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Steel Structures for Agricultural Production and Processing

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In modern agriculture, the demand for efficiency, durability and scalability has led to the widespread adoption of steel structures across various farming operations. From crop production to post-harvest processing, steel offers a reliable solution that meets the evolving needs of the agricultural sector. Unlike traditional materials such as timber or concrete, steel structures are faster to erect, easier to maintain and more adaptable to different environmental conditions. Have you ever noticed the large pivot steel sprinklers spanning acres of farmland at Delamere Estates in Naivasha? Or the clean, organized layout of steel-framed milk cooling and processing units at Brookside Dairy? Even the modern poultry houses seen in Kiambu and Thika, with their elevated, ventilated steel designs, reflect how steel is transforming everyday agricultural practices. These examples highlight how steel supports not just production but also efficiency in processing and livestock management. Over the past few decades, steel has gradually replaced traditional materials like wood and masonry in many agricultural settings. This shift was driven by the need for more resilient, cost-effective, and versatile structures to support the growing demands of modern farming. As mechanization and climate variability increased, farmers began seeking materials that could offer both structural strength and long-term value.

DEAR READER

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A monthly Newsletter touching on topical issues affecting our environment.

KeSEBAE NEWS is a Newsletter of the Kenya Society of Environmental, Biological and Agricultural Engineers (KeSEBAE)

Inside this Issue!

One of the primary advantages of steel is its **durability**. It withstands harsh weather, pests, fire, and heavy use without losing integrity, making it suitable for everything from livestock shelters to processing plants. In addition, steel structures allow for **fast construction**, especially with pre-engineered components that can be quickly assembled on-site.

Steel also requires **minimal maintenance**, reducing long-term costs. Unlike timber, it doesn't rot, warp, or attract termites, and treated steel can resist corrosion in humid or coastal environments. Furthermore, steel offers excellent **scalability**. Whether it's expanding a warehouse, extending a greenhouse, or modifying a poultry house, steel structures can be adapted or enlarged with ease, supporting the dynamic nature of agricultural operations.

1 Types of Steel Structures Used

Steel structures in agriculture can be grouped based on their role in either production or processing. This distinction helps to highlight the wide range of applications across the agricultural value chain.

1.1 Structures for Agricultural Production

These structures support on-farm activities that directly contribute to the cultivation of crops and rearing of animals:

i. **Greenhouses**: Steel-framed greenhouses provide controlled environments for growing high-value crops such as vegetables, flowers, and seedlings.

Figure 1.1*: Interior of a steel-framed greenhouse with raised seedling beds*
Source: Amiran Kenya Ltd (amiranltd.com)

ii. **Storage Sheds**: Used to store farm inputs like fertilizers, seeds, tools, and machinery. They can be fully enclosed or open-sided, depending on use.

iii. **Livestock Shelters**: Steel-framed poultry houses, dairy units, and pig pens ensure strength, ventilation, and hygiene for animal housing.

iv. **Irrigation Support Structures:** This includes steel towers and frameworks for overhead sprinklers and pivot systems, commonly seen in large-scale farms.

1.2 Structures for Agricultural Processing

These are facilities involved in handling, transforming, and preparing produce after harvest:

1. **Grain Silos**: Steel silos offer high-capacity, moisture-resistant storage for cereals, pulses, and other dry goods.

Figure 1.2*: Large-capacity steel silos for grain storage*
Source: Mysilo (www.mysilo.com)

2. **Processing Facilities**: Includes structures for cleaning, grading, milling, chilling, and packaging. Steel allows for hygienic, corrosion-resistant, and customizable layouts.

3. **Cold Rooms and Cooling Units**: Steel-panelled buildings used for temperature-controlled storage of perishables such as milk, fruits, and vegetables before they reach market.

2.0 Applications in Agricultural Settings

Steel structures have quietly transformed how agriculture operates, not just in what is grown, but in how it is stored, processed and brought to market. From dusty fields to high-tech processing lines, the strength and versatility of steel are evident at every stage of the agricultural value chain.

2.1 Greenhouses: Supporting Year-Round Crop Production

Modern greenhouses have been a game-changer for farmers managing unpredictable weather. In places such as Naivasha, curved steel frames arch over rows of tomatoes and capsicums, shielding them from harsh sun, wind and rain. These greenhouses are not merely about protection. They enable year-round cultivation, improved yields and better disease control. Steel makes this possible with its ability to span wide spaces, resist corrosion and withstand high humidity.

2.2 Storage Sheds: Safeguarding Farm Inputs and Equipment

Steel sheds tucked along field edges provide secure, weatherproof spaces to organise inputs and protect machinery from rust or theft. These storage units, commonly seen in maize-growing regions like Kitale, serve as command centres. Inside, tractors, sprayers and valuable farm inputs such as seeds and fertilisers are neatly arranged and shielded from the elements. Farmers rely on these sheds not only for protection but also for order and accessibility. Since steel structures are quick to erect and easy to extend, they grow alongside the farm itself.

2.3 Livestock Housing: Enhancing Animal Welfare and Hygiene

Livestock farmers have also tapped into the value of steel. In Kiambu, steel poultry houses dominate the landscape. Raised floors and ventilated roofing improve hygiene and airflow, reducing mortality and increasing productivity. In dairy-rich regions like Nyandarua, farmers use open-sided steel shelters that keep cows cool, comfortable and clean, directly contributing to better milk hygiene and quality. Steel does more than shelter animals. It supports modern, efficient livestock management.

Figure 2.1*: Poultry farming in battery cage system*

2.4 Steel Silos: Securing Grains and Reducing Post-Harvest Losses

Grains remain one of agriculture's most vulnerable yet essential commodities. Whether it is rice in Mwea or wheat in Narok, grain requires careful handling. No grain, however, is as central to Kenya's food security as maize. For decades, post-harvest losses have plagued maize farmers, largely due to inadequate storage facilities.

Steel silos are towering, sealed structures designed to keep maize dry and safe from moisture, weevils and fungal contamination. Unlike traditional cribs or granaries, steel silos are airtight, easy to fumigate and can last up to 100 years with proper maintenance. In Trans Nzoia County, several farmer cooperatives have adopted steel silos through county-supported programmes, reducing post-harvest losses by over 30 percent and enabling farmers to store maize until market conditions improve.

2.5 Sorting and Grading Facilities: Preparing Produce for Market

Sorting and grading are essential steps in the value chain, ensuring quality and consistency in produce before it reaches consumers. In towns like Thika and Eldoret, steel-framed packhouses host conveyor belts and grading lines where fruits and vegetables are cleaned, sorted and packed for supermarkets or export. The open-span design of steel allows for unobstructed movement of equipment and personnel, while its smooth, non-porous surfaces meet stringent hygiene requirements.

2.6 Milling and Processing Plants: Supporting Agro-Industry

Further along the chain, flour mills and feed factories rely on steel-framed buildings to house heavy-duty machinery and sensitive production processes. These

structures are designed to withstand vibration, dust and high operational loads, all while remaining adaptable to future expansion. Steel's inherent strength and modularity give processors the flexibility to grow with rising market demand.

2.7 Cold Storage and Cooling Units: Preserving Perishables

Temperature control is critical in preserving the quality of perishable goods. In dairy-rich counties like Meru and Nyandarua, milk cooling stations constructed from insulated steel panels are essential in maintaining milk freshness from farm gate to processor. Similarly, cold storage units for mangoes, avocados and other high-value fruits ensure that Kenya's exports reach global markets in premium condition. These are not merely storage rooms. They are precision-engineered environments made possible by the insulating and structural advantages of steel.

Figure 2.2*: Cold storage facility with ventilated racks*

2.8 Packaging and Dispatch Areas: Ensuring Product Quality and Compliance

Packaging and dispatch zones are often housed in steel processing blocks, where finished products are bagged, boxed or bottled. These structures are easy to insulate, clean and customise to suit various workflows. Steel enables the creation of controlled environments, which are critical for food handling, where temperature, humidity and dust levels can be strictly regulated. This ensures product integrity and compliance with quality and safety standards.

3.0 Emerging Trends and Innovations in Agricultural Steel Structures

Steel construction is advancing with cutting-edge solutions that are shaping the future of farming. Across the globe, from large-scale farms in the United States to intensive horticulture in the Netherlands and expanding agribusiness in Africa, steel structures are evolving through the following key innovations:

i. Pre-engineered buildings

These are factory-fabricated steel components that are delivered to the site ready for quick assembly. They significantly reduce construction time and labour costs. In countries like India and Brazil, pre-engineered agricultural warehouses, dairy units and machinery sheds are helping farmers scale operations faster and more affordably.

ii. Modular designs

Modular steel structures offer flexibility, allowing units to be easily expanded, relocated, or reconfigured as farming needs change. This trend is particularly useful in greenhouses, aquaculture facilities, and processing units. In urban agriculture hubs across Europe and Asia, modular greenhouses are being used to grow crops vertically with hydroponic systems, reducing land requirements and improving output.

iii. Corrosion-resistant coatings and galvanised finishes

Steel used in agricultural settings is often exposed to high humidity, fertilisers, manure, and coastal air. To combat rust and degradation, new coating technologies and galvanisation are being applied. In coastal regions like Mombasa and West Africa, galvanised grain silos and input stores now withstand harsh weather for decades, reducing maintenance costs.

iv. Smart-integrated systems

Modern steel structures are increasingly being embedded with technology. These include automated ventilation, solar-powered systems, real-time climate sensors, and digital monitoring platforms. For instance, in dairy and poultry farming across Canada and Australia, smart barns now regulate temperature, humidity and feed systems to optimise animal welfare and productivity.

Conclusion

Steel has proven to be a transformative material in the world of agriculture—serving both the production and processing sides with unmatched strength, adaptability, and efficiency. From greenhouses and storage sheds to sophisticated milling plants and cold rooms, steel structures are enabling farmers to expand operations, maintain product quality, and meet market demands under changing climatic and economic conditions. Its resilience against weather, pests, and time, coupled with innovations in modularity and technology integration, has made steel a smart, long-term investment for agricultural stakeholders globally.

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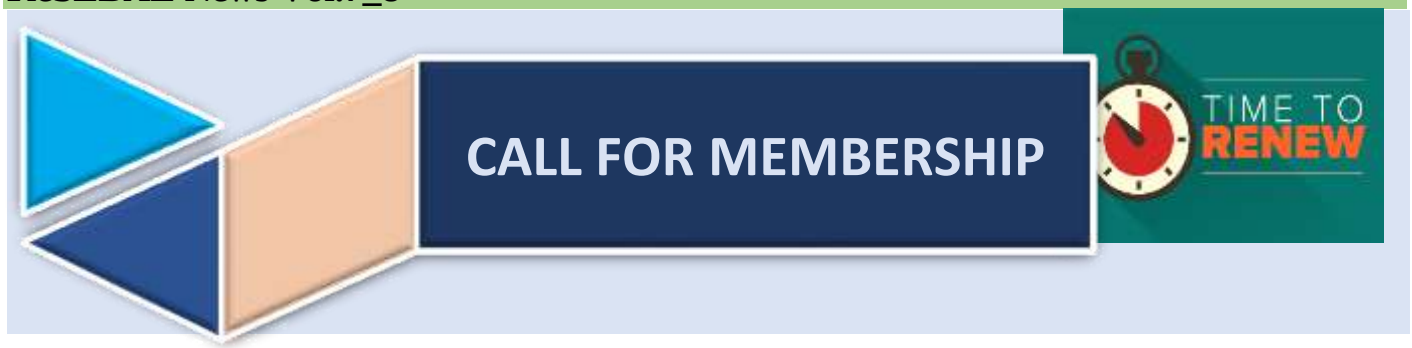

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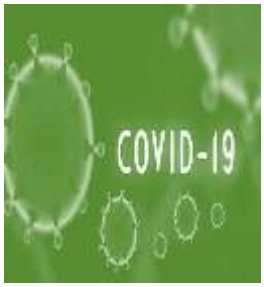

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