Food and Agriculture Organization
of the United Nations

MAXIMIZING NUTRITION IN LIVESTOCK USING A FOOD SYSTEMS APPROACH

AN EVIDENCE-BASED LITERATURE REVIEW

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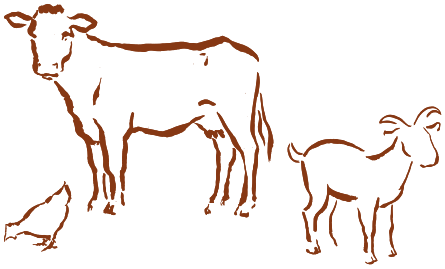
ACTION AGAINST HUNGER

World Vision



MAXIMIZING NUTRITION IN LIVESTOCK USING **A FOOD SYSTEMS APPROACH**

AN EVIDENCE-BASED LITERATURE REVIEW

Food and Agriculture Organization of the United Nations
Rome, 2021

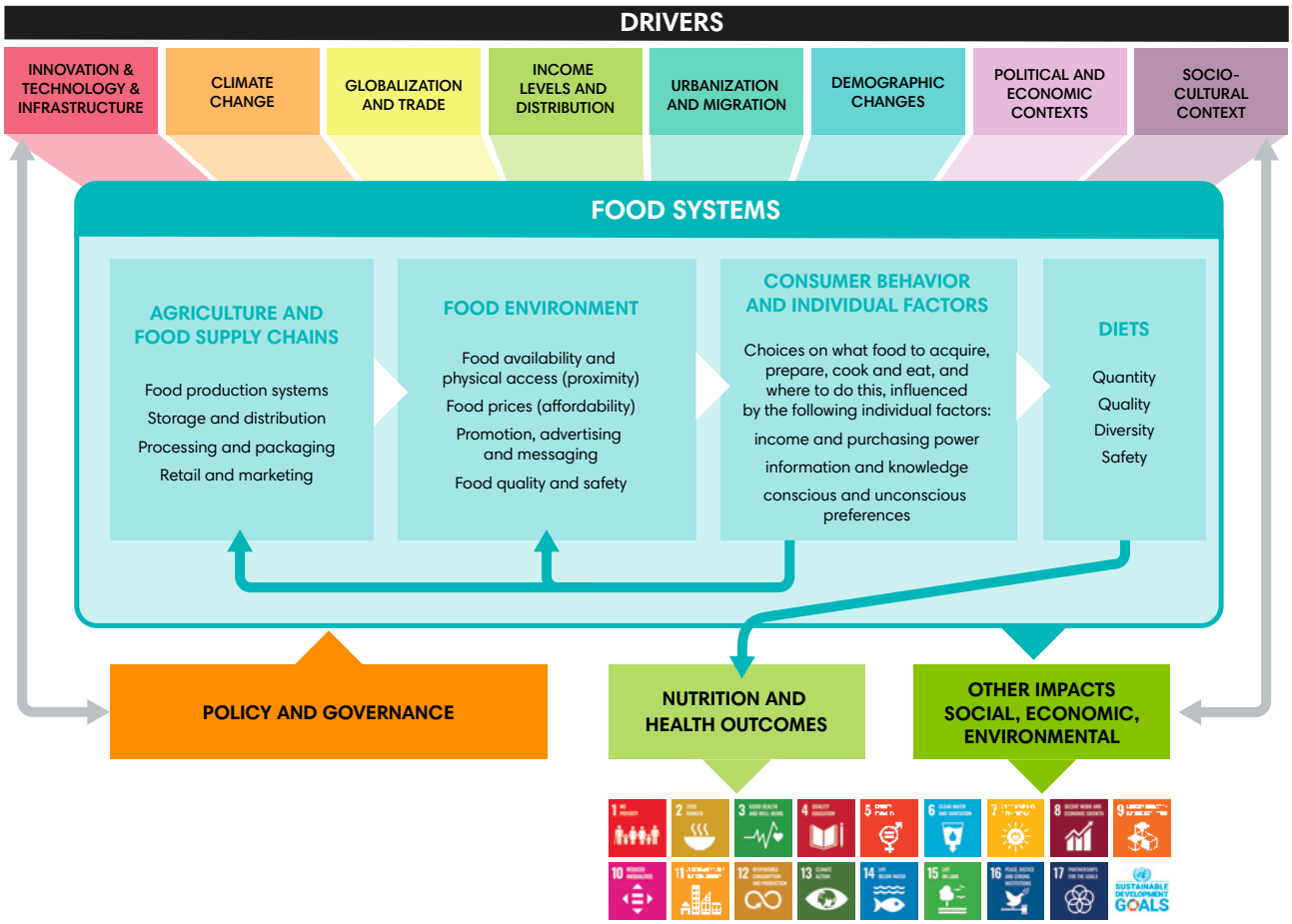
CONTENTS

Context

This literature review is one of a series of four sector-specific reviews aimed at informing the development of guidance notes for the integration of nutrition across the crops, fisheries and aquaculture, forestry and livestock sectors in 12 sub-Saharan African countries. The guidance notes will provide practical suggestions on how to formulate programmes and policies that contribute to sustainable healthy diets and enhanced nutrition. Both the literature reviews and the guidance notes form part of a collaboration by the Food and Agriculture Organization of the United Nations (FAO), Action Against Hunger and World Vision to support national decision-makers and programme implementers in strengthening sector policies, programmes and investments for improved food security and nutrition outcomes, especially for those who currently or could rely on this sector for subsistence and sustenance.[1]

The present literature review focuses on mainstreaming nutrition in the livestock sector using a food systems approach. Food systems refer to the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, marketing and advertising, preparation, consumption and disposal of food products that originate from crop and livestock production, forestry, fisheries and aquaculture, as well as the broader economic, societal and natural environments in which these diverse production systems are embedded (FAO *et al.*, 2019).

Figure 1. Food systems for healthy diets



Source: Adapted from the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (FAO, Rome, 2017).

1 The project covers the following countries: Burkina Faso, Chad, Côte d'Ivoire, the Democratic Republic of the Congo, Eswatini, Ghana, Kenya, Mali, Mauritania, Senegal, Uganda and Zimbabwe.

The review also discusses challenges faced by the most vulnerable groups in this sector, such as pastoralist, nomadic and semi-nomadic communities, and the women and youth within them.

Methodology and structure

In developing this review, a desk study of both peer-reviewed scientific literature and grey literature was conducted. An evidence mapping tool was developed and used to classify the findings across the different components of food systems, resulting in the following overview of the livestock sector's contribution to food and nutrition security, organized across several key questions:

- How do livestock contribute to sustainable healthy diets and prevent malnutrition?
- How is the livestock sector organized within the framework of the food system?
- Who are the most vulnerable groups in the livestock sector? What are the drivers of malnutrition and/or poverty in these groups?
- What are the main limitations and drivers that affect the livestock sector?
- What are the most relevant types of interventions that may enhance the contribution of the livestock sector to sustainable healthy diets and improved nutrition, while also addressing the challenges faced by the most vulnerable groups in this sector?

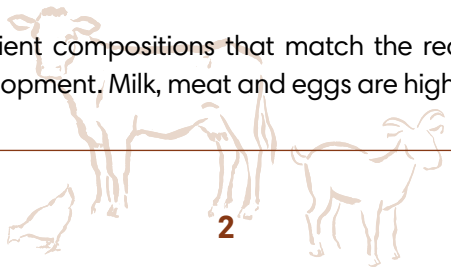
Background

The livestock sector accounts for about 40 percent of global income from agriculture (Nabarro and Wannous, 2014). Moreover, as incomes are increasing worldwide, the demand for both animal source foods (ASFs) and animal products is growing, as is their market price (Headey, Hirvonen and Hoddinott, 2018). In the case of Africa, the demand for ASFs is projected to increase by 80 percent by 2030, mainly due to population growth. This implies an expected consumption of 125 percent more beef, 65 percent more poultry, 46 percent more milk and 77 percent more eggs than in 2010 (Bonnet *et al.*, 2020) , and transforming food systems to meet this demand is and will be a major challenge. Livestock's impact on world food production, food security and nutrition, and landscape use is widely recognized, as are the various roles played by different livestock systems (including extensive, semi-intensive and intensive systems) in food production, nutritional diversity and the management of natural resources (FAO, 2017).

How do livestock contribute to sustainable healthy diets and prevent malnutrition?

According to a white paper published by the World Economic Forum in 2019, some 821 million people around the world are malnourished, and 151 million children under the age of five are stunted (Bonnet *et al.*, 2020). This is largely due to a lack of essential nutrients and proteins, which are readily available in nutrient-dense ASFs such as meat, milk/dairy, fish and eggs (FAO and WHO, 2019). Daily recommendations for protein intake from animal products vary significantly between continents; for example, in Africa the recommendation is listed as slightly over 15 g/day, whereas the World Health Organization (WHO) recommends that sedentary adults consume approximately 50 g/day (Beal *et al.*, 2017).

Livestock-derived foods offer nutrient compositions that match the requirements of the human body at varying stages of growth and development. Milk, meat and eggs are highly nutrient-dense and bioavailable



ASFs, providing quality protein and micronutrients, as well as vitamins A, B_{12} and D. These foods have an especially positive impact on the first 1 000 days of development (McDonald and Thorne-Lyman, 2017). Access to ASFs during this period can significantly reduce stunting and micronutrient deficiencies, and spur improved growth and nutrition security in children under five years of age. A recent white paper on livestock in emerging economies noted that when infants consumed a single egg per day in addition to their usual diet, stunting rates were reduced by approximately 47 percent (Headey, Hirvonen and Hoddinott, 2018). The contribution of livestock derived ASFs to the nutritional status of mothers is also well-documented, as is its effect on the quality of mother's milk. In Myanmar, women who supplemented their diet with protein (via ASFs) twice a day for two weeks were able to breastfeed more than women who did not consume ASFs (Mya, Kyaw and Tun, 2019).

Livestock production can have both negative and positive influences. The sector has been implicated in climate change through greenhouse gas emissions and soil and water depletion, and in threats to human health through zoonotic and food-borne diseases, as well as through an increase in antimicrobial resistance caused by inappropriate and excessive use of antimicrobials in livestock production (FAO, 2017). In select cases however, proximity and exposure to livestock may enhance the immune response. For example, close contact with livestock differentially improved human immunity to zoonotic diseases, thereby providing advantages for some cultural groups (Diamond, 2000). As noted in a study conducted by the International Livestock Research Institute (ILRI) and the International Food Policy Research Institute (IFPRI), there is limited awareness regarding the importance of the interface between livestock and human health, as well as a range of misconceptions regarding the management of livestock-related problems (Grace *et al.*, 2017). Gaps in delivery may best be filled by adopting an approach that is cross-sectoral, systems-oriented and strongly focused on poverty, to address issues related to livestock production, animal and human health, and nutrition in developing economies.

How is the livestock sector organized within the framework of the food system?

The main aspects of the livestock sector relate to the food supply chain, food environments and consumer behaviour, as follows:

1. Food supply chain

Production systems

While there are several different categories of livestock production systems, much of the production base typically depends on natural resource management and in particular, on promoting improved natural resource management and biodiversity and – in turn – on supporting dietary diversity (FAO, 2017). In the context of sub-Saharan Africa, livestock production systems within the food supply chain may be grouped into the categories listed below (Assouma *et al.*, 2018).

- Mixed crop–livestock systems (rainfed and dryland). These are largely used by settled and smallholder farmers who have a range of livestock (small ruminants, large ruminants and poultry), and who are also engaged in mixed cropping (Bonnet *et al.*, 2020). These farmers integrate livestock husbandry with crop husbandry and are commonly found in arable regions. The systems are often operated on smallholdings, often of less than 2 ha, and many of these small family farms are run by women. Keeping livestock enables women to earn incomes, acquire skills and accumulate productive assets (Pell, Stroebel and Kristjanson, 2010).
- Livestock-only systems (nomadic/pastoral). Over 200 million people around the world herd livestock for subsistence (Coppock *et al.*, 2018). These pastoralists, as they are known, can be found

predominantly in arid, semi-arid and grassland regions. The livestock-only system serves pastoralist, nomadic and semi-nomadic communities not only in terms of direct consumption and dietary requirements, but also as a source of income to support their food, nutrition and other needs. Although they are under increasing threat from an array of factors, pastoralist systems have proved the most appropriate livelihood options in landscapes not suited to arable production. In Africa, approximately 25–40 percent of meat comes from small ruminants, while some 56 percent of milk from small ruminants comes from grazing systems (Bonnet *et al.*, 2020). With improvements in animal health services, increased productivity and a reduction in losses, many pastoralists have the potential to meet the increasing demand for livestock-derived foods.

- Livestock intensification and industrial-scale livestock systems. The development of larger, industrial-scale livestock enterprises can also contribute to improving the accessibility and availability of ASFs (FAO, 2017). Even in and near urban areas, this is feasible with poultry, swine and dairy. In southern African countries for example, the development of highly intensive, large-scale production units in the poultry industry (for both broilers and layers) has contributed to increased productivity and has consequently made ASFs more accessible to a growing middle class. But while industrialization can make ASFs more readily available, it also presents significant challenges, especially in the context of emerging economies. Such systems are not without risks to smallholders (including competition and disease) and will inevitably depend on the overall approach for economic development, government, and policymaking in the given context.

The transfer of appropriate technology to developing nations is a critical element for increased productivity in the livestock sector and must be implemented in line with sociocultural and environmental factors (FAO, 2017). Selective breeding programmes aimed at the introduction of exotic breeds have not always worked well, as they have failed to consider issues of management, nutrition, disease and environmental adaptation across different circumstances.

Storage

The production, processing and subsequent storage of ASFs such as milk require that food safety standards are adopted and maintained at all stages of the supply chain (FAO and WHO, 2020). Food hygiene and proper handling prior to storage is critical for mitigating loss and contamination, and includes basic principles such as: 1) keeping the environment where food is handled clean (for example by washing hands, cleaning surfaces and utensils, and protecting food preparation areas from insects, pests and other animals); 2) separating raw and cooked food; 3) cooking food thoroughly; 4) storing food at safe temperatures; and 5) using hygienic water and raw materials.

Processing

For ASFs, food processing is not only a way to add value and preserve or extend shelf life, but also a means to increase the availability, access and uptake of these foods (Bai *et al.*, 2018). By increasing the shelf life of foods, processing reduces the effect of seasonality on food access. In addition, it can increase the nutritional value of foods by mitigating breakdown and losses. As such, food processing is and should be an important aspect of national agricultural policies and strategies for ensuring food and nutrition security with regard to ASFs (Dominguez-Salas *et al.*, 2019).

Retail and markets

Market linkages are critical in introducing small-scale producers into the market system, and in providing incentives for increased ASF production; they are achieved by connecting farmers, producers and local and institutional markets to schools, hospitals, other institutions and local communities (FAO, 2017). In addition to promoting the production and delivery of ASFs, such linkages also address the needs of a key element of

nutrition security – that of schoolchildren and mothers. One example of how the dairy sector in developing economies addresses market linkages is by aggregating household supply through milk collection centres and other conveniently located collection points; these are in turn linked to dairy processing entities (Chagwiza, Muradian and Ruben, 2016). Development of these linkages and of market outlets is crucial to ensuring a safe and reliable supply of ASFs. Examples of this approach have been implemented in both Ethiopia and Kenya; as a result, smallholders have managed to gain market entry and consumers have access to a safe and reliable supply of ASFs (Hoddinott, Headey and Dereje, 2015).

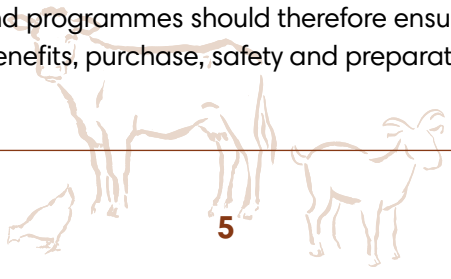
2. Food environment

Due to their fundamental role in growth and development, ASFs are a recommended dietary component in almost all food-based dietary guidelines (FAO, 2020). Access to retail markets for the sale and purchase of livestock-derived products, however, is limited in most rural communities (FAO, 2017). Due to challenges related to production capacity, transport and retail infrastructure, small agricultural communities are often unable to purchase or sell enough livestock produce (Dominguez-Salas *et al.*, 2019). Agropastoral communities are often unable to compete with larger retailers, and therefore fail to earn substantial income through commerce (Dlamini and Huang, 2020). On the other hand, smallholder farms and households that are non-livestock producing often find ASFs too expensive or inaccessible. As a result, vulnerable groups in these communities, such as women and children, are unable to purchase and consume foods that ensure a diverse diet, leading to negative nutritional consequences for these groups (HLPE, 2016). These issues can be addressed by increasing equitable access to markets nationally and by incentivizing the consumption of local ASFs.

Food safety in the food environment impacts households, communities, and national populations (FAO, 2017). Products derived from livestock are particularly hazardous, as they can contain highly toxic or pathogenic substances (Gil, Siebold and Berger, 2015). If unaccounted for, these hazards may manifest as food-borne diseases, which impact up to 600 million people annually worldwide (FAO and WHO, 2020). In some forest communities for example, bushmeat is an important source of nutrients such as iron, but it is also a potential source of zoonotic disease outbreaks (Brashares *et al.*, 2011). To prevent contamination through the interface between livestock production systems and people, appropriate quality and food safety standards should be implemented. Measures such as food traceability systems, food safety certifications and standard operating procedures for manufacturing may be applied to maintain compliance (Elmin, 2015).

3. Consumer behaviour

Raising awareness among consumers and producers on the nutritional benefits of ASFs, particularly for growth and development, is critical for increasing ASF uptake in diets (FAO, 2017). There is a significant need for generation, compilation and dissemination of data and information on the nutrient content of various ASFs, and for ASF producers to understand the relationship between improved animal husbandry and nutrition (FAO and WHO, 2019). This information must be disseminated to the general public in a targeted manner, taking into consideration those who may benefit most from this information, such as women and youth (FAO, 2017). Some examples of programmes that may increase consumer uptake of ASFs include food-based dietary guidelines and nutrition education in workplaces and schools (FAO, 2020). Consumers who regularly purchase and prepare a diverse range of livestock produce will add ASFs to their diet and improve their dietary diversity, whilst increased consumer demand should provide support for the livestock sector (Bai *et al.*, 2018). Policies and programmes should therefore ensure that consumers are empowered and educated on the nutritional benefits, purchase, safety and preparation of ASFs.



Who are the most vulnerable groups in the livestock sector? What are the drivers of malnutrition and/or poverty in these groups?

Meat production and demand has grown as economies have strengthened and as income levels have increased (FAO, 2017). More than half of the world's population depends on smallholder producers for their food, and livestock in turn are an integral part of these smallholders' food systems (Coppock *et al.*, 2018). These communities are usually made up of self-employed individuals, families and/or cooperatives living in rural areas, and livestock may contribute up to 33 percent of their income. But as smallholders they often lack access to modern machinery, investment, infrastructure and physical markets. This limited access contributes further to the marginalization of their communities, and to limits on their commercial freedom and food security (FAO, 2017).

Smallholders need policies that facilitate engagement with the economy in ways that increase incomes and ensure sustainable access to ASFs (HLPE, 2016). Women have a critical role to play, particularly in smallholder systems. Improving women's roles in livestock production systems, along with their access to inputs and services, has the potential to reduce the number of malnourished people by at least 100 to 150 million (FAO and WHO, 2019). Unfortunately, women are often relegated to the processing and packaging of livestock, and as livestock farmers, they typically lack access to investment and income. An equitable system that accounts for all individuals within these communities is needed (Amin *et al.*, 2010; Waters-Bayer and Letty, 2010).

In lower-income countries and among smallholders, livestock farming is affected and driven by a range of interrelated factors (FAO, 2017). Particularly in low-income countries (LICs), it is necessary to understand the various roles and reasons for keeping livestock and the complexity of different livelihood strategies (Swanepoel, Stroebel and Moyo, 2010). Livestock productivity is lower in LICs than in developed economies, and smallholder management systems are typically low-input/low-output systems in which the animals are left to forage for themselves; in many cases they reflect the resource constraints of their owners (for example, to do with finances, knowledge, land and feed) and of the given environment (Dominguez-Salas *et al.*, 2019). These smallholder systems are usually non-specialized (i.e. having a diverse range of species), as this protects against certain risks such as predators and zoonotic diseases, which can wipe out an entire herd (FAO, 2017). Among smallholders and the poor, risk mitigation is a key factor in keeping livestock. Other reasons include: 1) food production; 2) income generation; 3) financial investment; 4) social status; and 5) fertilizer/manure and animal traction (Swanepoel, Stroebel and Moyo, 2010). Understanding the reasons for livestock rearing in the context of vulnerable demographics is critical to supporting the role that livestock can play in nutrition and food security, not only in smallholder communities but also in society at large (Chantarat *et al.*, 2013).

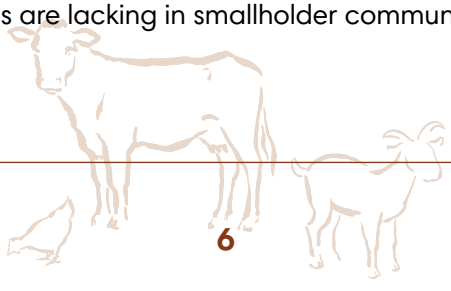
What are the main limitations and drivers that affect the livestock sector?

a) The livestock sector is dominated by large commercial businesses, leaving smallholders with limited access (FAO, 2017).

b) The role of ASFs in LICs is often underestimated (Dominguez-Salas et al., 2016).

c) Rural smallholder farmers often lack modern equipment, infrastructure and investment support (Dominguez-Salas et al., 2019).

d) Food safety and quality systems are lacking in smallholder communities (Häsler et al., 2017).



e) Many women in the livestock food system act as caregivers and providers but do not have access to the same resources, income and opportunities as their male counterparts. Likewise, youth are an essential part of the livestock sector workforce, but often lack access to training as well as to sufficient nutrition (Waters-Bayer and Letty, 2010).

What are the key interventions in the livestock sector that can contribute to sustainable healthy diets and improved nutrition while addressing social inequity?

Based on the issues identified in this review, there are several key interventions that should be considered when designing and implementing policies and programmes for the livestock sector:

a) Developing policies and strategies that identify and prioritize investments in the livestock sector through a food systems lens (FAO, 2017);

b) Supporting finance, infrastructure and modernization in marginalized communities and among vulnerable demographics such as women and youth (Dominguez-Salas et al., 2016);

c) Improving access to ASFs at a national level (Dominguez-Salas et al., 2019);

d) Improving knowledge and awareness of the benefits of ASFs (Ravikumar and Chander, 2011); and

e) Increasing the capacity for sustainable livestock production in rural communities (FAO and WHO, 2019).

This literature review informs and complements the development of a guidance note on the livestock sector, providing practical suggestions on the formulation of programmes and policies that contribute to better nutritional outcomes while taking environmental, social and economic impacts into account.

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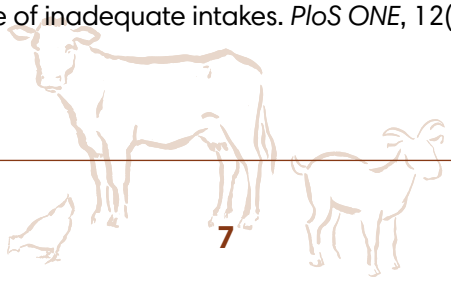

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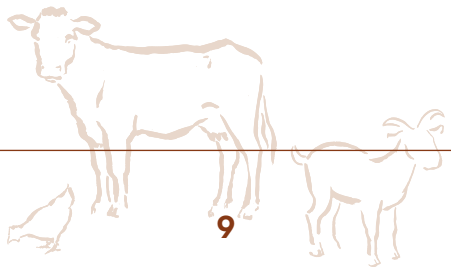
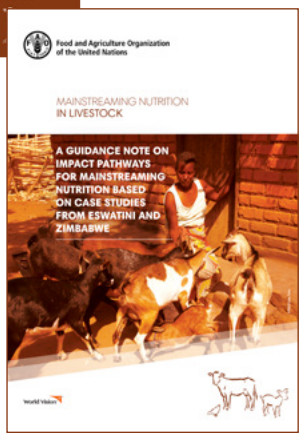


For more information check also:

Maximizing nutrition in the livestock sector in Eswatini and Zimbabwe

In brief



Maximizing nutrition in livestock

A guidance note on impact pathways for mainstreaming nutrition based on case studies from Eswatini and Zimbabwe

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