An Inventory of AI ethics: Analyzing 100 documents

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Abstract

AI ethics is a relatively nascent field whereby multiple guidelines, reports, statements, and initiatives on AI ethics have been developed. Despite the increased production on AI ethics in recent years, there is no systematic tracking in the literature that provides an in-depth study of the AI ethical production environment. Some of the previous research presents the geographic location and the date of the documents, however, necessary information about the documents of AI ethics remain missing such as their types, who issues them, and the covered and missing sectors. As a result, we analyze a dataset of 100 documents on AI ethics issued by various organizations between 2015 and 2022. The aim of this analysis is to provide a comprehensive view of the current AI ethical landscape. We use content analysis to highlight five key elements of the dataset: the time period for issuing (when), the type of documents created on AI ethics (how), the type of issuer (who), the geographic distribution (where), and the sectors they cover (what).
The findings show 2015 as the first year of publishing documents on AI ethics and 2018 as the peak year of publishing documents on AI ethics. Majority of documents are sets of guiding principles, followed by reports and the remaining document types. Moreover the majority of documents on AI ethics are developed by private entities followed by academia and governmental entities. In Addition, we notice a gap that the majority of the documents on AI ethics were developed by entities and organizations in the Global North. Lastly, most AI ethics documents are generic and do not focus on a particular sector. Nonetheless, a few documents have been created to address specific sectors such as health, mobility/automated transportation, and education. Nevertheless, documents on AI ethics remain non-binding guidelines raising several questions about the applicability of AI ethics in reality.
Keywords: Artificial Intelligence, AI ethics, Responsible AI, ethical AI.

1. Introduction

More and more nations are realizing the importance of keeping up with and capitalizing on the advancements in artificial intelligence (AI) [1]. In 2021, the OECD AI policy observatory, stated that 69 nations had issued official AI policy initiatives [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 around AI systems 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 their potential harms [5] [6] [7]. As a result, multiple normative frameworks, standards, and sets of ethical principles guiding the use of AI have emerged over the past few years [6]. 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 documents on AI ethics started to emerge to address the negative implications of AI and guide the development of AI systems toward the greatest public good [5] [6] [8] [9]. 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 only investigate these documents on AI ethics from specific perspectives. For instance, [8] examined a set of 108 ethical documents to investigate the ethical consequences of applying AI in justice systems. [8] aimed at determining which ethical principles and risk factors the documents primarily "converge" or agree on. The study's results show that there may be differences between how AI is used in justice and how it is used in other fields in terms of expected risks and how ethical values are protected. Similarly research by [9] examined the global landscape of existing AI ethics guidelines and analyzed 84 documents containing ethical principles and/or guidelines for AI. The study's findings of [9] show a "global convergence" - an agreement - among the documents on five key ethical principles of AI: transparency, justice and fairness, non-maleficence, accountability, and privacy. However the authors demonstrate a substantial variance in how these principles are interpreted throughout the documents. Both articles [8] and [9] provide an inventory of AI ethical documents as well as content analysis of these documents; however, the emphasis of the analysis is on the principles contained within these documents. Although the articles mention the geographic location and the date of the documents, some necessary data about the documents of AI ethics 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 by analyzing 100 existing documents on AI ethics to understand time of issuing (when), type of document (how), 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 landscape. We collect a set of 100 chronologically arranged documents on AI ethics in our inventory, with each categorized by (1) type, (2) date of issue, (3) type of issuer, (4) origin, and (5) sectors covered. The categories are then interpreted quantitatively to extrapolate the overall landscape of ethical AI production and publication.

The article proceeds as follows: first, we present the methodology for this study. Then, we present the inventory of the collected 100 existing documents issued between 2015 and 2022 addressing AI ethics. Next, in the results section, we analyze and describe the collected data on AI ethics. In the final discussion section, we reflect on the analysis by providing a comprehensive overview of the results of the 100-document analysis in relation to the four points mentioned above.

2. Methodology

The article aims at analyzing existing documents on AI ethics to understand the time period for issuing (when), the type of document (how), the type of issuer (who), geographic distribution (where), and the covered/missing sectors (what). In terms of the five aforementioned points, this tracing provides an overview and a more in-depth grasp of the present AI ethical Landscape. Furthermore, it points out the gaps in the published documents on AI ethics, which 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 Google search engine 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 reference lists and inventories of two scholarly articles [8] and [9] which aimed at analyzing a set of documents on AI ethics. We used 67 out of the 84 documents presented at [9] in our inventory of documents on AI ethics while 17 documents were excluded as they provided general insights and do not mention direct guidelines or principles on AI ethics. Additionally using search, we completed the dataset consist of 100 documents on AI ethics (presented in Table 1). The dataset includes reports, set of guiding principles, research articles, frameworks and declarations as we will explain later. The data collection took place between December 2022 and February 2023.

Phase 2 - Tracing the collected data: We traced the information of each document in the collected dataset of 100 documents on AI ethics to understand a) the time period for issuing (when), b) the type of document (how), c) the type of issuer (who), d) geographic distribution (where), and e) the covered/missing sectors (what).

Phase 3 - Analysis: We conducted a content analysis, presenting a chronologically ordered history of the existing documents on AI ethics from 2015 to 2022. Content analysis is a research method used to draw valid and replicable inferences from textual materials by interpreting and coding it. It serves as an important bridge between quantitative and

qualitative research methods [8]. As a result, we draw conclusions about the time of the emergence of documents on AI ethics, when the majority of these documents were formed, the origin and type of entities involved in the dissemination of these documents on AI ethics (such as private tech companies, governmental entities, non-profit organizations, or academia), and the sectors they cover or miss.

3. Analyzing 100 documents on AI ethics

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.

In Table 1, we add the dataset of 100 documents on AI ethics. According to the analysis in this article as well as the other examined sources, the earliest work on AI ethics was published in 2015 [5] [6] [8] [9]. We confirm that through our search we find that the earliest published document including guidelines for AI ethics is in 2015. Our dataset includes documents starting at this time, and the latest document that we could find was published in 2022. The collected dataset of documents on AI ethics presented in Table 1 is organized chronologically and includes a direct link to the document and information about the type of issuer and the sectors covered by each document.

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

	Title	Year (When)	Document type (How)	Issuer (Who)	Type of issuer (Who)	Origin of Issuer (Where)	Region (Where)	Sectors covered (What)
1	Unified Ethical Frame for Big Data Analysis. IAF Big Data Ethics Initiative, Part A	2015	Frame work	The Information Accountability Foundation	Non-profit organization	USA	Global North	General
2	DIGITAL DECISIONS: Building Trust in Algorithms	2015	Set of guiding principles	Center for Democracy & Technology	Non-profit organization	USA	Global North	General
3	Open AI Charter	2015	Set of guiding principles	Open AI	AI research and deployment company	USA	Global North	General
4	Civilian AI policy - Ethics Policy	2015	Set of guiding principles	Icelandic Institute for Intelligent Machines (IIIM)	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	2016	Report	AI Now Institute	Non-profit organization	USA	Global North	General
6	Position on Robotics and Artificial Intelligence	2016	Position Set of guiding principles	The Greens (Green Working Group Robots)	Intergovernmental organization	Europe	Global North	General
7	Statement on Algorithmic Transparency and Accountability	2017	Statement Set of guiding principles	Association for Computing Machinery (ACM)	Non-profit organization	USA	Global North	General
8	Artificial Intelligence and Machine Learning: Policy Paper	2017	Policy paper	Internet Society	Non-profit organization	International	International	General
9	The Asilomar AI Principles	2017	Set of guiding principles	The Future of Life Institute, in collaboration with attendees of the high-level Asilomar conference on beneficial AI.	Non-profit organization	USA	Global North	General

10	Microsoft's responsible AI principles	2017	Set of guiding principles	Microsoft	Multinational technology corporation	USA	Global North	General
11	Machine Learning: The Power and Promise of Computers that Learn by Example	2017	Report	The Royal Society	Academia	UK	Global North	General
12	The Montreal Declaration for Responsible AI	2017	Declaration	The University of Montreal	Academia	Canada	Global North	General
13	Human Rights in the Robot Age Report	2017	Report	The Rathenau Institute	Non-profit organization	Netherlands	Global North	General
14	Artificial Intelligence. The Public Policy Opportunity	2017	Set of guiding principles	Intel Corporation	Multinational technology corporation	USA	Global North	General
15	AI Index 2017 Report	2017	Report	Stanford Institute for Human-Centered Artificial Intelligence.	Academia	USA	Global North	General
16	Big Data, Artificial Intelligence, Machine Learning and Data Protection	2017	Report	UK Information Commissioner's Office	Governmental entity	UK	Global North	General
17	The Japanese Society for Artificial Intelligence Ethical Guidelines	2017	Set of guiding principles	Japanese Society for Artificial Intelligence	Academia	Japan	Global North	General
18	Ethics commission automated and connected driving-report	2017	Report	Federal Ministry of Transport and Digital Infrastructure, Ethics Commission	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	2017	Report	French Data Protection Authority (CNIL)	Governmental entity	France	Global North	General
20	The Ethics of Code: Developing AI for Business with Five Core Principles	2017	Set of guiding principles	Sage	Multinational technology corporation	International/ UK	International	General
21	The Future Society, Law & Society Initiative, Principles for the Governance of AI	2017	Set of guiding principles	The Future Society	Non-profit organization	USA	Global North	General
22	DeepMind Ethics & Society Principles	2017	Set of guiding principles	DeepMind Ethics & Society	Technology incorporation	UK	Global North	General

#	Title	Year	Type	Publisher	Entity type	Location	Region	Scope
23	Ethical Principles for Artificial Intelligence and Data Analytics	2017	Set of guiding principles	Software & Information Industry Association (SIIA), Public Policy Division	Trade association	International	International	General
24	AI Now 2017 Report	2017	Report	AI Now Institute	Academia	USA	Global North	General
25	Draft AI R&D Guidelines for International Discussions	2017	Conference Report	Institute for Information and Communications Policy (IICP), The Conference toward AI Network Society	Governmental entity, Academia	Japan	Global North	General
26	Top 10 Principles for Ethical Artificial Intelligence	2018	Set of guiding principles	UNI Global Union	International organization, global union federation	International/ based in switzerland	International	General
27	The Malicious Use of Artificial Intelligence: Forecasting, Prevention, and Mitigation	2018	Report	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	Academia, AI research and deployment company	International	International	General
28	White Paper: How to Prevent Discriminatory Outcomes in Machine Learning	2018	Report	World Economic forum (WEF), Global Future Council on Human Rights 2016-2018	International organization	International	International	General
29	Privacy and Freedom of Expression in the Age of Artificial Intelligence	2018	Report	Privacy International & Article 19	International Organization, Non-profit organization	International	International	General
30	The Toronto Declaration: Protecting the Right to Equality and Non-discrimination in Machine Learning Systems	2018	Declaration	Access Now; Amnesty International	Non-profit organization, International Organization	International, canada	International	General
31	Charlevoix Common Vision for the Future of Artificial Intelligence	2018	Set of guiding principles	Leaders of the G7	Intergovernmental organization	International	International	General
32	Business Ethics and Artificial Intelligence	2018	Briefing	Institute of Business Ethics	Non-profit organization	UK	Global North	General
33	Artificial Intelligence and Privacy	2018	Report	The Norwegian Data Protection Authority	Governmental entity	Norway	Global North	General
34	Work in the age of artificial intelligence-Four perspectives on the economy, employment, skills and ethics	2018	Report	Finland's ministry of Economic Affairs and Employment.	Governmental entity	Finland	Global North	General

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

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

58	Introducing Unity's Guiding Principles for Ethical AI—Unity Blog	2018	Set of guiding principles	Unity Technologies	Software company	USA	Global North	General
59	Responsible Bots: 10 Guidelines for Developers of Conversational AI	2018	Set of guiding principles	Microsoft	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	2018	Set of guiding principles	Monetary authority of Singapore	Governmental entity	Singapore	Global North	Financial
61	Governing Artificial Intelligence. Upholding Human Rights & Dignity	2018	Report	Data & Society	Academia Research Institute	USA	Global North	General
62	AI Now 2018 Report	2018	Report	AI Now Institute	Academia	USA	Global North	General
63	European Ethical Charter on the Use of Artificial Intelligence in Judicial Systems and Their Environment	2018	Ethical Charter	Council of Europe: European Commission for the Efficiency of Justice (CEPEJ)	International organization	Europe	Global North	Judicial systems
64	Ethics Framework: Responsible AI	2018	Framework	Machine Intelligence Garage Ethics Committee	Acceleration programme	UK	Global North	General
65	Our principles-Google AI	2018	Set of guiding principles	Google	Multinational technology company	USA	Global North	General
66	Open Ethics Manifesto	2018	Set of guiding principles	Open ethics initiative	Global initiative	International	International	General
67	GUIDING PRINCIPLES ON TRUSTED AI ETHICS	2019	Set of guiding principles	Telia Company	Multinational telecommunications company	Sweden	Global North	General
68	Recommendations on the inclusion subSaharan Africa in Global AI Ethics	2019	Set of guiding principles	Research ICT Africa	Think tank	South Africa	Global South	General
69	Responsible AI in Consumer Enterprise	2019	Framework	Integerate.ai	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.	2019	Report	The Office for Artificial Intelligence (OAI) and the Government Digital Service (GDS) in partnership with The Alan Turing Institute's public policy	Academia Governmental entity	UK	Global North	General
71	Building ethical AI approaches in the African context	2019	Set of guiding principles	UN global pulse	Initiative	International	International	General
72	IBM's Principles for Trust and Transparency	2019	Set of guiding principles	IBM	Multinational technology corporation	USA	Global North	General
73	AI Index 2019 Report	2019	Report	Stanford Institute for Human-Centered Artificial Intelligence.man	Academia	USA	Global North	General
74	Australia's AI ethics principles	2019	Set of guiding principles	Australian government department of industry science and resources	Governmental entity	Australia	Global North	General
75	Artificial Intelligence-Australia's ethics framework a discussion paper	2019	Framework	Australian government department of industry, innovation and science	Governmental entity	Australia	Global North	General
76	AI Needs an Ethical Compass	2019	Set of guiding principles	IDEO	design and consulting firm	USA	Global North	General
77	OECD AI Principles overview	2019	Set of guiding principles	OECD. AI policy observatory - OECD	Intergovernmental organization	Europe	Global North	General
78	Ethically Aligned Design. A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems, Version 2	2019	Report	Institute of Electrical and Electronics Engineers (IEEE), The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems	Non-profit association Non profit organization	International	International	General Health
79	Ethics of AI in Radiology: European and North American Multisociety Statement	2019	Report	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	Non-profit association Non profit organization	International	International	Health-Radiology

				Association of Physicists in Medicine			
80	A practical guide to Responsible Artificial Intelligence (AI)	2019	Framework	PricewaterhouseCoopers (PwC)	International professional services brand of firms	International based in England	International	General
81	10 Principles of Responsible AI	2019	Set of guiding principles	Women Leading in AI	action tank/think tank	N/A	N/A	General
82	Ethics Code for AI Engineers - AI ETHICS WITH ANDREW NG AND DEEPLEARNING.AI	2019	Set of guiding principles	Machine Learning Tokyo (MLT)	Non-profit organization	Japan,Phillipines, 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)	2019	Report	Institute of Electrical and Electronics Engineers (IEEE), The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems	Non-profit association Non profit organization	International	International	Health
84	Principled Artificial Intelligence: Mapping Consensus in Ethical and Rights-based Approaches to Principles for AIhttps://walton.uark.edu/business-integrity/images/PrincipledAIHarvard2020.pdf	2020	Research article	The Berkman Klein Center for Internet & Society at Harvard University	Academia	USA	Global North	General
85	Deloitte's Trustworthy AI™ framework	2020	Framework	The Deloitte AI institute	Private company Research/innovation center	International based in England.	International	General
86	AI Index 2021 Report	2021	Research article	Stanford Institute for Human-Centered Artificial Intelligence.	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	2021	Regulatory framework	European commission	Intergovernmental organization supranational organization	Europe	Global North	General
88	Working Group on Ethics and Data Protection in Artificial Intelligence	2021	Report	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	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	2021	Report	The European Insurance and Occupational Pensions Authority (EIOPA)	International/Intergovernmental organization	Europe	Global North	General
90	PAI six thematic pillars and Tenets	2021	Set of guiding principles	Partnership on AI	Non-profit organization	International	International	General
91	Six Steps To Execute Responsible AI In The Enterprise	2022	Set of guiding principles	Forbes Technology council	Invitation-Only Organization	USA	Global North	General
92	AI Hippocratic Oath	2022	Research article	Oren Etzioni, CEO of the Allen Institute for Artificial Intelligence	Academia	USA	Global North	General
93	Kakao Algorithm Ethics	2022	Set of guiding principles	Kakao corporation	Internet company	South Korea	Global North	General
94	Governance Guidelines for Implementation of AI Principles -Ver. 1.1	2022	Framework	The Ministry of Economy, Trade and Industry (METI), with the Expert Group on How AI Principles Should be Implemented	Governmental entity	Japan	Global North	General

95	**Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators**	2022	Report	European commission	Intergovernmental organization supranational organization	Europe	Global North	Education
96	AI Index 2022 Report	2022	Report	Stanford Institute for Human-Centered Artificial Intelligence.	Academia	USA	Global North	General
97	ITI Policy Principles for Enabling Transparency of AI Systems	2022	Set of guiding principles	Information Technology Industry Council (ITI)	global trade association	International	International	General
98	A Research Summary of the Ethical and Human Rights Implications of AI in Africa	2022	Report	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).	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	2022	Set of guiding principles	The white house	Governmental entity	USA	Global North	General
100	AI Ethics Principles for public consultation	2022	Framework	Saudi Data and Artificial Intelligence Authority (SDAIA)	Governmental entity	Saudi Arabia	Global South	General

4. Results

This study's purpose is to provide key information about the AI ethical landscape by analyzing 100 documents on AI ethics through four key lenses:

- The time period of issuing the documents (when): to understand when the documents on AI ethics emerged and how this changes over time.
- The type of documents (how): to investigate the nature of documents on AI ethics and principles in terms of whether they are A set of guiding principles; Reports; Frameworks; Research Articles; Declarations; Discussion Papers; Statements; Policy Papers; or Briefings.
- The type of issuer (who): to map the entities that are heavily and actively involved in the production of documents on AI ethics, providing a clearer picture of the type of entities that dominate the development and advancements of AI models.
- The geographic distribution of the documents (where): to expose the spatial distribution of the published documents on AI ethics' production and the countries and regions actively engaged in the field of AI ethics and the production of AI ethical frameworks and guiding principles.

- The sector's covered/ missed in the documents (what): 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.

The rest of the sections are structured accordingly;

4.1 The time period of issuing the documents (when)

In 2015, we notice that the earliest documents on AI ethics were primarily developed by non-profit organizations such as the framework developed by the Information Accountability Foundation in USA, the set of guiding principles developed by Center for Democracy & Technology in USA the set of guiding principles developed Open AI in USA, and the set of guiding principles developed by the Icelandic Institute for Intelligent Machines (IIIM) in Iceland. In 2017, the UK commissioner office (governmental organization) published a report titled 'Big Data, Artificial Intelligence, Machine Learning and Data Protection'. This can be considered as the first document on AI ethics by a governmental entity. From the analysis in Table 1, we find that the first document on AI ethics developed by a private company was issued in 2017 by Microsoft.

From the analysis of the dataset of 100 documents on AI ethics, we notice that the largest number of AI ethical documents was published in 2018 with a total of 43 publications, followed by the years 2017 and 2019 with a total of 19 and 17 documents, respectively (see Figure 1). In this regard, the period from 2017 to 2019 had the greatest number of published documents on AI ethics. This considerable growth between 2017 and 2019 in the production of documents on AI ethics can be understood as a response to advanced AI research,whose market size has increased dramatically in recent years [9]. Figure 1 shows an overview of the documents on AI ethics publications from 2015 to 2022. Figure 1 indicates 2015 as the first year of publishing documents on AI ethics and 2018 as the peak year of publishing documents on AI ethics.

Number of published documents on AI ethics per year of publishing
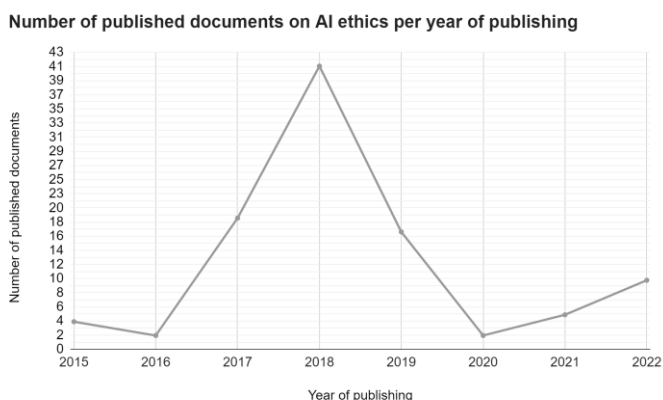

Figure 1: Number of published documents on AI ethics between 2015-2022 (based on analyzing a dataset of 100 documents publishing AI ethics, presented in Table 1). Source: Authors.

4.2 The type of documents (how)

The investigated dataset of 100 documents on 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 (i.e., transparency, accountability, and privacy) and a brief explanation and definition for each principle in relation to the issuer's mission. Some examples of documents that include a set of guiding principles include the <u>Open AI </u>Charter, published in 2015, and the Asilomar AI Principles, published in <u>2017</u>.

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. Some examples of the reports include the annual <u>AI Index Report</u> published in the years 2017, 2018, 2019,2021 ad 2022 and the '<u>Human Rights in the Robot Age Report'</u> published in <u>2017</u>.

Research articles include reports and scholarly articles published by individual researchers or research institutes on AI ethics and guiding principles such as the 'AI4People' report published by Floridi et al. in 2018.

A declaration, on the other hand, is a formal statement or announcement made by a formal institution that includes AI ethical principles. Some examples of these declarations include 'the Montreal Declaration for Responsible AI', published in 2017, and 'the Toronto Declaration: Protecting the Right to Equality and Non-discrimination in Machine Learning Systems', published in 2018.

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 results of the analysis of the collected 100 documents reveal that the majority of the documents are sets of guiding principles with a percentage of 41%, while reports come in second place with a percentage of 34%. Followed by Frameworks, Research articles, declarations, discussion papers, statements, policy paper and briefing with percentages of 10%, 6%, 3%, 2%, 2%, 1%, and 1% respectively (see Figure 2).

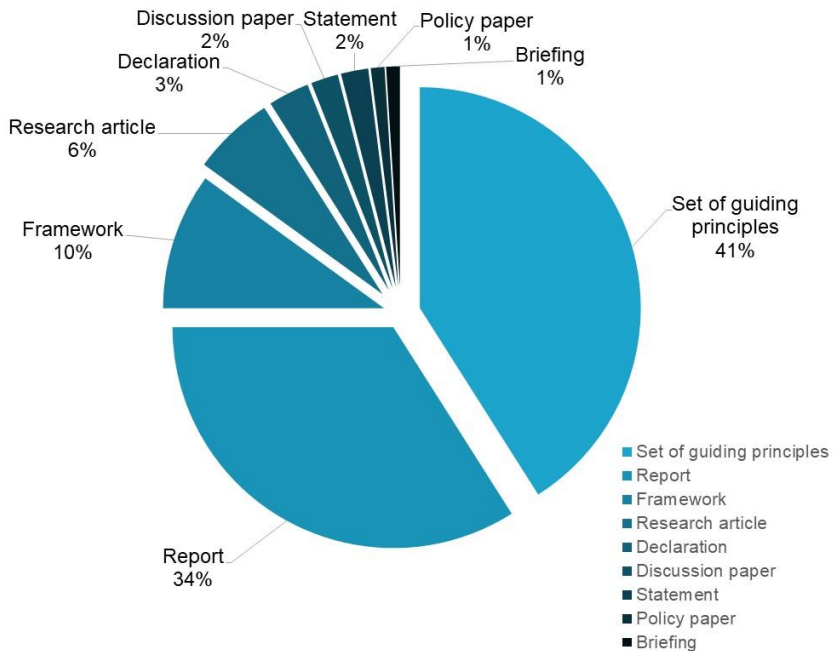## Number of published documents on AI ethics per type of issuer

Figure 2: Percentages of published documents on AI ethics by document type (based on analyzing a dataset of 100 documents publishing AI ethics, presented in Table 1). Source:Authors.

4.3 The type of issuer (who)

The investigation of 100 documents on AI ethics shows that the majority of documents on AI ethics are developed by private entities, with a percentage of 32% (32). This is in spite of the fact that documents on AI ethics by private companies started to be developed later starting 2017 (as seen in section 4.1) These private entities include multinational technology corporations, think tanks, trade associations, technology companies, AI research and deployment companies, software companies, initiatives, telecommunications companies, multinational corporation, cooperative financial services groups, acceleration programs, initiatives, international professional services brands of firms, private companies, research agencies, and technology incorporations.

The private entities mentioned can be broadly categorized into different types based on their function and purpose. Multinational technology corporations are large companies that operate in multiple countries [13], while think tanks are research organizations that study and provide insights on various topics [14]. Trade associations represent specific industries, while technology companies and AI research and deployment companies develop and implement

technology solutions. Software companies specialize in software development, while telecommunications companies offer communication services [15]. Cooperative financial services groups are financial institutions owned by their members [16], while acceleration programs and initiatives support startup growth [17]. International professional services brands of firms typically refer to companies that provide specialized consulting, advisory, and other professional services to clients across the world. These firms have a global presence and offer a wide range of services, including accounting, financial, legal, and management consulting services [18]. Private companies are businesses that are not publicly traded [19], while research agencies conduct research on various topics [20]. Technology incorporations involve the integration of technology into a business model [21].

Academia comes in second place in terms of the type of issuer of documents publishing AI ethics with (19 documents - 19 %), followed by governmental organizations (16 documents- 16 %), non-profit organizations (13 documents -13%), intergovernmental organizations (9 documents - 9 %), International (6 documents - 6 %) and supranational organizations (5 documents - 5 %) (See Figure 3). An international organization is one that has members from more than one country, whereas intergovernmental organizations are formed by multiple governments [22]. While supranational organization is an organization or union whose members transcend national boundaries or interests in order to participate in decision-making and vote on matters pertaining to the larger group. [23].

Figure 3 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 landscape, 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.

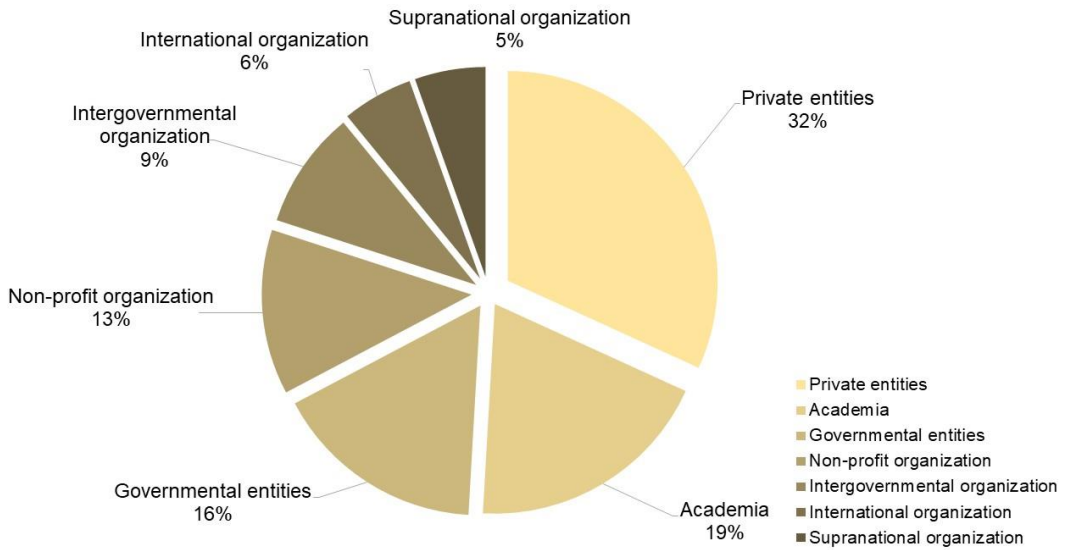# Number of published documents on AI ethics per type of issuer

Figure 3: Number of published documents on AI ethics per type of issuer. (based on analyzing a dataset of 100 documents publishing AI ethics, presented in Table 1) Source Authors.

4.4 The geographic distribution of the documents (where)

Among the analyzed 100 documents publishing AI Ethics in this article (Table 1), the results demonstrate that the majority of the documents on AI ethics were developed by entities and organizations in the Global North. The analysis demonstrates that there are 74 documents on AI ethics developed by organizations in the Global North region in comparison to only 6 documents on AI ethics 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 Figure 4.

Number of published documents on AI ethics by Geographical location (Region)
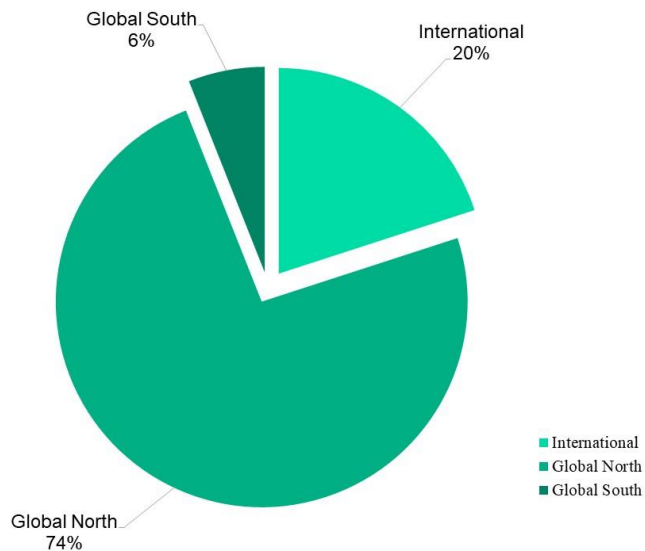

Figure 4: The number of published documents on AI ethics by geographical location (Region) (based on analyzing a dataset of 100 documents publishing AI ethics, presented in Table 1). Source Authors.

The percentages presented in the above figure indicate a gap between the Global North and the Global South when it comes to issuing documents that address the ethical concerns of AI systems. The gap in the production of AI ethical frameworks between the Global North and the Global South must be addressed. The origin and context of AI ethical texts are important because difficulties and concerns that are critical for one location might not be important or even be irrelevant to another. We must therefore address the disparity in the production of documents on AI ethics between the Global North and the Global South, as concerns and challenges that are crucial in one region may not be relevant or important in another.

In terms of geographic location, the documents are either published by entities that are based in a country (68 documents) or a collaboration between different entities based in one region like Africa (1 document) or Europe (11 documents) or international entities (20 documents). In terms of countries, the analysis of the 100 documents on AI ethics reveals that the United States is the highest ranking country with the most contributions to documents on AI ethics, with 28 documents. Following the United States are documents developed by international entities, which account for 20 of the 100 documents examined. The documents generated by the United Kingdom are 10 documents. Japan comes next with a contribution of 5 documents. While Germany, Finland and Canada follow with three documents each. France, Singapore, Spain, and Australia, each contribute with two publications. Finally, among the documents

examined, Iceland, the Netherlands, Norway, India, the UAE, South Africa, the Philippines, Hong Kong, Saudi Arabia, South Korea, and Sweden are equal with a contribution of one published document on AI ethics per each. Figure 5 shows the number of published documents on AI ethics in relation to the geographic location (countries and regions).
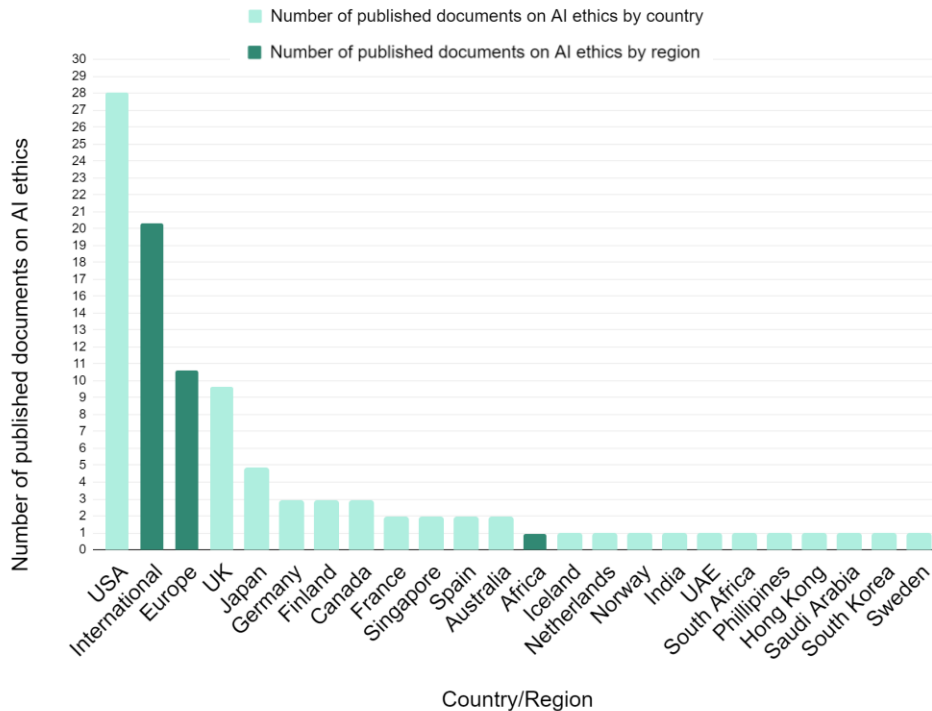

Figure 5: Number of published documents on AI ethics per country. (based on analyzing a dataset of 100 documents publishing AI ethics, presented in Table 1). Source Authors.

4.5   The sector's covered/ missed in the documents (what):

From the dataset in Table 1, we find that, a majority of 87% the published documents on AI ethics are broad and general and do not focus on a specific sector. These general documents on AI ethics outline general guidelines and principles that different fields and sectors can use. However, there are other documents on AI ethics that are sector focused aiming to contribute to specific sectors such as health (i.e., the report titled 'Ethical, Social, and Political Challenges of Artificial Intelligence in health' published in 2018), mobility/automated transportation sector (i.e., the report titled 'Ethics Commission automated and connected driving' published in 2017), AI design and development (i.e., the report titled 'Everyday Ethics for Artificial Intelligence. A Practical Guide for Designers and Developers' published in 2018), Conversational AI (i.e., the set of guiding principles titled 'Responsible Bots: 10

Guidelines for Developers of Conversational AI' published in 2018), Judicial systems (i.e., the ethical charter titled 'European Ethical Charter on the Use of Artificial Intelligence in Judicial Systems and Their Environment' published in 2018), Health-Radiology (i.e., the report titled 'Ethics of AI in Radiology: European and North American Multisociety Statement' published in 2019), AI Engineering (i.e., the set of guiding principles titled 'Ethics Code for AI Engineers - AI ethics with Andrew NG and deep learning.AI' published in 2019), Education (i.e., the report titled 'Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators' published in 2022).

In terms of sectors, the health sector is in second place with a percentage of 5 % (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. Figure 6 shows the number of documents on AI ethics published per each sector.
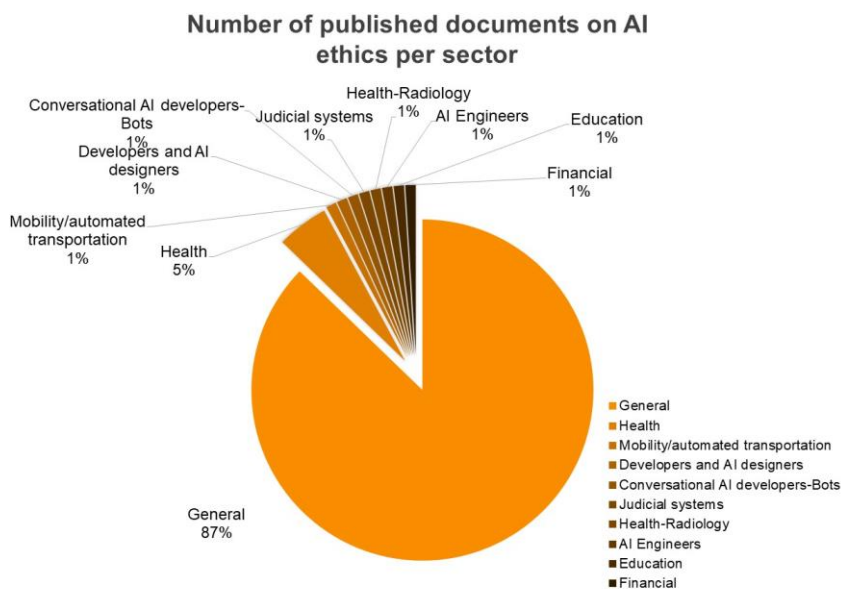
Figure 6: The number of published documents on AI ethics per sector (based on analyzing a dataset of 100 documents publishing AI ethics, presented in Table 1). Source Authors.

Although general documents on AI ethics provide valuable principles for guiding AI developers and creators toward more responsible AI, there is still a need for additional sector-specific documents on AI ethics which can be developed through collaborations between AI specialists and other field experts. In this regard, the Software & Information Industry Association's (SIIA) (2017) emphasizes the necessity for sector-specific guidelines since diverse scenarios present unique challenges. For example, the deployment of AI systems in medical care is more critical and sensitive than other sectors. It is accordingly "explicitly acknowledged that a tailored approach is needed given AI's context-specificity" (SIIA, 2017,

p.4). From the above analysis, we notice that among the sectors that still require sector-specific AI ethics may include: the policing sector, agriculture sector, and urban AI sector. For example, 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.

5. Discussion, Final Remarks and Future work

The analysis of the 100 documents on AI ethics 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.

In Figure 7, we provide a comprehensive overview of the findings from analyzing the 100-document analysis. The diagram is divided into 5 sections as follows 1) type of documents/year, 2)type of issuer/ year, 3) geographic distribution by country/ year, 4) geographic distribution by region/year and lastly 5) sectors covered/year.
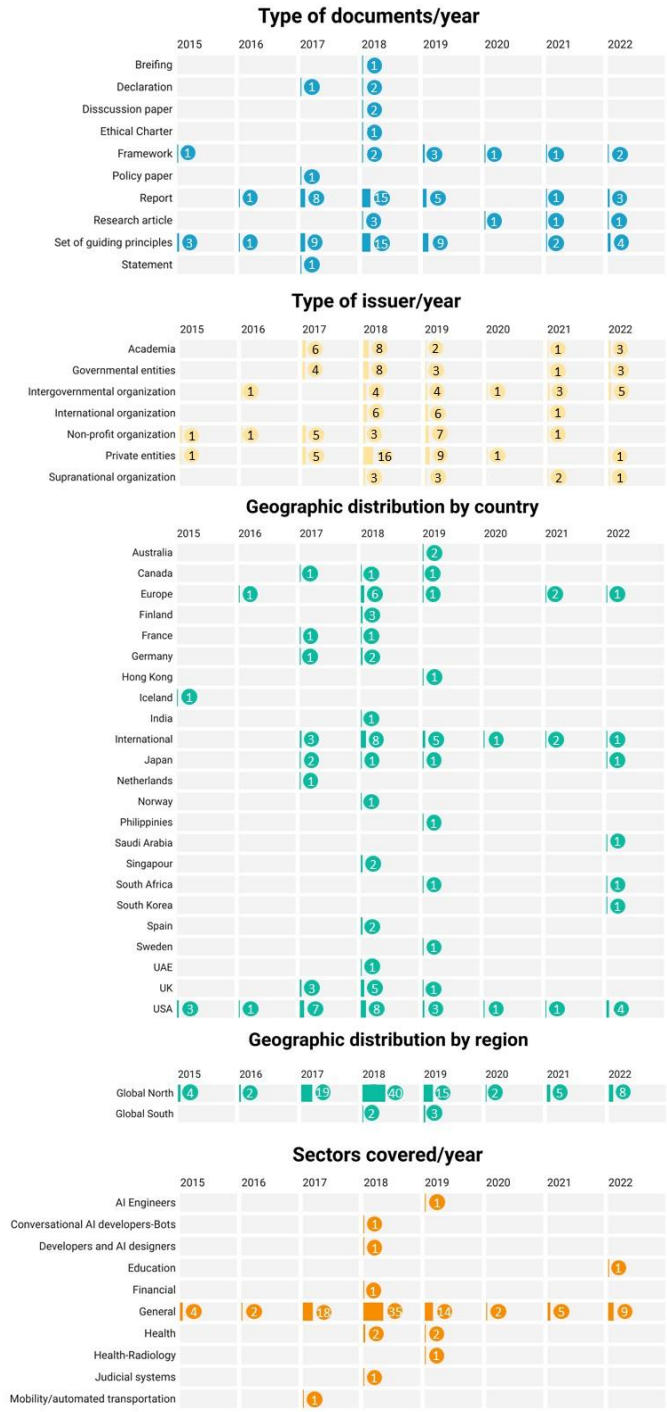
Type of documents/year

	2015	2016	2017	2018	2019	2020	2021	2022
Breifing				1				
Declaration			1	2				
Disscussion paper				2				
Ethical Charter				1				
Framework	1			2	3	1	1	2
Policy paper			1					
Report		1	8	15	5		1	3
Research article				3		1	1	1
Set of guiding principles	3	1	9	15	9		2	4
Statement				1				

Type of issuer/year

	2015	2016	2017	2018	2019	2020	2021	2022
Academia			6	8	2		1	3
Governmental entities			4	8	3		1	3
Intergovernmental organization		1		4	4	1	3	5
International organization				6	6		1	
Non-profit organization	1	1	5	3	7		1	
Private entities	1		5	16	9	1		1
Supranational organization				3	3		2	1

Geographic distribution by country

	2015	2016	2017	2018	2019	2020	2021	2022
Australia					2			
Canada			1	1	1			
Europe		1		6	1		2	1
Finland				3				
France			1	1				
Germany			1	2				
Hong Kong					1			
Iceland	1							
India				1				
International			3	8	6	1	2	1
Japan			2	1	1			1
Netherlands			1					
Norway				1				
Philippinies					1			
Saudi Arabia								1
Singapour				2				
South Africa					1			1
South Korea								1
Spain				2				
Sweden					1			
UAE				1				
UK			3	5	1			
USA	3	1	7	8	3	1	1	4

Geographic distribution by region

	2015	2016	2017	2018	2019	2020	2021	2022
Global North	4	2	19	40	15	2	5	8
Global South				2	3			

Sectors covered/year

	2015	2016	2017	2018	2019	2020	2021	2022
AI Engineers					1			
Conversational AI developers-Bots				1				
Developers and AI designers				1				
Education								1
Financial				1				
General	4	2	13	95	14	2	5	9
Health				2	2			
Health-Radiology					1			
Judicial systems				1				
Mobility/automated transportation			1					

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

Based on the previous investigation, in this section we share five main remarks to be taken into consideration. Furthermore, we identify research gaps and recommend future research work based on the discussions.

To begin, the above analysis reveals that the first AI ethical documents were created in 2015 (see Table 1 and Figure 1), 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. As a result, additional research is required to identify whether the increase in 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.

Another important remark is that the analysis of document types (section 4.2) 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. This raises several questions about the applicability of AI ethics in reality. In this 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 [24].

Additionally, a third remark can be drawn from the above analysis regarding the fact that private organizations produce the majority of AI ethical documents (32 out of 100 documents), followed by academia and governmental entities. Such a discrepancy in document production between non-governmental and governmental documents raises questions about the extent to which 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 Figures 4 and 5). 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 their 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.

Furthermore, as previously shown in the article, the vast majority of AI ethical documents available are generic (see Figure 6), 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 analyzed documents, necessitating future research to produce sector-specific and context-based frameworks. One example is the field of 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.

Acknowledgments

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