithmetic mean

Normalized matrix B = Initial matrix A /sum of columns of matrix A

Based on the normalized matrix, the weight of the criteria is calculated using the arithmetic mean of the sum of the elements of the rows of the matrix (e.g. Sum: 0.14 + 0.17 + 0.13 + 0.22 + 0.11 + 0.12 + 0.16 + 0.09 = 1.14. then the arithmetic mean is calculated as 1.14 /8 = 0.14 and it represents the weight of the criteria). The values representing the weight of the criteria form the last column of the matrix, which is shown in Table 13.

Table 13. Normalized Matrix B

B	Crit.1	Crit.2	Crit.3	Crit.4	Crit.5	Crit.6	Crit.7	Crit.8	Sum	Sum/8
Crit. 1.	0.14	0.17	0.13	0.22	0.11	0.12	0.16	0.09	1.14	0.1422
Crit. 2.	0.15	0.18	0.17	0.17	0.18	0.23	0.17	0.16	1.40	0.1754
Crit. 3.	0.12	0.11	0.11	0.10	0.12	0.09	0.09	0.12	0.87	0.1084
Crit. 4.	0.10	0.16	0.17	0.15	0.21	0.19	0.13	0.14	1.25	0.1561
Crit. 5.	0.14	0.11	0.10	0.08	0.11	0.10	0.15	0.10	0.88	0.1101
Crit. 6.	0.18	0.12	0.18	0.12	0.15	0.15	0.17	0.21	1.28	0.1598
Crit. 7.	0.06	0.07	0.08	0.07	0.05	0.06	0.07	0.09	0.53	0.0668
Crit. 8.	0.12	0.09	0.07	0.09	0.08	0.06	0.06	0.08	0.65	0.0813

Matrix C = Initial matrix A criteria weights*

A consistency check is then calculated to check whether the calculated values are correct or not. The values of the initial matrix A are multiplied by the calculated weight of the criteria and the matrix C is obtained.

By adding the values of the elements of each row, a weighted value of the sum is obtained. (eg in the first row the sum is 0.14 + 0.13 + 0.17 + 0.20 + 0.15 + 0.11 + 0.35 + 0.17 = 1.42). This value is divided by the weight of the criteria from matrix B and the value of the ratio is obtained (During the calculation, the values are rounded to two decimal places, but in the table the last rows are shown with four decimal places for accuracy, e.g. if 1.42/0.14 = 10.14 is divided, but if are represented by four decimal places, the exact value is 1.4187/0.1422 = 9.9784 or 9.98).

Table 14. Matrix C

C	Crit.1	Crit.2	Crit.3	Crit.4	Crit.5	Crit.6	Crit.7	Crit.8	Ponder	Weight	Rate
Crit. 1.	0.14	0.13	0.17	0.20	0.15	0.11	0.35	0.17	1.4187	0.1422	9.9784
Crit. 2.	0.19	0.18	0.27	0.20	0.29	0.27	0.46	0.34	2.1950	0.1754	12.5128
Crit. 3.	0.09	0.07	0.11	0.07	0.12	0.07	0.15	0.17	0.8448	0.1084	7.7961
Crit. 4.	0.11	0.14	0.24	0.16	0.32	0.20	0.31	0.26	1.7302	0.1561	11.0871
Crit. 5.	0.11	0.07	0.10	0.05	0.11	0.08	0.25	0.14	0.9063	0.1101	8.2350
Crit. 6.	0.21	0.11	0.26	0.12	0.23	0.16	0.41	0.42	1.9146	0.1598	11.9832
Crit. 7.	0.03	0.03	0.05	0.03	0.03	0.03	0.07	0.08	0.3298	0.0668	4.9356
Crit. 8.	0.07	0.04	0.05	0.05	0.06	0.03	0.07	0.08	0.4590	0.0813	5.6449
Sum											72.17

Checking the consistency of the solution

We calculate the consistency ratio CR according to the formula CR = CI/RI.

Consistency index CI = $(\lambda max - n) / (n - 1)$

λmax is the maximum value of the matrix A, and n is the number of rows of the matrix.

λmax is obtained by the arithmetic mean of the ratio, i.e. values of elements from the last column of matrix C (i.e. 9.98 + 12.51 + 7.80 + 11.09 + 8.23 + 11.98 + 4.94 + 5.64 = 72.17), which in the case of 8 rows of the matrix finally amounts to λmax = 72.17/8 = 9.02.

CI = (9.02 – 8)/ (8-1) = 1.02/7 = 0.14

The random consistency index according to Satty's table [1], for the case n = 8, is RI= 1.41.

Taking into account the values of CI and RI, the assessment of the relative importance (weight) of the criteria (alternatives) is CR = 0.14/1.41 = 0.099, which is considered acceptable.

Table 15. Criteria Importance Ranking

Criteria	Rate	Importance
Investing in AI research, high-speed networks and computing resource	9.98	4
Protection of personal data and privacy	12.51	1
Establishment of AI ethical guidelines by the business	7.80	6
Adopting an AI strategy and an AI regulatory framework	11.09	3
Raising awareness of AI benefits and dangers	8.23	5
Banning potentially dangerous AI and monitoring AI development	11.98	2
Free development of the AI market without new AI regulation	4.94	8
Gradual AI regulation accordingly to the AI market development	5.64	7

Determination of the most significant alternative

It is necessary to create a matrix for the alternatives to be compared with each other, so first each criterion is compared with all the alternatives.

In case of alternatives, the values of the columns in the matrix are filled in according to the principle of giving a rating of 0.1, 0.2; 0.3 and 0.4 (the sum is 1), according to the assessment to what extent a certain criterion is related to the alternative

Let's take an example of an assessment: Investment in AI research, high-speed networks and computing resources. The highest value of 0.4 is assigned to Alternative 4 because it implies the option to do the maximum, and then there will be the most likely state support for investments in research, high-speed networks and computing resources; 0.3 is given to Alternative 3 where we have a centralized regulatory function that would make a greater contribution compared to Alternatives 2 and 1; 0.2 was given to Alternative 2 with a focus on sectoral regulation, and 0.1 was given to Alternative 1. Similar assessments were made for the other criteria, as shown in table 8.6.

Then the weights and alternatives are multiplied, as shown in table 8.7. According to the mentioned alternatives, a matrix was created for the alternatives in order to compare them with each other, and each criterion is compared with all the alternatives. In order to get the final result, the values in each row are added together.

Table 16**.** The most significant alternative assessment

Criteria	Criteria Weight	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Investing in AI research, high-speed networks and computing resource	0.1422	0.10	0.20	0.30	0.40
Protection of personal data and privacy	0.1754	0.10	0.20	0.30	0.40
Establishment of AI ethical guidelines by the business	0.1084	0.10	0.40	0.20	0.30
Adopting an AI strategy and an AI regulatory framework	0.1561	0.10	0.20	0.30	0.40
Raising awareness of AI benefits and dangers	0.1101	0.10	0.20	0.30	0.40
Banning potentially dangerous AI and monitoring AI development	0.1598	0.10	0.20	0.30	0.40
Free development of the AI market without new AI regulation	0.0668	0.40	0.30	0.20	0.10
Gradual AI regulation accordingly to the AI market development	0.0813	0.30	0.40	0.20	0.10

Then the weights and alternatives are multiplied, as shown in Table 15. According to the mentioned alternatives, a matrix was created for the alternatives in order to compare them with each other, and each criterion is compared with all the alternatives. In order to get the final result, the values in each row are added together.

In order to get the final result, the values in each row are added together. Alternative 4 has the highest sum value and is the best choice according to the implemented AHP method. The ranking of alternatives is shown in Table 16.

Table 16**.** Matrix of alternatives determination

Criteria	Weight* Alternative 1	Weight* Alternative 2	Weight* Alternative 3	Weight* Alternative 4
Investing in AI research, high-speed networks and computing resource	0.0142	0.0284	0.0427	0.0569
Protection of personal data and privacy	0.0175	0.0351	0.0526	0.0702
Establishment of AI ethical guidelines by the business	0.0108	0.0434	0.0217	0.0325
Adopting an AI strategy and an AI regulatory framework	0.0156	0.0312	0.0468	0.0624
Raising awareness of AI benefits and dangers	0.0110	0.0220	0.0330	0.0440
Banning potentially dangerous AI and monitoring AI development	0.0160	0.0320	0.0479	0.0639
Free development of the AI market without new AI regulation	0.0267	0.0200	0.0134	0.0067
Gradual AI regulation accordingly to the AI market development	0.0244	0.0325	0.0163	0.0081
Sum	0.1363	0.2446	0.2744	**0.3448**

In order to get the final result, the values in each row are added together. Alternative 4 has the highest sum value and is the best choice according to the implemented AHP method. The ranking of alternatives is shown in table 8.8.

On the basis of the implemented AHP method, the problem was structured, and the determination of the most significant criterion was carried out using the AHP method. According to the results obtained in the selection of the regulatory model, in the opinion of the respondents, the option of a centralized AI regulator is preferred.

Table 17**.** Alternatives Ranking

Criteria	Priorities	Ranking
Alternative 1 – Not doing anything	0.1363	4
Alternative 2 – To do minimum	0.2446	3
Alternative 3 – Delegate the task to existing regulators with an obligation to respect the principles, supported by central AI regulatory functions	0.2744	2
Alternative 4 – Centralized AI regulator with new legal requirements for AI systems (to do maximum)	0.3448	1

When creating the regulatory framework, according to the respondents, the option of a centralized AI regulator is preferred. The importance of the criteria was evaluated in the following order: 1. Protection of personal data and privacy; 2. Banning potentially dangerous AI and monitoring AI development; 3. Adoption of AI strategy and AI regulatory framework; 4. Investing in AI research, high-speed networks and computing resources; 5. Raising awareness of AI benefits and dangers; 6. Establishment of AI ethical guidelines by the economy; 7. Gradual AI regulation in line with market development; 8. Free development of the AI market without new AI regulation.

Creating a regulatory framework is complex, because e.g. algorithmic decision-making can propagate discrimination in employment, credit approval, etc., increase harmful stereotypes and social inequality. Privacy and security issues are also essential. Therefore, although the AI Act is in focus, it is necessary to harmonize other relevant laws and rules in BiH with the EU.

10. AI and IoT Governance Model

10.1. AI and IoT regulatory framework development

The International Telecommunication Union (ITU) is advocating a new collaborative approach to ICT regulation [43]. Collaborative regulation is based on the cooperation of ICT regulators with regulators of other sectors. This cooperation is necessary between different competent authorities regarding the Internet, frequency management, consumer protection, competition, broadcasting, human rights protection, finance, etc.

Considering the convergence of technologies, the economy, the environment and ''a whole of society'', in addition to the cooperation between regulators and policy makers, it is necessary to establish wider cooperation to include the perspectives of other interested parties when forming and implementing a regulatory framework.

As the ICT regulator plays a central role in the advancement of innovation and the development of the electronic communications market, the same can be reflected in the central coordinating role in the context of IoT and AI governance model development.

Digital technologies use data as their driving force. When integrate AI with data from the IoT, a greater potential is enabled. This indicates that AI and IoT regulation should take place in parallel with the data regulation. Consequently, in addition to the ICT regulator as the leading coordinator, Data Agency has also been identified as coordinator that could play a key role from the aspect of data.

By forming a Working group for AI and IoT regulatory framework with representatives of identified competent bodies (ethics committee, bodies responsible for cyber security, relevant ministries, etc.), overlapping jurisdictions and legal gaps in the creation of a new AI and IoT regulatory framework will be avoided while areas of possible synergies will be identified. The ICT regulator and the Data Agency should be members of the body and should coordinate activities. Society as a whole approach should be respected too.

The importance and competence of sectoral regulators remain unchanged, while cooperation and contribution from their area is necessary.

10.2. National AI strategy development

Similarly, to drafts a national AI strategy, it is necessary to form an AI Strategy Working Group, which should include not only government agencies but also participants of civil society and the private sector, as this achieves access to the entire society. Most often, representatives of the government, industry, academia, trade union, ethics experts, public sector, civil society and non-governmental organizations are included in the AI Strategy Working Group. It is necessary to include representatives of the ICT regulator and the Data Agency here as well.

The national AI strategy should be developed with a clear strategic vision of the transformation of the country with precisely defined priorities and measurable goals, financial and human resources, and mechanisms for monitoring and evaluation. The AI Strategy Working Group forms a draft of the national AI strategy, which represents the basis for the national AI strategy development and adoption after consultation and revision.

After adoption, the national AI strategy should be divided into short-term plans through the Action Plan, ensuring adequate funding, capacity building, maintaining effective communication and continuous improvement.

Phase of creating AI and IoT Governance model is presented in Figure 8.

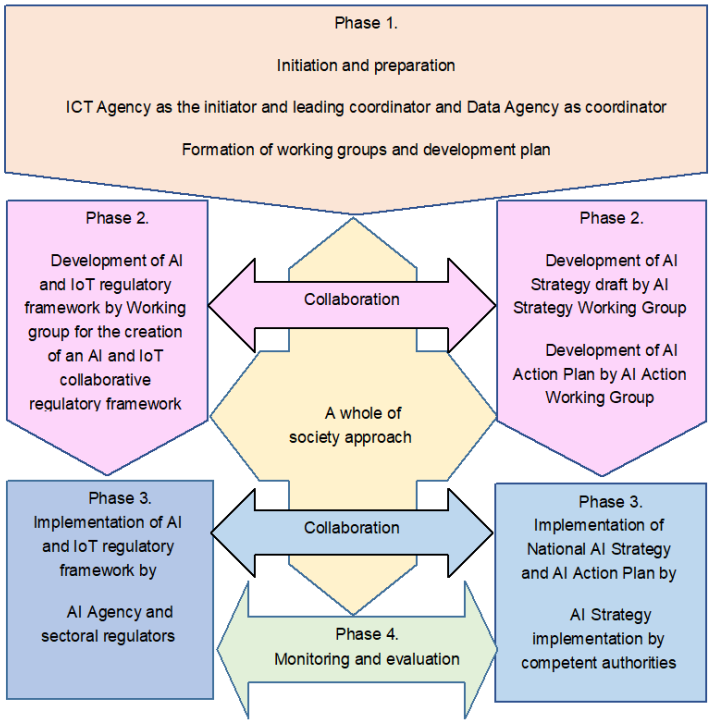


Fig. 8. Phases of creating AI and IoT Governance Model

10.3. AI and IoT Model building blocks

Based on UN and EU initiatives, and after the regulatory impact assessment by AHP method implementation, the AI and IoT Governance Model was proposed. This model should be flexible and dynamic to respond to the dynamic nature of new technologies as AI and IoT. The AI and IoT Governance Model is presented in Figure 9.

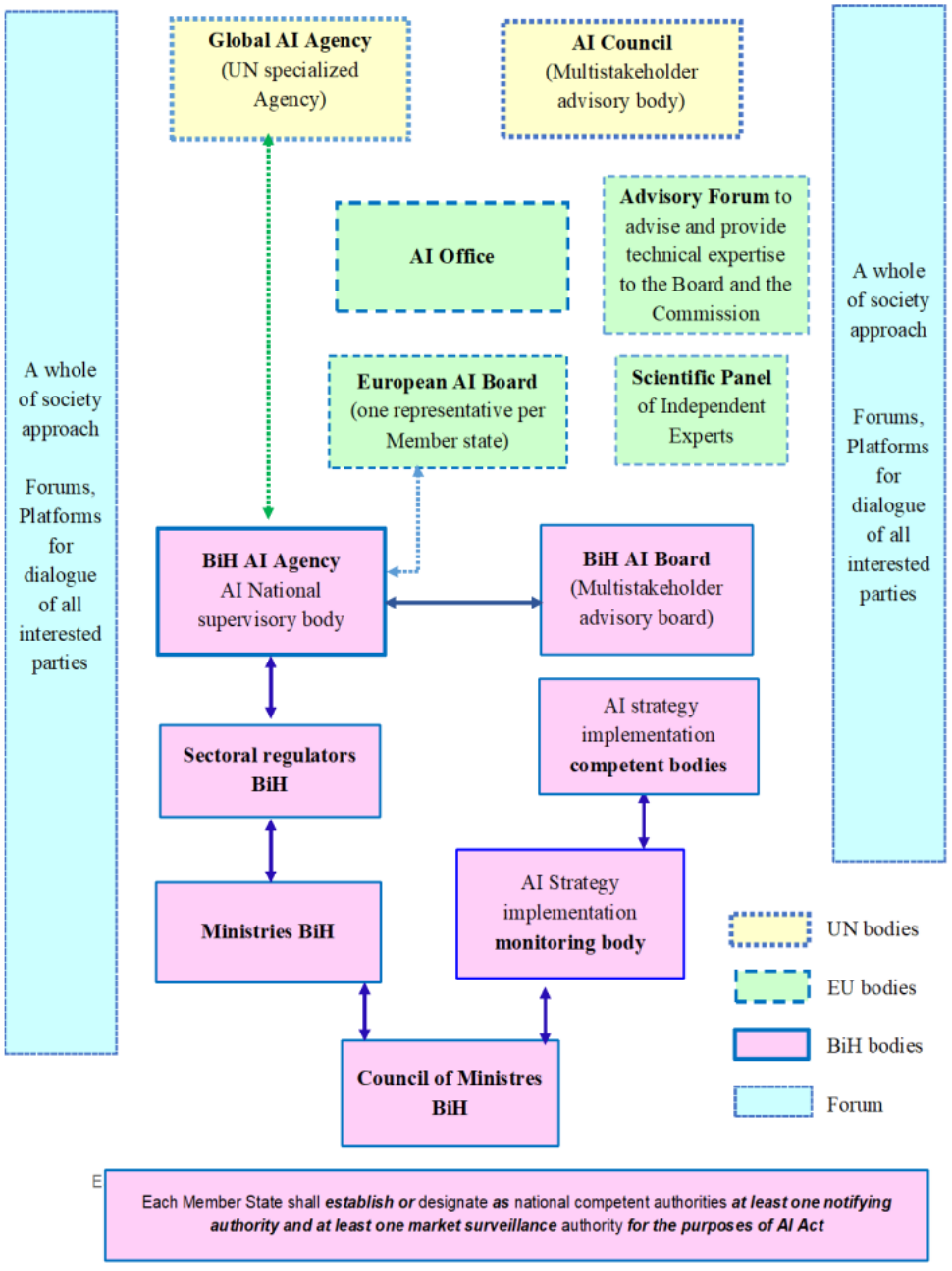


Fig. 9. AI and IoT Governance Model

The proposal of the AI and IoT model includes building blocks at three levels, global, EU and Bosnia and Herzegovina (BiH). Simply, at each level, there is one institution that represents the AI supervisory body, which is supported by the AI advisory body. Other building blocks vary depending on the level, but ensuring access by the entire society is necessary for all levels.

Global level:

- The Global AI Agency (UN Specialized Agency)
- UN AI Council is needed as a multistakeholder advisory body.
- A whole of society

The Interim report of the UN AI Advisory Body outlines the functions that an international governance regime for AI should perform in order to properly govern AI for humanity, and these functions can be performed by individual institutions or a network of

institutions [36]. What kind of global governance form will be finalized is not yet fully clear, as a final report is expected soon, and it will be discussed at the Summit of Future.

We support one of present public proposals, that the global AI governance should be established similar to the model of the global nuclear energy governance, which, like AI, can be of great benefit to humanity, but can also have its negative side. Therefore, a specialized UN agency for AI is needed, together with a multistakeholder advisory body and governance of entire society through participation in work of multistakeholder advisory body or through various platforms and forums.

We support present opinions that global AI governance should be established according to the example of global nuclear energy governance, which, like AI, can be of great benefit to humanity, but which can also have its negative side. In addition to a specialized UN AI Agency, it is necessary to establish governance by entire society in the form of multi-stakeholder body and various platforms and forums.

We are of the opinion that it is highly liked that these bodies will be established as the UN has the necessary power to lead the AI supervision globally supported by multistakeholder advisory body and entire society.

EU level:

- AI Office, European AI Board, Advisory forum, the Scientific Panel of Independent Experts
- A whole of society

EU level is built from building blocks whose functions are given in the AI Act. Therefore, the AI Office is defined in the AI Act Article 3; the European Artificial Intelligence Board is defined in Article 65 and 66; the Advisory forum is defined in the Article 67, and the Scientific panel of independent experts is defined in the Article 68 [42].

National level (i.e. BiH in the conducted research):

- AI Agency - Based on conducted research which included the implementation of a multi-criteria AHP analysis using the AHP method and a survey of awareness of AI governance, establishment of the AI Agency as a supervisory body is proposed.
- BiH AI Board is made up of experts from business, civil society, academia and government and has an advisory role. In the UN's Our Common Agenda document, it is recommended that some form of consultative body be formed to meet regularly to consider new regional, national and industrial AI governance arrangements.
- AI Strategy implementation monitoring body which is a competent authority who oversee the implementation of the AI Strategy. AI Strategy implementation activities should be aligned and coordinated. This body monitors the implementation of planned measures and activities, and requests. A report on the implementation of the strategy is submitted to the Council of Ministers in accordance with the deadlines defined in the Action Plan.
- Institutions for the implementation of the AI strategy, per Action Plan
- Identified institutions according to the Action Plan for the implementation of the AI strategy, which should implement the measures and thus lead to the realization of the planned values of the indicators in the given time.
- Sector regulators, sectoral regulatory bodies, i.e. health, ICT, data protection, competition, etc.
- Competent ministries, sectoral ministries, i.e. health, transport, energy, etc.
- Council of Ministers, a body of the executive power

EU Member States are free to decide how they will establish AI supervision at national level. According to the C/2024/1459 Commission Decision of establishing European Artificial Intelligence Office, (7) ‘’The European Artificial Intelligence Office should operate in accordance with Commission internal processes and its establishment should not affect the powers and competences of national competent authorities, and bodies, offices and agencies of the Union in the supervision of AI systems, as provided for by the forthcoming Regulation laying down harmonised rules on artificial intelligence and other sectoral Union legislation…’’ [44].

Spain is the first country in EU who established the autonomous agency for the AI supervision so their example can be very useful if the state decides to establish a separate body for AI supervision.

All levels

- Forums, platforms at national, regional, sectoral levels that serve for discussion between interested parties in order to develop and manage new technologies towards the goals of sustainable development. Regardless of the need to form institutions, groups, committees, it is necessary to establish platforms, forums and other opportunities through which each individual will be able to give their opinion and contribution. There are currently numerous forums, and an additional proposal in the UN document Global Digital Compact is the holding of the annual Digital Cooperation Forum to support the exchange of opinions and cooperation between different interested parties.

The implementation of the national AI strategy includes the application of the principles and goals stated in the country's AI strategy at the national level. This implements government initiatives, policies and investments aimed at encouraging the development, adoption and responsible use of AI in the country. The implementation of a national AI strategy requires coordinated efforts by government institutions, industry participants, academia and civil society to harness the potential of AI for economic growth, innovation and social benefits, while simultaneously addressing potential risks and challenges.

Monitoring and evaluation of the AI and IoT governance model is essential to assess its effectiveness, identify areas for improvement and ensure the achievement of goals. Effective monitoring and evaluation of the model requires a systematic approach, robust data collection and analysis, stakeholder engagement, and a commitment to transparency and accountability. By regularly assessing progress and adjusting the model accordingly, governments can maximize AI benefits while reducing risks and addressing societal issues.

11. Conclusions

Every country needs to be capable to respond to all challenges brought by transformative technologies such as AI and IoT, and others that they have yet to come. Therefore, it is important for country to develop the AI strategy and regulatory framework for AI and IoT as their rapidly affect all of us with a great potential for good but with risks as well.

Aim of this research is to give a contribution in a form of guidelines for AI and IoT governance model development. Particularly, this research can be useful for developing countries that do not have a national AI strategy and regulatory framework for AI and IoT. In this way, we hope that this paper gives a contribution towards reducing the digital divide and bridging the digital governance gap.

The issue of AI and IoT governance is complex and requires the involvement of a large number of actors. But among them, the ICT regulator and the Data agency stand out as key actors who have the capacity to initiate and coordinate activities towards AI and IoT governance model development. The importance and competence of sectoral regulators remain unchanged, while a whole of society approach needs to be respected.

The steps that should be taken are initiating this process by forums and conferences, working groups establishment for national AI Strategy development, and AI and IoT regulatory development. AI strategy and AI and IoT regulatory framework implementation and continuous monitoring and evaluation. After implementation, continous monitoring, evaluation and improvements are required. Governance model needs to be dynamic and adaptive in order to keep pace with AI and IoT.

EU legislation and recommendations that are the most relevant are presented in the article as a contribution towards regulatory framework development. National AI Strategy standard building blocks are presented and ranked by importance based on conducted research.

As AI and IoT are borderless, they need to be globally and nationally governed at least. Presented AI and IoT governance model have three levels, global, EU and national level.

AI posing new challenges to international security and global stability. New UN AI Advisory Body report is expecting soon and it is planned to be discussed at the Summit of the Future in September 2024. For global governance level, our proposal is the UN specialized agency establishment together with a multistakeholder advisory body and a whole of society approach.

AI Act establishes a governance structure at the European level and it defines AI Office, European Artificial Intelligence Board, Advisory forum, and Scientific panel of independent experts, which are part of presented AI and IoT governance model at EU level.

With the Stabilization and Association Agreement, BiH undertook the obligation to harmonize its existing and future legislation with the EU acquis, so EU level is applicable to BiH as future state of EU. This level can be applicable to other countries according to their circumstances and regional structure.

Regarding the national level, even after the adoption of the AI Act, there are dilemmas in the EU about the most appropriate body that should be appointed at the national level for the implementation of the AI Act. States are left free to decide whether to appoint a new agency or appoint an existing body to oversee AI.

At national level, based on the conducted research, the establishment of a new national AI supervisory body is the preferred option. This central AI supervisory body should be supported by institutions for the implementation of the AI strategy, identified institutions according to the Action Plan for national AI Strategy implementation, sector regulators, competent ministries, Council of Ministers with a whole of society approach.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors are able or have chosen to specify which data has been used

References

[1] Schiff, Daniel & Biddle, Justin & Borenstein, Jason & Laas, Kelly, 2019. "What's Next for AI Ethics, Policy, and Governance? A Global Overview," SocArXiv 8jaz4, Center for Open Science.

[2] Walter, Y. Managing the race to the moon: Global policy and governance in Artificial Intelligence regulation—A contemporary overview and an analysis of socioeconomic consequences. Discov Artif Intell 4, 14 (2024). https://doi.org/10.1007/s44163-024-00109-4

[3] Torrance, Andrew W. and Tomlinson, Bill, Governance of the AI, by the AI, and for the AI (May 4, 2023). Mississippi Law Journal, Forthcoming, Available at SSRN: https://ssrn.com/abstract=4437646

[4] W. Wallach and G. Marchant, "Toward the Agile and Comprehensive International Governance of AI and Robotics [point of view]," in Proceedings of the IEEE, vol. 107, no. 3, pp. 505-508, March 2019, doi: 10.1109/JPROC.2019.2899422.

[5] Bernd Carsten Stahl, Rowena Rodrigues, Nicole Santiago, Kevin Macnish, A European Agency for Artificial Intelligence: Protecting fundamental rights and ethical values, Computer Law & Security Review, Volume 45, 2022, 105661, ISSN 0267-3649, https://doi.org/10.1016/j.clsr.2022.105661

[6] Corporate author(s): CEPS , Directorate-General for Communications Networks, Content and Technology (European Commission) , ICF , Wavestone: ''Study to support an impact assessment of regulatory requirements for Artificial Intelligence in Europe'', 21.04.2021. https://op.europa.eu/en/publication-detail/-/publication/55538b70-a638-11eb-9585-01aa75ed71a1

[7] Novelli, Claudio and Hacker, Philipp and Morley, Jessica and Trondal, Jarle and Floridi, Luciano, A Robust Governance for the AI Act: AI Office, AI Board, Scientific Panel, and National Authorities (May 5, 2024). Available at SSRN: https://ssrn.com/abstract=4817755 or http://dx.doi.org/10.2139/ssrn.4817755

[8] Fatima, Samar, Desouza, Kevin C., & Dawson, Gregory S. (2020) National strategic artificial intelligence plans: A multi-dimensional analysis. Economic Analysis And Policy, 67, pp. 178-194, https://eprints.qut.edu.au/205010/

[9] S Fatima, KC Desouza, JS Denford, GS Dawson (2021) What explains governments interest in artificial intelligence? A signaling theory approach, Economic analysis and policy 71, 238-254, https://eprints.qut.edu.au/211761/

[10] Demaidi, M.N. Artificial intelligence national strategy in a developing country. AI & Soc (2023). https://doi.org/10.1007/s00146-023-01779-x

[11] Tim Dutton, Brent Barron, and Gaga Boskovic, Building an AI World: Report on National and Regional AI Strategies, CIFAR, 2020, https://cifar.ca/wp-content/uploads/2020/05/buildinganaiworld_eng.pdf

[12] Rantala, K., Alasuutari, N., & Kuorikoski, J. (2023). The logic of regulatory impact assessment: From evidence to evidential reasoning. Regulation & Governance. https://doi.org/10.1111/rego.12542

[13] Drummond JR, Radaelli CM. Behavioural Analysis and Regulatory Impact Assessment. European Journal of Risk Regulation. Published online 2024:1-16. doi:10.1017/err.2024.1

[14] Commission Staff Working Document Impact Assessment of the Regulation on Artificial intelligence, SWD(2021) 84 final, April 2021, https://digital-strategy.ec.europa.eu/en/library/impact-assessment-regulation-artificial-intelligence

[15] UK Artificial Intelligence Regulation Impact Assessment, March 2023, https://assets.publishing.service.gov.uk/media/6424208f3d885d000cdadddf/uk_ai_regulation_impact_assessment.pdf

[16] Taherdoost, H.; Madanchian, M. Multi-Criteria Decision Making (MCDM) Methods and Concepts. Encyclopedia 2023, 3, 77-87. https://doi.org/10.3390/encyclopedia3010006

[17] Šporčić, M. Landekić, I. Bartulac i K. Šegotić, "Primjena višekriterijske AHP metode u odabiru sustava pridobivanja drva", Šumarski list, vol.144, br. 5-6, str. 247-255, 2020. [Online]. https://doi.org/10.31298/sl.144.5-6.2

[18] P. Šisl, "Proces donošenja odluke pomoću AHP metode : Završni rad", Završni rad, Sveučilište Josipa Jurja Strossmayera u Osijeku, Ekonomski fakultet u Osijeku, Osijek, 2020. Dostupno na: https://urn.nsk.hr/urn:nbn:hr:145:648306

[19] Kusuma, Parama & Putera, Prakoso & Budiman, Renti & Gustina, Amelya & Hastanto, Wakhid. (2019). Regulatory Impact Assessment (RIA) Functional Food Policy in Indonesia. 5-10. 10.5220/0009980300050010.

[20] Liang, T.-C.; Peng, S.-H. Using Analytic Hierarchy Process to Examine the Success Factors of Autonomous Landscape Development in Rural Communities. Sustainability 2017, 9, 729. https://doi.org/10.3390/su9050729

[21] Taherdoost, Hamed. (2017). Decision Making Using the Analytic Hierarchy Process (AHP); A Step by Step Approach. International Journal of Economics and Management Systems.

[22] Stojanović, S. (2016): Razvoj modela za evaluaciju internet informacionih resursa primenom metoda višekriterijumskog odlučivanja, Doktorska disertacija, Fakultet za menadžment, Zaječar

[23] Svirčević, V. (2016): Razvoj sistema za procenu i odabir direktnih dobavljača u automobilskoj industriji, Doktorska disertacija, Fakultet tehničkih nauka, Novi Sad

[24] Vinovrški, Danijela. "Primjena metode višekriterijske analize pri donošenju odluka." Diplomski rad, Sveučilište Jurja Dobrile u Puli, 2016. https://urn.nsk.hr/urn:nbn:hr:137:761020

[25] Kadoić, N. (2018). Nova metoda za analizu složenih problema odlučivanja temeljena na analitičkom mrežnom procesu i analizi društvenih mreža (Disertacija), https://urn.nsk.hr/urn:nbn:hr:211:461809

[26] Kusuma, P.; Bhairawa Putera, P.; Budiman, R.; Gustina, A. and Hastanto, W. (2020). Regulatory Impact Assessment (RIA) Functional Food Policy in Indonesia. In Proceedings of the 16th ASEAN Food Conference - 16th AFC; ISBN 978-989-758-467-1, SciTePress, pages 5-10. DOI: 10.5220/0009980300050010

[27] OECD (2020), Regulatory Impact Assessment, OECD Best Practice Principles for Regulatory Policy, OECD Publishing, Paris, https://doi.org/10.1787/7a9638cb-en

[28] R.W. Saaty, The analytic hierarchy process—what it is and how it is used, Mathematical Modelling, Volume 9, Issues 3–5, 1987, Pages 161-176, ISSN 0270-0255, https://doi.org/10.1016/0270-0255(87)90473-8.

[29] UNDP Governance policy paper - Governance for sustainable human development, http://www.undp-aciac.org/publications/other/undp/governance/undppolicydoc97-e.pdf

[30] Hufty, Marc, Governance: Exploring Four Approaches and Their Relevance to Research (2011). RESEARCH FOR SUSTAINABLE DEVELOPMENT: FOUNDATIONS, EXPERIENCES, AND PERSPECTIVES, pp. 165-183, U. Wiesmann, H. Hurni, ed., Geographica Bernensia, 2011, Available at SSRN: https://ssrn.com/abstract=2019013

[31] What is Good Governance? United Nations Economic and Social Commission for Asia and the Pacific, https://www.unescap.org/sites/default/files/good-governance.pdf

[32] Ananyi, S. O. (2024). The concept of good governance and theories of good governance: Global perspective. https://orcid.org/0009-0000-0569-1603

[33] UN Global Digital Compact Policy Brief, Infographics, May 2023, https://www.un.org/techenvoy/global-digital-compact

[34] UN Resolution A/78/L.49 Seizing the opportunities of safe, secure and trustworthy artificial intelligence systems for sustainable development, www.un.org

[35] Simon Chesterman, Yuting Gao, Jungpil Hahn, et al. The Evolution of AI Governance. TechRxiv. December 04, 2023. DOI: 10.36227/techrxiv.24681063.v1

[36] AI Advisory Body: Interim Report: Governing AI for Humanity, https://www.un.org/techenvoy/ai-advisory-body

[37] The Ethics Guidelines for Trustworthy Artificial Intelligence, AI HLEG, 8.4.2019. https://op.europa.eu/en/publication-detail/-/publication/d3988569-0434-11ea-8c1f-01aa75ed71a1

[38] OECD (2022), "OECD Framework for the Classification of AI systems", OECD Digital Economy Papers, No. 323, OECD Publishing, Paris, https://doi.org/10.1787/cb6d9eca-en.

[39] National Institute of Standards and Technology, NIST AI 100-1 Artificial Intelligence Risk Management Framework (AIRMF1.0), January 2023 https://doi.org/10.6028/NIST.AI.100-1

[40] DIN SPEC 92001-3, Artificial Intelligence - Life Cycle Processes and Quality Requirements - Part 3: Explainability, https://www.researchgate.net/publication/372647154_Artificial_Intelligence_-_Life_Cycle_Processes_and_Quality_Requirements_-_Part_3_Explainability

[41] 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 (General Data Protection Regulation) (Text with EEA Relevance) OJ L 119, 4.5.2016. pp. 1–88. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02016R0679-20160504

[42] European Parliament legislative resolution of 13 March 2024 on the proposal for a regulation of the European Parliament and of the Council on laying down harmonised rules on Artificial Intelligence (Artificial Intelligence Act) and amending certain Union Legislative Acts (COM(2021)0206 – C9-0146/2021 – 2021/0106(COD)) https://www.europarl.europa.eu/doceo/document/TA-9-2024-0138_EN.html

[43] International Telecommunication Union Benchmark of fifth-generation collaborative digital regulation, ITUPublications 2021, https://digitalregulation.org/wp-content/uploads/Final-version_clean_E.pdf

[44] C/2024/1459 Commission Decision of 24 January 2024 establishing the European Artificial Intelligence Office, https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:C_202401459