

54. INTEGRATED DESIGN FOR EQUITABLE AGRICULTURAL SYSTEMS USING ARTIFICIAL INTELLIGENCE

ACTION AREA	UNIVERSAL FOOD ACCESS TO BUILD RESILIENCE
SOLUTION CLUSTER	NATIONAL FOOD SUPPLY CHAINS
THEMATIC AREA	POLICY AND INSTITUTIONAL INNOVATIONS FOR RURAL AREAS
SUBMITTED BY	NORTH CAROLINA A&T STATE UNIVERSITY

WHAT IS THE RISK, SHOCK, STRESS THAT THE SOLUTION IS TRYING TO ADDRESS?

The gaps between food supply and demand show global concerns. Access to food has been a crisis for over a decade with majority of the populations in developing countries exhibiting food insecurity. Farmers around the world, mostly small holder farmers, face a daunting mission to increase food production and security for both domestic and international markets, while battling issues such as declining rates of farm labor and land ownership, unpredictable climate change and market vulnerabilities, and non-responsive infrastructure embedded in the conventional supply chain. The COVID-19 pandemic is a prime example of how these challenges can exasperate farmers, supply chain operators, consumers, and policymakers as the crisis disrupts agriculture production, distribution, and consumption. News and community reports have revealed involuntary disposal of fresh produce at commercial farms juxtaposed against images of empty shelves at the grocery stores and long lines of people seeking food assistance. The negative impacts of climate change and unpredictable shocks have been shown to magnify existing threats to global food security and public health. Thus, there is an urgent need to modernize the agriculture and food systems to integrate complex interactions between food supply, demand, health, and environmental quality issues for effective and fast problem-solving using Artificial Intelligence (AI), real-time data, analyses, communication, training, and interactive/responsive decision-makings.

HOW DOES THE SOLUTION IMPROVE OR ENHANCE RESILIENCE OF FOOD SYSTEMS?

The proposed Integrated Design for Equitable Agricultural Systems Artificial Intelligence Institute for Global Resilience and Sustainability will revolutionize the global agriculture and food systems with affordable and effective innovative technologies, including artificial intelligence (AI), to efficiently enable farmers (Smart Agriculture), supply chain operators (Smart Supply Chain), and consumers (Smart Consumption) via transformative, equitable, and sustainable futuristic use-inspired solutions. Future innovations must engage a ground-breaking integrated systematic approach supported by technology to address future problems. Production intensification must be harmonized with the health of the environment and ecosystems. The modernized supply chain must improve resiliency and connectivity to ensure efficiencies and equitable distribution and consumption. Effective food and nutrition translation must incentivize consumers and communities to achieve and maintain long-term health. Here are a summary of three integrated proposed approaches that could be designed, implemented, and engaged with stakeholders around the world who aim to achieve resilient solutions and to support long-term sustainability for all

- **Thrust 1: Smart Agriculture.** This thrust focuses on increasing farm productivity, reducing labor intensity, and reducing food loss by creating an AI-powered 'healthcare' system for honeybees, animal/livestock, and food crops (fruits and vegetables). It represents a novel approach because (a)

there is limited research in incorporating AI to solve problems across these integrated agricultural ecosystems and (b) small farmers need effective technologies different from large commercial operations to detect, treat and prevent early deficiencies, diseases, and damages.

- **Thrust 2: Smart Supply Chain.** This thrust focuses on creating an intelligent architecture to build real-time connectivity, to increase communication across market operators, and to improve food accessibility for consumers. It is a novel approach that will link to the Smart Agriculture thrust because (a) instantaneous contact between farmers and market operators will reduce barriers and unintended surplus/wastes and (b) a secondary market will be generated to re-purpose imperfect/usable food surplus to create new value-added commodities for producers and consumers.
- **Thrust 3: Smart Consumption.** The focus of this thrust is to motivate a healthy diet, improve meal planning, and reduce food waste at the consumption level. This novel approach will link data and analyses from the Smart Supply Chain thrust using algorithms and mobile apps to guide food choices, shopping options, and budget planning with the goal of improving long-term health outcomes.

IS THE SOLUTION RELEVANT TO BUILDING FOOD SYSTEMS RESILIENCE?

Anticipate shocks/risks/stress and/or reduce vulnerability, Manage risks, Prevent (reduce exposure), Absorb, respond/cope, Adapt to shock-affected scenarios and evolving risk scenarios, Transform the Food System when the current Food System is no longer sustainable

IN WHAT REALMS OF INTERVENTION IS THE SOLUTION DESIGNED TO ACT ON RESILIENCE?

Individual, Household, Community, Land/sea-scape, Institutional

WHO ARE THE MAIN ACTORS THAT WOULD PUT THIS ACTION INTO PLACE?

Policymakers (government), Private (businesses, etc.), Civil (NGOs, etc.), Farmers, Scientists, Indigenous groups

IS THE SOLUTION APPLICABLE AT GLOBAL LEVEL, OR SPECIFIC CONTEXTS & PARTICULAR COUNTRIES?

Our solutions are scalable, adjustable, and adaptive to any scenarios, countries, region, local communities, and types of agriculture/food system configurations.

WHAT ARE THE KEY ACTIONS REQUIRED TO ADDRESS THIS SOLUTION?

We propose to create a healthy ecosystem while intentionally achieve agricultural prosperity and consumption health using integrated new Artificial Intelligence (AI) concepts that will support pollination, animal/livestock, and food crops based on audio-video mini-intelligent architecture, to achieve the highest accuracy and efficiency of pathogen detection and integrating novel sensors and Smart Deep Net image/sound/behavioral analyses to provide a customized approach to avoid loss, and to enhance health awareness and education with consumers around the world using novel and effective visualization connectivity that creates a truly integrated assistance and resource web for all.

ARE THERE ANY FINANCIAL SOURCES / FUNDS THAT IS SUPPORTING THIS IDEA?

We have funding from USDA, NSF, and some foundations in the US. We are seeking and will need larger grant and financial support to expand the scope and applications.

HOW DOES THIS SOLUTION CONTRIBUTE TO (A) EMPOWER WOMEN AND COMBAT GENDER INEQUALITIES, AND (B) THE FULFILMENT OF HUMAN RIGHTS, ESPECIALLY THE RIGHT TO FOOD AND THE RIGHT TO WATER, (C) MAKE USE OF INNOVATIONS (TECHNOLOGIES, INSTITUTIONS, PROCESSES)?

The solutions that we propose target on women, children, and other socially disadvantaged communities. Our approaches focus on affordability, accessibility, and accountability for small farmers, minority populations, and limited-resourced countries to use novel technologies that are often not available, accessible, or affordable to poor people. The primary topic of designing and creating an equitable food system and agricultural industry is our mission. Involving government agencies and various stakeholder that will ensure policy orientations will shift the paradigm.