

# Ethics of AI: A Systematic Literature Review of Principles and Challenges

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## ABSTRACT

Ethics in AI becomes a global topic of interest for both policymakers and academic researchers. In the last few years, various research organizations, lawyers, think tankers, and regulatory bodies get involved in developing AI ethics guidelines and principles. However, there is still debate about the implications of these principles. We conducted a systematic literature review (SLR) study to investigate the agreement on the significance of AI principles and identify the challenging factors that could negatively impact the adoption of AI ethics principles. The results reveal that the global convergence set consists of 22 ethical principles and 15 challenges. Transparency, privacy, accountability and fairness are identified as the most common AI ethics principles. Similarly, lack of ethical knowledge and vague principles are reported as the significant challenges for considering ethics in AI. The findings of this study are the preliminary inputs for proposing a maturity model that assesses the ethical capabilities of AI systems and provides best practices for further improvements.

## CCS CONCEPTS

• **Software and its engineering** → **Human-centered computing**; • **Computing methodologies** → *Artificial intelligence*; • **Philosophical/theoretical foundations of artificial intelligence**; • **Social and professional topics** → Empirical studies;

## KEYWORDS

AI Ethics, Machine Ethics, Principles, Challenges, Systematic Literature Review

## 1 INTRODUCTION

Artificial intelligence (AI) technologies are considered important across a vast array of industries including health, manufacturing, banking and retail [14]. However, the promises of AI systems like improving productivity, reducing costs, and safety has now been considered with worries, that these complex systems might bring more ethical harm than economical good [14].

Artificial intelligence (AI) and autonomous systems have a significant effect on the development of humanity [12]. The autonomous decision-making nature of these systems raises fundamental questions, i.e., what are the potential risks involved in those systems, how these systems should perform, how to control such systems and what to do with AI-based systems? [12]. Autonomous systems are beyond the concepts of automation by characterizing them with decision-making capabilities. The development of autonomous system components, such as intelligent awareness and self-decision making, is based on AI concepts.

There is a political and ethical discussion to develop policies for different technologies including nuclear power, manufacturing, etc. to control the ethical damage they could bring. The same ethical potential harm also exists in AI systems, and more specifically, they might end human control [12]. The real-world failure and misuse incidents of AI systems bring the demand and discussion for AI ethics [19]. The ethical studies of AI technologies revealed that AI and autonomous systems should not be only considered a technological effort. There is a broad discussion that the design and use of AI-based systems are culturally and ethically embedded [10]. Developing AI-based systems not only needs technical efforts but also includes economic, political, societal, intellectual and legal aspects [10]. These systems significantly impact the cultural norms and values of the people [10]. The AI industry and specifically the practitioners should have a deep understanding of ethics in this domain. Recently, AI ethics get press coverage and public voices, which supports significant related research [19]. However, the topic is still not sufficiently investigated both academically and in the real-world environment [10]. There are very few academic studies conducted on this topic, but it is still largely unknown to AI practitioners. The Ethically Aligned Design (EAD) [7] guidelines of IEEE mentioned that ethics in AI is still far from being mature in an industrial setting [18]. The limited or no knowledge of ethics for the AI industry develop the gap, which indicates the need for further academic and in practice research.

The aim of this study is to conduct a systematic literature review (SLR) and explore the available literature to identify the AI ethics principles. Moreover, the SLR study uncovers the key challenging

factors that are the demotivators for considering the ethics of AI. The following research questions are developed to achieve the given core objectives:

- RQ1: What are the key principles of AI ethics?
- RQ2: What are the challenges of adopting ethics in AI?

The remaining content of the paper is structured as follows: Section 2 presents the background of the study, and the research methodology is reported in Section 3. The SLR data are provided in Section 4 and results and analysis are discussed in Section 5. The study implications are discussed in Section 6. Finally, Section 7 provides an overview of threats to the validity of the study and Section 8 conclude the findings with future directions.

## 2 BACKGROUND

The implementation of AI or machine intelligence concepts brings a technological revolution that changes both science and society. Human to machine power transformation sparked important societal debate about the principles and policies that guide the use and deployment of AI systems [8]. Various organizations have developed ad hoc committees to draft the policy documents for AI ethics. These organizations reportedly developed AI policies and guide documents [8]. In 2018, technology corporates such as SAP and Google publicly introduced guidelines and policies for AI-based systems [8]. Similarly, Amnesty International, the Association of Computing Machinery (ACM) and Access Now come up with principles, and recommendations for AI technologies. The Trustworthy AI European Commission’s guidelines were developed with the aim to promote lawful, ethically sound and robust AI systems [15]. The report “Preparing for the Future of Artificial Intelligence” prepared by the Obama administration’s presents a thorough survey that focuses on the current AI research, its applications and impact on society [3]. The report further presents recommendations for future AI related actions. The “Beijing AI Principles” guidelines [13] proposed various principles in the domain of AI research, development, use and governance. These principles present a framework that focuses on AI ethics.

The world’s largest technical professional organization, IEEE launches the guidelines Ethically Aligned Design (EAD) [7] that provides a framework to address the ethical and technical values of AI systems based on a set of principles and recommendations. The EAD framework consists of the following eight general principles to guide the development and implementations of AI-based systems: human rights, well-being, data agency, effectiveness, transparency, accountability and awareness of misuse. Organizations such as ISO and IEC also embark on developing standards for AI [5]. ISO/IEC JTC 1/SC 42 [5] is a joint ISO/IEC international standard committee that focus on the entire AI ecosystem including ethical and social concerns, standardization, AI governance, AI computational approach and trustworthiness [5]. The effort of different organizations to shape AI ethics not only determines the need of guidelines, tools, and techniques, but also the interest of these organizations to manage ethics in a way that meet their respective priorities.

However, recently published studies reported that the existing guidelines developed for ethics of AI are not effective and adopted in practice [20]. It is evident from the empirical study conducted by McNamara et al. [11] to test the influence of the ACM code of

ethics in the decision-making process of software development. The results of the study revealed that the ACM code of ethics have no impact on making ethical decisions. The lack of effective techniques makes it challenging to successfully scale the available guidelines into practice [20]. Vakkuri et al. [20] used the accountability, responsibility, and transparency (ART) framework [6] and developed the conceptual model to explore ethical considerations in the AI environment. The conceptual model is empirically validated by conducting multiple case studies. The empirical results are concluded by highlighting that AI ethics principles are still not in practice; however, some common concepts are considered, such as documentation. Moreover, the study findings revealed that practitioners consider the social impact of AI systems [20].

There are no tools, methods, or frameworks that fill the gap between the AI principles and their implementation in practice. Further, studies in this area should conduct that explicitly discuss the AI ethics principles, challenges and provide evaluation standards/models that guide AI industry to consider ethics in practice.

## 3 RESEARCH METHOD

Systematic literature review (SLR) approach is used to explore the available primary studies. SLR is a widely adopted literature survey method in the evidence-based software engineering domain. SLR is “a means of evaluating and interpreting all available research relevant to a particular research question, topic area, or phenomenon of interest” [9]. The Kitchenham and Charters [9] SLR guidelines are used to conduct this study and systematically address the research questions. The SLR process plan is provided in Figure 1 and thoroughly discussed in the following subsections.

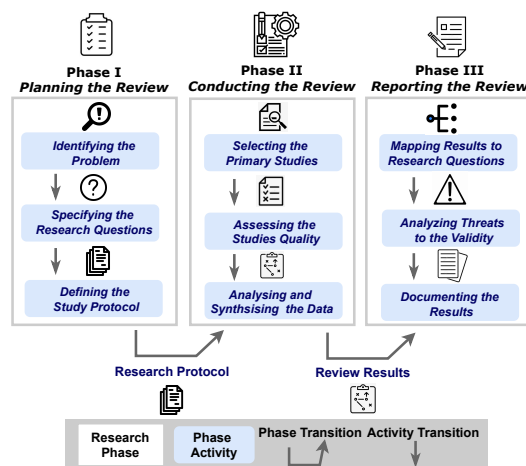


Figure 1: SLR research process

### 3.1 Research questions (RQs)

Research questions development in SLR studies is the most significant phase [9]. Developing research questions require deep understanding of the research area in general and the research problem in specific. We primarily studied relevant articles [19][10][18][7][8][15][3]

to better understand the problem and develop the questions of interest. The questions are finally developed based on the research concepts discussed in the mentioned research sources [3-9]. The details of the research questions are provided in Section 1.

### 3.2 Data sources

The authors had a series of team discussions to identify the list of digital data sources. The selected digital repositories are explored to extract the relevant data in order to address the given research questions (see Section 1). Finally, the following digital libraries are selected based on the authors SLR experience, discussions and guidelines provided by Chen et al. [4]: Springer Link, Science Direct, IEEE Xplore, Wiley Online Library and ACM Digital Library. These are the world leading digital data sources which collect a large number of original information and communication technology studies [4].

### 3.3 Search strategy

The research questions are analysed by the second and third authors to extract the terms or keywords used for the search process. All the authors participated in the group discussion to finalise the search terms and retrieve the relevant data from the selected repositories. Pilot search terms and strings are made that finally contributed to develop the following agreed search string:

*("artificial intelligence ethics" OR "AI ethics" OR "machine learning ethics" OR "software ethics") AND ("resistance" OR "barriers" OR "limitations" OR "challenges")*

The "principles" and "guidelines" terms were excluded from the final search string because these terms return irrelevant data from different other domains. The given search string was specifically testified during the pilot attempts to explore the data related to the AI "principles" and "guidelines" and we noticed that it precisely returns the desired results related to the RQ1, i.e., "principles" and "guidelines".

The search terms are concatenated using "AND" and "OR" operators to develop the search strings. The selected digital repositories have a customised search mechanism. The search strings are executed using the personalised search mechanism of electronic data sources.

### 3.4 Inclusion/Exclusion criteria

The inclusion/exclusion criteria are developed to filter the search string findings and remove irrelevant, not accessible, redundant and low-quality studies. The criteria are developed by the first and fifth authors, which are finalised by all the authors in the regular consensus meeting (see Table 1).

### 3.5 Study selection

The search string discussed in Section 3.3 is used to explore the selected digital repositories. The search process was initiated on 23rd December 2020 and ended on 5th February 2021. The search string retrieved a total of 811 studies in the first phase, which were further filtered based on the study title, abstract and keywords (see Figure 2). In the second phase of the selection process, the inclusion/exclusion of the 60 studies are performed based on the

full-text review. Finally, 24 primary studies are shortlisted using the SLR approach. Moreover, backward snowballing [21] is performed to search the references of the selected 24 studies. The backward snowballing is previously used by Tingting et al. [1] to explore text analysis techniques in software architectural, and we used with the aim to explore the references list of the selected primary studies to identify relevant studies that are missed during the SLR process. Additionally, 5 studies are selected, which are further filtered using the inclusion/exclusion criteria (see Figure 2). Eventually, only 3 studies fulfil the selection criteria and the final data sets consist of total 27 primary studies (24 SLR + 3 backward snowballing). A final set of the selected studies is provided in Appendix A, where each study is labeled as [Sn] to differentiate from the general list of references.

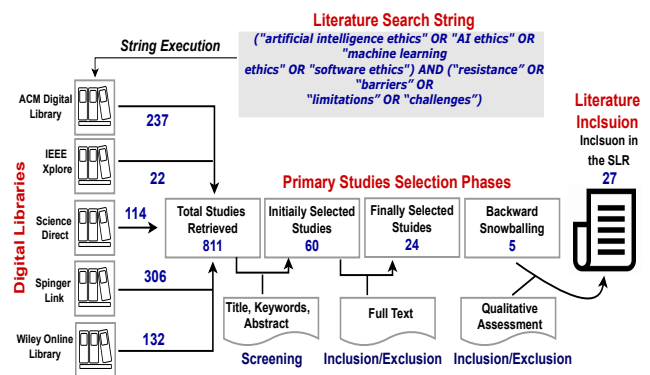


Figure 2: Studies selection process

### 3.6 Quality assessment (QA)

The assessment criteria are developed to evaluate the quality of the selected primary studies and remove the research bias. The quality assessment phase interprets the significance and completeness of each selected primary study [9]. The QA criteria checklist provided by Kitchenham and Charters [9] are analysed and designed the QA questions provided in Table 2. Each selected primary study evaluated against the quality assessment questions (QA1-QA6). Score (1) assigned if the study comprehensively addresses the quality assessment questions (see Table 2). Similarly, 0.5 points are assigned to those who have partially addressed the QA questions. Studies with no evidence of addressing the QA questions are assigned 0 points.

### 3.7 Data extraction

The relevant data to address the RQs are collected by thoroughly reading the selected primary studies and extract the AI ethics principles (RQ1) and challenges (RQ2). The extracted data are recorded on Excel sheets. Most of the data are collected by the second and third authors. They assess the quality of the primary studies based on the criteria discussed in Section 3.6. Moreover, the first, fourth and fifth authors participated in the review meeting to finalize the QA score of each study (Appendix A). Additionally, authors at positions six and seven are invited to assess the interpersonal bias in the data extraction process. They were asked to randomly select 15

**Table 1: Inclusion/Exclusion criteria**

#	Inclusion criteria
In1	Consider articles that specifically focus on AI ethics.
In2	Primary studies published in conferences, research workshops, book chapters, journals and magazines.
In3	Peer-reviewed and available in full text
In4	Written in the English language
No.	Exclusion criteria
Ex1	If two studies are published from the same project, then exclude the one with minimum contribution.
Ex2	Exclude grey literature material.
Ex3	Remove duplicate studies.
Ex4	Discuss ethics in other domains.

**Table 2: Quality assessment criteria**

No.	Assessment Questions	Score
QA1	Does the adopted research method address the research problem?	1/0.5/0
QA2	Does the study have clear research objectives?	1/0.5/0
QA3	Does the study explicitly discuss the proposed research approach?	1/0.5/0
QA4	Is the study clearly reported the experimental setting?	1/0.5/0
QA5	Do the study results and findings are systematically discussed?	1/0.5/0
QA6	Does the study present the real-world implications of the research?	1/0.5/0

primary studies from a set of total primary studies and perform the data extraction process as conducted by the other authors. Finally, the Kendalls coefficient of concordance (W) test is performed to statistically evaluate the significant differences in the data extraction process between both the groups (authors 1-5 and 6-7). Kendalls coefficient of concordance (W) is a widely adopted statistical approach to evaluate a level of agreement between groups of people, which assess a set of n-objects [16]. The Kendalls coefficient of concordance (W) assessment score varies from 0 to 1, where (W=1) shows strong agreement between the people and (W=0) refers to complete disagreement [16]. We used R-3.6.3 to conduct the (W) test for evaluating the level of agreement between both groups of authors. The test results (W= 0.792) given in Table 3 show that both author's groups are at a positive agreement level for the data extraction process. Based on the test results, we identified that no personal bias exists between the authors that could impact the data extraction process. Following is the R-code developed to run the (W) test.

```
library(DescTools)

AI_Ethics <- data.frame(AuthorsGroup1=c(3,5,
3,4,5,5,3,3,5,2,2,6,4,4,2),
Author6=c(3,6,4,5,4,4,2,4,4,3,2,5,5,4,2),
Author7=c(2,5,4,4,3,4,2,5,3,4,2,5,5,4,1))
KendallW(AI_Ethics, TRUE)
KendallW(AI_Ethics, TRUE, test=TRUE)
KendallW(t(d.att[, -1]), test = TRUE)
```

**Table 3: Kendall's coefficient of concordance (W) test values (DS-Data Set, df-Degrees of freedom,  $\chi^2$ -chi square, S-Subjects, R-Raters, PV-Probability Values)**

DS	$\chi^2$	df	S	R	PV	W
AI_Ethics	33.287	14	15	3	0.002	0.792

## 4 REPORTING THE REVIEW

The data collected from the selected 27 primary studies are analyzed and discussed in the following sections.

### 4.1 Temporal distribution

The year wise distribution of the primary studies is shown in Figure 3. Of the 27 studies, total 4, 17, 4 and 2 are respectively published in 2021 (till 5th February), 2020, 2019 and 2018. The first relevant study was found in 2018 and since then, there has been a gradual increase in the number of research publication. The SLR string was finally executed on 5th February 2021, therefore the given results only cover the first two months of 2021. The increasing number of publications reveal that AI ethics is significant, and state-of-the-art research direction. There is still need of substantial research work to explore ethics in AI.

### 4.2 Publication type

The selected primary studies are classified across four major types i.e., journal, conference (including workshop), book chapter and magazine. Figure 3 shows that 19 (70%) studies are published in journals, 6 (22%) in conferences, 1 (4%) book chapter and 1 (4%) is a magazine article. We noticed that journals are the most active venues to publish relevant studies.







AI ethics [S17]. It is very challenging to consider AI ethics in real world settings using these vaguely formulated principles [S3].

**5.2.3 Highly general principles.** The available principles are highly general and broad in concept to specifically consider in the AI industry [S18]. They are subjective in the term and used in various other domains than AI. Policymakers involved in drafting AI ethics principles might not have strong technical understanding of AI system development processes, which makes the principles more general and ambiguous.

**5.2.4 Conflict in practice.** Organizations, committees and groups involved in developing the AI ethics guidelines and principles have opinion conflicts regarding the real world implementation of AI ethics [S13, S16]. For example, the UK House of Lords suggested that robots cannot solely be in operation, but they should be guided by human beings [S10], on the other hand, in various hospitals' robots make autonomous decisions in diagnosis and surgical endeavors. It shows interpretation and understanding conflict for AI ethics in practice.

**5.2.5 Interpret principles differently.** AI ethics principles are widely considered ambiguous and general by majority of the organizations [S20]. It has been found that tech firms involved in the development of AI and autonomous systems follow ethical guidelines based on their own understandings [S27]. There are no universally agreed ethical principles that can bring all the institutions on one page.

**5.2.6 Lack of technical understanding.** The policymakers have the/a lack of technical knowledge, which makes AI ethics in practice a challenging effort [S10, S13]. They are not aware of the technical aspects of AI systems and the advancement in AI technologies as well their limitations. Lack of technical understanding develops the gap between system design and ethical thinking [S10]. The ethicists must have skills of grasping technical knowledge using their ethical framework [S10].

**5.2.7 Extra constraints.** Situational constraints could interfere with an employee's motivation to consider ethics in AI system development process. The possible constraints include lack of information, incorrect guidelines, organizational rules and policies, and top management interruptions. Organizational management should be highly aware of the AI ethics debate and keen to engage with the constraints proactively [S26].

**Analysis.** The above reported challenges provide an overview of the most common and frequently cited factors that could be potential barriers for scaling ethics in AI. *Lack of ethical knowledge* is identified as the most common challenge of AI ethics. Major ethical mistakes are made because of no moral awareness of specific problem [S14]. Practitioners only consider software development activities as the main responsibilities; however, they have limited interest to consider ethical aspects [S5]. The ethical uncertainty in AI systems could only be diminished by acquiring ethical knowledge. Continuous awareness of ethical policies, codes and regulations assists to properly manage the ethical values in AI and autonomous systems.

We noticed that very few studies are published where the barriers of AI ethics are directly or indirectly mentioned. It is evident from the frequency distribution of the challenging factors given in Table

**Table 5: AI ethics challenging factors**

#	Challenges	Reference
Ch-01	Lack of ethical knowledge	[S14], [S15], [S18], [S21], [S23]
Ch-02	Vague principles	[S3], [S17], [S24]
Ch-03	Highly general principles	[S19], [S20]
Ch-04	Conflict in practice	[S19], [S16]
Ch-05	Interpret principles differently	[S19], [S20]
Ch-06	Lack of technical understanding	[S10], [S13]
Ch-07	Extra constraints	[S11], [S24]
Ch-08	Lack of Audit and Monitoring	[S20]
Ch-09	No Legal frameworks	[S20]
Ch-10	Business interest	[S25]
Ch-11	Pluralism of ethical methods	[S14]
Ch-12	Cases of ethical dilemmas	[S14]
Ch-13	Machine distortion	[S14]
Ch-14	Lack of Guidance and Adoption	[S26]
Ch-15	Lack of Cross-cultural Cooperation	[S27]

5. This finding reveals that the AI ethics challenges aspect is a very young field and requires considerable research effort from diverse disciplines to be mature. The significance of AI technologies in various sectors calls for rush research to uncover the relevant challenges that hinder the process of considering ethics in AI.

#### Key Findings of RQ2

**Finding 3:** We noticed that only (n=17, 63%) primary studies discussed the AI ethics challenging factors.

**Finding 4:** The core themes of the identified challenges are: (*knowledge and expertise, organizational management, tools and technologies*).

**Finding 5:** *Lack of ethical knowledge* (n=5, 29%) is the most frequently cited challenge, followed by *Vague principles* (n=3, 18%).

The long-term plan of the research is to propose a maturity model that could be used to evaluate the ethical capabilities of the organizations involved in developing AI systems. The findings of this systematic review are the initial inputs for the development of the proposed model. Figure 7 shows the preliminary structure of the model and demonstrates how the findings of this review contribute to the development of the principles and challenges component. The identified principles and challenges will be classified across capability and maturity levels. Moreover, best practices will provide to tackle the identified challenges and implement the AI ethics principles. The given model is a proposed idea that will be systematically developed based on the industrial empirical studies and the concepts of the widely adopted CMMI process model [17]. A case study approach is selected to evaluate the real-world significance of the model.

## 6 RESEARCH AND INDUSTRIAL IMPLICATIONS

This SLR study has both research and industrial implications by providing a set of AI ethics principles and challenging factors. This

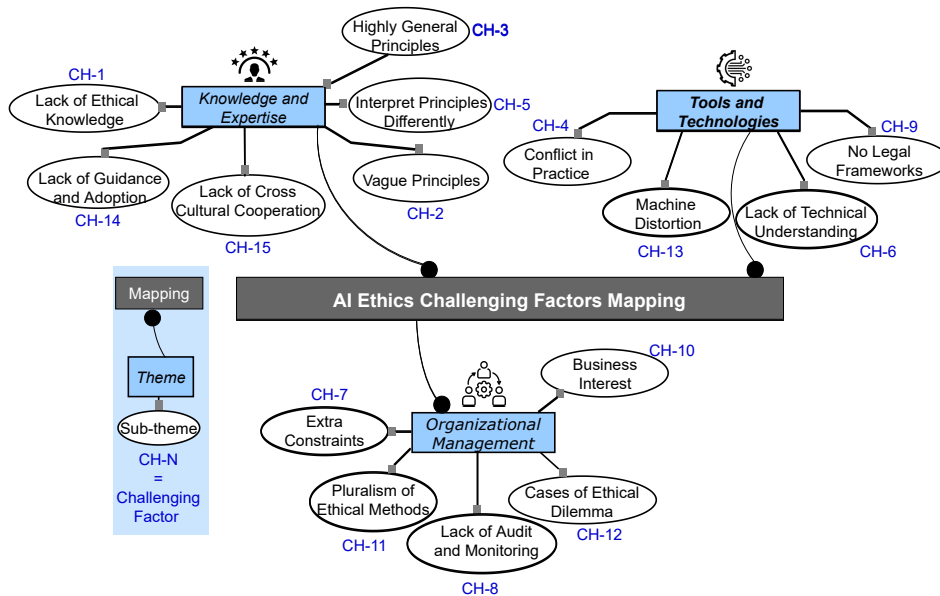


Figure 6: Thematic mapping of the identified challenges

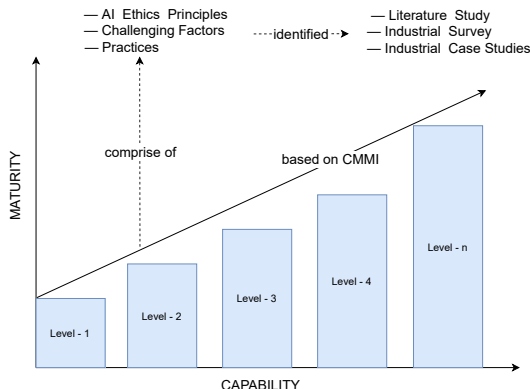


Figure 7: A proposed capability maturity model of AI ethics

study contributes to academic research by explicitly exploring the available AI ethics primary studies. Similarly, the study findings make a concrete research contribution by providing a significant overview of AI ethics principles and challenges, which can be core focus areas for future studies. In the industrial domain, the practitioners shall encapsulate the reported principles and challenges when they focus on ethics in AI projects. Additionally, the proposed maturity model is the first step to actualizing the AI ethics principles in the industrial setting. The model will assist the practitioners to assess and improve the ethical capabilities of a specific AI software development organization. Finally, this SLR study provides a consolidated knowledge base of literature that has not been done before.

## 7 THREATS TO VALIDITY

### 7.1 Construct validity

A relevant construct validity could be "data items" since we as the researchers observed, decided, and pick up the text fragments or content from the identified studies. The data items extraction process might not be well performed for several reasons. For example, an inappropriate search strategy could possibly return a set of irrelevant primary studies. However, we tried to minimize such threats by following operation measures e.g. developing a formal search strategy and constantly revising it during the regular consensus meetings, following SLR inclusion and exclusion criteria, performing studies quality assessment and mitigating interpersonal bias using a common data extraction form. Moreover, we tried to extract the most relevant primary studies by customizing the final search string based on the peculiarities of the selected digital libraries.

### 7.2 Internal validity

Internal validity refers to specific factors that may affect the data extraction, results, and analysis process. The search process might miss some relevant studies that focus on AI ethics challenges and principles, and it could be a possible threat to the study's internal validity. To lessen this threat, all the authors actively participated in the consent meetings to review the search activities, explored the research questions to extract relevant terms, and continuously revised the search strings based on their pilot implementation. Additionally, all the authors have substantial experience performing SLR-based studies in the software engineering domain.



### 7.3 External validity

External validity is related to the generalizability of the study findings. The results are summaries based on 27 primary studies, because of the novelty of the research topic, very few studies published in this domain. The primary studies sample size (n=27) might not be strong enough to generalize the study findings, however, we plan to extend this study in future by conducting an industrial study to evaluate the SLR findings and know the perceptions of the practitioners.

### 7.4 Conclusion validity

Potential threats to the conclusion validity of the study might exist, which could impact the credibility level of final conclusions. However, the study is conducted based on the well-defined SLR guidelines that focused on strict studies selection criteria to identify quality studies for final results and discussions. Additionally, all the authors participated in brainstorming sessions to discuss the study findings and draw precise conclusions.

## 8 CONCLUSIONS AND FUTURE DIRECTIONS

Ethics in AI gets significant attention in the last couple of years and there is a need of systematic literature study that discusses the principles and uncovers the key challenges of AI ethics. This study is conducted to fill the given research gap by following the SLR approach. We identified total 27 relevant primary studies and the systematic review of the selected studies return 22 principles and 15 challenging factors. We noticed that most of the studies focus on four major principles i.e., *transparency, privacy, accountability* and *fairness*, which should consider by the AI system designers. Moreover, the decision-making systems should also be aware of the ethical principles to know the implications of their actions.

The challenges of ethics in AI are identified to provide an understanding of the factors that hinder the implementation of ethical principles. The most frequently reported challenging factors are *lack of ethical knowledge* and *vague principles*. The knowledge and understanding of ethics are important for both management and technical teams. It further removes the vagueness in AI principles. Lack of ethical knowledge could undermine the significance of decision-making systems.

We plan to extend this study by conducting an industrial survey to investigate the understanding of AI ethics in practice and identify the best practices to tackle the given challenging factors and manage the reported principles. Moreover, industrial case studies will be conducted in AI industry to assess the effectiveness of the proposed maturity model in practice.

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**Table 6: Selected primary studies**

#	Selected Studies	Q1	Q2	Q3	Q4	Total
S1	Anna Jobin, Marcello Ienca, and Effy Vayena. 2019. The global landscape of AI ethics guidelines. <i>Nature Machine Intelligence</i> 1, 9 (2019), 389-399.	1	1	1	1	4
S2	Siau, Keng, and Weiyu Wang. 2020. Artificial intelligence (AI) ethics: ethics of AI and ethical AI. <i>Journal of Database Management</i> 31, 2 (2020), 74-87.	1	1	1	1	4
S3	Canca Cansu. 2020. Operationalizing AI ethics principles. <i>Communications of the ACM</i> 63, 12 (2020), 18-21.	1	1	1	1	4
S4	Hoffmann A. Lauren, Sarah T. Roberts, Christine T. Wolf, and Stacy Wood. 2018. Beyond fairness, accountability, and transparency in the ethics of algorithms: Contributions and perspectives from LIS. <i>Proceedings of the Association for Information Science and Technology</i> 55, 1 (2018), 694-696.	1	1	0	0.5	2.5
S5	Ville Vakkuri, Kai-Kristian Kemell, Joni Kultanen and Pekka Abrahamsson. 2020. The Current State of Industrial Practice in Artificial Intelligence Ethics. <i>IEEE Software</i> 37, 4 (2020), 50-57.	1	1	1	1	4
S6	Charles D. Raab. 2020. Information privacy, impact assessment, and the place of ethics. <i>Computer Law &amp; Security Review</i> 37 (2020), 105404.	1	1	1	1	4
S7	Wenjun Wu, Tiejun Huang and Ke Gong. 2020. Ethical principles and governance technology development of AI in China. <i>Engineering</i> 6, 3 (2020), 302-309.	1	1	1	1	4
S8	Sara Gerke, Timo Minssen, and Glenn Cohen. 2020. Ethical and legal challenges of artificial intelligence-driven healthcare. In <i>Artificial Intelligence in Healthcare</i> , (2020), 295-336.	1	0.5	1	0.5	3
S9	Richard Benjamins. 2021. A choices framework for the responsible use of AI. <i>AI and Ethics</i> 1, 1 (2021), 49-53.	1	1	1	1	4
S10	Thilo Hagendorff. 2020. The ethics of AI ethics: An evaluation of guidelines. <i>Minds and Machines</i> 30, 1 (2020), 99-120.	1	1	1	1	4
S11	Nagadivya Balasubramaniam, Marjo Kauppinen, Sari Kujala and Kari Hiekkanen. 2020. Ethical Guidelines for Solving Ethical Issues and Developing AI Systems. In <i>Proceedings of the 21st International Conference on Product-Focused Software Process Improvement (PROFES)</i> , LNCS, vol 12562, Springer, Cham, 331-346.	1	1	1	1	4
S12	Ville Vakkuri and Kai-Kristian Kemell. 2019. Implementing AI Ethics in Practice: An Empirical Evaluation of the RESOLVEDD Strategy. In <i>Proceedings of 10th International Conference on Software Business (ICSOB)</i> , LNBP, vol 370. Springer, Cham, 260-275	1	1	1	1	4
S13	Ray Eitel-Porter. 2021. Beyond the promise: implementing ethical AI. <i>AI and Ethics</i> 1, 1 (2021), 73-80.	1	1	1	1	4
S14	Tomas Hauer. 2020. Machine Ethics, Allosterity and Philosophical Anti-Dualism: Will AI Ever Make Ethically Autonomous Decisions?. <i>Society</i> 57, 4 (2020), 425-433.	1	1	1	1	4
S15	Josef Baker-Brunnbauer. 2020. Management perspective of ethics in artificial intelligence. <i>AI and Ethics</i> (2020), 1-9.	1	1	1	1	4
S16	Banu Buruk, Perihan Elif Ekmekci and Berna Arda. 2020. A critical perspective on guidelines for responsible and trustworthy artificial intelligence. <i>Medicine, Health Care and Philosophy</i> 23, 3 (2020), 387-399.	1	1	1	1	4
S17	Mittelstadt, Brent. 2019. Principles alone cannot guarantee ethical AI. <i>Nature Machine Intelligence</i> 1, 11 (2019), 501-507.	1	1	1	1	4
S18	Jess Whittlestone, Rune Nyruup, Anna Alexandrova, and Stephen Cave. 2019. The Role and Limits of Principles in AI Ethics: Towards a Focus on Tensions. In <i>Proceedings of the AAAI/ACM Conference on AI, Ethics, and Society (AI/ES)</i> . ACM, New York, NY, USA, 195-200.	1	1	0	1	3
S19	Luciano Floridi, Josh Cowls, Monica Beltrametti, Raja Chatila, Patrice Chazerand, Virginia Dignum, Christoph Luetge, Robert Madelin, Ugo Pagallo, Francesca Rossi, Burkhard Schafer, Peggy Valcke and Effy Vayena. 2018. AI4People—an ethical framework for a good AI society: opportunities, risks, principles, and recommendations. <i>Minds and Machines</i> 28, 4 (2018), 689-707.	1	1	1	1	4
S20	Jessica Morley, Luciano Floridi, Libby Kinsey, and Anat Elhalal. 2020. From what to how: an initial review of publicly available AI ethics tools, methods and research to translate principles into practices. <i>Science and Engineering Ethics</i> 26, 4 (2020), 2141-2168.	1	1	1	1	4
S21	Ángel G. de Ágreda. 2020. Ethics of autonomous weapons systems and its applicability to any AI systems. <i>Telecommunications Policy</i> 44, 6 (2020), 101953.	1	1	1	1	4
S22	Shuili Du, and Chunyan Xie. 2020. Paradoxes of artificial intelligence in consumer markets: Ethical challenges and opportunities. <i>Journal of Business Research</i> (2020).	1	1	1	1	4
S23	Mark Coeckelbergh. 2020. 11 Challenges for Policymakers. <i>AI Ethics</i> , MIT Press, 2020, 167-181.	0.5	0.5	1	1	3
S24	E. L. Sidorenko, Z. I. Khisamova and U. E. Monastyrsky. 2021. The Main Ethical Risks of Using Artificial Intelligence in Business. In <i>Current Achievements, Challenges and Digital Chances of Knowledge Based Economy</i> , Springer, Cham, 423-429.	1	1	0.5	3	
S25	Chris Rees. 2020. The Ethics of Artificial Intelligence. In <i>Unimagined Futures—ICT Opportunities and Challenges</i> , Springer, Cham, 55-69.	1	1	1	1	4
S26	Jan Jöhnik, Malte Weißert and Katrin Wyrтки. 2021. Ready or Not, AI Comes—An Interview Study of Organizational AI Readiness Factors. <i>Business &amp; Information Systems Engineering</i> 63, 1 (2021), 5-20.	1	1	1	1	4
S27	Seán S. ÓhÉigeartaigh, Jess Whittlestone, Yang Liu, Yi Zeng, and Zhe Liu. 2020. Overcoming barriers to cross-cultural cooperation in AI ethics and governance. <i>Philosophy &amp; Technology</i> 33, 4 (2020), 571-593.	1	1	1	1	4