

Harvesting the Future: An AI-Enabled Triple Helix Model of Good Governance for Pakistan's Livestock and Agricultural Transformation

Prof Muhammad Subhan Qureshi, President Dairy Science Park, 23-A, Royal Dairies, Industrial Estate, Hayatabad, Peshawar-25000, Pakistan

(From FAO-KP and ITC-UN Balochistan Experience to a National Innovation Ecosystem; the concept has evolved from my FAO-KP and ITC-UN Balochistan consultancies, the DSP experience since 2011, and the emergence of AI)

“The future of Pakistan's livestock and agriculture will not be harvested by Academia, Government, Industry or Farmers working alone. It will be harvested when they begin to work with one another — with AI multiplying their collective intelligence and Good Governance protecting the public interest.”

The proposed AI-enabled Triple Helix Model is not a theoretical construct developed in isolation. It has emerged from more than three decades of professional interaction with government, academia, farmers, industry and international development organizations, and particularly from two United Nations–related national consultancies undertaken in provinces where institutional fragmentation has constrained the conversion of livestock resources into rural prosperity.

1. The FAO–KP experience: 2019

In 2019, the Food and Agriculture Organization of the United Nations engaged Prof. Muhammad Subhan Qureshi as National Consultant for Livestock and Dairy Development in Khyber Pakhtunkhwa under the FAO programme TCP-PAK 3701-C1/AFOR. The agreed Terms of Reference included policy implementation, regulatory issues, value-chain development, private-sector engagement, institutional reform and market-oriented production.

The resulting FAO KP Livestock Action Plan 2019 proposed transformation of the livestock sector from a predominantly subsistence orientation toward a commercially integrated value chain, with a Good Governance Model based on Academia–Industry–Government–Society interaction and the proposed Livestock Technopark Peshawar. The report envisaged livestock resources being transformed into entrepreneurship, decent employment and exportable surpluses.

The subsequent Part II of the Action Plan went further by documenting policy gaps and conflicts of interest encountered during the consultancy. It observed that the Extension Wing had a dominant position in the provincial livestock system, while research, universities, farmers, processors and other private stakeholders had comparatively limited influence.

The central governance issue was particularly revealing.

A veterinary treatment system naturally measures activity through indicators such as animals treated and veterinary facilities utilized. A livestock development system, however, should ultimately measure success through indicators such as:

- disease-free animals;
- productivity;
- profitability;
- food safety;
- genetic improvement;
- farmer income;
- value addition;
- employment; and
- market and export performance.

These are not necessarily the same objectives.

The Action Plan therefore proposed a shift from an institution-centred model toward an integrated development model in which the interests of farmers, researchers, government, industry and society could be reconciled through shared governance.

This experience demonstrated an important principle:

Good governance is not achieved merely by adding more resources to an existing institutional structure. It requires aligning institutional incentives with the ultimate development outcome.

The FAO assignment also demonstrated the difficulty of implementing such reform when a powerful institutional stakeholder perceives structural reform as a threat to its established authority or operating model.

The lesson is therefore not to eliminate the public veterinary service.

It is to change the performance equation.

The veterinary service should be rewarded not only for treating disease, but increasingly for preventing disease and contributing to healthy, productive and economically viable herds.

In other words:

The best veterinary system should progressively make itself less necessary for emergency treatment by making livestock healthier in the first place.

This is precisely the type of governance challenge for which AI can now provide new tools for objective monitoring and performance measurement.

2. The ITC–UN Balochistan experience: 2022

The same governance challenge subsequently appeared in a different geographical and institutional context.

The International Trade Centre, a joint agency of the WTO and United Nations, engaged Prof. Qureshi as National Consultant for preparation of the Balochistan Livestock Breeding Policy 2022 under the EU-funded GRASP programme.

The Balochistan assignment demonstrated that the problem was not unique to Khyber Pakhtunkhwa.

Balochistan possesses substantial livestock resources, yet the sector was divided among several institutions with different mandates:

- Livestock and Dairy Development — animal health and production;
- Forest Department — rangelands;
- Local Government — markets and slaughterhouses;
- Industries Department — SMEs and industrial development;
- universities — research, education and innovation;
- Chamber of Commerce and industry — commercial activity;
- farmers and processors — production and value addition.

The policy consultation identified lack of coordination and good governance as a major constraint to translating these resources into prosperity.

The proposed response was again an integrated governance model rather than creation of another isolated departmental programme.

The consultancy proposed Livestock Technopark Quetta, involving government departments, universities, industry and farmers under a representative governance structure. It also proposed entrepreneurship development, farmers' and processors' empowerment, an endowment fund, functional units and integration of SDGs.

The consultation extended across the University of Balochistan, BUITEMS, Sardar Bahadur Khan Women's University, LUAWMS, government departments, Quetta Chamber of Commerce and Industry, farmers and processors.

Thus, the Balochistan experience provided an important second validation of the concept:

When a livestock value chain is distributed across many institutions, development cannot be achieved efficiently through departmental programmes operating independently of one another.

The institutions need a shared platform, shared objectives, shared data and shared accountability.

3. From two provincial experiences to a national principle

- The experiences of KP and Balochistan therefore reveal a common structural problem.
- The provinces are different.
- Their ecological systems are different.
- Their livestock species and production systems are different.
- Their administrative structures are different.

Yet a common pattern emerges:

- Resources are distributed.
- Responsibilities are distributed.
- Data are distributed.
- Expertise is distributed.
- Budgets are distributed.
- But the development mission is not sufficiently integrated.

This creates what may be called the: “Fragmentation–Coordination Gap.”

The answer is not necessarily administrative centralization. Rather, Pakistan needs a mechanism for integration without destroying institutional specialization. That is the central purpose of the proposed: Triple Helix Model

4. What changes with AI?

The governance environment has now changed dramatically since 2019. In 2019, establishing effective coordination required: meetings; workshops; correspondence; committees; manual data collection; physical consultations; reports; institutional negotiation.

AI now makes possible a new layer of coordination. A national platform could potentially connect the information generated by: farmers + veterinarians + laboratories + universities + government + markets + industry + climate systems.

Instead of waiting for an annual report to reveal a problem, AI could continuously identify emerging patterns. For example:

- If disease reports increase in a particular livestock cluster;
- and milk productivity simultaneously falls;
- and feed prices increase;
- and temperature rises;
- and veterinary medicine purchases increase;

The system could identify the combination as a possible emerging productivity or disease-risk signal.

- The government could investigate.
- Researchers could study it.
- Industry could develop or supply solutions.
- Farmers could receive preventive advice.
- The outcome could be measured.

This converts governance from: reactive administration into: evidence-based anticipatory governance.

5. Changing the incentive structure

This is perhaps the most important lesson from the FAO experience. Institutions naturally respond to the indicators by which they are evaluated. Therefore, if an institution is rewarded mainly for: number of animals treated. The system may become efficient at treating animals,

if it is rewarded for: reduction in disease incidence + increased productivity + increased farmer income, the system has an incentive to prevent disease and improve productivity.

AI can make such outcome-based governance much more practical. A provincial livestock dashboard could measure:

Traditional indicator	Development indicator
Animals treated	Disease incidence reduced
Veterinary visits	Healthy productive herds
Vaccinations administered	Disease outbreaks prevented
Hospitals established	Farmer access to preventive services
Artificial inseminations performed	Reproductive efficiency improved
Feed distributed	Feed conversion/productivity improved
Extension meetings	Farmer income and adoption increased
Government expenditure	Economic and social return

The objective is not to diminish veterinary professionals. It is to redirect professional excellence toward prevention, productivity and farmer prosperity.

6. From conflict of interests to convergence of interests

The term “conflict of interests” should therefore be understood institutionally rather than personally. Different stakeholders can have perfectly legitimate interests that nevertheless produce conflicting incentives as below:

- A government officer may seek an efficiently functioning veterinary service.
- A researcher may seek research opportunities.
- A university may seek academic recognition.
- An entrepreneur may seek profit.
- A farmer may seek higher income.
- A consumer may seek safe food.
- A government may seek political and fiscal stability.
- An exporter may seek international standards.

None of these objectives is inherently wrong. The governance problem occurs when one objective becomes dominant at the expense of the others. The solution is to create a system in which the interests converge around measurable public outcomes. That common outcome can be:

Healthy animals + profitable farmers + safe food + viable businesses + employment + exports + sustainable resource use.

This is where the Triple Helix becomes a Good Governance Helix.

7. The next generation: AI-enabled Good Governance Helix

The model can now be represented as:

- HUMAN HELIX: Academia ↔ Government ↔ Industry ↔ Farmers/Society; and above, below and throughout the system:
- INTELLIGENCE LAYER: Artificial Intelligence + Data + Digital Connectivity; while the entire system operates under:
- GOVERNANCE LAYER: Transparency + Accountability + Equity + Human Oversight + Public Interest; this creates a four-dimensional development architecture: People → Institutions → Intelligence → Governance.

8. The strategic significance for Pakistan

The significance extends beyond livestock. Livestock provides an excellent pilot sector because it simultaneously involves: agriculture; food security; public health; veterinary services; biotechnology; climate change; water; rangelands; industry; trade; rural; employment; women and youth; renewable energy and; artificial intelligence.

A successful livestock innovation ecosystem could therefore become a demonstration model for broader agricultural and rural development governance.

The experience of KP and Balochistan suggests that provinces that have historically received less benefit from national development processes should not merely receive additional programmes. They should receive better-integrated development systems.

That distinction is fundamental.

9. The DSP opportunity

Dairy Science Park can contribute to this transition because its evolution has already crossed several institutional boundaries.

Its philosophy has consistently attempted to connect: Academia → Industry → Government → Farmers → International partners; around indigenous resources, entrepreneurship, decent employment and sustainable development.

- The FAO KP assignment provided an early formal governance framework.
- The ITC-UN Balochistan assignment extended that framework to another province.
- Interaction with Turkish, Chinese and Egyptian organizations resulted in development of the ideas of Technopark models and establishment of National Eco-Security System Pakistan.
- The proposed AI-enabled model can now take the same principle to the national level.

Thus, DSP's future role need not be that of another implementing department. It can serve as:

a neutral knowledge, coordination and innovation platform through which existing institutions can work together without losing their individual mandates.

This is an important distinction. DSP should not replace: universities; livestock departments; research institutes; farmers' organizations; industry; regulatory agencies. It should help them work together more effectively.

10. From “Triple Helix” to “Living Helix”

The final evolution of the concept could therefore be called: The AI-Enabled Living Helix of Good Governance.

It is “living” because it continuously learns. A farmer generates information. A veterinarian interprets it. A researcher studies it. An entrepreneur develops a solution. The government enables scaling. AI connects the information. The farmer tests the solution. The result returns to the system. The system learns.

The next decision becomes better informed. Thus: Every successful intervention strengthens the knowledge base of the entire ecosystem. This is the essential difference between a conventional development project and an intelligent development ecosystem.

11. The ultimate lesson from 2019–2026

The FAO experience showed the difficulty of reforming an established institutional system. The ITC experience demonstrated that the same governance challenge could be approached through broader stakeholder integration. The emergence of AI now provides a new opportunity. AI can make institutional integration:

- faster;
- more transparent;
- more measurable;
- more evidence-based;
- less dependent upon individual personalities;
- less vulnerable to information silos;
- more responsive to farmers.

The strategic opportunity is therefore to convert the lesson learned from two provinces into a national governance innovation.

The journey can be summarized as:

- 2019 — FAO/KP: Identify governance gaps and propose Academia–Industry–Government–Society integration.
- 2022 — ITC-UN/Balochistan: Replicate the integrated governance principle across multiple departments, universities, industry and farmers.
- 2026 — AI era: Connect these institutional components through shared data, AI-enabled intelligence, outcome-based performance measurement and continuous learning.

- Future: Scale the model from livestock to agriculture and other resource-based sectors.

12. The governing philosophy

The fundamental question should therefore change from: “Which department owns the livestock sector?” to: “Which governance system can best serve the livestock farmer and the national economy?”

And from: “How many services has the government delivered?” to: “How much healthier, more productive and more profitable have the livestock herds and farming families become?”

And finally: “How can every institution contribute its strength without claiming ownership of the whole system?”

That is the essence of the DSP vision. It is also the point at which the Triple Helix, Good Governance and Artificial Intelligence converge:

The future is not a larger government. The future is a better-connected government, better-connected academia, better-connected industry and better-connected farmers — strengthened by responsible AI and united around measurable human outcomes.