

## **Global Food Security Strategy Technical Guidance: Investing in Livestock Production and Animal Source Food Market Systems**

*This is one of 18 technical guidance documents for implementing the U.S. Government's Global Food Security Strategy. The entire set of documents can be found at [www.feedthefuture.gov](http://www.feedthefuture.gov) and [www.agrilinks.org](http://www.agrilinks.org).*

### **Introduction**

Investments in livestock production and animal source foods (ASF) market systems support the three Global Food Security Strategy (GFSS) goals of inclusive and sustainable agricultural-led economic growth; strengthened resilience among people and systems; and a well-nourished population, especially women and children.

The livestock sector directly supports the livelihoods of 600 million smallholder farmers,<sup>1</sup> the majority of whom are women.<sup>2</sup> However the economic contributions of the livestock sector are frequently underestimated by policy makers and planners. The sector's growth presents an opportunity for sustainable economic development, inclusive employment, wage labor, and women's empowerment.<sup>3</sup> Population increase, urbanization, and income growth have stimulated surging consumer demand for ASF. This is driving domestic and regional trade and expansion of the livestock sector, fueled by available production technology, including investment in ASF processing and market and nutritional transformations. There are, however, important environmental and health externalities (e.g., greenhouse gas emissions and animal-to-human disease transmission) that need to be addressed.

Ownership of productive livestock assets and linkages to ASF markets also contribute to household, community, and system-level resilience capacities<sup>4,5</sup> and can support the development of social capital, for example, through inter-household livestock gifts and loans. Well-managed livestock build a household's asset base; reduce risk (by facilitating livelihood diversification); and effectively serve as a form of financial services (e.g., insurance against crop failure, investment capital, and savings).

Animal-source foods are nutrient-dense components of diversified diets, providing highly bio-available macro- (i.e., protein and fats) and micronutrients (e.g., iron, Vitamins A and B12) that are critical for health, particularly for adolescents and women of reproductive age, as well as for infant and child growth (including critical contributions to cognitive development).<sup>6</sup> Livestock contribute to nutritional outcomes through three key pathways: direct consumption of self-produced ASF; indirectly through income from sale of ASF produced; and through women's economic empowerment and sharing of household decision-making.<sup>7</sup> While the contribution of livestock is broadly positive, livestock also bring environmental health and food safety risks which need to be carefully addressed in designs.

### **Terminology and Context**

**Livestock:** includes sheep; goats; cattle; buffalo; swine; camelids; equids (donkeys, horses); yaks, poultry (including chickens, ducks, geese, turkeys); and *micro-stock* (e.g., rabbits, guinea pigs)

**Animal Source Foods (ASF):** includes milk, dairy, poultry, eggs, meat, and fish

**Livestock Production Systems:**<sup>8</sup> designs should consider differing agro-ecological, production, and marketing characteristics of four categories of production systems which are interlinked and interacting:

- Rangelands
- Small-Scale Urban/Peri-Urban
- Rural Mixed Crop-Livestock
- Intensive/Commercial

**Multi-functionality:** Animals play multiple roles in supporting livelihoods of the poor. These roles are context- and culture-specific and need to be supported to achieve GFSS objectives.<sup>9,10</sup>

#### **Box 1: Different Functions Played by Livestock**

- *Provide nutrient dense ASF* within diversified diets
- *Generate income* through markets for animals, ASF, and other animal products (hides, skins, manure, and fibers) and services (e.g., traction)
- *Offer financial and risk management services* such as liquid capital assets to address urgent cash needs; provide insurance (e.g., against crop failure); offer financing for diversification of productive livelihoods that spread risks; promote savings; and secure informal credit
- *Enhance crop production* through animal traction, threshing, expanding cropping area, and improving soil fertility nutrient cycling via manure
- *Provide transportation* (water, people, goods); expand market access; reduce labor inputs
- *Build social capital and informal safety nets* to strengthen formal and informal networks as

## **Designing Interventions**

Impactful design will be built on a contextual understanding of challenges and opportunities facing livestock production and marketing systems. Consider livestock ownership patterns and the roles different livestock species play for different segments of the target population. Approaches should utilize resources efficiently and sustainably, facilitating adoption of appropriate production technologies and management practices enabling livestock-keepers to organize to respond to market demand, strengthen their negotiating position, and reduce costs for traders and processors.

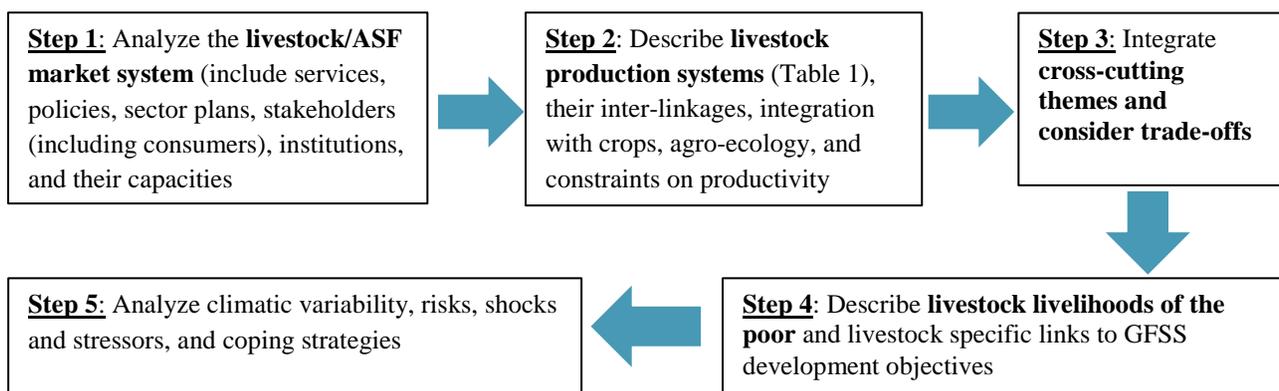
*To stimulate inclusive, sustainable agricultural-led economic growth*, designs should focus on increasing productivity through: identifying specific policy constraints and strengthening of the enabling policy environment; good management practices (including appropriate breed improvements and breeding programs); adoption of market-linked technologies; strengthening market systems<sup>11,12</sup> including input markets (e.g., animal feed and forage seed systems); access to finance, animal health, extension and advisory services; strengthening market information systems; research and innovation; and integration with cropping systems. Promote inclusivity and equity to ensure women, youth, and marginalized groups have equal access to inputs and resources and share the benefits of engagement in livestock systems.

*To strengthen resilience*, designs should consider strengthening animal health and advisory services and access to input and output markets. They should focus on diversifying and integrating livestock functions into broader livelihood approaches, understanding traditional risk management and coping strategies, and integrating them into social protection and emergency programs. Designs should also promote good natural resource governance and management (including sound policies) by users that assure critical mobility for pastoral groups, sustained rangeland productivity, animal feeds, and water accessibility and conserve advantageous genetic traits, germplasm, and biodiversity more broadly.

**To improve nutritional outcomes**, be deliberate about targeting the livestock-nutrition pathways and address trade-offs between sale of ASF and home consumption, follow agriculture/nutrition best practices, and promote ASF consumption in small, frequent amounts (especially milk and eggs). Consider food safety risk management (foodborne pathogens) and sanitary handling and processing of raw ASF. Reduce human exposure to zoonotic disease, including microbes linked to environmental enteric dysfunction, through appropriate housing and application of good production and hygiene practices.

### Process Map to Guide the Design of Livestock Investments

Multi-sectoral design teams should consider five key technical steps described below to ensure designs are poverty focused, have strong theories of change, and address the context specific objective(s). The steps present a linear flow; in reality, design processes benefit from iteration between steps.



### Livestock Production Systems

Design considerations for livestock investments vary by the production system. Table 1 provides illustrative details on production system-specific opportunities and approaches for designers to consider.

Table 1. Investment opportunities and approaches categorized by livestock production system

<b>Rangelands</b> (pastoral, agro-pastoral, sylvo-pastoral, and extensive grasslands)	
System characteristics	<ul style="list-style-type: none"> <li>• Arid and semi-arid zones, predominantly large and small ruminants</li> <li>• Rainfall dependent, producer focus on risk management</li> <li>• Economic and political exclusion resulting in significant inequalities</li> <li>• Limited infrastructure, weak service provision and regulatory environment</li> </ul>
Design opportunities and approaches	<ul style="list-style-type: none"> <li>• Pay attention to policy and inclusive governance including customary institutions and local administrations (and capacity strengthening)<sup>13</sup></li> <li>• Enhance land tenure, land-use management, and rangeland productivity</li> <li>• Improve mobility and movement corridors, improve access to water, and reduce conflict</li> <li>• Consider integrated landscape/watershed approaches (including sustainable extensification)</li> <li>• Focus on building resilience, asset protection, risk management, and drought cycle management, in particular; invest in strengthening local and regional market linkages, early warning/prevention, and market sensitive emergency assistance<sup>14</sup></li> <li>• Recognize environmental limits on sustainable intensification through supplemental feeding and integration with higher potential systems</li> <li>• Strengthen animal health systems<sup>15</sup> and increase market orientation and animal trade</li> <li>• Develop on and off farm livelihood diversification; promote and strengthen urban-rural linkages and resource flows<sup>16</sup></li> <li>• Foster important livestock-human nutrition linkages, notably milk consumption</li> </ul>

<b>Rural mixed crop-livestock</b>	
System characteristics	<ul style="list-style-type: none"> <li>• The predominant livestock system (diverse sub-systems, context) is critical</li> <li>• Ruminant meat and milk (and pork where culturally appropriate) plus micro-stock</li> <li>• Pro-poor role of backyard poultry whose eggs and meat are in high demand<sup>17</sup></li> <li>• Integrated, multi-functional roles of livestock (variable but often low productivity)</li> <li>• Limited access to inputs, services, and markets but systems are rapidly transforming</li> </ul>
Design opportunities and approaches	<ul style="list-style-type: none"> <li>• Support livestock production best practices and appropriate sustainable intensification (improve resource use efficiency and nutrient cycling, integrating crops and livestock)<sup>18</sup></li> <li>• Adopt conventional measures of herd/flock productivity that reflect commercial orientation and efficient use of natural resources. Consider genetic products and services where appropriate</li> <li>• Mediate sector transition for small holders through improved land tenure and support to producer organizations and input markets; strengthen linkages to urban market demand</li> <li>• Support animal health and disease control, extension services, and improved genetics</li> <li>• Support expansion of animal feed sector – dual purpose crops, safe use and processing of crop and agro-processing by-products, fodder production, and conservation</li> <li>• Develop incremental pathways to engage formal markets and meet quality standards</li> <li>• Improve food safety and zoonotic disease control (particularly in dairy sector)</li> <li>• Support producer groups, aggregation structures (e.g., milk collection centers), contract farming models to support smallholders, and inclusive sector development</li> <li>• Support expansion of small holder dairy sector<sup>19</sup> and inclusive fattening operations</li> </ul>
<b>Urban – Peri-urban</b>	
System characteristics	<ul style="list-style-type: none"> <li>• Poultry, dairy, small ruminants, pigs, micro-stock, fattening systems</li> <li>• Small scale, limited land, use of locally-available food processing by-products</li> </ul>
Design opportunities and approaches ( <i>see also rural mixed crop-livestock</i> )	<ul style="list-style-type: none"> <li>• Strengthen the important role of value chains and markets supplying perishable ASF products at household and local and regional levels</li> <li>• Address challenges of land availability and animal feed supply, land use zoning/plans, agri-byproduct use, feeding practices, and feedlots/finishing</li> <li>• Support producer groups and product aggregation to reduce transaction costs for traders and processors</li> <li>• Provide access to genetic products and animal breeding services</li> <li>• Support animal and veterinary public health, extension services, and improved genetics</li> <li>• Support employment potential and value addition, focusing on poverty, youth, and gender potential</li> <li>• Address environmental, sanitary, and veterinary public health issues</li> </ul>
<b>Intensive, commercial livestock production</b>	
System characteristics	<ul style="list-style-type: none"> <li>• Typically pig/poultry but also ruminant fattening and large scale feedlots</li> <li>• Production provides access to affordable ASF through productivity efficiencies</li> <li>• Significant public health and environmental externalities</li> <li>• Often under-pinned by contracts between producers/growers and processors (including externally sourced feed such as soybean, maize, and fodder)</li> <li>• Need for enabling policies and public infrastructure investment for roads, electricity grids, and water and sewerage infrastructure</li> </ul>
Design opportunities and approaches	<ul style="list-style-type: none"> <li>• Use output contracts to provide access to capital, feeds, and services</li> <li>• Cultivate private sector and public-private partnership potential</li> <li>• Increase sustainable production of crops for animal feeds, and expand the feed sector</li> <li>• Address environmental challenges: water, land use, and waste management</li> <li>• Increase productivity to reduce greenhouse gas emission intensity</li> <li>• Address anti-microbial resistance and emerging disease externalities</li> <li>• Foster inclusive, employment generation potential (including ASF processing)</li> <li>• Improve animal welfare (frame as a co-benefit when addressing increased productivity)</li> <li>• Improve productivity and food safety through good agriculture and processing practices</li> </ul>

## Activity design principles (the appropriateness and relative importance will depend upon context)

1. Conduct a **livestock sector analysis**;<sup>20</sup> disaggregate analysis by wealth group; incorporate market system dynamics, trade flows, policies,<sup>21</sup> and sector development plans;<sup>22</sup> and identify opportunities for engagement and employment of poor livestock keepers into expanding animal source food systems.
2. **Characterize agro-ecological contexts and livestock production systems** and relate these to market opportunities through sustainable natural resource management, good practices for **adaptive agriculture**,<sup>23,24</sup> and delivery of ecosystem services.
3. Identify direct consumption, indirect income, and women's empowerment pathways through which livestock and ASF contribute to **improving nutritional outcomes**.
4. Facilitate **development of local ASF markets** and increase availability, accessibility, and safety of ASF for nutritionally-challenged households (improve the food environment).
5. Understand the **role of livestock in strengthening household, community, and system resilience** through asset protection and risk management (animal health, improved mobility, and insurance), increased livestock productivity, and engagement of households with markets.
6. Address **ASF related food safety issues**, including linkages to hygiene, sanitation, and animal health.
7. Integrate gender, youth, and employment analysis within livestock system assessment.
8. Design an **integrated package of interventions** considering best livestock production practices, including breeding programs, animal health, and animal welfare,<sup>25</sup> and assessing the newest available technologies for their ability to fit within the local context. This should include **building the capacity of public and private agricultural advisory, animal health, ASF production input suppliers, and financial service providers**.
9. Apply **pro-poor market systems design approaches**,<sup>26,27,28</sup> engaging broad stakeholder participation in the design process. Facilitate **private sector investment**, access to **financial and business development services**, and **public-private partnerships**.<sup>29</sup>
10. Promote **sustainable productivity gains** through research, sustainable intensification, and a system-level extension approach. Include **optimized animal feeding**,<sup>30,31</sup> including support to forage production,<sup>32</sup> integrating crop-livestock systems, and developing fattening enterprises and services.
11. Support **producer, marketing, and processor organizations** to strengthen input and service provision and to facilitate market engagement.<sup>33</sup>

## Cross-cutting themes and livestock specific programming challenges

For all livestock production systems, the following few cross-cutting themes should be considered:

- **Gender equality and women's empowerment:** Women often have distinct and species specific roles in the care and feeding of livestock and in processing ASF. Ownership and control of livestock assets, products, and processes need to be assessed and can strengthen women's status within the household and community plus influence household consumption of ASF.
- **Youth and Employment:** Livestock production and downstream agri-food system value addition plus inter-connected off-farm services, feed, and crop markets have the potential to create substantial employment. Consider barriers to youth engagement; assess potential of vocational training, access to finance, and support for household-level, small- and medium-sized enterprises.
- **Natural resource-based conflict:** Use conflict assessment tools, identify livestock interactions with different types of conflict and their drivers, effectively manage natural resource-based trade-offs, and consider conflict mitigation interventions, embedding "do no harm" approaches into designs.

- **Governance and capacity strengthening of institutions:** Strengthen natural resource, land tenure, and value chain governance and livestock research systems. Weak producer groups and advisory and animal health services limit trade and use of new technologies and practices.
- **Policy environment:** Designs should align with national and regional policy frameworks and should consider supporting policy development to promote pro-poor, sustainable livestock development.

### Critical challenges to consider within designs

The following potential negative externalities must be considered in designs:

- **Foodborne disease risks:**<sup>34,35</sup> Risks include microbial infection and contamination of ASF, mycotoxin presence, and development of anti-microbial resistance. Adopt risk-based analysis, identify pathways to progressive formalization of markets, and engage key stakeholders when designing solutions.
- **Zoonoses and the potential emergence of novel human pathogens:** Adopt a One Health Approach,<sup>36</sup> strengthening and integrating human, environmental, and animal health, limiting risks of livestock disease and their potential amplification or spread to people.<sup>37</sup> Reduce environmental exposure to animal fecal materials<sup>38</sup> through proper animal manure management<sup>39,40</sup> and integrated WASH interventions.
- **Greenhouse gas (GHG) emissions:** Lower GHG emission intensity through improved productivity; reduce disease losses, improve feeds and feeding practices, and adopt production technologies, including management of manure and other animal wastes.<sup>41,42</sup>
- **Sustainable land and water use management:** Ensure good natural resource management via optimal use of soil, land, vegetation, water, and other natural resources.<sup>43</sup> Include effective land tenure,<sup>44</sup> landscape level land-use planning, and watershed and rangeland management approaches.
- **Climate variability and drought:** Increased climatic variability, rising temperatures, storms, and drought can limit available water as well as grazing and animal feed production. Consider supporting early warning<sup>45</sup> and long-range weather forecasting systems<sup>46</sup> as well as risk management (including insurance) and adaptation measures (including improved genetics and livestock and landscape management). Consider using drought cycle management,<sup>47</sup> commercial destocking,<sup>48</sup> and *Livestock Emergency Guidelines and Standards (LEGS)*<sup>49</sup> approaches.

### References

<sup>1</sup> In Sustainable Agricultural Development for food security and nutrition: what roles for livestock? (2016)

<http://www.fao.org/3/a-i5795e.pdf>

<sup>2</sup> Understanding and Integrating gender issues into livestock projects and programmes – a checklist for practitioners, FAO (2013) <http://www.fao.org/3/a-i3216e.pdf>

<sup>3</sup> Livestock Production: Recent trends, future prospects Thornton, 2010 CCAFS

<http://rstb.royalsocietypublishing.org/content/royptb/365/1554/2853.full.pdf>

<sup>4</sup> Enhancing Resilience to severe drought: What works?, Mercy Corps, 2017

[https://www.mercycorps.org/sites/default/files/Mercy%20Corps\\_PRIMEandDroughtResilience\\_2017\\_FullReport.pdf](https://www.mercycorps.org/sites/default/files/Mercy%20Corps_PRIMEandDroughtResilience_2017_FullReport.pdf)

<sup>5</sup> Ensuring escapes from poverty are sustained in Uganda, LEO, 2016

[https://www.microlinks.org/sites/default/files/resource/files/Transitory\\_escapes\\_and\\_Resilience\\_UgandaCaseStudy\\_final\\_edited\\_LS\\_002\\_....pdf](https://www.microlinks.org/sites/default/files/resource/files/Transitory_escapes_and_Resilience_UgandaCaseStudy_final_edited_LS_002_....pdf)

<sup>6</sup> Role of livestock in human nutrition and health for poverty reduction in developing countries (2007) T. Randolph et al J. Anim. Sci 85:2788-2800 doi: 10.2527/jas.2007-0467

<sup>7</sup> Linking Agriculture and Nutrition – understanding and applying primary pathways and principles, SPRING USAID

[https://www.spring-nutrition.org/sites/default/files/publications/briefs/spring\\_understandingpathways\\_brief\\_1\\_0.pdf](https://www.spring-nutrition.org/sites/default/files/publications/briefs/spring_understandingpathways_brief_1_0.pdf)

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- <sup>8</sup> Global Livestock Production Systems, FAO and ILRI, (2011) <http://www.fao.org/3/8d293990-ea82-5cc7-83c6-8c6f461627de/i3437e.pdf>
- <sup>9</sup> Multi-functionality of livestock in developing countries (F Swanepoel et al) In: The Role of Livestock in Developing Communities – Enhancing Multi-functionality (2010) (Ed. S Mayo and F. Swanepoel) <https://cgspace.cgiar.org/bitstream/handle/10568/3003/roleLivestockFarming.pdf?sequence=1>
- <sup>10</sup> Livestock Sector Development for Poverty Reduction - Livestock's Many Virtues FAO (2012) <http://www.fao.org/docrep/015/i2744e/i2744e00.pdf>
- <sup>11</sup> GFSS Technical Guidance for Market Systems and Value Chains <https://feedthefuture.gov/lp/guidance-and-tools-global-food-security-programs>
- <sup>12</sup> The Springfield Centre (2014) The Operational Guide for the Making Markets Work for the Poor (M4P) Approach, 2<sup>nd</sup> Edition, Springfield Centre (2014) funded by SDC & DFID <https://beamexchange.org>
- <sup>13</sup> Improving governance of pastoral lands – Governance of tenure technical guide No. 6 FAO (2016) <http://www.fao.org/3/a-i5771e.pdf>
- <sup>14</sup> Changes in the drylands of East Africa – implications for resilience strengthening efforts J Lind et al, IDS (2016) [https://assets.publishing.service.gov.uk/media/57a0895aed915d3cfd0001d2/61651\\_FINAL\\_Changes-in-eastern-Africa-drylands\\_Main-Report.pdf](https://assets.publishing.service.gov.uk/media/57a0895aed915d3cfd0001d2/61651_FINAL_Changes-in-eastern-Africa-drylands_Main-Report.pdf)
- <sup>15</sup> Community-based Animal Health Workers in the Horn of Africa - an evaluation for OFDA (2014) Leyland, T. et al Feinstein International Famine Center, Tufts University. [http://fic.tufts.edu/assets/TUFTS\\_1423\\_animal\\_health\\_workers\\_V3online.pdf](http://fic.tufts.edu/assets/TUFTS_1423_animal_health_workers_V3online.pdf)
- <sup>16</sup> GFSS Technical Guidance for Livelihood Diversification and Pathways <https://feedthefuture.gov/lp/guidance-and-tools-global-food-security-programs>
- <sup>17</sup> Decision support tools for family poultry development, FAO (2014) <http://www.fao.org/3/a-i3542e.pdf>
- <sup>18</sup> Application of TechFit to prioritise feed technologies in Sinana District of Bale Highlands, SE Ethiopia ILRI, Africa Rising [https://cgspace.cgiar.org/bitstream/handle/10568/24743/QFTechFit\\_sinana2012.pdf?sequence=1&isAllowed=y](https://cgspace.cgiar.org/bitstream/handle/10568/24743/QFTechFit_sinana2012.pdf?sequence=1&isAllowed=y)
- <sup>19</sup> Guide to Good Dairy Farming Practice, FAO <http://www.fao.org/docrep/014/ba0027e/ba0027e00.pdf>
- <sup>20</sup> Guidelines for the preparation of livestock sector reviews Animal Production and Health Guidelines FAO (2011) <http://www.fao.org/docrep/014/i2294e/i2294e00.pdf>
- <sup>21</sup> Livestock Sector Policies and Programmes in developing countries – a menu for practitioners PPLPI, FAO (2010) <http://www.fao.org/docrep/012/i1520e/i1520e00.pdf>
- <sup>22</sup> For example, Ethiopia's Livestock Development Master Plan (2015) , ILRI [https://cgspace.cgiar.org/bitstream/handle/10568/68037/lmp\\_roadmaps.pdf?sequence=1](https://cgspace.cgiar.org/bitstream/handle/10568/68037/lmp_roadmaps.pdf?sequence=1)
- <sup>23</sup> Climate-smart Agriculture Sourcebook- Module 8; Climate-Smart Livestock FAO (2013) <http://www.fao.org/3/a-i3325e.pdf>
- <sup>24</sup> GFSS Toolbox: A Guide to Food Security and Nutrition Development Resources [https://feedthefuture.gov/sites/default/files/resource/files/USG\\_Global\\_Food\\_Security\\_Toolbox.pdf](https://feedthefuture.gov/sites/default/files/resource/files/USG_Global_Food_Security_Toolbox.pdf)
- <sup>25</sup> Non-binding OIE standards and principles (welfare) Terrestrial Animal Health Code, OIE, Section 7, Animal Welfare, [http://www.oie.int/index.php?id=169&L=0&htmfile=titre\\_1.7.htm](http://www.oie.int/index.php?id=169&L=0&htmfile=titre_1.7.htm)
- <sup>26</sup> GFSS Technical Guidance for Market Systems and Value Chains <https://feedthefuture.gov/lp/guidance-and-tools-global-food-security-programs>
- <sup>27</sup> Microlinks value chain wiki: <https://www.microlinks.org/good-practice-center/value-chain-wiki>
- <sup>28</sup> The Springfield Centre (2014) The Operational Guide for the Making Markets Work for the Poor (M4P) Approach, 2<sup>nd</sup> Edition, Springfield Centre (2014) funded by SDC & DFID <https://beamexchange.org>
- <sup>29</sup> GFSS Technical Guidance for Private Sector Engagement <https://feedthefuture.gov/lp/guidance-and-tools-global-food-security-programs>
- <sup>30</sup> Evaluation of feed resources in mixed crop-livestock systems in the Sudano-Sahelian zone of Mali, 2014, ILRI Africa Rising <https://dx.doi.org/10.5455/ijlr.20150813090546>
- <sup>31</sup> Reducing food loss and waste 2013 Working Paper ,WRI [http://www.wri.org/sites/default/files/reducing\\_food\\_loss\\_and\\_waste.pdf](http://www.wri.org/sites/default/files/reducing_food_loss_and_waste.pdf)
- <sup>32</sup> Forage Market Development in the Bankass and Koro Cercles, (2016) USAID Livestock for Growth Project
- <sup>33</sup> Collective Action among African Smallholders. Trends and lessons for future development strategies. IFPRI West and Central Africa Office. 2014 <https://www.ifpri.org/publication/collective-action-among-african-smallholders-trends-and-lessons-future-development>
- <sup>34</sup> Guide to Good Farming Practices For Animal Production Food Safety, OIE-FAO [http://www.oie.int/fileadmin/Home/eng/Current\\_Scientific\\_Issues/docs/pdf/eng\\_guide.pdf](http://www.oie.int/fileadmin/Home/eng/Current_Scientific_Issues/docs/pdf/eng_guide.pdf)

- 
- <sup>35</sup> Food Safety in Developing Countries: An Overview A Learning Resource for DFID Livelihoods Advisers (2015) ILRI, D. Grace  
[https://assets.publishing.service.gov.uk/media/57a0897ee5274a27b20000dd/EoD\\_Learning\\_Resource\\_Food\\_Safety\\_Oct2015.pdf](https://assets.publishing.service.gov.uk/media/57a0897ee5274a27b20000dd/EoD_Learning_Resource_Food_Safety_Oct2015.pdf)
- <sup>36</sup> One Health: Food and Agriculture of the United Nations Strategic Action Plan  
<http://www.fao.org/docrep/014/al868e/al868e00.pdf>
- <sup>37</sup> Zoonosis emergence linked to agricultural intensification and environmental change B. Jones et al (2013)  
[www.pnas.org/cgi/doi/10.1073/pnas.1080591110](http://www.pnas.org/cgi/doi/10.1073/pnas.1080591110)
- <sup>38</sup> Preventing environmental enteric dysfunction through improved water, sanitation and hygiene: an opportunity for stunting reduction in developing countries Mbuya and Humphrey (2016), 12 (suppl. 1) pp106-120  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5019251/>
- <sup>39</sup> Manure helps feed the world – Integrated manure management Practice Brief, FAO <http://www.fao.org/3/a-bl516e.pdf>
- <sup>40</sup> The Manure Knowledge Kiosk <http://manurekiosk.info/>
- <sup>41</sup> Resilience and Economic growth in arid lands – accelerated growth in Kenya CCAFS Info Brief  
<https://ccafs.cgiar.org/publications/resilience-and-economic-growth-arid-lands-accelerated-growth-kenya-mitigation-co#.WRNIK-Hyupo> or  
<https://ccafs.cgiar.org/publications/related/low-emissions-opportunities-in-usaid-agriculture-and-food-security-initiatives>
- <sup>42</sup> Tackling Climate Change Through Livestock, FAO (2013) <http://www.fao.org/3/8d293990-ea82-5cc7-83c6-8c6f461627de/i3437e.pdf>
- <sup>43</sup> GFSS Technical Guidance for Increased Sustainable Agricultural Productivity <https://feedthefuture.gov/lp/guidance-and-tools-global-food-security-programs>
- <sup>44</sup> GFSS Technical Guidance for Land, Marine, and Resource Tenure <https://feedthefuture.gov/lp/guidance-and-tools-global-food-security-programs>
- <sup>45</sup> FEWS Net <https://www.fews.net/>
- <sup>46</sup> For example the W African organization Agrhymet: <http://www.agrhymet.ne/eng/>
- <sup>47</sup> Disaster Risk Reduction in Drought Cycle Management: A Learning Companion, Oxfam <http://policy-practice.oxfam.org.uk/publications/disaster-risk-reduction-in-drought-cycle-management-a-learning-companion-139094>
- <sup>48</sup> The impact of commercial destocking intervention in Moyale District, Ethiopia [www.alnap.org/pool/files/abebe-et-al-\(2008\)-impact-of-destocking.-ethiopia.pdf](http://www.alnap.org/pool/files/abebe-et-al-(2008)-impact-of-destocking.-ethiopia.pdf)
- <sup>49</sup> Livestock Emergency Guidelines and Standards (<http://www.livestock-emergency.net/>) LEGS Handbook (<http://www.livestock-emergency.net/resources/download-legs/>)