AGRISCIENCE AND TECHNOLOGY
Armenian National Agrarian University
ԱԳՐՈԳԻՏՈՒԹՅՈՒՆ ԵՎ ՏԵԽՆՈԼՈԳԻԱ АГРОНАУКА И ТЕХНОЛОГИЯ
International Scientific Journal
ISSN 2579-2822

UDC 378.6
doi: 10.52276/25792822-2025.sp-111

How to Meet the Challenges in Agriculture as a Life Science University

Eric J. Veulliet
University of Applied Sciences Weihenstephan-Triesdorf (HSWT), Germany
praesident@hswt.de

ARTICLE INFO

Keywords:
applied sciences,
sustainable agriculture,
transformation,
twin transition,
university

ABSTRACT

Agricultural systems across the globe are experiencing unprecedented pressure due to population growth, climate change, resource scarcity, and the demands of digital transformation. Life science universities stand at the heart of addressing these challenges through education, research, and societal engagement. This article outlines the role of the University of Applied Sciences Weihenstephan-Triesdorf (HSWT) in Germany as a model institution responding proactively to these trends. Through strategic investments, interdisciplinary research centers, and the development of innovative degree programs, HSWT exemplifies how academic institutions can become engines of sustainable change under the "twin transition" — the simultaneous pursuit of digital transformation and environmental sustainability.

Introduction

Universities in a Time of Transformation

In the 21st century, universities are being called upon to play a greater role in solving global challenges. The transition from traditional academic institutions to active agents of transformation is particularly important for life science universities. As the world grapples with crises like climate change, biodiversity loss, food insecurity, and energy shortages, the agricultural sector must evolve quickly.

Universities not only generate the knowledge required to tackle these issues, but they also educate the future professionals who will implement change. The Green Agriculture Conference in Yerevan, Armenia, 2025, underscores the urgency and highlights HSWT as a pioneering institution. The following sections describe how HSWT is building capacity, expanding knowledge, and creating tools for a more sustainable agricultural future.

Materials and methods

HSWT: A Profile of Applied Excellence

Founded in 1971 with a mission to offer practical, applied education, HSWT has become a cornerstone of agricultural and environmental innovation in Germany. Spread across two main campuses in Weihenstephan and Triesdorf, the

university hosts (https://www.hswt.de/en/):

- Over 6,000 students
- 1,600 to 1,900 new enrollments annually
- 650+ international students
- 170 full professors and over 400 adjunct staff
- Seven faculties and seven specialized research facilities

HSWT also offers:

- 20 Bachelor‘s programs
- 18 Master‘s programs
- 14 work-study programs
- Continuing education, including certifications and short courses

Research facilities include specialized institutes in ecology, digital agriculture, horticulture, food technology, smart indoor farming, and biomass research (https://www.hswt.de/en/research/research-profile/research-institutions). Innovation hubs like the Food Startup Incubator (https://www.hswt.de/en/research/research-profile/research-institutions/institute-for-food-technology/food-startup-incubator-weihenstephan-fsiws) and the newly formed SUN (Startup, Entrepreneurship, Succession) center are helping bridge academia and enterprise (https://fsiws.com/en/new-gruendungszentrum-startup-entrepreneurship-and-follow-up-center-sun/).

The Agricultural Challenge Landscape

Agriculture today is at a crossroads. Major global forces include:

- *Population Growth:* The world population is expected to exceed 9 billion by 2050, increasing food demand by at least 60%.
- *Climate Change:* Droughts, floods, and rising temperatures threaten crop yields, livestock, and biodiversity.
- *Globalization:* International trade, supply chains, and economic interdependence bring both opportunities and vulnerabilities.
- *Resource Scarcity:* Water, soil, and energy are becoming limiting factors.
- *Technological Disruption:* Automation, AI, robotics, and IoT are transforming how farms are managed.

These interconnected challenges require complex, interdisciplinary solutions – the very type that life science universities are well-positioned to provide.

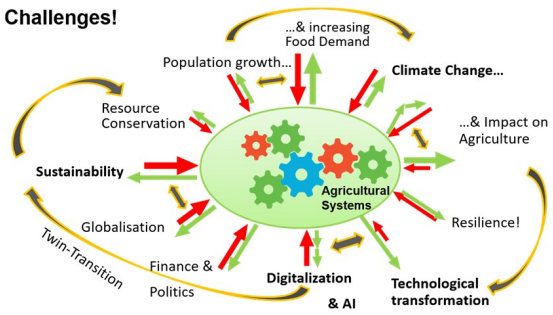

Figure. The challenges in agriculture and their interactions.

The Twin Transition: Digital and Green Integration

The “twin transition” merges two vital shifts:

Digitalization: Using digital technologies to optimize operations, monitor systems, and predict outcomes.

Green Transformation: Transitioning to environmentally sustainable practices that reduce emissions and conserve resources.

Examples at HSWT include:

- Precision agriculture using drones and satellite imaging
- AI algorithms for crop health monitoring
- Smart irrigation systems that conserve water
- Biodiversity-friendly farming practices

This dual approach not only increases efficiency but also helps mitigate agriculture’s environmental footprint. Students trained under this paradigm become change agents in both digital and ecological domains.

Results and discussions

Strategic Response: The Hightech Agenda Bayern

To meet these challenges, the Bavarian government launched the Hightech Agenda Bayern (https://www.hightechagenda.de/en/), an unprecedented investment program totaling €5.5 billion. Its key elements include:

- Creation of 1,000 professorships in future-oriented fields such as AI, sustainability, and clean tech
- €600 million investment in infrastructure modernization
- 46 new Technology Transfer Centers (TTZs) for regional knowledge exchange

- 19 digital startup centers to foster entrepreneurship
- Support for SMEs in digital transformation

HSWT is a major beneficiary, enabling it to expand its academic offerings, upgrade labs, and collaborate more closely with regional industries.

Climate Change and Agricultural Resilience

To address climate change, HSWT has strategically introduced:

New Professorships (2020-2025):

- Agricultural Systems and Climate Change
- Sustainable and Resilient Farming
- Novel Grain Crop Breeding
- Climate Change Hydrology and Advanced Irrigation
- Forestry and Climate Change

New Degree Programs:

- MSc Climate Change Management (English) https://www.hswt.de/studium/studienangebot/master/climate-change-management
- MSc Sustainable Regional Development (English) https://www.hswt.de/en/study/study-offer/master/sustainable-regional-development
- MSc Resilient Horticulture (English) https://www.hswt.de/en/study/study-offer/master/resilient-horticulture
- BSc Climate Change Mitigation and Adaptation (German)
- BSc Green Urban Planning (German)
- BSc Energy and Water Management (German)

Specialized Research Centers:

- *Peatland Science Centre (PSC):* Focuses on peatland conservation, carbon storage, and biodiversity https://www.hswt.de/en/research/research-profile/research-institutions/institute-of-ecology-and-landscape/peatland-science-centre
- *B.Life Centre:* Integrates social and scientific dimensions of climate adaptation https://www.hswt.de/en/about/university-profile/sustainability-environmental-management/blife-centre

These initiatives promote a deeper understanding of climate impacts and foster practical solutions for resilience.

Digitalization and Technological Transformation in Agriculture

Parallel to climate strategies, HSWT also prioritizes digital transformation through:

Professorships in:

- Smart Farming
- Digital Farm Management
- Green Digital Engineering
- Data Science for Life Sciences
- IoT in Agriculture and Environment

Degree Programs:

- MSc Digital Farming (English) https://www.hswt.de/en/study/study-offer/master/digital-farming
- MSc Green Digital Engineering (German)
- BSc Applied Informatics (English) https://www.hswt.de/en/study/study-offer/bachelor/applied-informatics

Clusters and Centers:

- *KoDA* (Competence Center for Digital Agriculture): A hub for data-driven innovation https://www.hswt.de/en/research/research-profile/research-institutions/competence-centre-for-digital-agribusiness-koda
- *Cluster Green AI:* Fosters robotics, machine learning, and digital twins for farming.

These efforts equip students with hands-on skills in precision agriculture, cloud computing, and AI applications.

Interdisciplinary and Intersectoral Knowledge Transfer

Real-world transformation depends on more than research – it needs action. HSWT embraces this by:

- Creating interdisciplinary platforms for students, researchers, and professionals
- Hosting “real-world laboratories” to test innovations in live environments
- Offering continuing education and certification for lifelong learning
- Actively involving stakeholders in curriculum development

Transfer isn’t one-way: HSWT listens to the needs of industry and communities and co-creates solutions.

Networking and Global Collaboration

Agricultural challenges are global, and so must be the responses. HSWT engages in:

- International research collaborations and EU-funded projects
- Exchange programs with universities on all continents
- Shared innovation platforms for policy dialogue and best practices
- Capacity-building programs for developing countries

Standardizing data, sharing methodologies, and learning from others are essential to accelerate progress.

The Vision: Centre for Systemic Agricultural Sciences

As a next step, HSWT is developing a Centre for Systemic Agricultural Sciences (working title). An agricultural centre in Weihenstephan, also connected with Triesdorf, where the University of Applied Sciences Weihenstephan-Triesdorf (HSWT), the Technical University of Munich (TUM), and the Bavarian State Research Center for Agriculture (LfL) collaborate closely, offers several key advantages, especially when viewed through the lens of agricultural systems science:

Interdisciplinary Synergy and Complementary Expertise

Each institution brings its unique strengths to the table, fostering a truly interdisciplinary approach:

- *HSWT* excels in applied research, focusing on practical, hands-on agricultural innovation and technology transfer.
- *TUM* is renowned for its cutting-edge basic research and academic rigor in life sciences, agronomy, and environmental sciences.
- *LfL* provides a bridge between research and agricultural policy, offering practical implementation insights and ensuring that findings contribute to regional agricultural development. Together, these complementary roles create a holistic research ecosystem that addresses challenges at every stage, from basic research to field application.

Systems Thinking Approach to Agriculture

By integrating the expertise of these institutions, the center can adopt a systems-level perspective on agriculture. Agricultural systems science aims to understand and optimize the interconnected components of agriculture, including soil health, plant breeding, crop production, resource efficiency, biodiversity, and sustainability.

The combined knowledge allows for the development of innovative, systemic solutions to complex agricultural challenges such as climate change, sustainable food production, and digitalization in farming.

Innovation and Technology Transfer

The close collaboration between academic researchers, applied scientists, and government researchers ensures that innovations in precision farming, plant genetics, and sustainable agricultural practices are efficiently translated from research to real-world applications. Farmers and agricultural businesses can benefit more directly from cutting-edge research.

Efficient Use of Resources and Infrastructure

Sharing resources—such as laboratories, experimental fields, greenhouses, and data infrastructure—promotes efficiency and cost savings. It also fosters joint projects that would be difficult to implement independently.

Strengthened Regional and Global Impact

The agricultural center can enhance the global reputation of Weihenstephan as a hub for agricultural excellence, while also addressing region-specific challenges. This dual focus strengthens both local agriculture and the international competitiveness of Bavarian agricultural research.

Enhanced Educational Opportunities

Students and young researchers benefit from exposure to a broad spectrum of agricultural sciences, gaining access to diverse research methodologies, practical applications, and cross-institutional learning. This fosters a new generation of experts equipped with the interdisciplinary skills needed to tackle the future challenges of agriculture.

A tightly integrated agricultural center in Weihenstephan creates a powerful platform for addressing complex agricultural challenges through collaboration, innovation, and systems-based thinking. By pooling the strengths of HSWT, TUM, and LfL, the center not only drives sustainable agricultural development but also strengthens Bavaria's position as a leader in agricultural research and education.

Together, we will create a European agricultural centre with well over 100 professorships in the agricultural sector. It is expected to be launched in 2027, in the area of teaching, with its own degree programmes and in the area of research.

Outlook: The Role of Universities in Shaping the Future

Universities must not only react to global change – they must anticipate and shape it. Their responsibilities include:

- Educating future leaders with practical and ethical tools
- Uniting digital progress and ecological stewardship
- Serving as think tanks and testbeds for innovation
- Engaging with citizens, governments, and businesses

Life science universities, in particular, hold the key to balancing productivity and sustainability – a task that will define the coming decades.

Conclusion

The agricultural sector is undergoing a historic transformation. Life science universities like HSWT demonstrate that academic institutions can – and must – be proactive leaders in this change. By embedding sustainability and digital innovation into their mission, they help build the resilient food systems of the future. HSWT's example illustrates that with strategic foresight, interdisciplinary thinking, and strong partnerships, universities can serve as true engines of change in a complex and rapidly evolving world.

Declarations of interest

The author declares no conflict of interest concerning the research, authorship, and/or publication of this article.

Received on 06.05.2025
Revised on 04.06.2025
Accepted on 12.09.2025