



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

*No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.*



# How Communication Affects the Adoption of Technologies in Agriculture: a Comparative Study in the United States and Brazil



Joana Colussi<sup>1</sup>, Steve Sonka<sup>1</sup>, Gary Schnitkey<sup>1</sup>, Eric Morgan<sup>2</sup>, and Antônio Padula<sup>3</sup>

<sup>1</sup> Department of Agricultural and Consumer Economics and <sup>2</sup> ALEC Program, University of Illinois Urbana-Champaign

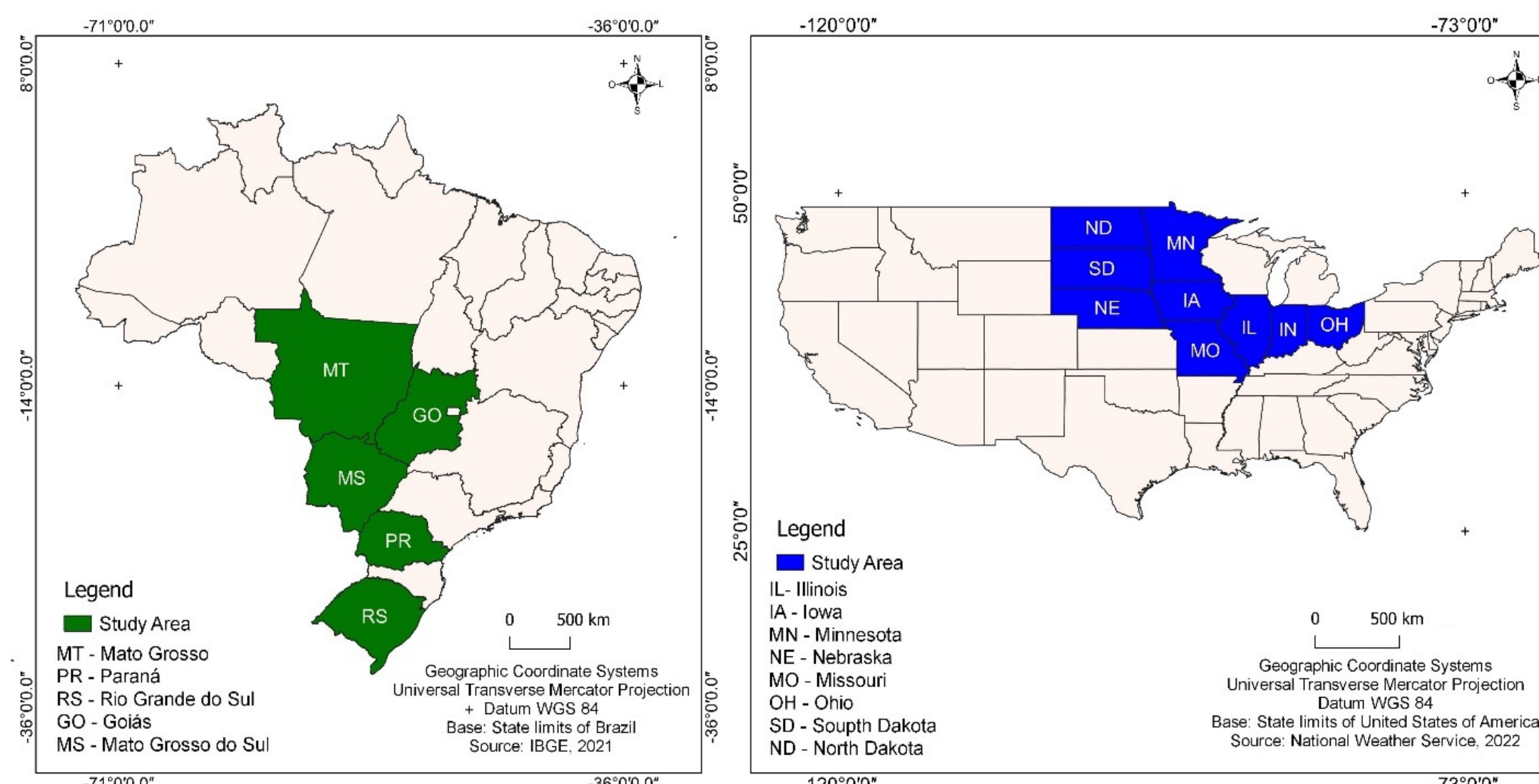
<sup>3</sup> School of Business Administration, Federal University of Rio Grande do Sul, Brazil

## Overview

- Over the last two decades, **digital agriculture has advanced rapidly**, particularly in the United States and Brazil, which are world leaders in soybean production.
- This **transformation is crucial** because it leads to more informed decisions, higher efficiency, and easier knowledge sharing.
- However, studies have shown that the need for more ability to use these tools and the shortage of knowledge contribute to **current farmer unease about digital technology**.
- Previous studies** have examined factors such as farmer age, farm size, and level of education, and their influence and relationship with the adoption rate of technologies.
- This study investigates the **influence of communication channels** on farmers' adoption, decision-making, and benefits obtained concerning the use of digital technologies.

## Study Region

- This comparative study was conducted in **Brazil's top five soybean-producing states** (Mato Grosso, Paraná, Rio Grande do Sul, Goiás and Mato Grosso do Sul) and in the **United States' top nine soybean-producing states** (Illinois, Iowa, Indiana, Minnesota, Nebraska, Ohio, Missouri, North Dakota, and South Dakota).
- These states account for 75% of soybean production in each country. Completed surveys were obtained from **461 farmers in Brazil** and **340 farmers in the United States**.



## Methods

### Survey Instrument

- The online survey hosted on the Qualtrics platform was divided into **three main sections**:
  - use of digital technologies
  - influence of communication channels
  - demographic information
- Soybean farmers in both countries were invited to indicate the use of eight precision and digital technologies on **interval scales in numeric format, from 0 being "never use" to 5 being "always use"**.
- The producers also indicated the influence of many types of communication channels on **interval scales in numeric format, from 0 being "not at all influential" to 5 being "extremely influential"**.

### Data Collection

- In Brazil, the data were collected through an online questionnaire (in Portuguese) available to the farmers from **March to June 2021**.
- In the United States, data were collected through an online questionnaire (in English) open to the farmers from **July 2021 to April 2022**.
- In both countries, participants were recruited by **random sampling**.

### Data Analysis

- The data were analyzed using descriptive statistics, **Spearman rank correlation (ρS)**, and one-way **ANOVA**.
- The reliability of the scales used to measure the variables was investigated using **Cronbach's α coefficient**.

## Main Results

Table 1: Level of use of the technologies on-farm and level of their influence in making decisions and realizing benefits

Digital Technologies	Means	Means
Guidance/Autosteer	3.56	4.23
Yield Monitors	2.92	4.31
Sprayer control systems	1.98	3.93
Automatic rate control telematics	2.11	3.36
Electronic records/mapping for traceability	2.09	3.26
Satellite/drone imagery	2.99	2.94
Wired or wireless sensor networks	2.10	2.36
Soil electrical conductivity mapping	1.50	1.81
<b>Decisions</b>		
	<b>Means</b>	<b>Means</b>
NPK fertilization and liming application	3.64	3.93
Overall hybrid/variety selection	3.49	3.53
Overall crop planting rates	3.44	3.45
Pesticide selection	3.26	2.91
Variable seeding rate	2.38	2.72
Cropping sequence/rotation	3.12	2.69
Irrigation decisions	2.02	1.41
<b>Benefits</b>		
	<b>Means</b>	<b>Means</b>
Autosteer (less fatigue/stress)	3.54	4.18
Increased crop yields	3.70	3.92
Cost reductions	3.63	3.78
Purchase of inputs	3.38	3.40
Labor efficiencies	3.57	3.30
Time savings	3.51	3.17
Lower environmental impact	3.34	2.99
Marketing choices	3.31	2.96

### Sample Characteristics

#### Age group

In Brazil, 43.2% are under 41 years old. In the United States, only 17.1% are under 41 years old. In Brazil, 21.4% are more than 56 years old, while in the United States, 61% are more than 56 years old

#### Level of education

In Brazil, 35.1% of respondents have a postgraduate degree. In the United States, however, the corresponding percentage is only 17.1%.

#### Farm size

In Brazil, 50.9% of the respondents farm less than 500 hectares. In the United States, 38.6% farm less than 405 hectares. The percentage of respondents who farm more than 2,000 hectares in Brazil is almost double that of the U.S.

Table 2: Relationship between use of digital technologies and communication channels

Digital technologies	Communication Channels (Spearman's rank correlation coefficient ρS)	Communication Channels (Spearman's rank correlation coefficient ρS)
Guidance/Autosteer	1 <sup>st</sup> Conversation with neighbors (ρS 0.209) 2 <sup>nd</sup> Conferences, forums, seminars (ρS 0.120) 3 <sup>rd</sup> Field Days (ρS 0.096)	1 <sup>st</sup> YouTube (ρS 0.208) 2 <sup>nd</sup> Twitter (ρS 0.159) 3 <sup>rd</sup> Website and blog (ρS 0.154)
Yield monitors	1 <sup>st</sup> LinkedIn (ρS 0.178) 2 <sup>nd</sup> Conversation with neighbors (ρS 0.170) 3 <sup>rd</sup> Cable Television (ρS 0.145)	1 <sup>st</sup> YouTube (ρS 0.181) 2 <sup>nd</sup> Peer groups (ρS 0.163) 3 <sup>rd</sup> Website and blog (ρS 0.145)
Satellite/drone imagery	1 <sup>st</sup> LinkedIn (ρS 0.253) 2 <sup>nd</sup> Conferences, forums, seminars (ρS 0.246) 3 <sup>rd</sup> Instagram (ρS 0.226)	1 <sup>st</sup> Website and blog (ρS 0.225) 2 <sup>nd</sup> Twitter (ρS 0.180) 3 <sup>rd</sup> YouTube (ρS 0.165)
Soil electrical conductivity mapping	1 <sup>st</sup> LinkedIn (ρS 0.228) 2 <sup>nd</sup> Instagram (ρS 0.183) 3 <sup>rd</sup> Messenger (ρS 0.182)	1 <sup>st</sup> Cable Television (ρS 0.199) 2 <sup>nd</sup> YouTube (ρS 0.163) 3 <sup>rd</sup> Peer Groups (ρS 0.141)
Wired or wireless sensor networks	1 <sup>st</sup> LinkedIn (ρS 0.261) 2 <sup>nd</sup> Instagram (ρS 0.208) 3 <sup>rd</sup> Conferences, forums, seminars (ρS 0.183)	1 <sup>st</sup> Instagram (ρS 0.271) 2 <sup>nd</sup> YouTube (ρS 0.231) 3 <sup>rd</sup> Twitter (ρS 0.209)
Electronic records/mapping for traceability	1 <sup>st</sup> LinkedIn (ρS 0.224) 2 <sup>nd</sup> Instagram (ρS 0.180) 3 <sup>rd</sup> Conferences, forums, seminars (ρS 0.148)	1 <sup>st</sup> Website and blog (ρS 0.252) 2 <sup>nd</sup> YouTube (ρS 0.190) 3 <sup>rd</sup> Facebook (ρS 0.158)
Sprayer control systems	1 <sup>st</sup> LinkedIn (ρS 0.221) 2 <sup>nd</sup> Cable Television (ρS 0.189) 3 <sup>rd</sup> WhatsApp (ρS 0.151)	1 <sup>st</sup> YouTube (ρS 0.165) 2 <sup>nd</sup> Website and blog (ρS 0.164) 3 <sup>rd</sup> Retailers and Extension agents (ρS 0.133)
Automatic rate control telematics	1 <sup>st</sup> LinkedIn (ρS 0.246) 2 <sup>nd</sup> Instagram (ρS 0.186) 3 <sup>rd</sup> Peer groups (ρS 0.135)	1 <sup>st</sup> YouTube (ρS 0.238) 2 <sup>nd</sup> Website and blog (ρS 0.204) 3 <sup>rd</sup> Facebook (ρS 0.145)

Statistical significance is denoted as  $p < 0.05$

## Conclusions

- YouTube** had the highest positive correlation with four among eight digital technologies analyzed in the United States.
- LinkedIn** had the highest positive correlation with seven among eight digital technologies analyzed in Brazil.
- The findings may suggest that adopters of **established decisions** regarding digital agriculture tend to prioritize **in-person connections**. In contrast, adopters of **emergent technologies** tend to prefer **social media**.

## Implications

- The results offer insights into current **farmers' behavior** regarding adopting new technologies, helping **analyze strategies** for the generation and dissemination of information
- Our results suggested that agricultural companies, farmers, policymakers, and stakeholders focus on the **vital role of communication** in disseminating new technologies.