

Exploring Pathways for Artificial Intelligence Applications in Rural Areas: A New Mechanism for Youth Participation in Rural Revitalization

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Abstract

Artificial intelligence (AI) is increasingly being integrated into agricultural production, rural industrial operations, public services, and cultural communication. Its practical value in rural contexts lies in its capacity to process dispersed, repetitive, and time-sensitive information across production, business, and grassroots governance. Image recognition, text processing, knowledge retrieval, and data analysis can enhance record management, anomaly detection, and service responsiveness. This paper examines the practical rationale for AI applications in rural areas, analyzes the conditions enabling youth participation, and delineates the division of responsibilities among young people, farmers, grassroots officials, agricultural technicians, and technology firms. It proposes four application pathways: record-based monitoring and on-site verification in agricultural production; product-information integration and market-feedback analysis in rural industrial operations; knowledge management and feedback mechanisms in rural public services; and community participation and governance in rural culture and tourism. Youth can contribute through needs assessment, technological mediation, digital content management, and organizational coordination. Effective implementation requires reliable data records, clearly defined review responsibilities, sustained technical and organizational support, privacy protection, and equitable benefit-sharing arrangements.

Keywords Artificial Intelligence; Youth Participation; Rural Revitalization

1 Introduction

The adoption of AI in rural areas should be guided by its capacity to address specific problems in agricultural production, rural business operations, grassroots public services, and cultural communication. Rural households, village organizations, cooperatives, and local service providers routinely generate production records, photographs, transaction data, customer feedback, policy documents, and other information. These materials are often dispersed across mobile devices, paper forms, social-media accounts, and independent platforms, limiting their systematic organization, retrieval, verification, and use in decision-making. Digital-village development therefore entails the integration of information infrastructure with rural production, governance, and everyday life, rather than merely the deployment of digital equipment [1].

The practical value of AI derives from its capacity to support recurrent information-processing tasks, including image-feature recognition, textual information extraction, knowledge-base retrieval, data comparison, and preliminary anomaly detection. These functions can improve the completeness of production records, the usability of business information, and the timeliness of service responses. National policy documents on smart agriculture similarly emphasize the coordinated development of data resources, technical equipment, service systems, and application scenarios [2][3]. Nevertheless, AI applications in rural areas cannot be based on a uniform technological model; they must be aligned with local work processes and evaluated according to their contribution to workload reduction and decision quality.

Rural areas vary considerably in industrial structure, organizational capacity, digital infrastructure, and the availability of reliable data. Agricultural activities are seasonal and context-dependent, many transactions are embedded in established social relations, and numerous decisions continue to rely on local

knowledge. Accordingly, initial applications should focus on frequently recurring tasks governed by relatively explicit rules and amenable to human verification. Within this division of responsibilities, farmers provide production experience, agricultural technicians exercise professional judgment, village officials coordinate public affairs, and technology firms supply technical tools and maintenance. Young people function as intermediaries connecting local needs, digital resources, and organizational actors rather than substituting for these established participants. This arrangement is consistent with research indicating that technological empowerment depends on its integration with local practices, organizational structures, and community relations [4][5].

2 Rationale for Rural AI Applications and Youth Participation

2.1 Practical Imperatives for AI Adoption in Rural Areas

The practical demand for AI applications arises from the information-intensive character of contemporary rural work. Agricultural production requires continuous observation of crops, livestock, equipment, weather conditions, and agricultural inputs. Rural industries must process product information, consumer inquiries, order adjustments, logistics data, and market feedback, while grassroots public services involve policy interpretation, administrative procedures, public notices, and records of residents' concerns. The fragmented and repetitive nature of these tasks can impede the accumulation of experience and delay problem identification. AI tools can mitigate these constraints by supporting information classification, retrieval, comparison, and preliminary screening, while leaving professional and community judgment intact.

The potential value of AI is particularly evident in contexts characterized by abundant but poorly structured information. Cooperatives may accumulate extensive crop-growth images without systematic procedures for longitudinal comparison; village e-commerce teams may repeatedly address similar consumer inquiries without maintaining structured records; and local service centers may need to interpret the same policy provisions for different residents. Tools that classify materials, identify recurring issues, or retrieve verified responses can improve administrative efficiency and procedural traceability. Accordingly, the principal criterion for adoption is not technological sophistication in itself, but measurable improvement in the quality, timeliness, and accountability of specific rural tasks.

2.2 The Intermediary Role of Youth in Rural AI Applications

Youth participation derives from the intermediary position that many young people occupy between digital platforms, external resources, and local rural contexts. Their familiarity with mobile platforms, digital content, online transactions, and urban-rural communication can enable them to identify mismatches between technical systems and local practices, explain technical functions in accessible terms, and facilitate coordination among farmers, village officials, technicians, enterprises, and external service providers. Experience in e-commerce, media production, information services, or community activities further strengthens their capacity to support the introduction and routine operation of AI applications.

Farmers possess contextual knowledge of cultivation, livestock production, and local conditions; agricultural technicians provide specialized diagnosis and extension services; village officials coordinate public responsibilities; and technology firms develop systems and provide technical support. Youth participation complements these functions through needs assessment, information organization, interpretation of technical outputs, digital content management, and communication of implementation problems to technical teams. Research on county-level urban-rural mobility indicates that the return and circulation of young people can introduce skills, information, and organizational connections into rural development [6]. Sustained participation, however, requires clearly defined roles, systematic training, reasonable remuneration, and institutional channels for involvement in local decision-making.

3 Pathways for AI Applications in Rural Areas

3.1 AI-Assisted Agricultural Production: Record-Based Monitoring and On-Site Verification

The first pathway integrates AI into routine agricultural production records. Appropriate entry points include crop-growth images, pest and disease observations, feeding logs, input-use records, equipment status, and weather-related reminders. The objective is not comprehensive automation, but the

establishment of standardized and comparable records of recurrent production activities. Cooperatives, family farms, and village service stations can adopt templates specifying time, location, crop or livestock category, and problem description, thereby providing a basic data foundation for subsequent recognition, retrieval, and analysis.

Based on these records, image-recognition and rule-based comparison tools can support preliminary screening. A system may, for example, flag images showing leaf discoloration, identify recurrent descriptions of equipment malfunction, or issue reminders when recorded input levels deviate from predetermined ranges. Such outputs should be treated as indicative information rather than definitive conclusions: farmers verify conditions on site, and agricultural technicians determine whether diagnosis or intervention is required. This allocation of responsibility preserves professional accountability and prevents model outputs from being treated as substitutes for agricultural expertise.

Young people can perform essential implementation functions within this pathway, including establishing record templates, communicating image-capture and labeling standards, organizing uploaded materials, and documenting false alerts or missing categories. In this capacity, they translate technical functions such as image classification into operational procedures that local users can understand and apply. Agricultural technicians should define classification categories, review criteria, and escalation procedures; technology firms should maintain and refine systems on the basis of verified local feedback; and village organizations can provide shared service facilities for households with limited devices, connectivity, or digital literacy.

Complementary offline service mechanisms remain necessary, particularly during peak agricultural seasons, network disruptions, and urgent incidents. Paper records, telephone consultation, and in-person technical guidance can ensure continuity of service for users who cannot rely consistently on digital tools. AI applications are therefore most effective when they extend existing agricultural extension systems rather than displace them. A sustainable implementation model should form a feedback loop in which records generate preliminary alerts, farmers conduct on-site verification, technicians provide guidance, and verified outcomes are incorporated into the knowledge base. This process can progressively improve both system performance and the quality of local production data.

3.2 AI-Assisted Rural Industrial Operations: Information Integration and Market Feedback

The second pathway applies AI to information management and market coordination in rural industries. Although many local products possess distinctive quality attributes, their presentation and documentation often lack standardization. Product specifications, origin information, packaging details, consumer inquiries, and after-sales feedback may be stored separately, hindering the construction of coherent product profiles and the identification of recurring operational problems. AI tools can support product-data organization, preparation of descriptive drafts from verified materials, classification of customer inquiries, summarization of feedback, and analysis of common causes of returns or complaints. These functions can strengthen the routine operations of cooperatives, rural enterprises, and small e-commerce teams.

The establishment of a shared product-information base is a prerequisite for this pathway. Such a base should include product name, variety, place of origin, seasonal characteristics, quality standards, packaging information, available traceability documentation, and approved promotional language. AI systems can retrieve and synthesize these materials when product descriptions are prepared or routine inquiries are addressed. All externally disseminated content nevertheless requires review by designated personnel. Claims concerning quality, origin, nutritional value, and delivery conditions must be accurate and consistent with the products offered, thereby safeguarding consumers and limiting the dissemination of exaggerated or misleading information.

Market feedback should be treated as a source of operational evidence rather than solely as material for promotional communication. The classification of inquiries, reviews, reasons for returns, and logistics complaints can reveal unclear product descriptions, inadequate packaging, or unrealistic delivery expectations. Young people with experience in platform operations can organize these materials, monitor recurrent problems, and communicate findings to producers, packaging teams, and logistics providers. Such practices can reduce information asymmetry between producers and consumers and enhance coordination across rural industrial chains [7].

The principal value of this pathway lies in improving information organization and organizational learning. Because the market position of rural products depends substantially on trust, large-scale automated content generation that is detached from quality control and customer experience may undermine commercial credibility. An appropriate process therefore comprises product verification, data

organization, AI-assisted drafting or analysis, human review, publication, and systematic feedback collection. Youth can coordinate this process, while producers and enterprises retain responsibility for product quality and commercial commitments.

3.3 AI-Assisted Rural Public Services: Knowledge Management and Feedback Mechanisms

The third pathway concerns the application of AI to grassroots public-service provision. Rural residents require timely and comprehensible information on agricultural subsidies, social assistance, medical insurance, employment services, disaster prevention, land-related procedures, and public notices. Although relevant policy documents generally exist, their length, periodic revision, and context-specific application can impede effective access. A locally reviewed knowledge base can organize frequently used policy documents, administrative procedures, contact channels, and common questions, while AI-assisted retrieval can enable staff to locate applicable information more efficiently.

Clear institutional responsibility is a prerequisite for such systems. Each policy item should include its source, update date, scope of application, and responsible office. AI-generated responses should be based exclusively on approved materials and should identify cases requiring manual review. Village officials and service personnel remain responsible for authoritative explanations and case-specific decisions. Research on digital rural governance similarly emphasizes that technological tools should be integrated with established institutional responsibilities and used to enhance public-service capacity, rather than forming an autonomous layer of unaccountable technical authority [8].

Youth can contribute to the maintenance of service interfaces and feedback mechanisms by organizing frequently asked questions, identifying ambiguous procedures, assisting residents with digital forms, and communicating unresolved issues to the competent departments. Their role extends beyond the operation of automated question-answering tools and connects online inquiries with offline administrative resolution. Requests that cannot be answered accurately should be transferred to designated personnel and their outcomes recorded. Recurrent unresolved issues should inform the revision of administrative procedures, public notices, and staff training.

Stringent safeguards are required for personal information. Service systems should collect only data necessary for specified tasks, implement differentiated access controls, exclude sensitive information from training materials, and establish explicit retention and deletion rules. The Personal Information Protection Law requires personal information to be processed lawfully, legitimately, necessarily, in good faith, and with appropriate transparency [9]. In rural communities, where dense social relations may amplify the consequences of unauthorized disclosure, these safeguards are particularly important. Improvements in service convenience must therefore remain compatible with residents' rights to control their personal information.

3.4 AI-Assisted Rural Culture and Tourism: Community Participation and Governance

The fourth pathway addresses AI applications in rural culture and tourism. Rural communities possess oral histories, festival customs, craft knowledge, historical photographs, genealogical materials, local songs, and records of historic sites. These materials are significant for cultural preservation and carefully governed tourism communication, yet they are often dispersed and insufficiently catalogued. AI can assist with interview transcription, photograph classification, audio and video tagging, record retrieval, and the preparation of preliminary multilingual introductions. It can also support the organization of visitor inquiries and the provision of clearer route information.

The governance of cultural and tourism applications should be grounded in community participation and collective authority. Local residents, cultural inheritors, village collectives, and relevant cultural institutions should determine which materials may be recorded, displayed, adapted, or commercialized. Young people may assist in collection, digitization, online presentation, and visitor communication, but the interpretation of local culture should remain subject to community review. Materials involving personal narratives, sacred practices, family records, or collective memory require explicit consent and review prior to publication. Technology should facilitate cultural preservation and interpretation without subordinating community resources to platform-traffic incentives.

AI-generated text and images require particular caution in cultural contexts because they may introduce factual inaccuracies, simplify traditions, or reproduce stereotypical representations of rural life. Research on digital rural governance has identified risks including mismatches between technological supply and farmers' needs, governance distortion arising from technological dependence, and disorder associated with

excessive digitization [10]. Responsible projects therefore require documented sources, local review, revision procedures, and transparent benefit-sharing arrangements. Evaluation should prioritize cultural understanding, community participation, preservation outcomes, and benefits returned to the local community rather than the scale of online exposure.

This pathway also provides an institutional mechanism for youth participation by combining digital competencies with locally grounded cultural work. Young participants can serve as archive organizers, interview coordinators, content editors, and intermediaries linking villages with schools, museums, tourism operators, and online audiences. Their contribution is most effective when embedded in local relationships and governed by collectively established rules. Under these conditions, AI can support the organization and communication of cultural resources while preserving the community's authority to define their meaning and boundaries.

4 Institutional and Operational Conditions for Implementation

The four pathways depend on several shared institutional and operational conditions. First, AI projects in rural areas require limited but reliable data foundations; maintaining a small set of accurate and consistently updated records is preferable to accumulating large volumes of unusable information. Second, each application requires a clearly defined review chain in which automated alerts, generated drafts, and retrieval results are assessed by the individual or organization accountable for the final decision. Third, implementation depends on sustained technical and service support, including training, equipment maintenance, network access, and complementary offline channels. Fourth, benefit-sharing arrangements must be explicit. Young people undertaking sustained operational responsibilities require reasonable remuneration, training, and development opportunities, while villages contributing collective data or cultural resources should retain corresponding benefits and decision-making rights.

Pilot initiatives should be organized around a limited number of clearly defined tasks rather than generalized objectives. Initial projects may focus on a single production-recording procedure, shared product-information base, reviewed public-service knowledge set, or cultural archive. Before implementation, project teams should specify intended users, data sources, review responsibilities, feedback channels, and evaluation indicators. Relevant indicators may include consistency in record completion, response time for public-service inquiries, recurrence of product complaints, and community understanding and approval of cultural content. Task-based piloting enables systems to be refined through iterative use and reduces the risk that rural AI initiatives remain short-term demonstrations with limited enduring value.

5 Conclusion

The applicability of AI in rural areas derives from the need to organize and act upon dispersed information across production, industrial operations, public services, and cultural activities. Its principal contribution is to improve information flows and support decision-making within a clearly defined division of responsibilities, rather than replace farmers, grassroots officials, agricultural technicians, or enterprises. Effective applications should therefore address specific tasks, rely on verified records, retain human review, and remain integrated with offline service provision.

Youth participation is valuable because it connects local needs with digital tools, platform resources, and external organizations. Young people can contribute through needs assessment, technological mediation, digital content management, and organizational coordination. This arrangement does not assign young people sole responsibility for rural revitalization; instead, it positions their participation as an intermediary mechanism linking multiple actors. Supported by reliable data, accountable review procedures, public-service capacity, privacy protection, community participation, and equitable benefit-sharing, the four pathways identified in this study can facilitate the integration of AI into sustainable rural development.

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Conflicts of Interest

The authors declare no conflicts of interest.

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鄉村人工智能應用路徑探討

——青年參與鄉村振興的新機制

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摘要：人工智能技術正逐步進入農業生產、鄉村產業經營、公共服務和文化傳播等領域。鄉村應用人工智能，旨在處理生產經營與基層服務中分散、重複且難以及時整理的資訊事務。圖像識別、文本處理、知識檢索和數據分析等工具，能夠提高資料歸類、異常提示和服務回應的效率。本文從鄉村人工智能應用的現實基礎出發，分析青年參與的角色條件及其與農戶、基層幹部、農技人員和技術企業的分工，進而提出四類應用路徑：以生產記錄和現場核驗為基礎推進智能輔助；以產品資料、市場反饋和經營分析支撐產業運營；以知識整理和問題迴流提升公共服務能力；以社區參與和文化保護規範文化旅遊應用。青年在這一過程中承擔需求識別、技術轉譯、內容運營和組織協同等工作。鄉村人工智能應用需要穩定的數據記錄、明確的審核責任、持續的公共服務支撐和合理的利益聯結機制。

關鍵詞：人工智能；青年參與；鄉村振興

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