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ARTIFICIAL INTELLIGENCE IN E-GOVERNMENT: EMERGING APPLICATIONS, OPPORTUNITIES AND CHALLENGES

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Abstract— **Artificial intelligence (AI) is moving from research laboratories into practical information systems. Governments are beginning to examine AI for public services, decision support, fraud detection, information search, language interfaces, prediction, and pattern recognition. The central question for developing countries is not whether AI is useful, but whether public institutions have the basic conditions needed to use it safely and effectively. This paper examines the readiness of Nepal and comparable developing countries to adopt early AI applications in e-government. It develops a conceptual framework with three dimensions: institutional readiness, technological readiness, and social readiness. The framework is applied to Nepal using published studies on e-government readiness, ICT infrastructure, information-system security, national ICT policy, and the 2016 United Nations E-Government Survey. The analysis finds that Nepal has a useful foundation for selected, narrow AI applications, but important gaps remain in infrastructure, skilled human resources, data quality, security, institutional coordination, and citizen capability. The paper argues that Nepal should not begin with complex autonomous systems. It should first strengthen digital government foundations and test small, human-supervised AI applications in areas where reliable data already exist.**

Keywords*—*Artificial Intelligence, E-Government, E-Readiness, Machine Learning, Public Services, Nepal, Developing Countries

I. INTRODUCTION

Artificial intelligence (AI) is entering a new period of practical use. Progress in machine learning, neural networks, deep learning, natural language processing, computer vision, and computing capacity is making it possible for computers to perform tasks that previously required substantial human judgment [1],[2]. AI is already being considered for health, education, agriculture, finance, law, transportation, cybersecurity, and public administration [1],[3]. For government, the attraction is clear: government data can support faster search, better prediction, improved service targeting, and more consistent administrative decisions.

Yet AI adoption requires more than software. Government agencies need reliable data, suitable infrastructure, skilled staff, secure information systems, institutional leadership, clear responsibility, and citizens who can access and trust digital services. These conditions are especially important in developing countries, where basic e-government implementation may still face infrastructure, human-resource, security, and adoption barriers[4][5][6].

Nepal provides a useful case. The country has developed electronic government services and adopted a National Information and Communication Technology Policy in 2015, but its e-government development remains below regional leaders[7][8]. This raises a practical question: can a country that is still strengthening e-government foundations adopt AI effectively?

This study asks: Is Nepal, and are other developing countries, institutionally, technologically, and socially ready to adopt AI, and what factors determine this readiness? The objectives are to identify early AI applications, assess readiness, examine Nepal's position, and propose practical steps for responsible adoption.

II. LITERATURE REVIEW

AI research has a long history, but the present period is marked by strong growth in data-driven methods. The Stanford AI100 study describes AI as a field covering perception, learning, reasoning, language, planning, and action, while noting the increasing importance of data-driven approaches[3]. LeCun, Bengio, and Hinton explain that deep learning had already produced major gains in speech recognition, image recognition, and other tasks by 2015 [9]. Thus, by 2017, AI was not limited to traditional expert systems; machine learning and deep learning were important parts of the field.

The policy literature also shows that AI was becoming a public-sector concern. The 2016 U.S. National Science and Technology Council report examined AI applications and public-policy questions, including safety, fairness, regulation, workforce skills, and government operations [2]. Its companion national R&D plan called for

sustained research because important societal applications still required further technical progress [10]. The 2017 Congressional Research Service report identified applications in finance, law, cybersecurity, health, education, agriculture, transportation, and other public-interest areas. It also highlighted reliability, accountability, privacy, ethics, and equitable distribution of benefits as policy concerns [1].

Digital-government literature provides the foundation on which such AI applications depend. The OECD recommendation stresses leadership, coordination, data-driven government, security, privacy, and citizen engagement [11]. Its 2016 study further links digital government to service quality, productivity, data use, and changing relationships with service users [8]. Brown et al. show that government platforms require not only technical components but also organisational and governance arrangements [12]. Margetts and Naumann's study of Estonia similarly points to data registries, information exchange, secure identification, and sustained leadership as important digital-government foundations [13].

Research on predictive analytics demonstrates that these foundations can support practical government applications. Shroff reports that municipal records combined with machine learning can improve decisions and service delivery, but stresses data quality, organisational constraints, communication, and ethical judgment [14]. Chatfield and Reddick identify institutional and political barriers to effective use of predictive analytics in government decision making [15]. These findings suggest that AI readiness is multidimensional rather than purely technical.

The developing-country literature reinforces this point. Dada argues that e-readiness measures should consider both the wider environment and organisational technology acceptance [16]. Heeks notes that information-system projects in developing countries can fail when the design assumes conditions that do not exist locally [17]. Layne and Lee likewise show that e-government develops through stages and requires simultaneous organisational and technical change [18]. Bannister and Connolly emphasize that ICT in government should be assessed against public values such as openness, transparency, participation, and responsiveness [19]. Together, these studies support the view that AI adoption should be treated as an extension of e-government capability, not as an isolated technology purchase.

III. Methodology and Conceptual Framework

This study uses a qualitative, comparative, literature-based case study method. The evidence base is restricted to publications and official documents available. Sources include peer-reviewed journal articles, conference papers, government reports, international organisation reports, and established e-government studies. The review focuses on AI applications relevant to public administration and on conditions that affect technology adoption in developing countries. Nepal is used as the principal case, with selected international examples used for comparison.

The conceptual framework defines AI readiness through three dimensions: institutional, technological, and social readiness. Institutional readiness concerns leadership, policy, organisational coordination, funding, skilled public employees, procurement capacity, accountability, and clear responsibility for AI decisions. Technological readiness concerns connectivity, computing infrastructure, government information systems, data quality, interoperability, cybersecurity, privacy controls, and the ability to maintain AI applications. Social readiness concerns digital literacy, citizen access, trust, willingness to use electronic services, language accessibility, inclusion, and public understanding of automated decisions.

The framework is derived by combining the e-readiness literature with digital-government and AI policy literature [4],[5], [6],[11], [8], [16]. It is not presented as a statistically validated index. Instead, it is a diagnostic framework for examining whether a government can move from ordinary electronic services toward selected AI-supported services. Each dimension is assessed using observable indicators.

For Nepal, evidence is drawn from the 2015 National ICT Policy, the 2016 United Nations E-Government Survey, published studies of ministry e-readiness, information-system security,

infrastructure, and human resources, and documented government systems available by 2017 [4][5][6][20][21][22]. The analysis compares the identified readiness conditions with the minimum requirements of early AI applications. This approach avoids claiming that Nepal has implemented AI where evidence is not available. The assessment uses a simple three-level judgment—relatively ready, partly ready, and weak—to distinguish areas where existing foundations can support limited experimentation from areas requiring prior investment. The assessment is intended for early-stage planning.

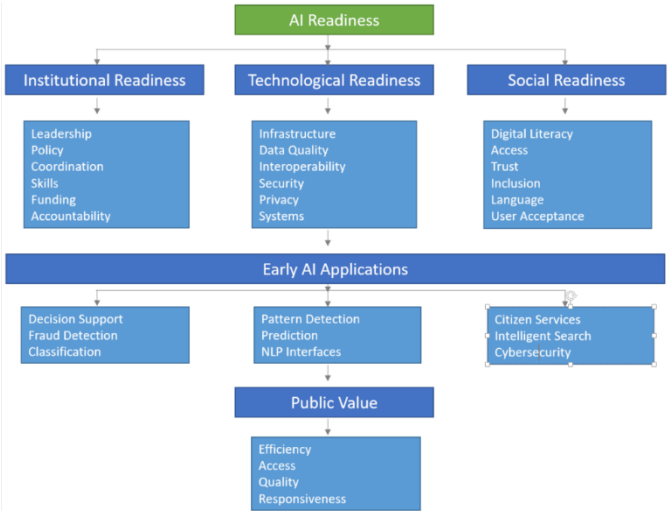

Fig. 1 Conceptual framework for AI readiness

TABLE I
AI-READINESS DIMENSIONS AND INDICATORS

Dimension	Main indicators	Relevance to AI adoption
Institutional	Leadership, policy, coordination, funding, skills, accountability	Determines whether AI projects can be planned, governed and sustained
Technological	Infrastructure, data, systems, interoperability, security, privacy	Determines whether AI applications can operate reliably
Social	Digital literacy, access, trust, inclusion, language, acceptance	Determines whether citizens can use and benefit from AI-enabled services

The framework extends earlier e-readiness thinking rather than replacing it. Gupta, Marasini and Shakya identify infrastructure, hardware, software and information systems, human resources and ICT security as central elements of Nepalese ministry readiness [4]. Marasini and Shakya similarly emphasize infrastructure and human-resource readiness [5], [6]. These factors remain important when AI is introduced because AI applications depend on the same institutional and technical foundations.

IV. Analysis and Discussion: Nepal Case Study

Nepal enters the AI discussion with a mixed readiness position. The 2016 UN E-Government Survey gives Nepal an EGDI value of 0.3458 and a rank of 135 among 193 countries. Its Online Service Index was 0.3986, Telecommunication Infrastructure Index 0.1674, and Human Capital Index 0.4714 [7]. The figures show progress, but also indicate that the basic digital platform remains uneven.

Institutionally, Nepal has important foundations. The 2015 National ICT Policy calls for institutional arrangements, government-wide ICT coordination, standards, security, and wider use of ICT in public services [23]. Studies by Gupta and colleagues identify infrastructure, information systems, human resources, ICT plans, and security as major elements of ministry e-readiness [4][5][6][20][21][22]. However, the same literature shows that security, coordination, skills, and implementation capacity need continued attention.

Technologically, Nepal can support selected narrow applications where structured data already exist. Tax administration, company registration, passports, licensing, procurement, and government information portals provide possible sources for search, classification, anomaly detection, and decision support [24]. Social readiness is more limited because access, literacy, language, trust, and rural connectivity affect citizen use of electronic services. Compared with stronger digital-government environments such as Estonia, Nepal therefore appears partly ready rather than fully ready[13].

The appropriate conclusion is not to delay AI completely, but to adopt it gradually. Nepal can begin with low-risk, human-supervised applications while strengthening the foundations needed for wider use.

V. Case Studies and Examples

Nepal has several government systems that can be viewed as possible starting points for AI-supported services, although the available evidence does not establish broad AI deployment in government by 2017. The Inland Revenue Department's electronic services, the Office of the Company Registrar, passport services, electronic procurement, vehicle and licence systems, and other sector systems show that government data and processes are being digitised[24]. These systems could later support rule-based decision support, anomaly detection, intelligent search, or predictive analysis, subject to data quality and safeguards.

International experience provides clearer examples. The 2017 CRS report identifies machine analysis of legal case history, detection of unusual financial activity, and autonomous cybersecurity detection as practical AI application areas [1]. In New York City, predictive analytics had been examined in children's services, showing both the potential and organisational and ethical choices required [14]. In Japan, the SPEEDI predictive system was used during the Fukushima nuclear emergency, with organisational and political factors affecting its use [15]. A 2017 study of corporate tax evasion in Iran also demonstrated the use of neural networks, support vector machines, logistic regression, and optimisation methods for detecting suspicious tax behaviour[25].

These examples show that early government AI does not require general intelligence. It can begin with narrow tasks: identifying unusual transactions, finding relevant records, predicting service demand, classifying documents, or supporting officials. For Nepal, such applications are more realistic than automated public decisions.

VI. Emerging AI Application in E-Government

The potential applications identified in the literature can be grouped according to the type of government activity they support.

A. Intelligent government information systems

Government produces large volumes of documents, forms, reports, laws, notices, correspondence, and administrative records. Traditional information systems normally store and retrieve these records using predefined fields and keywords. AI can extend this capability through pattern recognition, classification and language processing.

An intelligent information system could, for example, classify incoming documents, identify related records, extract important terms, or direct a document to the appropriate government unit. These applications are relatively low risk because the system can provide recommendations while a civil servant retains control.

B. Expert systems and decision support

Expert systems are among the earlier forms of AI and remain relevant where government decisions depend on established rules and expert knowledge. A government agency could encode legislation, administrative procedures, eligibility requirements, or technical rules into a knowledge-based system.

Such systems would be useful for:

- eligibility assessment;
- licensing support;
- tax guidance;
- agricultural advice;
- administrative compliance;
- public information;
- technical inspection.

The advantage is consistency. The limitation is that the system depends heavily on the quality and completeness of the rules provided by experts.

C. Fraud and anomaly detection

Government agencies manage large financial and administrative datasets. AI and machine learning can identify unusual patterns that may be difficult for manual inspection to detect. The 2017 CRS report already identified unusual financial activity and fraud-related applications as relevant areas for AI [1]. Research on tax evasion also demonstrated the feasibility of combining machine learning methods to identify suspicious financial behaviour [25].

For Nepal, tax administration is a particularly relevant candidate because it involves structured records and recurring transactions.

D. Intelligent search and natural language interfaces

Government websites often contain large amounts of information, but citizens may not know the correct department, document title, or search term. Natural language processing can make government information easier to find.

A citizen might ask:"What documents do I need to register a company?"

An intelligent interface could identify the relevant government information and present it in simple language. Such a system should initially be designed as an information-access tool, not as an autonomous authority.

E. Predictive systems

Predictive analytics can help government anticipate demand, identify risks, allocate resources, and support policy decisions. Research available in 2017 already described applications in health, safety, housing, education, law enforcement and fraud auditing [14][15].

However, prediction creates a special risk. A prediction is not necessarily a fact. Therefore, predictive systems should support human decision making and should be evaluated for accuracy, bias and unintended consequences.

F. Cybersecurity and pattern recognition

Government systems contain sensitive citizen and financial information. AI can support cybersecurity by identifying unusual network activity, suspicious access patterns, malware behaviour, and other anomalies. The CRS report specifically identified autonomous detection and decision making as possible cybersecurity applications [1].

For Nepal, however, cybersecurity should be strengthened before advanced AI security systems are introduced. Gupta and Shakya's studies show that information-system security and audit remain important concerns for Nepalese organisations [20][21][22].

VII. Readiness of Developing Countries for AI in Government

The Nepal case reflects a wider problem faced by many developing countries. AI can create significant benefits, but the benefits are dependent on existing digital capacity.

A useful way to understand this relationship is:

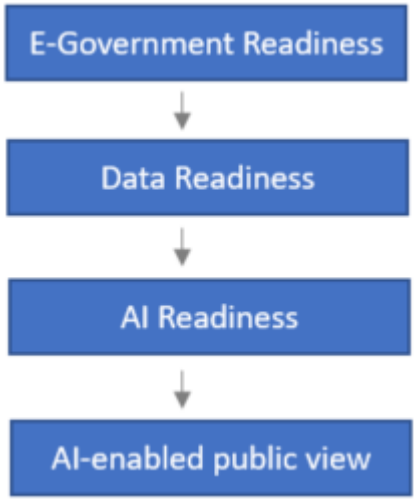

Fig. 2Digital Capacity Relationship

If the first stages are weak, an AI project may create more problems than benefits.

G. Institutional readiness

Institutional readiness is likely to be the most important starting point. Government AI projects cross traditional administrative boundaries. A predictive system may require data from several ministries, while a citizen service may need cooperation between central and local government.

Without coordination, agencies may develop separate systems and datasets. This can create duplication and make AI models less reliable.

The OECD's digital-government principles already emphasize leadership, coordination, institutional capacity, data use, privacy and security [11]. Brown et al. similarly show that government platforms require organisational arrangements as well as technology [12].

H. Technological readiness

AI requires more than internet connectivity. It requires:

1. reliable data;
2. adequate storage;
3. computing capacity;
4. interoperable information systems;
5. secure networks;
6. backup and recovery;
7. data management skills; and
8. security and privacy controls.

This is a major concern for developing countries. Dada argues that e-readiness assessments can be misleading when they focus only on the external environment and do not examine organisational capability [16].

Nepal's low telecommunication infrastructure component in the 2016 EGDI demonstrates why infrastructure remains important [11]. Rural connectivity is also a major concern. Dawadi and Shakya identify geography, electricity, literacy, poverty, infrastructure and sustainability as challenges to rural ICT development in Nepal [26].

I. Social readiness

AI-enabled government will ultimately be judged by citizens. If citizens do not trust government information systems, cannot access them, or lack the skills to use them, technological investment will have limited value.

Social readiness includes:

- digital literacy;
- affordability;
- accessibility;
- language;
- trust;
- privacy awareness;
- willingness to use online services;
- confidence in electronic transactions.

This is especially important in Nepal, where differences between urban and rural communities can create unequal access to electronic government.

AI should therefore be introduced as a tool for improving citizen service rather than as a replacement for citizen contact. Human channels should remain available where citizens cannot use digital systems.

VIII. Policy Recommendations

The readiness assessment suggests that Nepal should treat AI adoption as a gradual extension of e-government rather than as a separate technology programme. The first policy goal should be to strengthen the foundations that make narrow AI useful and safe.

J. Establish an institutional AI coordination function

Government should assign clear responsibility for AI-related planning within the existing ICT governance structure. The responsible unit should maintain an inventory of proposed AI projects, review business cases, coordinate ministries, define minimum technical requirements, and monitor results. This is consistent with the OECD emphasis on leadership, coordination, institutional capacity, and clear responsibility in digital government [11], [8]. For Nepal, the function should initially be small and should use existing public ICT institutions rather than create several competing bodies.

K. Start with low-risk, high-value applications

Early projects should support officials rather than replace them. Suitable pilots include intelligent search across government documents, classification of records, detection of unusual transactions, demand prediction, document routing, and decision-support tools.

Tax administration is a strong candidate because financial records can support anomaly detection. Citizen information portals are another candidate because natural language interfaces and search can reduce the effort required to find government information. Every pilot should define measurable benefits before procurement.

L. Improve government data quality

AI depends on usable data. Ministries should establish common data definitions, remove duplicate records, improve metadata, document data sources, and create controlled data-sharing arrangements. Data should be collected for clear public purposes and protected according to sensitivity.

Nepal’s e-readiness studies already identify software, information systems, infrastructure, human resources, and security as core readiness areas [4][5][6]. AI makes these requirements more important because poor data can produce poor decisions.

M. Strengthen infrastructure and interoperability

The low telecommunication infrastructure component of Nepal’s 2016 EGDI indicates that connectivity remains a major constraint [7]. Government should therefore improve reliable

broadband, secure government networks, data storage, backup, and computing capacity.

Shared infrastructure can reduce duplication, but critical public data should not be placed in systems without clear security and ownership controls. Interoperability standards should be applied so that AI applications can use approved data from multiple agencies without creating new isolated databases.

N. Build public-sector skills

AI adoption requires more than programmers. Government needs data managers, statisticians, cybersecurity specialists, system architects, domain experts, and managers who understand the limits of AI.

Training should begin with practical subjects:

- data quality;
- basic machine learning concepts;
- privacy;
- security;
- interpretation of results; and
- human oversight.

Partnerships with universities can provide research support while keeping institutional knowledge inside government. The 2015 Nepal e-readiness studies and international AI policy reports both point to human capacity as a central condition for successful technology use [4][2][10].

O. Protect security, privacy, and accountability

AI applications should undergo information-security assessment before deployment. Gupta and Shakya identify security and audit as important concerns for Nepalese information systems [20][21][22]. AI projects should therefore include access control, logging, backup, vulnerability assessment, secure development, and incident response.

Personal data should be minimized and protected. Where an AI system recommends an action affecting a citizen, the responsible official should remain identifiable. Automated outputs should be reviewable and corrected when they are wrong.

P. Improve citizen digital literacy and adoption

Citizen adoption is a social condition of e-government readiness. Nepal should expand digital-literacy programmes through schools, local government offices, community centres, libraries, and service points.

Training should focus on practical tasks such as:

- creating accounts;
- using government portals;
- protecting passwords;
- recognizing fraudulent messages; and
- checking official information.

Services should be designed for users with low digital skills and should provide clear language and alternative access channels. Dada's e-readiness analysis shows why environmental readiness alone is insufficient; user capability and organisational acceptance also matter [16].

Q. Use local language and inclusive service design

Natural language interfaces could be useful in Nepal, but language capability must be developed carefully. Early systems should support common government terms and frequently requested information rather than attempt unrestricted conversation.

Where possible, interfaces should support Nepali and other major local languages, with human escalation for uncertain requests. Accessibility for people with limited literacy, disabilities, or weak connectivity should be considered from the beginning.

R. Create an AI pilot and evaluation process

Before scaling an AI application, government should conduct a controlled pilot. Each pilot should specify:

- the public problem;
- data source;
- AI method;
- responsible agency;
- expected benefit;
- error tolerance;
- security risks;
- privacy risks;
- human review process; and
- evaluation measures.

A pilot should be stopped or redesigned if the system performs poorly or creates unacceptable risks. This reflects the lesson from public-sector predictive analytics that technical performance alone does not determine whether a system is appropriate [14][15].

S. Develop public trust through transparency

Government should explain where AI is being used and what role it plays. Citizens should know when an automated recommendation contributes to a decision that affects them.

Public communication should avoid exaggerated claims about AI. Trust will be stronger if agencies publish simple descriptions of the purpose, data sources, limits, and human controls of AI systems. This is consistent with the broader public-value approach to ICT, which links technology with transparency, participation, accountability, and responsiveness [19].

TABLE II
PRIORITY ACTIONS FOR NEPAL

Priority	Action	Main readiness dimension	Expected result
1	Establish AI coordination and project review	Institutional	Clear ownership
2	Improve data quality and interoperability	Technological	Usable government data
3	Strengthen security and privacy controls	Technological/Institutional	Safer AI pilots
4	Train ICT staff and domain officials	Institutional/Social	Skilled users and managers
5	Launch 2–3 low-risk AI pilots	All three	Evidence before scale
6	Expand citizen digital literacy	Social	Greater service adoption
7	Provide simple, local-language interfaces	Social/Technological	Wider inclusion
8	Publish pilot results and limitations	Institutional/Social	Public trust

The recommended sequence is therefore:

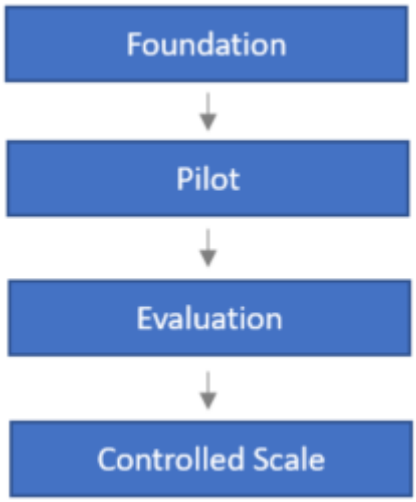

Fig. 3Sequence

This is more suitable for Nepal than attempting broad automation before basic e-government capabilities are reliable.

IX. CONCLUSIONS

Artificial intelligence is becoming an important area of information technology, and governments are beginning to examine its practical use. The evidence available in 2017 shows that useful government applications do not require general artificial intelligence. Narrow systems can already support document classification, intelligent search, anomaly detection, predictive analysis, language processing, cybersecurity, and decision support[1][2][14]. The main question for developing countries is therefore whether their institutional, technological, and social foundations are strong enough to use these applications.

This paper proposes a three-dimensional AI readiness framework based on institutional, technological, and social conditions. Institutional readiness includes leadership, coordination, funding, skills, accountability, and policy. Technological readiness includes infrastructure, data, interoperability, security, privacy, and information systems. Social readiness includes digital literacy, access, trust, inclusion, language, and willingness to use electronic services.

The Nepal case shows partial readiness. The country has an established ICT policy, growing electronic government services, improving communication infrastructure, and identifiable

government information systems. At the same time, the 2016 EGDI results and Nepal-focused studies show weaknesses in telecommunications infrastructure, human resources, information-system security, coordination, and implementation capacity [4][5][6][7] [12][20][21][22]. These weaknesses do not prevent all AI use, but they limit the scale and complexity of appropriate applications.

The contribution of this paper is to connect AI adoption with the earlier e-government readiness problem. It argues that AI readiness should not be treated as a completely new policy field. It is an additional layer built on digital government foundations. The paper also provides an operational set of indicators that ministries can use to identify suitable pilot areas.

The study has limitations. It is based on secondary literature and does not conduct a new survey of ministries or citizens. The framework is conceptual and is not statistically validated. Future research should therefore test the framework with Nepalese ministries, measure citizen acceptance of AI-supported services, compare readiness across developing countries, and evaluate specific AI pilots using cost, accuracy, security, fairness, and public-value measures.

Such research can help determine which AI applications are technically feasible and socially appropriate for Nepal. In 2018, the most useful policy position is therefore neither enthusiasm nor rejection. Nepal should adopt AI selectively, maintain human responsibility, strengthen its e-government foundations, and learn from controlled experiments. This approach can allow the country to obtain practical benefits from AI while reducing technological, institutional, and social risks.[4]

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