Ag Sector Council: Sanitary and Phytosanitary Priorities for Sub-Saharan Africa: Opportunities for Expanding Regional Trade and Improving Safety Systems

Webinar Audio Transcript

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Julie McCartee: All right, we are going to go ahead and get started. Good morning, afternoon, or evening everyone depending on where you are joining from in the world. Welcome to today's Ag Sector Council webinar titled SPS Priorities for Sub-Saharan Africa: Opportunities for Expanding Regional Trade and Improving Safety Systems. Trade, food safety, and the policy enabling environment are essential contributors to global food security, so we are very excited to be having this webinar discussion today.

We have three speakers from ACDI/VOCA and the LEO project who will be covering a lot of material, so I won't be too long here at the beginning. I'll just go over a few housekeeping issues. First I wanted to let you all know that this webinar is hosted by Agrilinks, Feed the Future's technical knowledge sharing platform. Agrilinks hosts regular seminars and special events to facilitate the exchange of knowledge among practitioners, and you can visit AgriLinks.org where you can contribute to online discussions, submit resources, and post to the blog.

Of course I should introduce myself. My name is Julie MacCartee and I'm a knowledge management specialist with the USAID Bureau for Food Security, and I will be your main facilitator today. To let you know, you should use the chat box on your screen, which many of you have already done to connect with other participants, share resources, and ask questions throughout the event. We'll be pulling your questions, noting them down, and asking as many as we can during the Q&A session, which will follow on the presentations after the speakers.

If you have any technical issues at any time, if you think you're having audio issues or something is seizing up in your webinar experience, please try starting a private chat with our AV tech who's up there in the host section of the attendees pod. You can hover over AV tech and click "start private chat." You can also start private chats with anyone else who's joining the webinar today, so we certainly encourage making those connections. Lastly, this event is being recorded and you will receive an email with the recording and other post-event resources shortly after this event, and that will include the new reports that will be referenced in this webinar.

So anything you aren't able to download today you will definitely get an email with those reports in a short period of time, we hope about a week, but we'll see how quickly we can get all of that out to you. All right, so with that we're going to dive into an introduction and get started with our content today. So I would like to go ahead and introduce Jeff Hill who is the director for policy with the USAID Bureau for Food Security, and he'll be giving a brief intro and introducing our speakers, so I'm going to go ahead and turn the microphone over to Jeff.

Jeff: Thank you, Julie. It's a real pleasure to be here and I really want to actually also thank everybody for joining us on this webinar. We have a lot of people from all

over the world and looking forward to a great discussion here. So we're going to dig into this issue of SPS.

What is SPS? Sanitary and photo-sanitary systems that are really playing a critical role in trade health and productivity issues in agriculture. For a long time the SPS issues have been out there, but unpacking this and really understanding what are the problems that exist around this, what are the opportunities for being able to fix this, why should we care about this has actually been an important set of questions that we have felt really need to be dealt with more effectively.

I wanted to actually just put in perspective how this fits within some of our thinking here within USAID and within Feed the Future. This is actually an important part of the FTF work is a focus on selected value chains, agricultural and food security value chains that are really important to both the economy and the nutrition and the health of people from across all of Africa and other parts of the world as well. Within that, clearly being able to get the benefits from the work on value chains is important for people to be able to trade the goods that they are producing, and it's important for people to be able to have healthy food that they are eating here.

So really looking at this issues of SPS and how important they are for the success of different value chains is an important concern, and those relate to both policy issues and interventions but also technical issues of being able to solve some of these. So we really look forward to learning what the studies that have been completed now and that have been sponsored by the Bureau for Food Security in East Africa, West Africa, and Southern Africa. In East Africa the studies have helped look at both the maize and livestock value chains across a number of countries, within countries but also across the different countries.

Southern Africa has looked at maize and soya and groundnut both again across a number of countries and looking at also the issues of the regional standards that have been established, and in West Africa again looking at the maize and livestock value chains. So this gives us a chance to look across these areas and see what is different, what is similar, what is working, what isn't working, what's the impact that we are seeing from the status of SPS efforts right now.

We're really delighted that in fact we've got three great presenters that are going to actually help us understand the findings of what has come from these three different studies in East, West, and Southern Africa. So we have with us today Daniel Plunkett: Plunkett who has been involved with regional economic integration and dealing with a number of these issues for a number of years. So we also have with us Sophie Walker who is currently the chief of party with the AflaSTOP program in East Africa, and we have with us also Andy Cook.

This being a unique mechanism the webinar here, we're having people join us from the speakers from around the world, so this is a great opportunity for us to be able to link people together from around the world and get this experience and share

that here. So we're looking forward to the presentations. We're looking forward to the discussion that's going to follow it as well. Let me just hand it over now to Sophie Walker. Sophie?

Sophie Walker: Thank you very much, Jeff for the introduction. I appreciate it and the introduction of my colleagues. As Jeff mentioned we're reporting on three different regions: East, West, and Southern Africa. We're covering the value chains of maize, livestock, and some areas, and we will talk in our presentation today in three main sections. The first section we'll look at the regional trade and how that is worked at the moment. The next section we'll look at the SPS constraints that are currently existing in the regions that we're looking at, and finally we're going to present some investments that we believe will help move the SPS agenda forward.

I first got involved in the SPS agenda back in 2004 in aflatoxin when Kenya had just had the outbreak with 125 people dying, and I got involved in policy meetings and in the private sector. When CDC put out a number of samples on the table and we all chose which ones would we destroy and which ones we would eat, we were horrified when the best quality looking maize had something in the region of 8,000 parts per billion in it. Maize is key trading commodity in all of the regions that we're talking about, and much of USAID's investment looks at increasing productivity in maize.

The maize moves from the rural areas into the urban markets. If the urban market happens to be across a border and is closer, it will move across the border, formally or informally. The maize moves wherever there is demand, so you have the deficit areas driving the movement of maize. Those are primarily the urban areas, and in

West Africa that mainly moves the maize down from upcountry down into the coastal areas. In East Africa we have Kenya that's sitting on a structural deficit of 300,000 to 500,000 tons. Uganda next door has a surplus.

Not only that, Uganda's production comes off their fields around about eight weeks earlier than the Kenyan, and so it moves in because there is no maize currently in the Kenyan market. Zambia is another surplus producing country alongside with South Africa, and they're seeding into their neighbors of Zimbabwe, sometimes into Malawi, sometimes into DRC. The maize moves fluidly around the region, relatively fluidly around the region based on the deficit markets.

At the same time we have maize seed. Maize seed in Eastern and Southern Africa is primarily managed by large commercial interests, though in Kenya that commercial interest is mainly the government. It produces high quality hybrid seeds, which is sold both into the local markets but also moves across the borders. The maize seed is adapted to the quality in the area that they're working on. Excuse me, I couldn't move the slide forward. Sorry everyone, I got distracted because I couldn't move my slide forward.

The maize seed is moving across borders also into the neighboring countries because the climatic conditions are similar. West Africa has a much poorer seed development, and their seed markets are not nearly so well developed, and Andy is now going to cover you in the next slide about some of the issues there.

Andy Cook: I'm going to talk about ruminants in West Africa and East Africa, which were covered in the studies that we've done. In addition to domestic value chain, West Africa has a longstanding and dynamic trade in cattle, sheep, and less so goats. From the arid and semi-arid Swahilian countries to the humid and sub-humid coastal countries. West African herd owners track animals to collection markets with traders, then mostly trucking them within the country to an export market and then to the coastal country destination market. Slaughter takes place near the point of consumption.

Almost no red meat crosses land borders. In practice, little veterinary intervention along the value chain makes much difference to animal health. For decades slaughter in the Sahel followed by trucking red meat to the West African coast has been the Holy Grail, but it has never worked sustainably. Small quantities of meat are irregularly flown from Swahilian capitals to the West African coast and to Central Africa. Prospective Middle Eastern buyers sometimes visit Swahilian countries, but abattoir conditions have not been favorable, and so this value chain has not prospered.

There is little ruminant trade between countries within East Africa, though considerable trade within each country to urban centers takes place. In contrast to West Africa, animals move mostly on the hoof to their final destinations. Sudan, Ethiopia, and Somalia export live animals to the Middle East by sea, and meat cuts and processed meats are produced and marketed in Ethiopia and particularly Kenya. I'm now going to hand over to Daniel Plunkett: who will lead us into SPS systems and regional trade constraints.

Daniel Plunkett: Thank you, Andy. Hello, everybody. Just to give you an idea about trade in groundnuts, this was covered in the Southern Africa report, though the bulk of trade in groundnuts is informal in nature and generally goes unrecorded in official statistics, although we can see official data showing South Africa exporting about $4.5 million in groundnuts and peanut butter. Just other sodic countries, Mozambique is at about $1.5 million per year. These are in the official statistics, and we have estimates that Malawi typically exports 50,000 to 100,000 tons of ground nuts per year just to the countries of the north, the RDC, Tanzania, Burundi and Kenya.

Zambia shows up as a steady exporter of peanut butter within the region. Aflatoxin contamination is a major issue for groundnuts with recent testing showing that nearly half the crop in Malawi, Mozambique, and Zambia tests above the EU limit of two parts per billion, and when the ministries of health have done testing, the level of aflatoxin in peanut butter on store shelves has found to be many times the

permitted threshold. Perhaps as a consequence of this, nearly half the children in Malawi, Mozambique, and Zambia in recent surveys are shown to suffer from stunting.

Generally it is South African importers in the formal sector who are the ones who require aflatoxin testing. Many of them now test for aflatoxin in the countries of origin so that when the groundnuts arrive in South Africa they know they are safe. Two other value chains specific to one region, poultry in West Africa is a sector that can be divided into extensive backyard chicken operations and more modern semi-intensive operations in competition with imports off the world market.

Within West Africa there is cross-border trade in live birds and vigorous trade in baby chicks, but there's little or no trade in poultry meat. These backyard poultry known as “poulet” beef “eclet” in West Africa are generally not being fed much maize. So the issue of aflatoxin contaminated feed for the chickens is not as pronounced in West Africa as perhaps elsewhere. Interestingly the backyard poultry is preferred by consumers as it's considered to have greater flavor.

Certainly a major SPS issue in recent years has been the recurrence of avian influenza in West Africa in 2015, and the SPS control systems for avian influenza are generally pretty effective despite the poorest borders, the borders where poultry can be easily passed by, whether at the formal border post or elsewhere. The lack of veterinary services for backyard poultry production is not always very effective, and as for soy products in Southern Africa, which are report covers, we did not identify any real trade related SPS issues. It's interesting to note that South Africa produces GMO derived soybeans, which can limit trade with the other Southern African countries such as Malawi, Mozambique, and Zambia, which are less accepting of GMO products.

Moving to our second section of the presentation this morning, SPS systems and regional trade constraints, we can say that SPS systems are really the domain of the national governments, which have the responsibility and the mandate to set their own SPS standards and regulatory structures. Our research has found that the standards are often in place for these food products, but there is insufficient enforcement and regulatory oversight. The problem of overlapping competencies across the National Ministry of Agriculture, the Ministry of Health, and the National Bureau of Standards when it comes to laboratory capabilities is a real problem. Coordination really could be improved. Outside of South Africa, few labs are accredited.

A regional approach to the regional economic communities has been attempted and could be reinforced, but to date it has not been all that effective. The Regional Economic Communities, the RECs, generally have the mandate to develop common regional SPS standards but have a lack of resources and a lack of executive authority, which means that mostly all the RECs can do is coordinate national SPS policies. One example of successful collaboration at the regional

level is through COMESA Ensadic, and they have developed seed harmonization regimes, which we have found that can facilitate trade.

I think above all our main message is that the SPS discussions at both the national and regional level would be more effective if the private sector were involved, and now I'm going to pass along back to my colleague Sophie.

Sophie Walker: Thank you very much, Daniel. As I mentioned at the beginning, you can't see aflatoxin, you can't taste aflatoxin, and you can't smell aflatoxin. The picture that we have there of maize is what people traditionally think is an aflatoxin contaminated maize plant, but it's not. It's probably looking at the green color that I can't actually tell. Aflatoxin is actually 1,000 times more potent and more carcinogenic than fumonisin. It is the key mycotoxin currently in Africa to be concerned about, and it's spread from Ethiopia all the way down into Mozambique. It's spread across West Africa.

It's particularly prevalent in the lower lying tropical areas that then have moisture problems at some of the times in the season. Most consumers aren't aware that there is aflatoxin in their country, and yet studies looking at research paper proves that many of these countries are existing with problems of 20 to 30 percent of their commodities actually contaminated. That's both maize and groundnuts. Some countries have no contamination, very little contamination in their maize such as Zambia, but at the same time it has high contamination of its groundnuts. There is limited testing, both testing capacity and the capacity for the labs to have the budget.

The government loves to have a budget to actually carry out the test, but also requirements of testing. Because although in some countries there might be a regulation on the books such as ten parts per billion in Kenya, it's not tested because if 20 or 30 percent of your maize is contaminated, that's 300,000 or 400,000 tons. You can't afford to destroy that amount of maize without creating a food insecurity problem. So there's been a lack of policy enforcement, although there has been a movement towards regional standards for aflatoxin particularly in East Africa, less so in South Africa and less so in West Africa.

Moving on to maize lethal necrosis, this is an SPS issue that suddenly leapt into our view in 2011 in Kenya. It has no implication to health like aflatoxin does, but has significant implications to the maize plant health. It can cause up to 100 percent failure depending when the maize plant is exposed to these two viruses that act together. It's spread both through insects from field to field and through seed, and so it can spread rapidly and did into the neighboring countries into Uganda and Rwanda probably through seed sales. That's not entirely unproven.

We see in more Southern Africa the countries neighboring these contaminated areas, Tanzania is the latest country to be contaminated with the disease, now setting up surveillance systems. So both Zambia and Malawi have limited

surveillance, but they also have limited budget moving the surveillance forward. We have seen particularly in Kenya and Uganda and Rwanda that the national SPS bodies coming together to respond to MLN and to put in action plans, but as I mentioned South Africa has only a small awareness of it, and West Africa has almost no awareness of this issue, and that leads Andy in to talk again about the maize seed systems in West Africa.

Andy Cook: Thanks, Sophie. We've heard that West Africa lags behind the rest of the continent in its awareness of MLN. More generally, West Africa is less concerned by quality of maize because of a history of serial shortages. One person we talked to while doing fieldwork for our study said simply "Empty bellies don't worry about quality." West Africa's low maize productivity diminishes SPS concerns in the face of food security problems, and it also drives up poultry prices and constrains the development of that sector.

Contrast this situation with, say, Kenya or Zambia where seed markets are much more efficient. Until maize productivity increases and scarcity is reduced, the focus is more on quantity than quality. SPS issues are not the most important. Low maize productivity in West Africa is caused by inefficient national and regional seed markets. The regional maize seed market is composed of national markets that are segmented and protected. Here are the constraints.

Firstly, at the national level, agricultural research organizations may produce good breeder seed, but public sector bureaucracies are unable to get that seed to commercial multipliers and thus to the farmer. The farmer's access to improved seed from outside the country is also limited. It's limited by a lack of regional certification of seed so that buyers outside the country of origin can have confidence that the seed is of the advertised quality, and it's limited by a bias against improved seed from multinationals, leading to barriers to trade.

I'm now going to talk about the SPS constraints to livestock, and what I say is true for West Africa and mostly true for East Africa after some triangulation. I'd like to start by making a statement to which I'll come back in a minute. Informality dominates and constrains the livestock value chains. Herd owners, extensive poultry farmers, traders, and butchers resist incurring extra costs to improve health because a lack of traceability of animals means that improved health is not rewarded. This is fundamental.

Other constraints are, and they are numerous, seasonal weight losses, which increase morbidity because seed markets do not compensate for the dry season shortage of pasture. Secondly, government vaccination campaigns against infectious diseases may be insufficient, not attaining the roughly 80 percent coverage needed for herd health. Veterinary medicines may be expensive because of delays in official approval of these medicines, choking off competition, or they may be imported illegally and so possibly be adulterated.

Then, large areas of range have low ruminant densities and thus thin veterinary coverage, and civil insecurity further reduces that coverage. Laboratories for testing for disease are often poorly managed, deficient in equipment or consumables, or poorly linked to front line service agents. Veterinary agents receive informal payments. You might call them bribes, though these are often at least partially to cover costs that the state does not pay, for example, motorbike expenses, and they are small in the overall scheme of things.

More important is the lack of sanitary inspection that actually takes place due to a lack of equipment, a lack of motivation on the part of the veterinary agents, often due to low expectations, and a lack of means to deal with animals identified as diseased. At borders, poorly equipped veterinary agents often lack quarantine pens and procedures to deal with diseased animals. In East Africa, most trade ruminants cross borders without bothering to pass by veterinary posts. They're doing so on the hoof. So border disease checks are ineffective.

In West Africa, most trade ruminants cross in trucks that pass by border posts, but in the background large numbers of transhumant animals cross back and forth across border segments, which are uncontrolled by veterinary agents. And then when we get to the bottom of the value chain downstream, abattoirs are dilapidated, ill equipped, and unhygienic because of inefficient public sector management and the influence of traditional butchers who cater to a mass market and have no formal training in veterinary science.

Let us come to the lack of traceability of the animals. Supermarkets in the destination market have no way of knowing which traders have delivered the cattle slaughtered to provide the beef they sell, never mind which mix of herders actually raised those animals. So the premium for quality that middleclass consumers will pay cannot be directed to herd owners who raise healthy animals. The animals are indistinguishable.

If those animals could be distinguished, there would be a value chain constituency with an interest in raising sanitary standards in order to capture some of the consumer surplus that today remains entirely downstream in the value chain. So there is little market segmentation along the value chain, dividing the mass market from premium meat. There is almost no branding, and there are no reputations for quality to protect. The sector is trapped in a low-level equilibrium. Now I'd like to make a few remarks about poultry, which we also covered in West Africa. Most farmed poultry is produced near urban consumers on a large scale.

Large producers have a self-interest in preventing infectious diseases, but aflatoxins from maize threaten the profitability of these farms because birds die or at best grow slowly. In contrast, the backyard poultry presents more of a trade problem. These birds receive few veterinary inputs, and their production involves high morbidity and mortality, and at least in West Africa they participate in longer

distance, cross-border value chains where border crossing failures in terms of tracking the veterinary status of these birds are similar to those of ruminants.

Daniel Plunkett: has mentioned avian flu, which is recurrent. In West Africa there were outbreaks in 2006 and again in 2015. Despite bans linked to the declaration of avian influenza, informal traders continue to import some birds across porous borders. This is difficult to stop because avian influenza has little impact on human health. I'm now going to hand over again to Daniel Plunkett: who will start outlining our recommended investment opportunities.

Daniel Plunkett: Great. Thank you, Andy. A lot of interesting ideas. We're moving into the third section of our presentation before the question and answer period, and we certainly invite you to submit questions, which you can do on the right hand part of your screen. Part of our assignment in all three reports was to identify public and private sector investment opportunities. So not only U.S. donor bodies such as USAID or USDA or MCC but also other bilateral or multilateral donors, and also the private sectors in these value chains in each country. And there are a lot of counties involved. Within each country, the multi-stakeholder dialogues that take place or that need to take place involve a lot of people and involve a lot of coordination.

So one of our recommendations is an investment in coordination to bring people from the different agencies and the different interest areas together at the national level, not just in the national capitals but also in the local capitals within each country, and then to bring them together at the regional level a lot of coordination involved. One of our main conclusions is that there is a great need to encourage greater private sector participation and investment in the SPS systems.

We came up with recommendations for all three regions in the reports, which should be available pretty soon on the same website that you're logged into now, and there are many recommendations at both the regional level and the national level that could be taken up by the public or private sector. One of the intriguing ideas was to develop early warning systems or systems for risk monitoring for mycotoxins such as aflatoxin, maize lethal necrosis (MLN), and livestock diseases, and these systems or a lot of other examples throughout the world could bring together technology, analysis based on better data.

With outreach to farmers, processors and traders can let them know what to look for. How do you tell when MLN is in your field? How do you identify aflatoxin on groundnuts? Who do you take it to, to get your maize tested for aflatoxin? This gets at the need to raise awareness among people, actors throughout each value chain, about these specific SPS issues. In our reports we try to offer market-oriented solutions to arrive at a safer food supply. Raising awareness means not just producers and farmers groups and millers and animal feed manufacturers but also looking to involve consumers, mothers groups interested or concerned about aflatoxin contamination, healthcare workers.

An example, Mozambique hires ambulant doctors that go around in rural regions from house to house asking about nutrition, household health, women's and children's health. Agricultural extension workers are another avenue. Most ministries of health are able to access public service announcements through local community radio and national TV stations. There's now social media. Our report suggests a number of ways to raise awareness. I'm going to pass along now to Sophie to talk about more specific investments related to mycotoxin.

Sophie Walker: Thank you very much, Daniel Plunkett: Looking first at aflatoxin, I have to say it's a rather exciting time to be involved in it. 12 years ago there was very little available for the African governments or the South American governments, the Asian governments to actually look at to see how they could address this problem that was affecting their populations.

However with support and research and development, we now have a number of mitigations that will address it. Funding supported by USAID and the Gates Foundation will treat the soil. It produces an 80 to 95 percent reduction of actual occurrence of aflatoxin there. Hermetic storage will also reduce the increase of aflatoxin during storage 95 percent, and these are now being commercialized into the market.

The IITA is moving Aci-Safe. It's registered in Kenya, Nigeria, and is in the process of registering in Senegal, Gambia, and they have plans to move that out over another nine countries in West, East, and Southern Africa over the next couple of years. The movement of hermetic storage is gaining speed particularly through the ag results program in Kenya where we're now having hundreds of thousands of sales of hermetic storage, not to deal with aflatoxin but to deal with infestation, insects. But at the same time it's also mitigating aflatoxin increases in storage. So it's an exciting time that there are now solutions, but as Daniel Plunkett: said we need to now raise awareness.

Now there is a solution. Now countries can adjust the aflatoxin aspect. We need to raise the awareness to everyone, to the consumers at the political level and the producers on how to address this issue, and that requires local champions. While the USAIDs have appointed regional SPS advisor in East Africa helps coordinate and link people together, it doesn't become personal until you start talking about your children are being poisoned, and to make it personal you want local people in the media, the politicians talking about this as part of their agenda to actually move this into the public consciousness.

As it moves into public consciousness then it allows support of the private sector incentives, very similar to the program. For instance, you can create a private sector reward for all the volume of aflatoxin regulated levels peanut butter in Malawi, and as you reward the private sector to change their systems to improve the quality of their peanut butters, simultaneously you can now start bringing in the regulatory side so that the government can now start imposing these safe

regulations so that the foodstuff that is being fed to our children and to our families is now safe. This all feeds into each other. It becomes a self-supporting system. As the trade and the processors want clean food, so therefore the producers of the food have to deliver the clean food, otherwise it won't sell into the market.

Looking at maize lethal necrosis, there has been great movement in East Africa to put together national action plans and those national action plans are active and being moved forward. There is the ability now to bring West Africa and Southern Africa into East Africa to see what's been done and what can be done, not just for maize lethal necrosis. Maize lethal necrosis is today's problem. In five years' time or ten years' time there will be a new lethal plant disease that needs to be addressed, and if we've already worked out how to have national action plans, who should be involved, who needs funding, these countries will be more able to rapidly respond to potential outbreaks in the future.

We also need to bring in the private sector particularly in Southern Africa and potentially in West Africa to develop. They need to understand why MLN might be important to them because as some of the Kenyan seed companies say, they've closed down their seed production because they can't afford the loss when MLN was found on their land. So that surveillance and the private sector support to surveillance is absolutely important as we move the investments forward. I'm now going to hand over to Andy who's going to cover the West African investments in maize.

Andy Cook: Thanks, Sophie. I made the point earlier that West Africa has particular maize problems and this particular slide is to emphasize the need to help West Africa catch up on its maize productivity in order that it can begin to really focus as much as Eastern and Southern Africa on the SPS issues which are the core theme today. So there's a need to increase maize productivity in West Africa, a need to develop commercial seed markets.

Nationally in each country by licensing of multiplication and distribution rights of public domain seeds to private firms and regionally, harmonizing national seed policies, and through regional certification of seed produced nationally so that seed traders and ultimately farmers in a given West African country can have some confidence that imported seed, seed imported from another West African country will be what it says, will do what it says on the bag. And with improved maize seed and other inputs, the farmer can increase his production and focus his attention on SPS issues and quality. Let me now talk about livestock sector investment recommendations from our reports.

Upstream on the value chain, livestock production systems need improvements in ruminant and poultry health by reestablishing or in some cases establishing for the first time para vet systems under the supervision of licensed veterinarians, public or private. Para veterinarians have basic training in veterinary medicine, a stock of

the most important veterinary drugs, a link to more qualified veterinarians, which allows them to get advice and to have the means of replenishing their drug stocks.

Downstream facilitation of the creation of abattoirs targeting high-end markets is another recommendation. The components would be private management of slaughter operations and the code chain, and strict hygiene rules. Supports could take the form of cost share grants to upgrade facilities and obtain quality standards.

This would allow the export of hygienic meat as well as the production of hygienic meat for domestic middle class consumers, particularly if the abattoir were linked – and this is important – to a shorter regional red meat value chain linking the producer and the abattoir with direct deals between rural and urban producers and supermarkets. Imagine producers clustered around helium urban centers who already invest in improved cross-bred animals and provide good veterinary care and supplementary feed to their animals, and these are the people who already exist and they will make great candidates for a source of quality red meat. They would be linked through perhaps joint ventures with coastal and helium participants, ensuring that there is a constituency to solve problems that may arise in both the producing country and the consuming country.

It would be preferable to supplement the direct deals with traceability, which I've talked about before, so that there would be ways to follow the animal along the value chain from farm to fork, thus allowing feedback back up the value chain on hygiene lapses. There should also if possible be a development of irrigated fodder crops and a more integrated regional feed market to compensate for seasonal deficits of natural pasture, and investment in exotic indigenous cross-breeds. These options can be combined into three models.

Firstly, the first model is the transport of animals to coastal west Africa for slaughter as currently happens, but with better abattoirs in coastal cities. This is linked to what the West Africa trade hub is developing at the moment. A second model is slaughter in the Sahel for road and possibly air shipments to coastal West African cities. The third model is a development of that, slaughter in the Sahel for air shipment to the Middle East, etc. So that I think is largely the end of our presentation. I'm going to leave you with a slide, which I don't propose to discuss that summarizes some of the major points that we have been making. Thank you very much.

Julie McCartee: Wonderful. Thank you, Sophie, Andy, and Daniel Plunkett: Well thank you all who are participating in the chat box. We've had a lot of really interesting questions, comments, and shared experiences come in. *[End of Audio]*