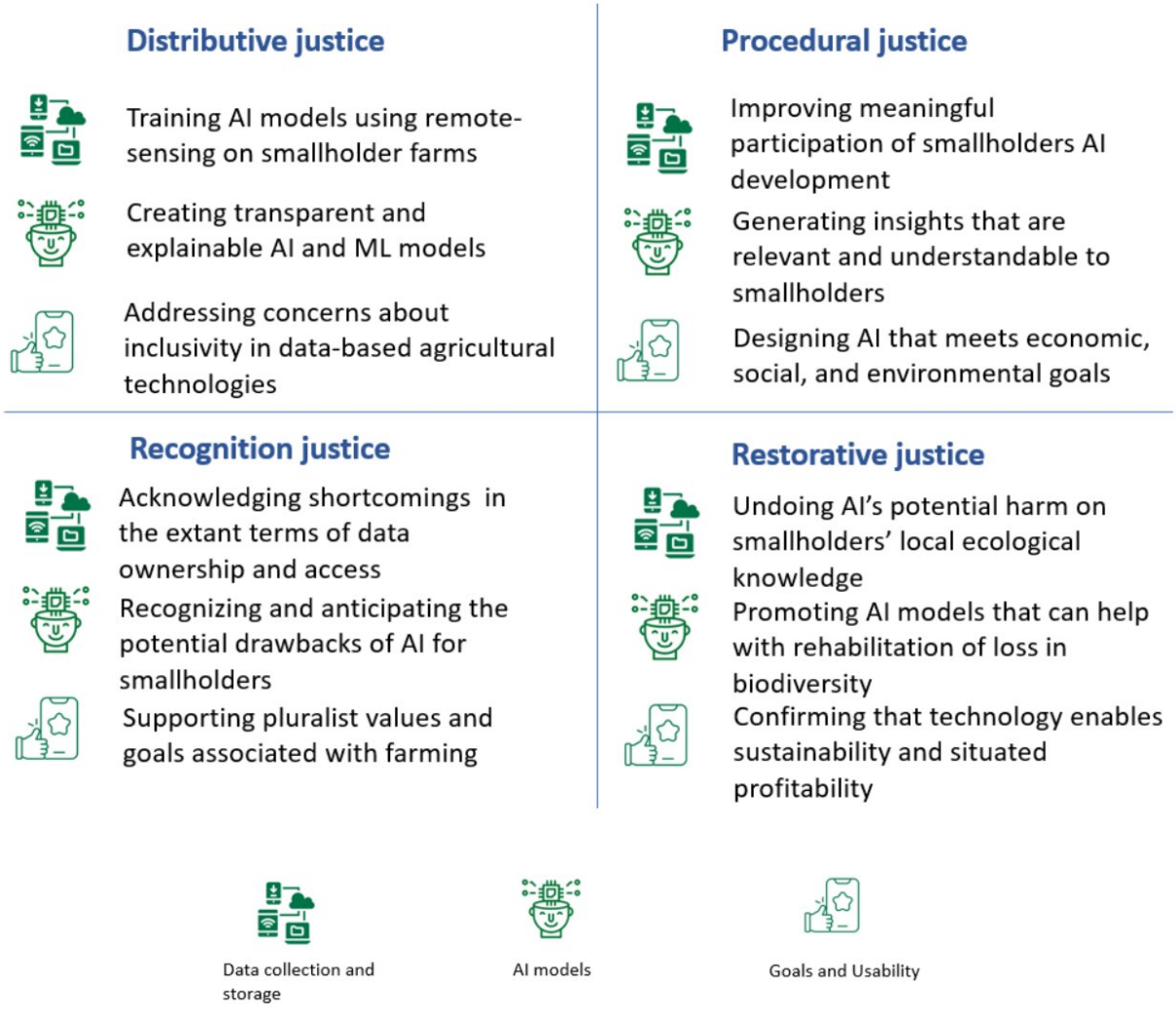
Research examines whether AI is helping small-scale farming operations

June 12 2023, by Addison Dehaven



Governance challenges of AI technologies in agriculture from a justice lens. Credit: *Artificial Intelligence applications in agriculture need a justice lens to address risks and provide benefits to smallholder farmers. (2023).*

Artificial intelligence tools can be found in nearly every sector of society and are quickly becoming this century's great technological advancement. In the agriculture sector, large-scale farming operations are utilizing AI to increase profitability, reduce environmental impacts and promote sustainable practices.

But how are small-scale operations utilizing AI? Are smallholder farmers seeing the same benefits as large-scale operations?

A group of South Dakota State University graduate and recently-graduated students—including Skye Brugler, Ajoy Kumar Saha and Maryam Sahraei—looked to answer these questions in a research brief that discussed AI-related challenges in the agriculture sector. They also made policy recommendations in their recently published brief titled "Artificial intelligence applications in agriculture need a justice lens to address risks and provide benefits to smallholder farmers."

"We are looking at how these smallholder farmers are dealing with AI," Sahraei said, "in terms of both the speed and development of the technology."

AI and smallholder farms

While large-scale farming operations appear to dominate the world's food production, smallholder farming, or farms that are five acres or less, actually account for nearly 35% of the total food production in the world. In addition, five out of six producers, or 83% of all farmers, are considered smallholders. Because of this, there is an "urgent need to place smallholders at the front and center of innovation in AI used for agricultural purposes," the research team explained in the brief.

In the Global South—generally defined as countries in Latin America, Africa, Asia and Oceania—smallholder farmers are key to overcoming many of the food security challenges facing these growing populations. Many smallholder farmers in these regions rely on traditional techniques and lack the technical expertise that is required for many of these AI applications.

"Smallholder farmers often cannot get the same benefits from AI as the very big operations of food production," Sahraei said.

There are several reasons why this is true, Sahraei explained. First, smallholder farmers often lack the technical skills needed to utilize the available data. For example, remote sensing techniques that produce satellite imagery help reduce fieldwork and provide accurate data. The data from these satellites supply the AI models that then help make agronomical decisions.

Understanding the raw data requires technical skills that smallholder farmers often don't have. Computational platforms trained to read the data—like Google Earth Engine—have provided a needed opportunity for farmers to access the data.

Second, smallholder farmers often lack the capital resources needed to adopt these technologies. For example, precision agriculture, which enables site-specific application of farm inputs to improve farm profits and environmental sustainability, has low adoption rates among smallholder farmers due to a few of the aforementioned reasons along with economic instability.

"They are less willing to adopt AI because if they use it wrong or lose the benefits, it will be difficult for them to financially overcome the failure," Sahraei said.

The economic limitations of smallholder farms have created a "technology gap" between small- and large-scale operations.

"Surveys have demonstrated that larger farmers have more capital to invest in the technology and software, are more capable of taking risks due to the ability to absorb decreases in profit and can create specialized jobs to analyze and make decisions based on the collected data," Saha said.

Policy recommendations

To combat these challenges, the research team provided a set of policy recommendations aimed at governing big data and AI through a social justice lens. One of the recommendations included requiring standards of transparency for the models used by AI tools and applications.

Other recommendations included market regulation, specifically ensuring AI markets remain competitive in which to limit the power of any individual developer.

Finally, recognizing the benefits of AI technology to farming operations, the research team recommended extension services to help educate smallholder farmers about technologies that work best in their operations.

"There needs to be more extension education so smallholder farmers can learn about the new technologies," Saha said.

More information: Report: Artificial Intelligence applications in agriculture need a justice lens to address risks and provide benefits to smallholder farmers

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Provided by South Dakota State University

Citation: Research examines whether AI is helping small-scale farming operations (2023, June 12) retrieved 21 May 2024 from https://phys.org/news/2023-06-ai-small-scale-farming.html

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