(Recognition of Good Practice/Innovation by FAO-UN; DOI: 10.13140/RG.2.2.26108.24968)

Livestock Technoparks: Advancing Good Governance for Livelihood Security and Food Safety in Pakistan through the Triple Helix Model

Irfan ul Haq Qureshi and Muhammad Subhan Qureshi, Dairy Science Park, 23-A, Industrial Estate, Hayatabad Peshawar-25000, Pakistan; Email: drmsqureshi@gmail.com

Summary

Dairy Science Park (DSP) was established in 2011 at Peshawar, Pakistan, as a Triple Helix Model of Good Governance—bridging academia, industry, civil society, and government to support sustainable development in the livestock sector. This model has been operationalized through five international conferences and industrial exhibitions held in Peshawar, Quetta, Bahawalpur (Pakistan), and Konya (Türkiye), providing platforms for dialogue, collaboration, and innovation.

DSP introduced a Biorisk Management Initiative in collaboration with Sandia National Laboratories, USA, to sensitize stakeholders on biological and chemical risks along the livestock value chain. Entrepreneurial models were developed by engaging postgraduate students in field research with local farmers and processors, supporting capacity building and evidence-based interventions.

Quality assurance and regulatory support were extended to startups and entrepreneurs, enhancing food safety and business viability. A notable international collaboration was established with Konya Teknokent in Türkiye. During the 4th DSP Conference in 2017, delegates from 20+ countries visited Konya Teknokent. A Memorandum of Understanding was signed, aiming to replicate the techno-entrepreneurship model in Pakistan.

Dairy Science Park envisions expanding its impact by institutionalizing good governance mechanisms across the entire livestock value chain. This will involve establishing regional Livestock Technoparks as innovation hubs for value addition, quality certification, and market access. DSP will focus on empowering youth and women through skill development programs, fostering public-private partnerships, and creating decent employment opportunities. It will support regulatory reform and policy advocacy to ensure food safety, animal health, and sustainable livelihoods. Through collaboration with national and international stakeholders, DSP aims to contribute to the SDGs by transforming the livestock sector into a driver of economic resilience and rural prosperity.

1. Beneficiaries

Farmers & Livestock Producers, Women & Youth Entrepreneurs, Veterinarians & Paravets, Solar Energy Users, Students and Interns, Small-Scale Entrepreneurs, Eco-Tourism Community Members

2. Impact

Under SunSaviour/GreenWend Energy, we have completed 15 MW installations in the last 2 years. It means reducing 24,638 metric tons of CO_2 in 2 yearsEquals to: I) “49 M kWh of Clean Energy”; ii) “24,638 tonnes CO_2 Avoided”; “Equivalent to 1.1 M Trees”.

In addition to our renewable energy initiatives, Dairy Science Park (DSP) has significantly contributed to climate change mitigation through sustainable livestock and agribusiness practices as follows:

Methane reduction through improved animal health and feeding practices: By training over 3,000 farmers and veterinary professionals in efficient feeding, early disease detection, and reproductive biotechnology, methane emissions from livestock have been reduced by an estimated 18–22% per animal unit; 1,500 tons of CO_2-equivalent annually over 10 years ≈ 15,000 tons.

Resource efficiency in livestock production: Pilot-scale technoparks in Peshawar and Quetta demonstrated models that cut water usage by up to 30%, feed waste by 25%, and antibiotic misuse—minimizing pollution and antimicrobial resistance risks;

Integrated waste-to-energy solutions: DSP promoted the use of animal waste for biogas production, with field models producing up to 150 m^3/day, reducing reliance on firewood and fossil fuels, and saving approximately 1,500 tonnes of CO_2 annually; over 5 years ≈ 7,500 tons

Livelihood and eco-security integration: By linking 500+ smallholder farms to market-driven value chains, DSP has fostered climate-resilient livelihoods, reducing urban migration and land degradation pressures.

Together, these efforts complement our renewable energy work and present a holistic solution aligning food security with environmental stewardship.Total emissions abated have been assessed as: 47,138 tons of CO_2

Beyond climate action, our solution has improved lives across multiple domains; Health, Food, and Energy, by delivering sustainable, community-driven innovations.

Health: Through Dairy Science Park, we’ve improved animal health services by training over 3,000 veterinarians and para-vets, reducing disease transmission and zoonotic risks. Introduction of hygienic slaughterhouses and meat inspection systems led to a 30% reduction in foodborne illness reports in pilot districts.

Food: Enhanced productivity of livestock (milk/meat) through climate-smart farming practices resulted in a 20–30% increase in household food availability among 500+ smallholder families. Better market access and food safety standards improved consumer trust and local food security, with over 10,000 consumers benefiting from clean, traceable animal products.

Energy: The SunSaviour/GreenWend initiative installed 15 MW of solar energy, supplying over 49 million kWh of clean power—benefiting over 20,000 households. DSP also promoted biogas from livestock waste, powering farms and small businesses, replacing firewood and fossil fuels in off-grid communities.

Together, these efforts have led to healthier families, more secure food systems, and access to sustainable energy in previously underserved areas.

3. Meeting FAO-UN objectives

- Dairy Science Park contributes to the FAO's objectives on Animal Production and Health by promoting sustainable livestock development through a structured governance model. Key contributions include:
- Livelihood Security: DSP empowers smallholders, youth, and women through entrepreneurial training and value chain integration, creating decent employment and improving rural incomes.
- Animal Health and Welfare: DSP has introduced the Biorisk Management Initiative in partnership with Sandia National Laboratories (USA), enhancing awareness and preparedness for biological and chemical threats within the livestock sector, supporting One Health principles.
- Food Safety and Quality: It provides regulatory and technical support for hygienic food production, including standards for milk, meat, and poultry, addressing food safety and public health concerns.
- Innovation and Capacity Building: Postgraduate research is directly linked with real-world challenges faced by farmers and processors, generating practical solutions in animal health, breeding, nutrition, and biotechnology.
- Infrastructure Development: Through the concept of Livestock Technoparks, DSP promotes innovation hubs that facilitate veterinary services, quality certification, agribusiness incubation, and technology transfer in underdeveloped regions of Pakistan.

By addressing multiple aspects of animal production—health, food safety, biosecurity, and socio-economic development—Dairy Science Park aligns closely with FAO's strategic framework and Sustainable Livestock Transformation goals.

4. International applications

Internationally, the practice was introduced in Türkiye, where DSP collaborated with Konya Teknokent at Selçuk University. During the 2017 DSP Conference, delegates from 20+ countries visited the Teknokent to exchange knowledge on entrepreneurship, food safety, and innovation ecosystems. This visit led to the signing of an MoU for joint development of TechnoParks in Pakistan, with shared goals in smart agriculture, biotechnology, and food processing.

Initially, DSP successfully engaged Sandia National Laboratories, USA, for collaboration on Biorisk Management across the food value chain. A total of 105 persons/times were sensitized and trained through targeted workshops, focusing on biosafety, biosecurity, and risk communication for stakeholders across the livestock and food sectors.

Additionally, Dairy Science Park Cairo was proposed through collaboration with the Academy of Scientific Research and Technology (ASRT), Egypt. ASRT officials appreciated the DSP model's emphasis on linking academic research with entrepreneurship and food security, and recommended its replication to support the region's livestock sector, with a

focus on value addition, food safety, and women-led enterprise development in Egypt and the broader North African region.

More recently, DSP innovations have been adopted under the framework of the National Eco-Security System (NESS-Pak), launched in collaboration with the International Science Network (NESS-ISN), Beijing. The NESS-Pak initiative expands DSP's principles of good governance and sustainable development into broader domains, including environment, biodiversity, food security, public health, and livelihood security. Protected areas such as the Khunjerab National Park are being linked with ecotourism, livestock-based livelihoods, and academic research through this platform.

The DSP model's flexibility and integrative approach make it adaptable to various agroecological and institutional settings, offering a replicable solution for transforming livestock systems through inclusive governance and innovation.

5. Partnerships

Dairy Science Park (DSP) has developed strong partnerships across academia, industry, government, civil society, and international organizations to achieve its mission of sustainable livestock development and food security. Key collaborations include:

- Academic Institutions:
    - *University of Agriculture, Peshawar* – Founding institution for DSP, providing academic leadership and research support.
    - *Women University Mardan, BU, BUITMS, SBKWU, and others* – Collaborated in TechnoPark proposals and entrepreneurship development.
    - *Khyber Medical University, Peshawar – Collaborated in Biorisk Management (BRM) training and One Health initiatives alongside DSP and Sandia National Labs USA.*
    - *Selçuk University, Konya, Türkiye* – Academic partner for international conferences and joint initiatives with Konya Teknokent.
    - *Academy of Scientific Research and Technology (ASRT), Egypt* – Recommended replication of the DSP model as DSP Cairo.

- International Partners:
    - *Sandia National Laboratories, USA* – Collaborated on the Biorisk Management Initiative, delivering workshops and training 105 persons/times on biosafety and food value chain risk mitigation.
    - *Higher Education Commission (HEC), Pakistan – Supported BRM awareness and capacity-building programs across universities and research institutions in Pakistan.*
    - *Pakistan Veterinary Medical Council was engaged for particpation of various inland universities in the BRM Consultation and trainings and integration of BRM Concepts into the Doctor of Veterinary Medicine degree program.*
    - *Konya Teknokent, Türkiye* – Partner in innovation-led entrepreneurship, smart agriculture, biotechnology, and TechnoPark replication in Pakistan.
    - *International Science Network (ISN), Beijing* – Collaborated to establish the National Eco-Security System Pakistan (NESS-Pak) to extend DSP's governance model across food security, environment, and One Health

domains.

- Government and Policy Stakeholders:
    - *Khyber Pakhtunkhwa Chamber of Commerce and Industry* – Supported industrial exhibitions and private sector engagement.
    - *Small and Medium Enterprise Development Authority (SMEDA)*, *BRSP*, and SDG Task Force – Facilitated implementation of DSP initiatives at the regional level.

- Civil Society and Industry:
    - Engagement of farmers, processors, youth, and women entrepreneurs through training, incubation, and market linkages.
    - Organization of international conferences and industrial exhibitions in Peshawar, Quetta, Bahawalpur, and Konya, linking knowledge with practice.

These partnerships have been central to achieving DSP's goals of good governance, livelihood security, food safety, and entrepreneurship, and will continue to drive its expansion through the TechnoParks and NESS-Pak platforms.

6. Future Scope:

Dairy Science Park envisions expanding its impact by institutionalizing good governance mechanisms across the entire livestock value chain. This will involve establishing regional Livestock Technoparks as innovation hubs for value addition, quality certification, and market access. DSP will focus on empowering youth and women through skill development programs, fostering public-private partnerships, and creating decent employment opportunities. It will support regulatory reform and policy advocacy to ensure food safety, animal health, and sustainable livelihoods. Through collaboration with national and international stakeholders, DSP aims to contribute to the SDGs by transforming the livestock sector into a driver of economic resilience and rural prosperity.