Beacon

A series of key messages from works by academics useful for tackling industrial animal agriculture in developing countries

A project of Burning Questions Initiative

TINY BEAM FUND

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Six studies are featured. They cover:

1. Not easy to industrialize animal agriculture in Kazakhstan.
2. Livestock sector is not hit by meat analog's growth in Korea.
3. Mariculture's adverse impacts on wild environment and lives.
4. Senegal's import ban benefits smaller scale broiler producers.
5. Power dynamics within Indonesia's laying hen industry.
6. Economic and financial drivers of livestock industries in LMICs.

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Brief mention (non-academic reports)

1 Abdikerimova, Gulzhanar, et al. **"Economic assessment of the state of livestock industry in Kazakhstan: Prerequisites for the creation of a meat hub."** *Agricultural and Resource Economics: International Scientific E-Journal Science* 10.1 (2024): 29-45. link.

Expanding animal agriculture to meet increased demand in LMICs is often assumed to be simple, straightforward, and inevitable, but this is far from true.

Demand for animal products may be rising in LMICs such as Kazakhstan, but there are many impediments to expanding and industrializing livestock production to meet that demand. Industrialization will happen only if governments and others take deliberate steps to address these impediments, and are successful in overcoming them.

- Livestock production in Kazakhstan has increased in recent years, but the country is a net importer of meat.
- Kazakhstan subsidizes animal agriculture and has the land and breeding stock to support expanding the industry, but the sector lacks infrastructure, feed production capacity, technology, and skilled labor.
- In order to meet domestic demand and enter new markets, this paper proposes the concept of a "meat hub". This institution would develop technology and standards and connect input providers, producers, and processors.
- The meat hub will not arise "naturally" out of market dynamics. Creating it would require an investment of $31M USD, along with close coordination between the private sector and the state.
- Although many aspects of society, culture, politics, etc. may *favor* the production and consumption of industrial animal products in LMICs, this study shows that increasing industrial production is *not inevitable*. It requires concerted efforts from many actors.

Why is this academic study particularly useful for addressing 'burning questions'?

- This study is relevant to GOV 2: "What are the key supply-side drivers of the introduction and growth of industrial animal agriculture in LMICs? Are government policies and value chain activities significant and influential drivers (e.g., government subsidies to industry, free trade agreements, corporate marketing and partnerships with governments)?"
- Academic researchers in Kazakhstan analyze what it would take to grow the livestock sector and value chain there. The paper gives concrete examples of the number and kinds of barriers that would need to be overcome.

- The paper also presents a vision for the future of animal agriculture in a middle-income country: how it would work and whom it is intended to benefit. Implementing the authors' recommendations would likely lead to features typical of large-scale, industrial systems.
- Understanding the vision and the multifaceted, multi-layered requirements for realizing it may reveal avenues for influencing the pathways that animal agriculture in Kazakhstan can take. For example, the paper mentions the need to grapple with pig diseases, which may be an argument against expanding and industrializing the pork sector.
- The specific barriers to industrialization most likely differ from country to country, and should be investigated on a case-by-case basis. Nonetheless, this paper is useful as an example of the kind of information that can be gathered and that should be considered by those who advocate against industrialization.

Deeper Dive

1. Barriers to expanding meat production in Kazakhstan

- Homesteads and peasant farms account for just over half of the livestock and poultry in Kazakhstan, and the country currently accounts for only 0.8% of the meat produced in Asia.
- The authors of this study conducted a Strength-Weakness-Opportunity-Threat analysis (among other things) in order to investigate how the meat industry could be expanded.
- Kazakhstan's strengths include land, animals, low labor costs, and government subsidies for feedlots, animal breeding, etc. The country could breed more productive animals, develop and irrigate currently unused pasture land, and develop its industry to supply growing domestic and international markets.
- At the same time, Kazakhstan suffers from inadequate technology and equipment for both feed and animal production, poor infrastructure, a lack of skilled workers, and long distances between producers and markets. Agricultural land has been degraded, workers have migrated to cities, and Kazakhstan's animal products are not competitive with those from the main meat exporting countries.
- These threats and weaknesses suggest that expansion and industrialization of Kazakhstan's meat industry is *not a given*. Concerted efforts would be needed from both the public and private sectors to overcome these barriers.

2. The authors' solution: a "meat hub"

- The authors suggest establishing a "meat hub" for Kazakhstan. The meat hub would educate workers, disseminate technology, implement standards, collect data, and establish connections between various parts of the value chain. This is intended to lower production costs, increase export earnings, and increase incomes for smaller producers.
- *The meat hub concept may introduce elements of industrialization*. The study describes that larger companies would supply young animals, feed, veterinary care, etc., and handle processing, while smaller farms would raise the animals.
- This potentially resembles the vertically-integrated, contract-farming model that is common in the US and elsewhere, in which farmers assume the risks of constructing infrastructure and dealing with animals and their waste while having limited power to negotiate with large companies.

3. An opportunity for advocacy

- In addition to satisfying demand and making money from exports, the authors argue that their model for expanding Kazakhstan's livestock industry will benefit "technology and skill transfer, youth employment, women entrepreneurship, and … the rural economy, … competitiveness and rural prosperity".
- However, the authors note that the livestock sector is built on a shaky foundation. It is highly dependent on unreliable domestic feed and fodder production; disease outbreaks have prevented the expansion of pig production; and meat consumption actually dropped by 5% in the most recent period they studied (2020 to 2021).

- Possible drawbacks of expanding livestock production, particularly its effects on the environment, human health, and animals, are mentioned only in passing, but they have been well documented in other countries.
- The authors acknowledge that some experts and environmentalists recommend transitioning away from industrial animal production, because of its pervasive negative impacts. However, they find that this movement is not widespread in LMICs and has had little impact on Kazakhstan.
- Put together, this suggests that (1) expanding livestock production in Kazakhstan may not be an easy or effective way of realizing the benefits claimed in this study, and (2) *the future of the industry is not predetermined*; advocates and campaigners have an opportunity to help shape it.

2

Lee, D.Y., et al. **"Market status of meat analogs and their impact on livestock industries."** *Food Science of Animal Resources* 44.6 (2024): 1213. link.

The plant-based meat analog sector in Korea is growing and local consumer interest is high, yet the conventional livestock industry continues to expand.

It has been predicted that alternative proteins will rapidly displace conventional meat in Korea and elsewhere. However, the sheer scale of the livestock industry, and rising demand for meat, mean that alternatives have so far had little effect on animal agriculture.

- According to one consulting company, 60% of the global meat market will be occupied by alternative proteins by 2040. Another study claimed that alternative proteins will swiftly take over the market for meat in Korea.
- The livestock industry has in some cases opposed the development of alternative proteins, presumably out of concern that they will encroach on their markets.
- This study finds that revenues from plant-based meat analogs are indeed expected to rise rapidly in Korea, and that companies are working to overcome technical and other barriers.
- At the same time, numerous initiatives are underway to increase the scale and productivity of the Korean animal agriculture sector. Total livestock production has risen in recent years and is expected to continue growing.
- Although plant-based meat analogs are becoming more popular in Korea, they have *a long way to go* before they *significantly* affect the huge market for conventional meat, especially given that meat consumption is rising.

Why is this academic study particularly useful for addressing 'burning questions'?

- This study is relevant to PROD 4: "How will the increasing production and availability of alternative proteins (e.g., plant-based and cultivated meat) affect industrial animal agriculture in LMICs, including meat consumption, producers' incomes, and greenhouse gas emissions from farmed animals?"
- The study demonstrates that the production and availability of one type of alternative protein (plant-based meat analogs), as well as consumer interest, are increasing in Korea.
- It also addresses the question of whether this increase is affecting animal agriculture in Korea, in particular its trend toward larger scale, increased productivity, and fewer farmers. So far, the answer is "no".
- The paper also describes the situation in other countries, where *livestock production remains similarly unaffected by the development of plant-based meat analogs*.

Deeper Dive

1. Sales of plant-based meat analogs in Korea are expected to rise

- Revenue from plant-based meat analogs in Korea is expected to grow by about 60% in 5 years, from $97M USD in 2024 to $157M USD by 2029. This represents about 1% of global revenues from this type of product.
- Projections for Asia as a whole are similar: the largest markets are in China, Japan, and Indonesia, and they are projected to increase by about 10% per year until 2029.
- Korean consumers cite health, the environment, and animal protection as reasons for buying plant-based meat analogs. They value convenience, taste, protein content, and perceived health benefits when making purchases.
- Regulations and technological barriers have held back growth in the sector to date, and the paper describes the industry in Korea as "relatively passive". Nonetheless, institutions and plant-based meat companies are investing in R&D to improve their products.
- Current offerings tend to reinterpret traditional Korean dishes, resulting in products such as Better than Meat™ Plant-Based Tteokgalbi, Plantable™ Bibimbap Rice Ball, and Soymaru™ Vegan Gochujang Bulgogi.

2. Production and consumption of conventional meat also continue to rise

- Despite these developments in plant-based meat, total production in Korea's livestock industry increased between 2016 and 2022. The industry is expected to grow until at least 2035, and per capita consumption of animal-based pork, beef, and chicken in Korea is projected to rise by 0.8% each year through 2033.
- Although the *number* of animal farms in Korea has been decreasing, changes such as higher sow fertility and higher cattle carcass weights are leading to higher *total production*.
- This actual and projected growth in production likely results from a suite of factors, including strategies to scale and specialize livestock farms, government marketing schemes, the introduction of productivity-enhancing technologies such as precision farming, and efforts to reduce the country's dependence on imported meat.

3. How to reconcile these observations?

- How is it possible for the Korean plant-based meat industry to grow rapidly without shrinking the conventional meat industry? This paper mentions two factors.
- First, *the market share of conventional meat is many times larger* than that of plant-based analogs (the study notes that in Canada, it is approximately 100 times larger). This means that, even though the latter industry is expanding relatively fast, it will take a very long time to displace a significant portion of animal agriculture.
- Second, *the market for conventional meat is not yet saturated*. Even though more people are purchasing plant-based meat analogs, consumption of conventional meat is also rising, in Korea and beyond.
- Sales of plant-based meats can likely be increased by lowering prices, improving product quality, addressing regulatory barriers, etc. However, the sheer size of the livestock industry should not be underestimated.

3 Sellars, Laurie, and Becca Franks. **"How mariculture expansion is dewilding the ocean and its inhabitants."** *Science Advances* 10.42 (2024): eadn8943. link.

Expansion and intensification of mariculture (farming aquatic species in the ocean) has adverse impacts on the wild environment and marine lives.

Intensive marine aquaculture is frequently positioned by scientists and policymakers as a solution to human nutrition and global food security. However, its effects on the environment and nonhuman animals are comparatively neglected in the academic literature, and need to be brought into the discussion.

- Mariculture can contribute to nutrition and food security, but it can pose risks to workers and communities while disproportionately benefiting wealthy nations and individuals.
- Mariculture can also have negative effects beyond those experienced by humans. This study identifies four categories of potential nonhuman impact, which are collectively termed "dewilding".
- *Environmental dewilding* includes pollution and the modification of seascapes. *Wildlife dewilding* involves altering wildlife populations and wellbeing, such as by introducing pathogens and parasites. *Captive dewilding* refers to how captivity affects the welfare and behavior of farmed animals. *Conceptual dewilding* is the effect that mariculture has on humans' perception and treatment of the natural world, such as viewing certain animals as pests.
- Captive dewilding is widely evident in academic papers about mariculture, but it is rarely recognized as harmful. For example, an article may study the growth rate or size of farmed salmon without considering variables relevant to their welfare.
- Harm to the environment and wild animals is less widely documented but is generally recognized as a negative outcome. Conceptual dewilding is least documented, and rarely recognized as harmful.
- The authors identified a "language of inevitability" in the literature, where expansion and intensification of mariculture are treated as a given and not subject to question.
- The study recommends that all four forms of dewilding be considered as part of a *full accounting of the costs and benefits of intensive mariculture*. Mariculture should also be assessed alongside other food security strategies such as plant-forward diets and reducing food waste.

4 Chibanda, Craig, Christine Wieck, and Moussa Sall. **"An analysis of the broiler value chain and economics of broiler production in Senegal: Status quo after two decades of import restrictions."** *Journal of Agribusiness in Developing and Emerging Economies* 14.4 (2024): 829-844. link.

Medium and small-scale broiler producers in Senegal benefit from a two-decade ban on imports of chicken products.

Senegal banned imports of uncooked chicken products in 2005, ostensibly to protect the country from an outbreak of avian influenza. The ban has protected domestic producers from cheap chicken imports, and potentially slowed the rise of industrial broiler production.

- Prior to the ban, domestic poultry production in Senegal was growing slowly while imports – largely of cheap, frozen cuts from Europe and Brazil – were rising fast. Total poultry consumption has roughly doubled since the ban, and is almost entirely based on *domestic* production.
- Broiler production in Senegal takes place on small-, medium-, and large-scale farms (<10,000, 10,000-100,000, or >100,000 birds per year, respectively).
- Large farms often operate their own hatcheries, feed mills, and processing plants. The slaughtered birds are sold directly to retailers or to "bana-banas" (poultry traders).
- Small- and mid-scale farms purchase commercial feed and chicks. Their birds, which tend to be raised in open barns, may be slaughtered on-farm, or sold live to bana-banas, retailers, restaurants, and individuals.
- This study examined small- and medium-scale farms and their value chains. It found that both farm types are *profitable*.
- Production costs are higher for small-scale farms, as they have less power to negotiate lower prices for chicks and feed, and often do not use cost-effective management practices. However, they are able to *sell birds directly to local consumers at higher prices*.
- The authors suggest that allowing imports of cheap, frozen chicken pieces would undermine the profitability of domestic producers. It seems plausible that, had a long-term ban not been imposed, industrial facilities and large players with deep pockets would now dominate broiler production in Senegal.

5 Makmun, Makmun et al. **"Power relations among actors in laying hen business in Indonesia: A MACTOR analysis."** *Open Agriculture*, 9.1 (2024): 20220334. link.

It is important to pay attention to the power dynamics within Indonesia's laying hen industry, which help to shape the balance between small-, medium-, and large-scale producers.

Analyzing the individuals, groups, and institutions involved in Indonesia's egg industry reveals that small farmers are in a vulnerable position relative to large producers and the companies that supply inputs. However, there are ways in which the government could support smaller egg farmers.

- In Indonesia's egg industry, large companies supply inputs to farms of various sizes, who sometimes form groups and cooperatives to obtain better prices. Farms work together and via middlemen to market their products, while the government implements policies and programs to regulate the industry (Table 1).
- This gives rise to a *complex network of relationships*, between entities whose goals and interests may be aligned or in conflict. This study analyzed these relationships in domains related to obtaining inputs (chicks, feed, and vaccines) and marketing eggs.
- Relationships and power dynamics vary between domains. For example, central and local governments have high influence over the availability and prices of inputs, but have been relatively ineffective in marketing.
- Smaller-scale farmers depend on others for inputs and access to markets. They use farmer groups and cooperatives to buy chicks and feed at lower prices, sometimes obtain feed from larger farms, and may need to sell to middlemen to obtain money for buying feed.
- The government could play a stronger role in keeping smaller farms competitive: strengthening cooperatives, improving smaller farmers' access to resources, and protecting them from exploitation.
- Where smaller farmers are vulnerable, industrial production may have an easier time becoming dominant. Those wishing to intervene in this dynamic may benefit from considering the actors, networks, and power relations that support and undermine various systems of production.

No	Actor	Roles and responsibility
1	Small-scale farmers	Individuals who own and maintain livestock under 11,500 birds
2	Medium-scale farmers	Individuals who own and maintain livestock between 11,500–230,000 birds
3	Large-scale farmers	Individuals who control and raise livestock of more than 230,000 birds
4	Local government	Local government institutions working to provide regulations/policies related to egg production
5	Central government	Ministries working to provide regulations/policies related to egg production
6	Feed/medicine producers	Companies that produce and distribute feed/medicine
7	Traders/collectors	Individuals or groups who buy eggs from farmers and have sales channels to consumers
8	Farmers group	An association of farmers who own and raise livestock jointly for the same purpose
9	Cooperative	Breeder organizations help farmers meet the needs of their livestock and market eggs
10	Poultry shop	Individuals or companies that provide livestock production facilities to partner farmers (plasma)
11	DOC producers	A company that manufactures and distributes DOC

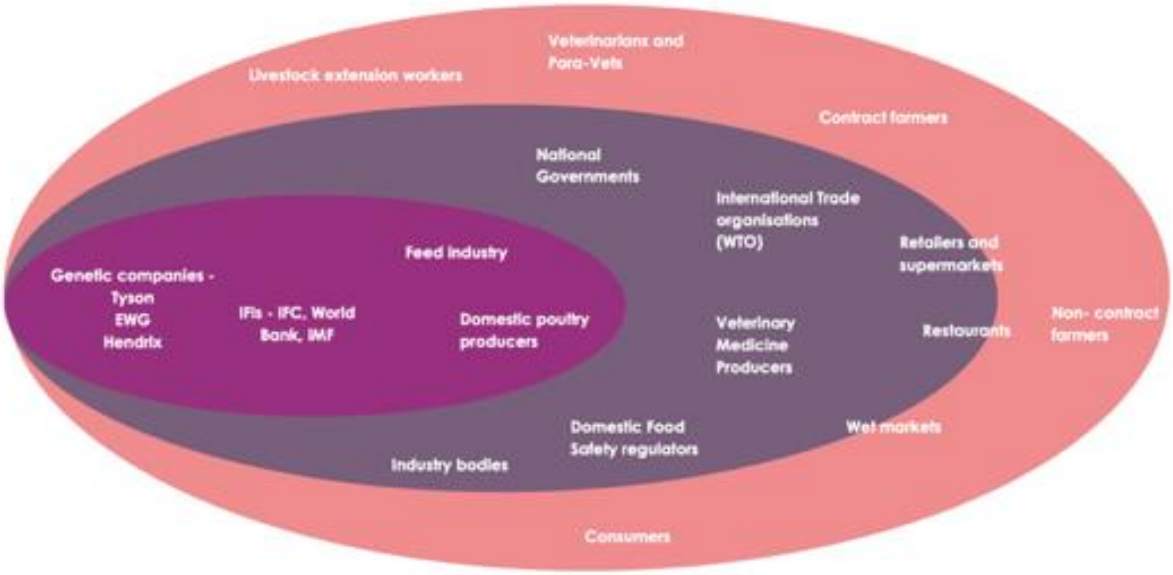
Table 1: Actors and their roles in the laying hen industry in Indonesia. From Makmun et al., (2024).

6 Tak, Mehroosh, Ambarish Karamchedu, and Ivo Syndicus. **"Identifying economic and financial drivers of industrial livestock production - The case of the global chicken industry."** Tiny Beam Fund, 13 June, 2022. link.

Expansion of livestock industries in LMICs such as India is crucially driven by corporate concentration, government policies, public and private capital.

Corporations engaged in industrial livestock production in low- and middle-income countries are expanding and consolidating. This is especially evident in the global chicken genetics industry and in India's chicken sector. Power asymmetries, government support, global finance are key drivers of this trend.

- A clear case of corporate concentration and expansion in industries that directly impact global livestock production is *chicken genetics*. Two companies - EW Group (Germany) and Tyson (USA) - supply 95% of the world's commercial breeding stock for broilers.
- Another excellent example is the *chicken sector in India*. With support from the government, "the private sector chicken production system in India continues unabated, set to double in size and USD value by 2030". Key milestones from the 1970s to early 2020s reveal how public policies and corporate concentration have shaped the Indian chicken sector into vertically integrated production systems:
    - 1974: Joint venture of Venkys (Indian breeding firm) and Cobb-Vantress (top U.S. breeding company).
    - 1980s: Government import ban on grandparent stock. Venkys became the first vertically integrated poultry corporation in India.
    - 1990s to early 2000s: Serious restrictions, tariffs, quotas, slashed and lifted. Liberalization led to increased productivity overall and provided further advantage to Venkys.
    - 2021: GM soymeal poultry feed imports allowed temporarily, easing chronic shortage of feed.
- To help one understand the asymmetries of power relations, policies, financing that have sped up corporate concentration and expansion of livestock industries in LMICs, this report also provides an *analytical framework and step-by-step guide* that anyone can use to map and identify economic and finance drivers that shape a country's industrial animal agriculture.



"Spheres of influence for economics drivers of global broiler and layer industry". From Tak, Karamchedu, Syndicus (2022).

Brief mention (non-academic reports):

1 Food Systems Countdown Initiative. *The food systems countdown report 2024: Tracking progress and managing interactions*. Columbia University, Cornell University, FAO, Global Alliance for Improved Nutrition, 2025. link.

- "Food Systems Countdown Initiative is a global interdisciplinary scientific collaboration that aims to track the progress of this [food system] transformation by regularly providing updated data on 50 food system indicators and producing thematic analyses related to key food system topics."
- "The results of the analysis offer reasons for optimism: of the 42 indicators with time trends examined, 20 have changed in a desirable direction, on average, globally. These positive trends include indicators in all five Countdown themes—diets, nutrition, and health; environment, natural resources, and production; livelihoods, poverty, and equity; resilience; and governance. . . . However, some indicators (7 of 42) have significantly worsened globally over this period. . . . For 15 indicators, there has been no significant change despite the need for steady progress to meet key global goals."
- "The 2024 Countdown report shows that progress toward food systems transformation is not only possible but already occurring. . . . Progress cannot be achieved in isolation—it requires a holistic approach that recognizes the intricate web of connections within our global food systems. . . . "

2 Food and Agricultural Organization. *The guidelines for sustainable aquaculture.* Rome: FAO, 2025. link.

- "The Guidelines for Sustainable Aquaculture (GSA) were prepared at the request of Members in an inclusive, transparent and participatory manner. . . . "
- "The GSA were created in response to the rapid expansion of aquaculture, the fastest-growing food production sector in the world, driven by scientific progress, technological innovations and investment, amid a consistently increasing global demand for aquatic foods. However, as with all food production sectors, this rapid growth has exposed challenges to the sustainability of aquaculture and raised concerns about potential negative impacts. The GSA provide a comprehensive framework for addressing these challenges."
- "The GSA consist of three sections: A) vision, objectives, scope and guiding principles; B) guidelines for promoting sustainable aquaculture; and C) implementation and monitoring. In line with the FAO Blue Transformation roadmap, which has a major pillar dedicated to the sustainable intensification and expansion of aquaculture, the GSA envision an aquaculture sector that contributes significantly to a world free from hunger and to the equitable improvement of the living standards of all actors in its value chain, including the poorest."

About Beacon

A project of Burning Questions Initiative

Why?

- Tiny Beam Fund's flagship *Burning Questions Initiative* produces a list of 'burning questions'. These questions were contributed by over 25 organizations and funders critical of and working to tackle industrial animal agriculture, especially concerning low- and middle-income countries (LMICs). These questions focus on topics that they would most like academic researchers to address and answer. The current (2023) list is here.
- Every 'burning question' is complex and multifaceted. It would be foolish to believe that there is a single, simple, definitive answer to a question.
- Addressing these questions requires welding together many pieces of nuanced, contextualized information, research findings, and perspectives drawn from a broad knowledge base, a rich knowledge bank of studies by academic researchers. It also requires extracting key messages from these studies.
- This welding and extracting endeavor is arduous. But, "a journey of a thousand miles begins with a single step". We hope that our curated series of key messages — named *Beacon* — will serve as a beacon, guiding all those keen to take the first step.

Who's the audience?

- Those who have contributed to the 'burning questions', those who are curious about these questions, those who are interested in using the research undertaken by academics to address the questions.
- Anyone can access *Beacon* on our website. It is easy to read and understand. No academic jargon!

What's in it?

- Each issue contains 6-8 main items. These are works by academic researchers in peer-reviewed journals from the past couple of years. Also included are reports written for Tiny Beam Fund by recipients of its *Burning Questions Initiative* fellowship awards (they are all PhD holders or PhD students close to obtaining their degrees). 1-2 'Brief mention' non-academic reports may also be included.

Read This Issue