

File S1: Query search applied in the google search engine

“Farming systems” and “Artificial intelligence” AND “Food security”
“Food systems” AND “Artificial intelligence”
“Food security” AND “Artificial intelligence”
“Agricultural policy” AND “Food security” AND “Artificial intelligence”
“Agricultural subsidy policies” AND “Food security” AND “Artificial intelligence”
“Farming systems” AND “Food security” AND “Artificial intelligence”
“Landownership” AND “Food security” AND “Artificial intelligence”
“Cropping systems” AND “Food security” AND “Artificial intelligence”
“Agricultural activities” AND “Food security” AND “Artificial intelligence”
“Chemical fertilizer and pesticide input subsidy” AND “Food security” AND “Artificial intelligence”
“Farming systems” AND “Decision making” AND “Food security” AND “Artificial intelligence”
“Access to food” AND “Artificial intelligence”
“Affordability to food” AND “Artificial intelligence”
“Availability to food” AND “Artificial intelligence”
“Farming systems” and “Agent based modelling” AND “Food security”
“Food systems” AND “Agent based modelling”
“Food security” AND “Agent based modelling”
“Agricultural policy” AND “Food security” AND “Agent based modelling”
“Agricultural subsidy policies” AND “Food security” AND “Environment”
“Farming systems” AND “Food security” AND “Environment”
“Landownership” AND “Food security” AND “Agent based modelling”
“Cropping systems” AND “Food security”
“Agricultural activities” AND “Food security”
“Chemical fertilizer and pesticide input subsidy” AND “Food security”
“Farming systems” AND “Decision making” AND “Food security”

File S2 List of funding organisations that sponsored AI-based analytical research

Type of funding Organisation	Organisation
Development agencies	<ul style="list-style-type: none"> • The Belgian Directorate General for Development Cooperation (DGCD) • USAID • SANREM-CRSP • The Swiss Development Centre through the African Highlands Initiative • The Bill & Melinda Gates Foundation • The World Bank • SIDA • The Department for International Development (DFID) • UNDP • DANIDA • The "Meeting Urban Food Needs" project of the Food and Agriculture Organization of the United Nations • The 2SCALE (Towards Sustainable Clusters in Agribusiness through Learning in Entrepreneurship) program led by The International Fertilizer Development Center (IFDC)
Research institutions	<ul style="list-style-type: none"> • The NASA, Earth and Space Science Graduate Fellowship • Graham Environmental Sustainability Institute Graduate Fellowship, Rackham Graduate School George Mason University • The NASA (the Land Cover and Land Use Change Program) • The Universities of the State of Baden-Württemberg • The Australian Centre for International Agricultural Research • The French National Research Agency (ANR) • The CGIAR Fund Donors and through several bilateral funding agreements (the CGIAR Fund Council, Australia-ACIAR, European Union, International Fund for Agricultural Development-IFAD, Ireland, New Zealand, Netherlands, Switzerland, USAID, UK, and Thailand) and CGIAR groups • The Food Security Center from University of Hohenheim • The Center for Development Research (University of Bonn) • The Institute for Regional Studies (Seoul National University) • Noragric (Norwegian University of Life Sciences) • The International Food Policy Research Institute (IFPRI) • The Office of Naval Research (ONR) • The Center for Social Complexity at George Mason University • IRRI (International Rice research Institute) • Kasetsart University • The Center for Development Research (ZEF—Bonn)

	<ul style="list-style-type: none"> • The Office of Education Research of the National Institute of Education in Nanyang Technological University Singapore The Heidelberg Institute of Global Health (HIGH) • The Dutch Science Council (NWO) • Research Council of Norway • The Natural Sciences and Engineering Research Council of Canada • Wageningen, Foundation Stichting Dienst Landbouwkundig Onderzoek (DLO) research institute Plant Research International • The Commonwealth Scientific and Industrial Research Organisation • The Ludwig Kruhe Fellowship, Purdue University, U.S. • The Purdue Climate Change Research Center (PCCRC) • The European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme • The Economic and Social Research Council (ESRC) • The Natural Environment Research Council (NERC) • Marie Curie Actions • Echel Eau Project at Agropolis International • Chulalongkorn University • Department of Geography and Environmental Management • The International Development Research Centre, Canada, • China Scholarship Council • The National Science Foundation (NSF) Graduate Research Fellowship Program • Vanderbilt University's Graduate School Dissertation Enhancement Grant • The Mexican National Council of Science and Technology (CONACYT) • The International Development Research Centre (IDRC-Canada) • The Water Research Center for Agriculture and Mining (WARCAM) • CONICYT/Chile in the framework of FONDAP • Latin American and Caribbean Environmental Economics Program (LACEEP) • The Leverhulme Trust Research Fellowship • UK Engineering and Physical Sciences Research Council (EPSRC) • UK EPSRC • The Scottish Food Security Alliance-Crops; an alliance between the Universities of Aberdeen and Dundee and the James Hutton Institute • The Leibniz University of Hannover • The Tyndall Centre • The School of Geography and the Environment • University of Oxford • Stockholm Environment Institute
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	<ul style="list-style-type: none"> • Deakin University • The Faculty of Science and Technology at Anglia Ruskin University • The National Socio-Environmental Synthesis Center (SESYNC) under funding received from the National Science Foundation • The Agence Nationale pour la Recherche (ANR) • The Rackham Predoctoral Fellowship
State Organisations	<ul style="list-style-type: none"> • The Ministry of Science, Research and the Arts • The European Union • The state of Baden-Württemberg through their bwHPC program • The Federal Ministry of Education and Research (BMBF) of Germany • The DAAD (German Academic Exchange Service) programme • The Federal Foreign Office of Germany • The Scottish Executive Environment and Rural Affairs Department • Global Environmental Research Fund 2-1702 of the Ministry of Environment of Japan • The French Ministry for Research and Higher Education (4 per 1000 international research program 2016-2017 grant) • The Norwegian Government • The Basque Government through the BERC 2018-2021 program • Spanish Ministry of Economy and Competitiveness MINECO through BC3 María de Maeztu excellence • The Dutch Ministry of Economic Affairs • The Swiss State Secretariat for Education, Research and Innovation (SERI) • Ministry of Foreign Affairs in the Netherlands; Ministerie van Buitenlandse Zaken • An Australian Government Research Training Program scholarship
Financial institution	<ul style="list-style-type: none"> • The Dawe Charitable Trust • AXA Group
Others (e.g. Foundations or Platforms)	<ul style="list-style-type: none"> • The Heinrich-Böll Foundation and the Brazilian Coordination for the Improvement of Higher Education Personnel • The Swiss National Science Foundation • U.S. National Science Foundation INFEWS Grant • NSF CNH Grant • Foundation Evangelisches Studienwerk Villigst, • Deutsche Forschungsgemeinschaft (DFG) within Research Unit FOR 1695 'Regional Climate Change' • The European Community's Seventh Framework Programme (The IMPRESSIONS Project - Impacts and Risks from High-End Scenarios: Strategies for Innovative Solutions) • The Brazilian Coordination for the Improvement of Higher Education Personnel (CAPES) • The German Research Foundation (DFG) • The EU Framework Desertification Mitigation & Remediation of Land Global Approach for Local Solutions (DESIRE) project

	<ul style="list-style-type: none"> • The fiat panis foundation • The Robert Bosch Foundation • Senator Dr. Hermann Eiselen under the Josef G. Knoll Professorship • National Science Foundation PIRE project • The International Network on Climate Change (INCA) • The US National Science Foundation through a Doctoral Dissertation Research Improvement grant • US NSF grant • NSF Biocomplexity in the Environment program for project SLUCE at the University of Michigan • RSS—Remote Sensing Solutions GmbH • The Baden-Württemberg Landesgraduiertenförderung Program (LGF). • The Water Resource Commission (WRC), South Africa • The African Climate and Development Initiative (ACDI) • National Science Foundation • The National Key R&D Program of China • the National Natural Science Foundation of China • JSPS KAKENHI • JSPS Overseas Research Fellowships • The NRF (National Research Foundation) of the Korean government • The Cooperative Research Program for Agriculture Science & Technology Development, Rural Development Administration, Republic of Korea • The Bill and Melinda Gates Foundation (BMGF), • The STARS Grant Agreement • EPSRC Doctoral Training Centre grant • ESPA Early Career Fellowship Grant • The Ecosystem Services for Poverty Alleviation (ESPA) programme • BizkaiaTalent, • Juan de la Cierva incorporación • The International Climate Initiative (IKI) of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) • The Consortium Research Program on Forests, Trees, and Agroforestry • The Curb Center for Art, Enterprise, and Public Policy • The multiple "Africa-CIMA" projects • National Technology of Mexico • The Nederlandse Organisatie voor Wetenschappelijk Onderzoek • The Bosch foundation • The Ikertzaile Doktoreentzako Hobekuntzarako doktoretza-ondoko Programa
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	<ul style="list-style-type: none"> • The ASSETS (Attaining Sustainable Services from Ecosystems) project • The Barilla Centre for Food and Nutrition, with the BCFN!YES Award 2018 • The John D. and Catherine T. MacArthur Foundation • RIVAGE • CAVALBIO • ADEME for Research Proposals GRAINES (project EXPLORER) • The European Regional Development Fund (FEDER, Guadeloupe Region) projects • Fondazione Cariplo, Milan, IT, • Regione Lombardia, IT • Consiglio Nazionale delle Ricerche, IT • The United States National Science Foundation • The Belmont Forum • The Global Challenges Research Fund from the United Kingdom Research and Innovation (UKRI) • The "FutureDAMS: Design and Assessment of resilient and sustainable interventions in water-energy-food-environment Mega-Systems" project • The MISS-ABMS 2017 International Summer School, for the support of the INRA "VITAMIN" • The COST Action CA15118 (FoodMC) project • The Project "Meeting urban food needs", from the Food and Agriculture Organization, (United Nations, B619 – AGS, FAO - Rome – Italy) • The NRF • The Ramón y Cajal program • The Economics of Energy Innovation and System Transition (EEIST) Project • The U.S. National Science Foundation Coupled Natural and Human Systems Program
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File S3. Type of data applied in approach two

Type of primary collection approaches	Specific Approach adopted
Iterative process	The potential contribution of the project to farmers' livelihoods, was preconceived and defined by the researchers; stakeholder participation was initiated by modelers where stakeholders voiced their own ideas, which initiated exploration of further production options and defined research questions for subsequent analysis. In order to provide the necessary information, several strategies were used. These includes local stakeholder and authority meetings, inception workshops in pre-selected communities, direct observation and the use of secondary data
Q methodology	The method comprise of six steps: (1) define the research question; (2) design the Q-set of statements/photographs; (3) select participants; (4) administration of the Q-sort; (5) conducting a factor analysis using specialized Q software; and (6) interpret the qualitative meaning of the factor structure, by developing accompanying narratives
Participatory methods	Participatory rural appraisal tools like trend lines; Natural resource and land use past, present and future maps including extreme events incidence; transect walks, seasonal crop calendars, flow chart of activities, historical graphs representing production systems; and problem tree. Also, diagrams on significant behaviour and decision making processes were used as a tool for information elicitation and confirmation of these diagrams, which were hypothetically pre-determined from all available information and data of the surveys.
Surveys/questionnaire Surveys were focusing on local agents or expert knowledge (Get type of agent from the codes) Likert scale, open ended, close ended	National Household Survey, example, Living Standard Survey or Census Farmer/Household survey by international organisations like the International Food Policy Research Institute (IFPRI) Structured questionnaire (open and closed-ended) and longitudinal survey data The research adopted datasets, e.g. the Program for Emerging Agricultural Research Leaders (PEARL) project Socioeconomic Survey conducted by National Statistics Agency
Biophysical data This approach is achieved by integrating information from cadastral and recent land-use maps, agricultural statistics, and sampled survey data.	Plot and crop-level input and production data Historical rainfall Living Standard Survey Cadastral and land-use maps, and Latitude and Longitude Dataset Land use, Land cover database, and land productivity data GIS and remotely sensed spatial data Field and laboratory experiments (on water moisture, soil health, leaf size etc.) The map was derived from Landsat satellite images and geospatial information (i.e., with national forests, rivers and road networks) The other datasets include the distance to road, distance to nearest settlement, elevation, slope, and soil type, which were also prepared in a raster format at 70 m resolution Crop data Geo-referenced soil samples Meteorological variables including temperature, precipitation, air pressure, air specific humidity, downward shortwave radiation, downward longwave radiation, and wind speed, at a spatial resolution of 0.1 degrees and temporal resolution of 3 h. Drought index Actual evapotranspiration (ETa)

	<p>Cropland Data Layer (CDL) maps for crop type classification</p> <p>Satellite data (including organic carbon, phosphorous, total nitrogen, conductivity, and pH)</p>
Other qualitative methods	<p>Focus group discussions</p> <p>Interviews</p> <p>Workshops</p> <p>Role playing games</p> <p>Community meetings</p> <p>(non) participant observations</p> <p>Ethnographic research</p>
Bioeconomic data	<p>Gross Primary Productivity (GPP)</p> <p>Net primary productivity (NPP) This study employed NPP data from the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite.</p>
Secondary data	<p>Literature review (peer-reviewed literature, review of project and government documents outlining government directives and food security strategies and plannings)</p>