



An Inventory of AI ethics: Tracing 100 documents

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Abstract

AI ethics is a relatively nascent field, and its importance and recent growth have been the focus of multiple organizations and corporations, whereby multiple guidelines, reports, statements, and initiatives on AI ethics have been developed and published. However, there is still no systematic analysis that provides a comprehensive overview of the various developed AI ethical frameworks. As a result, in this article, we trace and investigate a dataset of 100 documents on AI ethics and principles released between 2015 and 2022 issued by governmental entities, academic institutions, and private corporations. The aim of this investigation is to provide useful insights on the AI ethical landscape. We use text analysis and quantitative data analysis to highlight five key elements of the dataset as follows: the type of documents created on AI ethics (how), the time period for issuing (when), the type of issuer (who), the geographic distribution (where), and the sectors they cover (what). The findings reveal a gap in the creation of AI ethics between the Global North and the Global South as 72.4% AI ethics documents are released from the former. Furthermore, the analysis shows that private firms are the dominant institutions responsible for developing these frameworks with a percentage of 31.8%, followed by academia (19.1%) and, finally, governments (16.4%). Eventually, we emphasize the need for more sector-specific ethical frameworks which are noticeably lacking and highly needed.

Keywords: Artificial Intelligence, AI ethics, Responsible AI, ethical AI.

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1. Introduction

More and more nations are realizing the importance of keeping up with and capitalizing on the advancements in artificial intelligence [1]. According to the OECD.AI policy observatory, in 2021, 69 nations will have issued official AI strategies, [2]. However, as AI systems grow larger and more complex, they become more likely to generate results that conflict with human ideals [3] [4]. These conflicts pose social challenges and require ethical considerations when it comes to utilizing AI in societies. Some of the ethical considerations include respecting local public values, eliminating bias in decision-making, ensuring equality, protecting privacy and data ownership, and building trust and transparency [3].

In response to these challenges and ethical concerns, many public and private stakeholders are turning to normativity to control and manage AI's technical innovations in relation to its potential harms [5] [6] [7]. As a result, multiple normative frameworks, standards, and sets of ethical principles guiding the use of AI have emerged. These frameworks aim to develop norms or criteria that, if followed, should limit the threat that artificial intelligence poses to fundamental rights and ideals [7] [8].

In 2015, the first AI ethics documents started to emerge to address the negative implications of AI and guide the development of AI systems toward the greatest public good [5] [9] [6] [8]. Several frameworks for AI ethics, both general and sector specific, have arisen in the years thereafter to address the harm that can be caused to people and society by the misuse, abuse, bad design, or unforeseen negative effects of AI systems [3][10]. However, despite the increased production on AI ethics in recent years, there is no systematic tracking in the literature that provides a wide overview and in-depth study of the AI ethical production environment.

Previous research attempted to investigate these ethical frameworks from specific perspectives. For instance, [8] examined a list of ethical frameworks from 2016 to 2019 in relation to the consequences of AI in justice systems. [8] analyzed documents of AI ethics with the aim of determining which ethical principles and risk factors the texts primarily converge on. The study findings demonstrate the potential distinctions between justice and other contexts of AI deployment in terms of anticipated risks and ethical values protected. Earlier research by [9] examine the global landscape of existing AI ethics guidelines and analyze whether a global convergence is forming in terms of both ethical AI principles and recommendations for its implementation. The study's findings show a global convergence arising around five ethical principles (transparency, justice and fairness, non - maleficence, accountability, and privacy), with substantial variance in how these principles are interpreted. Despite the fact that both articles give inventories of AI ethical documents and do content analysis on the obtained data, their emphasis is on the principles included within the studied documents. However, some necessary data and categorization of ethical documents remain missing, such as the types of these documents, who issues them, as well as the covered and uncovered sectors. As a result, we aim in this article to complement the previous research by addressing these gaps.

Hence, the goal of this article is to trace 100 existing documents on AI ethics documents to understand their type (how), time of issuing (when), issuer type (who), geographic distribution (where), and covered and missing sectors (what), in order to provide a better understanding and overall overview of the current AI ethics scene. We collect a set of 100 chronologically arranged AI ethics documents in our inventory, with each categorized by type, date of issue, type of issuer, origin, and sectors covered. The categories are then interpreted quantitatively to extrapolate the overall scene of AI ethical production and publication.

The article proceeds as follows: first, we provide a background on the aspects that led to the development of AI ethics and define AI ethics. Then, we present the methodology for this study. Next, we present an inventory of 100 existing documents addressing AI ethics issued between 2015 and 2022. The last section analyzes and describes the collected data on the AI ethics.

2. What prompted the need for AI ethics?

A major percentage of the current capability of artificial intelligence (AI) is accounted for by the use of data-driven deep learning. This growing amount of data is utilized to train increasingly accurate AI models. However, in some cases, the strength of these approaches of data-driven deep learning also acts as their downfall. In that sense, if AI systems are not taught with accurate and diverse datasets, their accuracy and fairness may be compromised [11]. AI ethics has mostly grown as a response to the different kinds of damage that can be done to people and society by the misuse, abuse, bad design, or unintended negative effects of AI systems [3] [10].

The challenge AI faces is that as systems grow larger and more complex, they become more likely to generate results that conflict with human ideals. Despite the fact that certain AI systems perform exceptionally well, the moral concerns they pose are growing [4]. To make sure that the communities that will be affected by the development of AI technologies are safe and healthy, it will be important to make sure that the development of these technologies is in line with ethical norms and principles [3]. This has resulted in growing attention towards ethical issues concerning AI, not only among academics but also among commercial sectors [4].

Accordingly, every step of the process for delivering an AI project must take into account the social and ethical consequences of the project's design and use of AI technology. Furthermore, data scientists, product managers, data engineers, domain specialists, and delivery managers will all need to work together to achieve success [3].

AI is a technology that is both transformational and disruptive. In ways that we can't yet imagine, AI systems will continue to have an impact on society and citizens. Its development over the past few years has been made possible by the accessibility of vast amounts of digital data, significant technological advancements in computing power and storage capacity, as well as significant scientific and engineering innovations in AI methods and tools.

Since humans will only be able to confidently and fully reap the benefits of AI when the technology, including the processes and people behind the technology, is trustworthy, it is crucial to develop AI systems that are worthy of trust in this context.

2.1. What is AI ethics?

AI ethics is a set of beliefs, concepts, and methodologies that apply widely recognized moral standards to govern moral behavior in the development and application of AI technologies. These ideals, ideas, and methodologies are meant to encourage morally acceptable activities as well as to dictate the fundamental duties and responsibilities required to create ethical, fair, and safe AI applications [3] [10].

In this sense, urban AI ethics can be defined as urban AI systems or practices that respect human rights, ethics, and fairness. It should, however, include transparency, algorithm accountability, and data privacy. As a result, urban AI systems must be designed responsibly. It considers unbiased datasets and actively searches for algorithmic discrimination, which it opts to correct. Furthermore, AI designers from various backgrounds are needed to ensure the creation of fair AI algorithms.

The field of AI ethics mitigates these risks and involuntary harm by equipping project teams with the values, principles, and procedures required to create ethical, fair, and safe AI applications. Such risks and harms may arise when AI systems are utilized for reasons other than those for which they were designed, when creators fail to examine technical difficulties linked to algorithmic bias and safety risks, or when creators fail to consider their influence on individuals and communities [10].

3. Methodology

The article aims at tracing existing AI ethical frameworks to understand their type (how), the time period for issuing (when), the type of issuer (who) geographic distribution (where), and the covered/missing sectors (what). In terms of the five aforementioned points, this should provide an overview and a more in-depth grasp of the present AI ethical scene. Furthermore, it emphasizes existing gaps in the body of text generated on AI ethics that need to be addressed through additional research. In order to achieve this, the study followed three phases, as follows:

Phase 1 - Data collection: Using human manual coding, we searched the web for the following keywords: "AI ethical frameworks," AI guiding principles, African AI ethical frameworks, European AI ethical frameworks, and International AI ethical frameworks. In addition, we reviewed the ethical documents' reference lists and inventories of other scholarly articles such as [9] and [8]. In this phase we identified 100 documents drafted on AI ethics and principles. The documents included Reports, set of guiding principles, research articles, frameworks and declarations

Phase 2 - Tracing the collected data: we traced the 100 collected documents to determine type of document, year of issue, type of issuer, geographic distribution and sectors

Phase 3 - Analysis: We conduct a content analysis and quantitative analysis, presenting a chronologically ordered history of the existing frameworks from 2015 to 2022. Moreover, we draw conclusions about the time of the emergence of artificial intelligence ethical frameworks, when the majority of these frameworks were formed, the origin and type of entities involved in the dissemination of these ethical frameworks, whether private tech companies, governmental entities, non-profit organizations, or academia, and the sectors they cover. parts.

4. Tracing Existing AI ethical framework

Although AI ethics is a relatively nascent field, its importance and recent growth have been the focus of multiple organizations and corporations, whereby multiple guidelines, reports, and initiatives on AI ethics have been developed and published. For instance, the [AI Index Report](#), the annual report about AI's impact and progress that is produced by the [Stanford Institute for Human-Centered Artificial Intelligence \(HAI\)](#) with partners from industry, academia, and government, Microsoft's responsible AI principles, and The Alan Turing Institute AI ethics report in collaboration with UK government [4].

In table 1, we collect 100 documents addressing AI ethics and principles. This data was collected by searching for published work on the principles and guidelines on ethical or responsible AI produced by governmental entities, academics, non-profit organizations, intergovernmental organizations and private corporations. According to the analysis in this article and other sources examined, the earliest work on ethical AI found was published in 2015 [5] [9] [6] [8]. Our data set includes documents starting this time and the latest document

that we could find was published in 2022. The search was primarily conducted using the Google search engine, as well as reviewing other scholarly literature on the subject of AI ethics. The article 'The global landscape of AI ethics guidelines' by [9], was a useful resource, whereby it provides a list of 84 publications about ethical principles or guidelines for AI. 67 of the 84 documents were added to our created inventory of AI ethical frameworks while 17 documents were excluded as they provided general insights and do not mention direct guidelines or principles on AI ethics. The collected dataset of AI ethical frameworks in Table 1 is organized chronologically including information about the type of issuer and the sectors covered by each document, as well as a direct link to the document.

Table 1: A timeline of 100 published AI ethical frameworks and guidelines (Authors, with 67 documents from [9])

	Title	Issuer	Document type	Year	Type of issuer	Origin of Issuer	Region	Sectors covered
1	Unified Ethical Frame for Big Data Analysis. IAF Big Data Ethics Initiative, Part A	The Information Accountability Foundation	Framework	2015	Non-profit organization	USA	Global North	General
2	DIGITAL DECISIONS: Building Trust in Algorithms	Center for Democracy Technology	Set of guiding principles	2015	Non-profit organization	USA	Global North	General
3	Open AI Charter	Open AI	Set of guiding principles	2015	AI research and deployment company	USA	Global North	General
4	Civilian AI policy - Ethics Policy	Icelandic Institute for Intelligent Machines (IIIM)	Set of guiding principles	2015	Non-profit organization	Iceland	Global North	General
5	The AI Now Report. The Social and Economic Implications of Artificial Intelligence Technologies in the Near-Term	AI Now Institute	Report	2016	Non-profit organization	USA	Global North	General
6	Position on Robotics and Artificial Intelligence	The Greens (Green Working Group Robots)	Position Set of guiding principles	2016	Intergovernmental organization	Europe	Global North	General
7	Statement on Algorithmic Transparency and Accountability	Association for Computing Machinery (ACM)	Statement Set of guiding principles	2017	Non-profit organization	USA	Global North	General

8	Artificial Intelligence and Machine Learning: Policy Paper	Internet Society	Policy paper	2017	Non-profit organization	International	International	General
9	The Asilomar AI Principles	The Future of Life Institute, in collaboration with attendees of the high-level Asilomar conference on beneficial AI.	Set of guiding principles	2017	Non-profit organization	USA	Global North	General
10	Microsoft's responsible AI principles	Microsoft	Set of guiding principles	2017	Multinational technology corporation	USA	Global North	General
11	Machine Learning: The Power and Promise of Computers that Learn by Example	The Royal Society	Report	2017	Academia	UK	Global North	General
12	The Montreal Declaration for Responsible AI	The University of Montreal	Declaration	2017	Academia	Canada	Global North	General
13	Human Rights in the Robot Age Report	The Rathenau Institute	Report	2017	Non-profit organization	Netherlands	Global North	General
14	Artificial Intelligence. The Public Policy Opportunity	Intel Corporation	Set of guiding principles	2017	Multinational technology corporation	USA	Global North	General
15	AI Index Report	Stanford Institute for Human-Centered Artificial Intelligence.	Report	2017	Academia	USA	Global North	General
16	Big Data, Artificial Intelligence, Machine Learning and Data Protection	UK Information Commissioner's Office	Report	2017	Governmental entity	UK	Global North	General
17	The Japanese Society for Artificial Intelligence Ethical Guidelines	Japanese Society for Artificial Intelligence	Set of guiding principles	2017	Academia	Japan	Global North	General
18	ETHICS COMMISSION AUTOMATED AND CONNECTED DRIVING-report	Federal Ministry of Transport and Digital Infrastructure, Ethics Commission	Report	2017	Governmental entity	Germany	Global North	Mobility/automated transportation
19	How Can Humans Keep the Upper Hand? Report on the Ethical Matters Raised by AI Algorithms	French Data Protection Authority (CNIL)	Report	2017	Governmental entity	France	Global North	General
20	The Ethics of Code: Developing AI for Business with Five Core Principles	Sage	Set of guiding principles	2017	Multinational technology corporation	International/ UK	International	General

21	The Future Society, Law & Society Initiative. Principles for the Governance of AI	The Future Society	Set of guiding principles	2017	Non-profit organization	USA	Global North	General
22	DeepMind Ethics & Society Principles	DeepMind Ethics & Society	Set of guiding principles	2017	Technology incorporation	UK	Global North	General
23	Ethical Principles for Artificial Intelligence and Data Analytics	Software & Information Industry Association (SIIA), Public Policy Division	Set of guiding principles	2017	Trade association	International	International	General
24	AI Now 2017 Report	AI Now Institute	Report	2017	Academia	USA	Global North	General
25	Draft AI R&D Guidelines for International Discussions	Institute for Information and Communications Policy (IICP), The Conference toward AI Network Society	Conference Report	2017	Governmental entity Academia	Japan	Global North	General
26	Top 10 Principles for Ethical Artificial Intelligence	UNI Global Union	Set of guiding principles	2018	International organization global union federation	International/ based in switzerland	International	General
27	The Malicious Use of Artificial Intelligence: Forecasting, Prevention, and Mitigation	Future of Humanity Institute; University of Oxford; Centre for the Study of Existential Risk; University of Cambridge; Center for a New American Security; Electronic Frontier Foundation; OpenAI	Report	2018	Academia AI research and deployment company	International	International	General
28	White Paper: How to Prevent Discriminatory Outcomes in Machine Learning	World Economic forum (WEF), Global Future Council on Human Rights 2016-2018	Report	2018	International organization	International	International	General
29	Privacy and Freedom of Expression in the Age of Artificial Intelligence	Privacy International & Article 19	Report	2018	International Organization Non-profit organization	International	International	General
30	The Toronto Declaration: Protecting the Right to Equality and Non-discrimination in Machine Learning Systems	Access Now; Amnesty International	Declaration	2018	Non-profit organization International Organization	International canada	International	General
31	Charlevoix Common Vision for the Future of Artificial Intelligence	Leaders of the G7	Set of guiding principles	2018	Intergovernmental organization	International	International	General

32	Business Ethics and Artificial Intelligence	Institute of Business Ethics	Briefing	2018	Non-profit organization	UK	Global North	General
33	Artificial Intelligence and Privacy	The Norwegian Data Protection Authority	Report	2018	Governmental entity	Norway	Global North	General
34	Work in the age of artificial intelligence- Four perspectives on the economy, employment, skills and ethics	Finland's ministry of Economic Affairs and Employment.	Report	2018	Governmental entity	Finland	Global North	General
35	Tieto's AI Ethics Guidelines	Tieto	Set of guiding principles	2018	Technology company	Finland	Global North	General
36	Ethical, Social, and Political Challenges of Artificial Intelligence in Health	Future Advocacy	Report	2018	consultancy and think tank	UK	Global North	Health
37	OP Financial Group's ethical guidelines for artificial intelligence	OP Group	Set of guiding principles	2018	a cooperative financial services group	Finland	Global North	General
38	For a Meaningful Artificial Intelligence. Towards a French and European Strategy	Mission Villani- CÉDRIC VILLANI	Mission Report	2018	Academia	France	Global North	General
39	The Ethics Guidelines for Trustworthy Artificial Intelligence (AI)	European Commission.	framework	2018	Intergovernmental organization supranational organization	Europe	Global North	General
40	SAP's Guiding Principles for Artificial Intelligence	SAP	Set of guiding principles	2018	Software company	Germany	Global North	General
41	AI code-AI in the UK: ready, willing and able?-five overarching principles for an AI code	UK House of Lords Artificial Intelligence Committee's report	Report	2018	Governmental entity	UK	Global North	General
42	Guidelines for Artificial Intelligence	Deutsche Telekom	Set of guiding principles	2018	Telecommunications company	Germany	Global North	General
43	A Unified Framework of Five Principles for AI in Society	By Luciano Floridi and Josh Cowls& other researchers	research article	2018	Academia	Europe	Global North	General
44	Discussion Paper: National Strategy for Artificial Intelligence	National Institution for Transforming India (NITI Aayog)	Discussion paper	2018	Governmental entity	India	Global South	General
45	Sony Group AI Ethics Guidelines	Sony	Set of guiding principles	2018	Multinational corporation	Japan	Global North	General

46	AI Index report	Stanford Institute for Human-Centered Artificial Intelligence.	Report	2018	Academia	USA	Global North	General
47	Discussion Paper on Artificial Intelligence (AI) and Personal Data—Fostering Responsible Development and Adoption of AI	Personal Data Protection Commission Singapore	Discussion paper	2018	Governmental entity	Singapore	Global North	General
48	AI Principles of Telefónica	Telefónica	Set of guiding principles	2018	Telecommunications company	Spain	Global North	General
49	Initial Code of Conduct for Data-Driven Health and Care Technology	UK Department of Health & Social Care	Report	2018	Governmental entity	UK	Global North	Health
50	SMART DUBAI - AI ETHICS PRINCIPLES & GUIDELINES	Smart Dubai office	Report	2018	Governmental entity	UAE	Global South	General
51	Statement on Artificial Intelligence, Robotics and ‘Autonomous’ Systems	European Commission, European Group on Ethics in Science and New Technologies	Statement Set of guiding principles	2018	Intergovernmental organization supranational organization	Europe	Global North	General
52	Ethics Guidelines for Trustworthy AI	High-Level Expert Group on Artificial Intelligence - European commission	Report	2018	Intergovernmental organization supranational organization	Europe	Global North	General
53	Declaration on Ethics and Data Protection in Artificial Intelligence	40th International Conference of Data Protection and Privacy Commissioners (ICDPPC)-council of Europe	Declaration	2018	International organization	International	International	General
54	Intel’s AI Privacy Policy White Paper: Protecting Individuals’ Privacy and Data in the Artificial Intelligence World	Intel Corporation	Set of guiding principles	2018	Multinational corporation	USA	Global North	General
55	Everyday Ethics for Artificial Intelligence. A Practical Guide for Designers and Developers	IBM	Report	2018	Multinational technology corporation	USA	Global North	Developers and AI designers
56	AI4People—An Ethical Framework for a Good AI Society: Opportunities, Risks,	AI4People	Research article	2018	Academia	Europe	Global North	General

	Principles, and Recommendations							
57	The Barcelona declaration for the proper development and usage of artificial intelligence in Europe	Luca Steels, , Ramon Lopez de Mantaras	Research article	2018	Academia	Spain	Global North	General
58	Introducing Unity's Guiding Principles for Ethical AI—Unity Blog	Unity Technologies	Set of guiding principles	2018	Software company	USA	Global North	General
59	Responsible Bots: 10 Guidelines for Developers of Conversational AI	Microsoft	Set of guiding principles	2018	Multinational technology corporation	USA	Global North	Conversational AI developers-Bots
60	Principles to Promote Fairness, Ethics, Accountability and Transparency (FEAT) in the Use of Artificial Intelligence and Data Analytics in Singapore's Financial Sector	Monetary authority of Singapore	Set of guiding principles	2018	Governmental entity	Singapore	Global North	Financial
61	Governing Artificial Intelligence. Upholding Human Rights & Dignity	Data & Society	Report	2018	Academia Research Institute	USA	Global North	General
62	AI Now 2018 Report	AI Now Institute	Report	2018	Academia	USA	Global North	General
63	European Ethical Charter on the Use of Artificial Intelligence in Judicial Systems and Their Environment	Council of Europe; European Commission for the Efficiency of Justice (CEPEJ)	Ethical Charter	2018	International organization	Europe	Global North	Judicial systems
64	Ethics Framework: Responsible AI	Machine Intelligence Garage Ethics Committee	Framework	2018	Acceleration programme	UK	Global North	General
65	Our principles-Google AI	Google	Set of guiding principles	2018	Multinational technology company	USA	Global North	General
66	Open Ethics Manifesto	Open ethics initiative	Set of guiding principles	2018	Global initiative	International	International	General
67	GUIDING PRINCIPLES ON TRUSTED AI ETHICS	Telia Company	Set of guiding principles	2019	Multinational telecommunications company	Sweden	Global North	General

68	Recommendations on the inclusion subSaharan Africa in Global AI Ethics	Research ICT Africa	Set of guiding principles	2019	Think tank	South Africa	Global South	General
69	Responsible AI in Consumer Enterprise	Integerate.ai	Framework	2019	Software company	Canada	Global North	General
70	Understanding artificial intelligence ethics and safety - A guide for the responsible design and implementation of AI systems in the public sector program.	The Office for Artificial Intelligence (OAI) and the Government Digital Service (GDS) in partnership with The Alan Turing Institute's public policy	Report	2019	Academia Governmental entity	UK	Global North	General
71	Building ethical AI approaches in the African context	UN global pulse	Set of guiding principles	2019	Initiative	International	International	General
72	IBM's Principles for Trust and Transparency	IBM	Set of guiding principles	2019	Multinational technology corporation	USA	Global North	General
73	AI Index Report	Stanford Institute for Human-Centered Artificial Intelligence.man	Report	2019	Academia	USA	Global North	General
74	Australia's AI ethics principles	Australian government department of industry science and resources	Set of guiding principles	2019	Governmental entity	Australia	Global North	General
75	Artificial Intelligence-Australia's ethics framework a discussion paper	Australian government department of industry, innovation and science	Framework	2019	Governmental entity	Australia	Global North	General
76	AI Needs an Ethical Compass	IDEO	Set of guiding principles	2019	design consulting firm and	USA	Global North	General
77	OECD AI Principles overview	OECD. AI policy observatory - OECD	Set of guiding principles	2019	Intergovernmental organization	Europe	Global North	General
78	Ethically Aligned Design. A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems, Version 2	Institute of Electrical and Electronics Engineers (IEEE), The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems	Report	2019	Non-profit association Non profit organization	International	International	General Health

79	Ethics of AI in Radiology: European and North American Multisociety Statement	American College of Radiology; European Society of Radiology; Radiology Society of North America; Society for Imaging Informatics in Medicine; European Society of Medical Imaging Informatics; Canadian Association of Radiologists; American Association of Physicists in Medicine	Report	2019	Non-profit association Non profit organization	International	International	Health-Radiology
80	A practical guide to Responsible Artificial Intelligence (AI)	PricewaterhouseCoopers (PwC)	Framework	2019	International professional services brand of firms	International based in England	International	General
81	10 Principles of Responsible AI	Women Leading in AI	Set of guiding principles	2019	action tank/think tank	N/A	N/A	General
82	Ethics Code for AI Engineers - AI ETHICS WITH ANDREW NG AND DEEPLARNING.AI	Machine Learning Tokyo (MLT)	Set of guiding principles	2019	Non-profit organization	Japan, Philippines, Hong Kong / Asia	Global North+Global South	AI Engineers
83	Ethically Aligned Design: A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems, First Edition (EAD1e)	Institute of Electrical and Electronics Engineers (IEEE), The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems	Report	2019	Non-profit association Non profit organization	International	International	Health
84	Principled Artificial Intelligence: Mapping Consensus in Ethical and Rights-based Approaches to Principles for AI https://walton.uark.edu/business-integrity/images/PrincipledAIHarvard2020.pdf	The Berkman Klein Center for Internet & Society at Harvard University	Research article	2020	Academia	USA	Global North	General
85	Deloitte's Trustworthy AI™ framework	The Deloitte AI institute	Framework	2020	Private company Research/innovation center	International based in England.	International	General
86	AI Index Report	Stanford Institute for Human-Centered Artificial Intelligence.	Research article	2021	Academia	USA	Global North	General

87	Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL LAYING DOWN HARMONISED RULES ON ARTIFICIAL INTELLIGENCE (ARTIFICIAL INTELLIGENCE ACT) AND AMENDING CERTAIN UNION LEGISLATIVE ACTS	European commission	Regulatory framework	2021	Intergovernmental organization supranational organization	Europe	Global North	General
88	Working Group on Ethics and Data Protection in Artificial Intelligence	Office of the Privacy Commissioner for Personal Data (PCPD), Hong Kong, China Commission Nationale de l'Informatique et des Libertés (CNIL), France European Data Protection Supervisor (EDPS), European Union	Report	2021	Intergovernmental organization supranational organization governmental entity	International	International	General
89	ARTIFICIAL INTELLIGENCE GOVERNANCE PRINCIPLES: TOWARDS ETHICAL AND TRUSTWORTHY ARTIFICIAL INTELLIGENCE IN THE EUROPEAN INSURANCE SECTOR	The European Insurance and Occupational Pensions Authority (EIOPA)	Report	2021	International/Intergovernmental organization	Europe	Global North	General
90	PAI six thematic pillars and Tenets	Partnership on AI	Set of guiding principles	2021	Non-profit organization	International	International	General
91	Six Steps To Execute Responsible AI In The Enterprise	Forbes Technology council	Set of guiding principles	2022	Invitation-Only Organization	USA	Global North	General
92	AI Hippocratic Oath	Oren Etzioni, CEO of the Allen Institute for Artificial Intelligence	Research article	2022	Academia	USA	Global North	General
93	Kakao Algorithm Ethics	Kakao corporation	Set of guiding principles	2022	Internet company	South Korea	Global North	General

94	Governance Guidelines for Implementation of AI Principles -Ver. 1.1	The Ministry of Economy, Trade and Industry (METI), with the Expert Group on How AI Principles Should be Implemented	Frame work	20 22	Governmental entity	Japan	Global North	General
95	Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators	European commission	Report	20 22	Intergovernmental organization supranational organization	Europe	Global North	Education
96	AI Index Report	Stanford Institute for Human-Centered Artificial Intelligence.	Report	20 22	Academia	USA	Global North	General
97	ITI Policy Principles for Enabling Transparency of AI Systems	Information Technology Industry Council (ITI)	Set of guiding principles	20 22	global association trade	International	International	General
98	A Research Summary of the Ethical and Human Rights Implications of AI in Africa	African AI ethics and human rights: the Human Sciences Research Council (HSRC) and Meta announced a collaborative project and released a request for proposals (RFP).	Report	20 22	Research agency think tank academia	Africa	Global South	General
99	BLUEPRINT FOR AN AI BILL OF RIGHTS MAKING AUTOMATED SYSTEMS WORK FOR THE AMERICAN PEOPLE	The white house	Set of guiding principles	20 22	Governmental entity	USA	Global North	General
100	AI Ethics Principles for public consultation	Saudi Data and Artificial Intelligence Authority (SDAIA)	Frame work	20 22	Governmental entity	Saudi Arabia	Global South	General

5. Results

This research purpose is to provide key information into the AI ethical landscape by analyzing the documents through four key lenses:

- a) The time of issuing of the documents to understand when the AI ethical framework documents emerged and how this changes over time.
- b) The type of documents to investigate the nature of documents addressing AI ethics and principles in terms of whether they are soft-laws, non-binding recommendations that AI developers and engineers voluntarily follow or regulatory, official documents that are legally binding.
- c) The type of issuer to map the entities that are heavily and actively involved in the production of AI ethical frameworks, providing a clearer picture of whether such ethical frameworks are

dominated by big tech companies or governmental entities attempting to supervise the development and advancements of AI models.

d) The geographic distribution and where the documents come from: to expose the spatial distribution of the published ethical frameworks' production and the countries and regions actively engaged in the field of AI ethics and the production of AI ethical frameworks and guiding principles.

e) The sector's covered in the documents to explore which sectors are advanced in relation to AI ethics and which sectors need further development requiring AI ethical frameworks that directly address the potential repercussions of implementing AI systems and technologies within them.

5.1. The year of issuing the documents

The earliest AI ethical frameworks identified were found in 2015 and were primarily developed by non-profit organizations. For instance, the Unified Ethical Frame for Big Data Analysis , Unified Ethical Frame for Big Data Analysis. IAF Big Data Ethics Initiative, Part A, the DIGITAL DECISIONS: Building Trust in Algorithms and the Open AI Charter, which were developed by the Information Accountability Foundation, the Center for Democracy & Technology, the Open AI, and the Icelandic Institute for Intelligent Machines (IIIM) respectively. In 2017, the UK commissioner office published the Big Data, Artificial Intelligence, Machine Learning and Data Protection, which is the first ethical framework to be developed by a governmental entity. In 2018, the Digital dubai office published the SMART DUBAI - AI ETHICS PRINCIPLES & GUIDELINES, which is the first AI ethical framework developed by a gulf country.

From the analysis of the dataset of 100 documents addressing AI ethics, we notice that the largest number of AI ethical frameworks was published in 2018 with a total of 43 publications, followed by 2017 and 2019 with a total of 19 and 17 respectively (see figure 2). In this regard, the period from 2017 to 2019 had the greatest number of published AI ethical frameworks. This considerable growth in the production of AI frameworks can be understood as a governance response to advanced AI research, the output of which and the market size of which have both increased dramatically in recent years [9] .The diagram in figure 2 provides an overview of AI ethical frameworks publications from 2015 to 2022, indicating 2015 as the first year year of publishing AI ethical frameworks and 2018 as the peak year of publishing the ethical frameworks publications. Moreover, 2018 is the year with the most variations of document types followed by 2019 and then 2017 (see figure 3).

Number of published ethical frameworks vs. Year of publishing

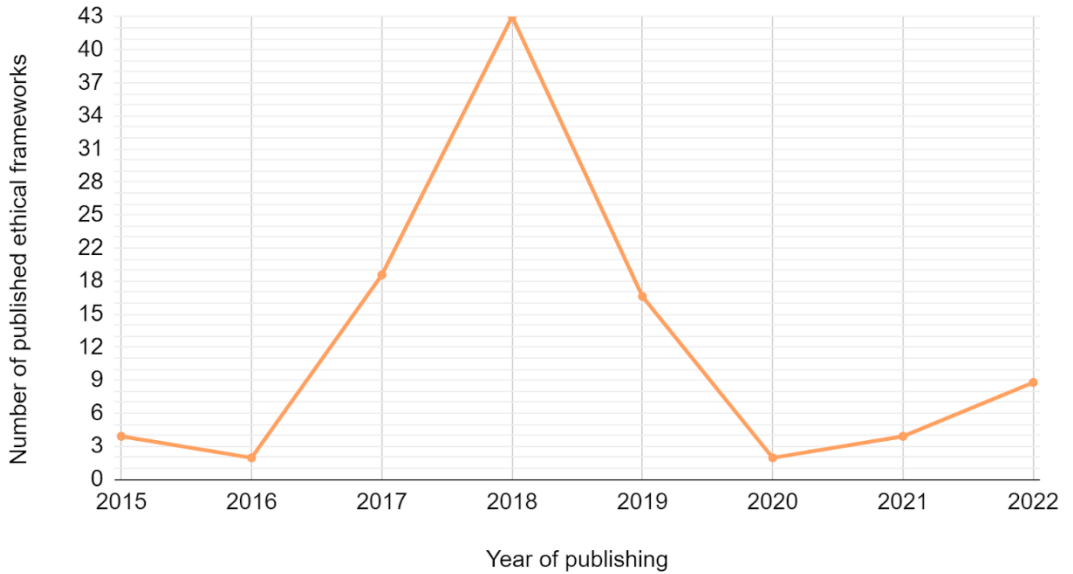


Figure 2: Number of published AI ethical frameworks over the years (2015-2022). Source: Authors.

Type of document vs. Year

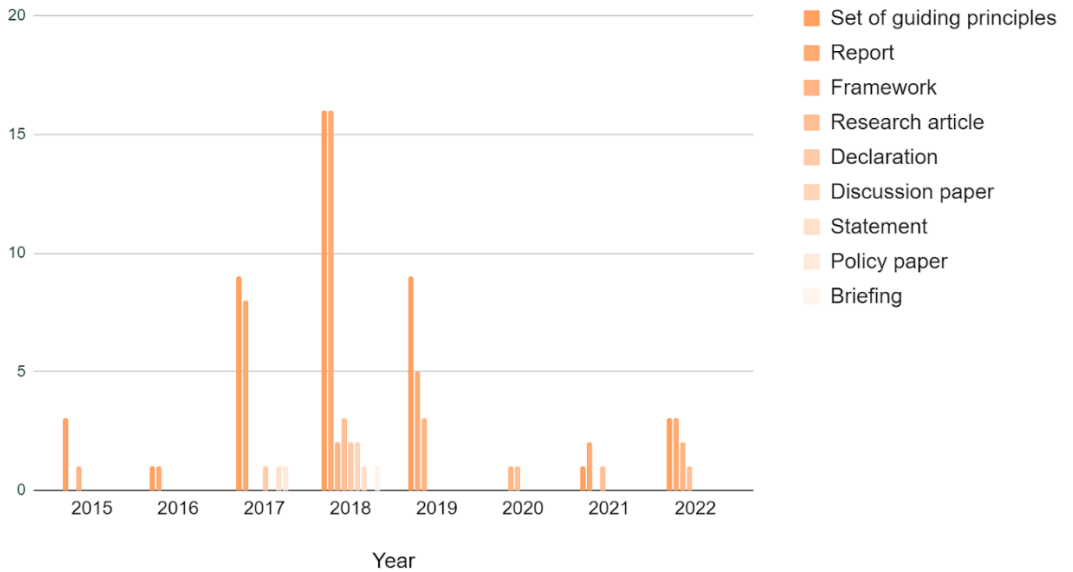


Figure 3: The number of types of published documents per year (2015-2022). Source: Authors.

5.2. The type of documents

In general, all types of documents provide AI engineers, AI developers, and governments with principles, rules, and suggestions to drive the creation of responsible, ethical AI systems.

The investigated dataset of 100 documents addressing AI ethics (listed in Table 1) can be classified into six main types: I) A set of guiding principles, II) Reports, III) Frameworks ,IV) Research articles V) Declarations, VI) Discussion papers,VII) Statements, VIII) Policy Papers, and IX) Briefings.

The set of guiding principles often includes obvious principles such as transparency, accountability, and privacy, as well as a brief explanation and definition for each principle/title in relation to the issuer's mission such as the Open AI Charter 2015 and the Asilomar AI Principles 2017. Reports are typically more detailed, providing an overview and introduction to the issue of AI ethics, as well as a set of principles and recommendations such as the annual AI Index Report, the Human Rights in the Robot Age Report 2017. Research articles include reports and scholarly articles published by individual researchers or research institutes on AI ethics and guiding principles such as the AI4People—An Ethical Framework for a Good AI Society: Opportunities, Risks, Principles, and Recommendations) (Floridi et al., 2018) A declaration, on the other hand, is a formal statement or announcement made by a formal institution that includes AI ethical principles such as The Montreal Declaration for Responsible AI 2017 and the Toronto Declaration: Protecting the Right to Equality and Non-discrimination in Machine Learning Systems 2018.

The results of the analysis of the collected 100 documents reveals that the majority of the documents are sets of guiding principles with a percentage of 43%, while reports came in second place with a percentage of 35%. Frameworks, Research articles, declarations, discussion papers, and statements followed by percentages of 9%, 6%, 3%, 2%, and 2% respectively (See figure 1).

Type of documents published on AI ethics

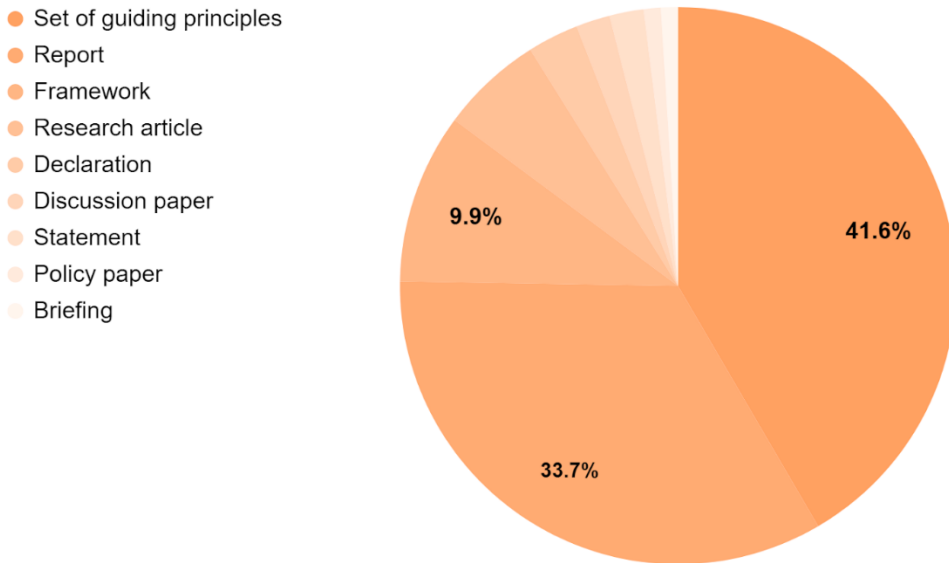


Figure 1: percentages of published ethical frameworks by document type. Source: Authors.

The breakdown of document types and the quantity of documents published each year as well as the total number of each document type published is presented in Table 1. Table 1 shows that there are 42 different sets of guiding principles derived from the examination of the 100 different documents. There are 34 AI ethical reports, 10 frameworks, and 6 research articles. Finally, declarations, discussion papers, statements, policy papers, and briefing received the fewest numerical values, totaling , 3, 2, 2,1,1 each.

Table 1: The number of AI Ethics documents published per year, broken down by document type.

Year	Set of guiding principles	Report	Framework	Research article	Declaration	Discussion paper	Statement	Policy paper	Briefing
2015	3	0	1	0	0	0	0	0	0
2016	1	1	0	0	0	0	0	0	0
2017	9	8	0	0	1	0	1	1	0
2018	15	15	2	3	2	2	1	0	1

2019	9	5	3	0	0	0	0	0	0
2020	0	0	1	1	0	0	0	0	0
2021	1	2	1	1	0	0	0	0	0
2022	4	3	2	1	0	0	0	0	0
Total	42	34	10	6	3	2	2	1	1

5.3. The type of issuer

The investigation of 100 documents addressing AI Ethics shows that the majority of ethical frameworks are developed by private entities, with a percentage of 31.8%. These Private entities include Multinational technology corporation, Think tank, Trade association, Technology company, AI research and deployment company, Software company, Initiative, Telecommunications company, Multinational corporation, a cooperative financial services group, Acceleration programme, Global initiative, International professional services brand of firms, Private company, Research agency, and Technology incorporation. Academia comes in second with 19.1%, followed by non-governmental organizations (16.4%), non-profit organizations (12.7%), and intergovernmental organizations (9.1%). International and supranational organizations come in last, contributing 5.5% each. (See figure 4).

Number of publications per type of issuer

- Private entities
- Academia
- Governmental entity
- Non-profit organization
- Intergovernmental organization
- International organization
- supranational organization

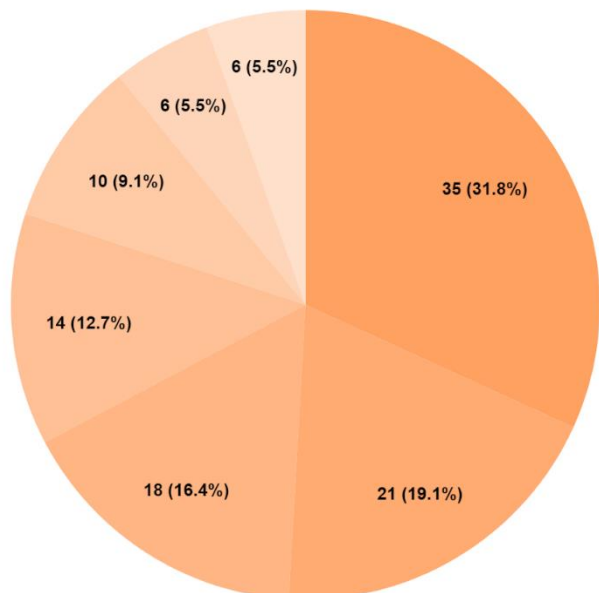


Figure 4: Number of published AI ethical frameworks per type of issuer. Source: Authors.

In numbers, AI ethical frameworks developed by private non governmental entities totaled 35 documents out of the investigated 100 documents. Documents developed by academia were 21 documents, followed by 18 documents developed by governmental entities and 14 documents developed by non-profit organizations. However, intergovernmental and international organizations, and supranational organizations such as the European Commission and the Organization for Economic Cooperation and Development (OECD) participated in the development of 10 and 6 documents, respectively.

The bar chart in figure 5 demonstrates in detail the number of documents developed in relation to the type of issuer. This classification of issuers provides an overview of the major entities involved in the production of these frameworks, which provides a better understanding of the current AI ethics scene, who controls it, and whether these frameworks are binding or just soft laws created by the same entities developing the AI systems and software applications.

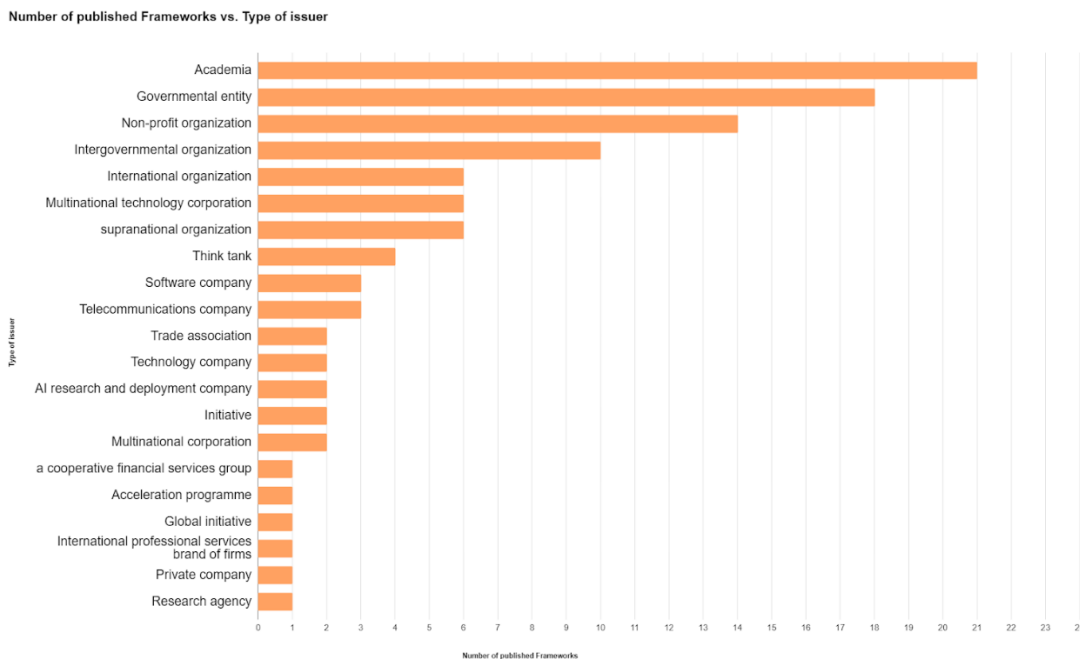


Figure 5: Number of published AI ethical frameworks in relevance to type of issuer. Source: Authors.

5.4. The geographic distribution of the documents

Among the 100 documents addressing AI Ethics we analyzed in this article, the results demonstrate that the majority of the AI ethical frameworks were developed by entities and organizations in the Global North. The analysis demonstrates that there are 74 AI ethical frameworks developed by organizations in the Global North region in comparison to only 6 AI ethical frameworks developed by entities and organizations located in the Global South.

The remaining 20 documents of AI ethics are developed by entities with international origins..., as demonstrated in table 2.

Table 2: The number of published ethical frameworks by geographical location (Region)

The number of published ethical frameworks by Geographical location (Region)		
Region	Number of publications	Percentages
International	20	20%
Global North	74	74%
Global South	6	6%

In other words, 72.4%% of the analyzed documents were developed in the Global North, while only 7.6% were developed in the Global South, and 20.0% were developed internationally . These percentages indicate a gap between the Global North and the Global South when it comes to issuing frameworks that address the ethical concerns of AI systems. Furthermore, it is worth mentioning that even International Ethical Frameworks are primarily established by experts and organizations in the Global North, which adds to the already existing gap in AI ethical frameworks between the Global North and the Global South. The gap in the production of AI ethical texts between the Global North and the Global South must be addressed. The origin and the Context of AI ethical texts is important because difficulties and concerns that are critical for one location might not be important or even be irrelevant to another.

In terms of countries, the analysis of the 100 documents reveals that the United States is the highest ranking country with the most contributions to AI ethical frameworks, with 28 documents on AI ethics and guidelines. Following the United States are documents developed by international entities, which account for 20 of the 100 documents examined. Documents generated by the European entities ,and the United Kingdom on the other hand, were 11, 10 respectively. Japan came next, with a contribution of 5 documents. While Germany, Finland and Canada followed Japan with three documents each. France, Singapore, Spain, Australia, and Africa followed, each contributing two publications. Finally, among the documents examined, Iceland, Netherlands, Norway, India, UAE, South Africa, Philippines, Hong Kong, Saudi Arabia, South Korea, and Sweden are equal with a contribution of one published ethical framework per each. The bar chart in figure 7 shows the contributions of countries on AI ethical frameworks in relevance to one another.

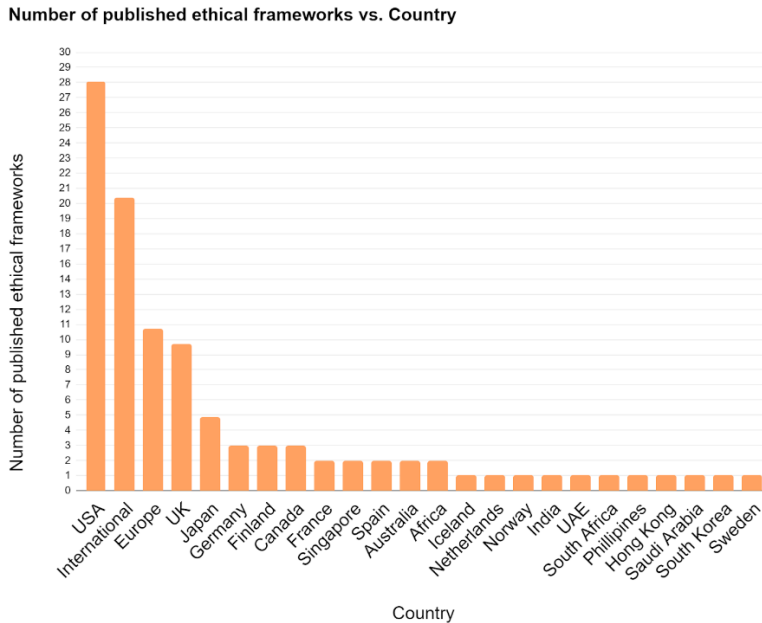


Figure 7: Number of published AI ethical frameworks per country. Source: Authors.

5.5. The sectors addressed in the documents

The majority of the published AI ethical frameworks with a percentage of 87.3% are broad and general and don't necessarily address a specific sector as shown in figure 8. These general AI ethical frameworks outline general guidelines and principles that can be followed and adopted by various fields and sectors. However, there are other AI ethical frameworks that are sector focused aiming at contributing to specific sectors such as health (Ethical, Social, and Political Challenges of Artificial Intelligence in Health, 2018), Mobility/automated transportation sector (ETHICS COMMISSION AUTOMATED AND CONNECTED DRIVING-report 2017), Developers and AI designers (Everyday Ethics for Artificial Intelligence. A Practical Guide for Designers and Developers 2018), Conversational AI developers-Bots (Responsible Bots: 10 Guidelines for Developers of Conversational AI 2018), Judicial systems (European Ethical Charter on the Use of Artificial Intelligence in Judicial Systems and Their Environment 2018), Health-Radiology (Ethics of AI in Radiology: European and North American Multisociety Statement 2019), AI Engineering (Ethics Code for AI Engineers - AI ETHICS WITH ANDREW NG AND DEEPLARNING.AI 2019), Education (Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators 2022).

The AI ethical frameworks that focus on the health sector are in second place after general frameworks with a percentage of 5 % and a count of 5 documents. While the percentage of published documents on each of the rest of the sectors is 1% with a count of 1 document per each sector.

Table 3 shows the number of documents on AI ethics published per each sector. For instance, there are 5 AI ethical documents produced addressing the health sector, whereas each of the other areas has just one published document.

Table 3: The number of published ethical frameworks per sector

Sectors	Number of published ethical frameworks	Percentages
General	89	89%
Health	5	5%
Mobility/automated transportation	1	1%
Developers and AI designers	1	1%
Conversational AI developers-Bots	1	1%
Judicial systems	1	1%
Health-Radiology	1	1%
AI Engineers	1	1%
Education	1	1%
Financial	1	1%

Although general AI ethical frameworks provide valuable principles for guiding AI developers and creators toward more responsible AI, there is still a need for additional sector-specific AI ethical frameworks developed through collaborations between AI specialists and other field experts. In this regard, the 2017 Software & Information Industry Association's (SIIA) draft guidelines emphasize the necessity for Sector Specific Guidelines in various application domains and industries. Because diverse scenarios present unique challenges For example, the deployment of AI systems in medical care is more critical and sensitive than the case of AI systems recommending songs. “It is, therefore, explicitly acknowledged that a tailored approach is needed given AI’s context-specificity” (SIIA, 2017, p.4).For example, the educational sector, policing sector, judicial sector and urban AI sector. The rising deployment of AI systems and technologies within cities, requires an urban AI ethical framework that addresses and guides the potential ramifications of AI deployment in cities on an urban scale.

6. Discussion and Future work

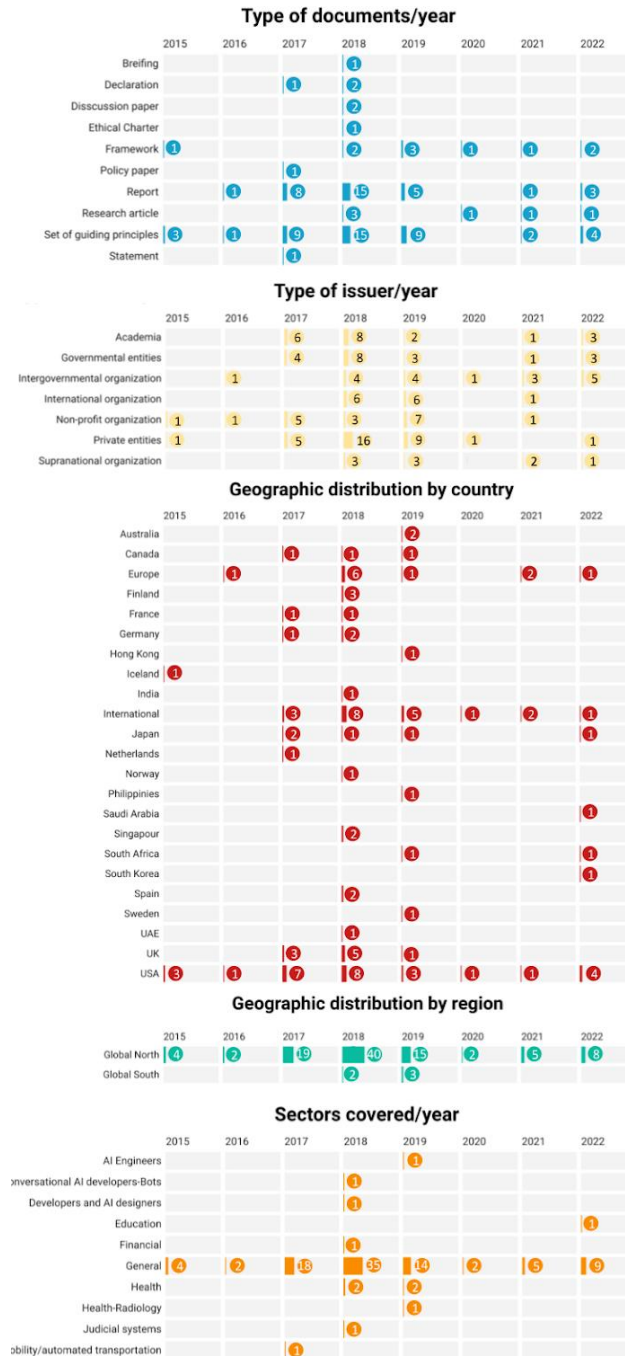


Figure 9: Timeline chart of AI ethical documents collected in this article Source: Authors

The analysis of the 100 documents in this article provides valuable insights into the AI ethical landscape, as well as the ethical gaps that need to be addressed in future ethical frameworks. To begin, the analysis of document types revealed that the created documents on AI ethics and principles are still soft-laws non-binding guidelines that AI developers and engineers can choose to follow or not. In that context, more research is needed in this area to establish a ground where these recommendations and ethical frameworks can be transformed into legislation and laws without limiting AI advancement or risking human safety and privacy.

Moreover, the document tracking revealed that the first AI ethical documents were created in 2015 (see figure 9), and a multitude of further resources were developed in the years that followed. It is worth noting that the production of documents on AI ethics has increased in recent years, particularly in 2018. In 2017, the German Federal Ministry of Transport and Digital Infrastructure published an AI ethical document on Mobility/automated transportation. As a result, additional research is required to identify whether the increase of AI ethics documents is related to the rapid development and deployment of AI systems or to the numerous incidents of unanticipated damages and ramifications created by AI system implications.

Furthermore, as previously shown in the article, the vast majority of AI ethical documents available are generic (see figure 9), with only a few sector-specific AI ethical documents available, such as those for the health industry, automated transportation, and radiology. There are still unaddressed sectors in the 100 traced documents, necessitating future research to produce sector-specific and context-based frameworks, as well as AI ethical documents. Specifically, Urban AI, because the deployment of AI applications and systems in cities will have a significant impact on cities, as a result, the daily lives of individuals who live within.

Additionally, private, non-governmental organizations produce the majority of AI ethical documents, followed by academia and governmental entities. Such a discrepancy in document production between non-governmental and governmental documents raises the question of how the principles, guidelines, and their interpretation differ between documents generated by private entities and those developed by governmental or academic entities.

In a similar manner, there is a substantial gap between the Global North and the Global South in terms of the regional distribution of AI ethical documents (see figure 9). This could be due to the fact that most big tech companies are based in the Global North, as well as the fact that having strong economies allows these countries to adapt AI technologies and hence address its ethical implications early on. This gap, however, must be addressed early on in order to understand how these AI ethical texts would differ if developed from a Global South viewpoint.

7. Conclusion

When we reviewed the collected data on AI ethical frameworks, we discovered that the majority are produced and developed by private entities or companies primarily located in the Global North. This calls for more AI ethical frameworks developed by entities in the Global

South in order to provide AI ethics and guiding principles that tackle the contextual issue and needs.

Moreover, some governments in the Global South are participating in the development of national AI strategies, yet very few in comparison to the Global North countries have developed an AI ethical framework that takes into account the local context in addition to the social and political circumstances. If African nations want to harness the potential of AI without exacerbating existing societal and political problems that might be developed when implementing AI systems in the urban fabric, this is an essential step for them to take.

The majority of published AI ethical frameworks are general and do not necessarily address a specific sector, with a few exceptions, such as Health, Education, AI engineering, and Health-Radiology. In this regard, more study is needed to address the ethical implications of adopting and exploiting AI in different sectors and fields as well as to establish sector-specific AI ethical frameworks. Moreover, it's worth noting that there is a need for an urban AI ethical framework, since there is a lack of AI ethical frameworks that analyze or focus on the potential ramifications or drawbacks of deploying and employing urban AI in cities.

Despite the fact that there is a growing research interest in the fairness and transparency of AI. The current ethical framework has been heavily criticized for being too abstract, lacking context, and being majorly developed by certain privileged groups. Furthermore, several researchers and activists highlighted the shortcomings of such frameworks and how their creators must adopt a different approach in order to achieve an inclusive, comprehensive framework.

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