

Optimizing the Corn Supply Chain in Bone Regency

Practical Insights for Sustainability and Profitability



Highlights

- The model maps the corn supply chain from farm to market, identifying pivotal points where targeted interventions can drive value addition and maximize efficiency.
- The model's adaptable design enables its application to agroforestry and diverse crops, fostering income diversification and promoting environmental sustainability.
- Sun-drying enhances corn quality, increases market value by up to 15%, and reduces both transportation weight and costs.
- Converting sun-dried corn into poultry feed meets local demand, stabilizes farmer income, and lessens dependence on raw corn sales.
- Investing in local warehousing reduces reliance on Makassar, cuts emissions, stabilizes prices, and strengthens local markets.
- Local warehousing and product diversification lessen dependence on long-distance transport, bolstering supply chain resilience in Bone Regency.

Introduction: A Model for Practical Solutions

This brief presents findings from an optimization model developed to improve the corn supply chain in Bone Regency, South Sulawesi Province, Indonesia. By analyzing key factors—drying techniques, warehousing, and product diversification into poultry feed—the model identifies actionable steps for farmers, traders, and policymakers. These steps, which include sun-drying, establishing local warehousing, and diversifying corn products, aim to reduce greenhouse gas (GHG) emissions, increase logistical efficiency, and improve income stability for smallholder farmers (Coley et al., 2009; Galanopoulos et al., 2018; García-Lara & Serna-Saldivar, 2019; Shee et al., 2019).

Corn production in Bone Regency faces challenges due to high moisture content, which reduces corn value and increases transportation costs. Without local drying facilities and warehousing, traders must transport corn over 150 kilometers to centralized facilities in Makassar, the province capital city, as farmers often lack the resources for long-distance transport. This reliance on distant markets affects income stability and adds logistical challenges (Ariningsih et al., 2021; Suryanto et al., 2022). Corn's susceptibility to quality loss during transport also emphasizes the need for optimized drying and handling practices (García-Lara & Serna-Saldivar, 2019; Xu et al., 2022).

This model-driven approach provides locally actionable recommendations in drying, warehousing, and poultry feed production. By simulating different supply chain scenarios, the model offers tailored solutions that support sustainable livelihoods, environmental objectives, and regional food security (Orjuela-Castro et al., 2021; Suryanto et al., 2022). Detailed technical information is available in the full thesis.

Modeling the Corn Supply Chain: Insights from Farm to Market

The model maps corn's journey from farms in Bone Regency to markets, pinpointing critical decision points that impact profitability and sustainability. Each stage of the corn supply chain—from harvesting and drying to storage and transport—presents opportunities for cost reduction and value enhancement. Through a data-driven approach, the model empowers stakeholders to visualize the supply chain, supporting informed decisions for a more sustainable and profitable corn sector.

The model reveals that three interventions—sun-drying, local warehousing, and poultry feed production—are especially impactful. Sun-drying is a cost-effective method that improves corn quality, enhances market price, and reduces transport weight and emissions, aligning with Bone Regency's sustainability goals.

Local warehousing offers decentralized storage, stabilizing prices and reducing logistical dependence on Makassar. By selling to local warehouses, farmers gain reliable, nearby access to the market without needing to store their own corn.

Finally, producing poultry feed from sun-dried corn enables farmers to diversify products, capturing local demand and reducing transportation emissions. Together, these interventions provide farmers with higher returns while contributing to a more sustainable supply chain.

Potential Extensions: From Corn to Agroforestry

Originally developed for Bone Regency's corn supply chain, this model was designed with adaptability in mind, making it applicable beyond a single crop. Its structure can be modified to support agroforestry commodities—crops that integrate well with tree-based farming systems and bring environmental benefits like biodiversity enhancement and soil conservation. This flexibility makes the model a valuable tool not only for Bone Regency but also for regions looking to diversify their agricultural landscape and strengthen local economies.

Agroforestry practices offer benefits that align with Bone Regency's goals of sustainability and resilience. Integrating select tree crops alongside cash crops like corn could provide additional income opportunities, support soil health, and contribute to carbon sequestration efforts (Jose, 2009). Although the model primarily focuses on logistical efficiency and profitability in the corn sector, its adaptable framework can help assess the economic feasibility of introducing tree crops into existing farming systems. By exploring such scenarios, the model may reveal configurations that benefit local farmers seeking to diversify their agricultural practices.

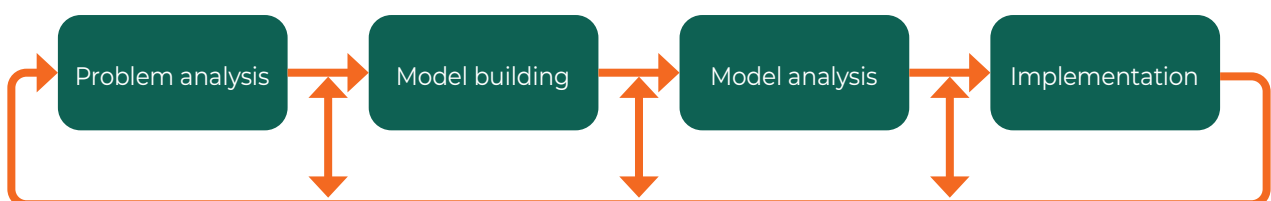


Figure 1. Four Stages of Applying Models to Support Decision Processes

Adapted from Claasen et al. (2007)



Figure 2. Sun-Drying at Maggenrang Village

Sun-Drying by Farmers: Improving Quality and Price

Sun-drying emerged in the model as a pivotal decision point that can significantly impact corn quality and farmer income. In Bone Regency, sun-drying is not only accessible to smallholder farmers but also requires minimal equipment, making it a low-cost solution that yields high returns. By sun-drying their corn, farmers can reduce moisture content, improve product quality, and secure up to 10-15% higher prices in the market compared to wet corn. This method provides farmers with a higher-value product without the need for costly drying infrastructure.

Beyond its economic advantages, sun-drying brings environmental and logistical benefits. The reduced weight of dried corn leads to lower transportation costs and emissions—a critical improvement given the long-distance transport typically required to reach central markets in Makassar. By decreasing transport expenses and the carbon footprint associated with wet corn logistics, sun-drying aligns with Bone Regency's environmental sustainability goals.

Moreover, sun-drying enhances the durability and storage life of corn, protecting it from quality degradation and fungal contamination during transit. This not only safeguards the product but also reduces the risks of aflatoxin accumulation, making it safer and more marketable. For farmers in Bone Regency, sun-drying offers a practical, effective way to boost income, reduce transportation strain, and increase product resilience, providing long-term benefits with minimal resource investment.

Product Diversification: Tapping into Local Demand with Corn Poultry Feed

Corn contributes significantly to Bone Regency's economy, extending its value beyond raw commodity sales. The model highlights an opportunity to diversify by transforming sun-dried corn into poultry feed, meeting the growing demand for locally-produced chicken feed. Currently, traders primarily handle feed production, but with the right support and resources, farmers could also engage in this value-added process. By shifting from raw corn sales to feed production, farmers could tap into a stable local market, achieving greater income security and reduced vulnerability to price fluctuations often seen with raw corn.



Figure 3. Corn-feed processing site

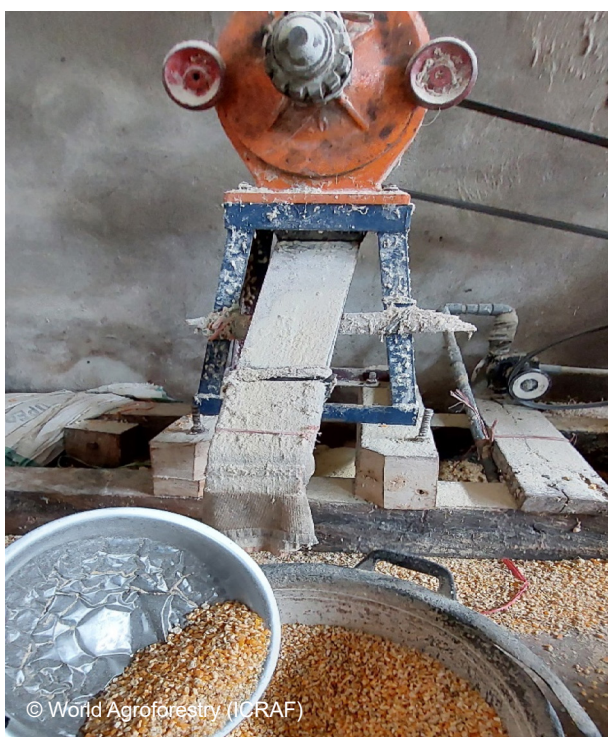


Figure 4. Shredder machine for corn-feed

The demand for corn feed in Bone Regency presents a promising opportunity to build a more resilient agricultural economy. Farmers with access to the necessary resources for feed production could diversify their income streams while also meeting an immediate local need for sustainable, locally-sourced feed. This diversification allows farmers to maximize the value of their harvests, retain more of

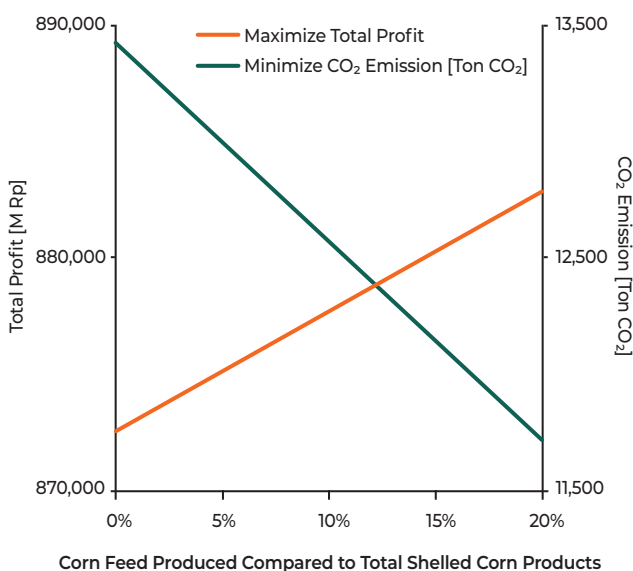


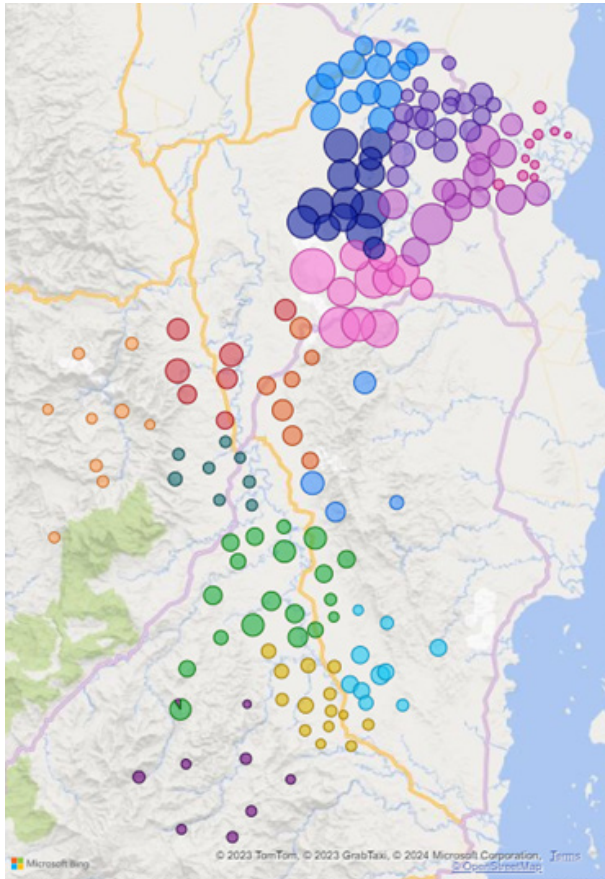
Figure 5. Trade-off Analysis between Corn Feed Production to Total Profit and CO₂ Emissions

their production within the local economy, and decrease dependency on long-distance markets. If equipped with the necessary tools and training, farmers could help Bone Regency move toward a more self-sustaining, locally integrated agricultural system.

Furthermore, corn feed production aligns with regional food security goals by keeping resources within Bone Regency and creating a more self-sufficient agricultural community. This diversification provides farmers with a buffer against market shifts, contributes to local supply stability, and allows Bone Regency to leverage its agricultural resources to meet its own needs effectively.

Strategic Planning: Investing in Local Warehousing

The optimization model reveals that strategic investment in local warehousing could bring transformative benefits to Bone Regency's agricultural landscape. By identifying optimal locations and capacities for local storage facilities, the model provides data-driven insights that could reduce the region's reliance on distant warehouses in Makassar. Local warehousing offers a decentralized solution that has the potential to stabilize corn prices, improve market access, and enhance economic resilience within the community.



Subdistrict

- | | | |
|-------------|--------------|-------------------|
| ● Ajangale | ● Dua Boccoe | ● Patlmpeng |
| ● Amali | ● Kahu | ● Ponre |
| ● Bengo | ● Lamijru | ● Tellu Limpoë |
| ● Bontocani | ● Lappariaja | ● Tellu Siattinge |
| ● Cenrana | ● Libureng | ● Ulaweng |

Figure 6. Distribution of Corn Production at the Subdistrict Level, with Bubbles Representing Villages within Each Subdistrict

Local warehousing within Bone Regency offers both economic and environmental advantages. First, by decreasing the distance and frequency of transportation to Makassar, local storage significantly lowers both transportation costs and CO₂ emissions, aligning with the region's sustainability goals. Additionally, having local warehousing facilities ensures that farmers have a reliable and nearby point of sale for their corn, providing them with steady income opportunities immediately following harvest. This localized market access can contribute to more stable prices, as it reduces the logistical strain and dependency on distant markets.

Beyond these immediate economic benefits, local warehousing could strengthen local market activity and support logistical independence. With the model's insights on optimal warehouse location and capacity, Bone Regency's government can make informed decisions when planning infrastructure investments that strengthen the local corn supply chain. By committing to these facilities, Bone Regency would foster a self-sustaining agricultural ecosystem where farmers, traders, and the broader community can benefit from improved market access, stable prices, and reduced environmental impact.

Infrastructure Challenges: The Need for Localized Solutions

Currently, Bone Regency's corn supply chain depends heavily on the limited transport routes to Makassar, increasing costs and exposure to risks associated with long-distance logistics. This reliance on a distant market infrastructure limits farmers' options, particularly when logistical bottlenecks or disruptions occur. The model's insights reveal two critical interventions—local warehousing and product diversification—that could mitigate these infrastructure-related risks and reduce dependency on Makassar.

By decentralizing the supply chain and focusing on meeting local demand, Bone Regency can create a more resilient agricultural network. Local warehousing and the production of corn feed for animal husbandry not only reduce transport needs but also tap into a reliable local market. These steps build greater flexibility into the corn supply chain, making it easier for farmers and traders to adapt to changing market conditions and logistical challenges. In this way, localized solutions foster a self-sustaining, resilient agricultural economy in Bone Regency.

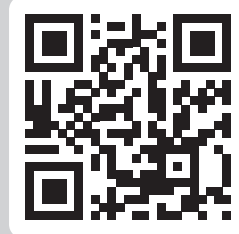
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Additional Resources

For a detailed exploration of the optimization model and data, access the full thesis <https://edepot.wur.nl/647624>

For follow-up inquiries, contact
Zaki Ruhyaman Bakran at zakiruhnyaman@gmail.com



QR Code Thesis

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