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Provision of technical assistance for enhancing climate-resilience and economic sustainability of livestock farming in a rural community in Mongolia

Deliverable 4.1:
Feasibility analysis of establishing a meat-processing center in Bayantumen soum

Submitted to: The United Nations

UN environment programme

CTCN
UN Climate Technology Centre & Network

alinea

About the project

The project will strengthen climate-resilient livestock farming while deriving the economic sustainability for vulnerable herding communities in Bayantümen soum and contributing to the Nationally Determined Contributions (NDC) and national climate change adaptation and mitigation priorities for Mongolia. Alinea implements this project with the Alberta Biodiversity Monitoring Institute (ABMI) and the R&D Center for Climate Change and Sustainable Development (CCSD) in Mongolia (www.climatechange.mn).

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Acronyms and abbreviations

AMBI	Alberta Biodiversity Monitoring Institute
CCP	Critical Control Points
CCSD	Center for Climate Change and Sustainable Development
GHP	Good Hygiene Practices
GMP	Good Manufacturing Practices
HACCP	Hazard Analysis Critical Control Point
MMA	Mongolian Meat Association
NDC	Nationally Determined Contributions
PPT	Power Point Presentation

1 Purpose of the analysis

The Meat Processing Feasibility Study Mission was carried out between October 1 and 15, 2022 by the Project Manager (Debra Rasmussen), the National Agriculture Engineer (Mr. Byambadorj) and meat processing expert Dr. Wolfgang Lutz, a skilled butcher and a veterinarian. Dr. Lutz was formerly Director of the German Butcher Association where he and his team provided consulting to German butchers in view of business models, food and hygiene regulations, slaughtering equipment and troubleshooting. The Mission included meetings in Ulaanbaatar with stakeholders and site visits in Ulaanbaatar, Khentii aimag and Bayantumen soum in Dornod aimag.

The Objectives of the mission were to:

- Assess the feasibility of a small-scale community-based meat plant in Bayantumen soum
  - considering two potential types of location (soum center and remote)
  - using a criteria-based "checklist" approach that can be used by any soum as a decision-support-system.
- Gather information on different meat-business models and discuss problems and opportunities with stakeholders during the site visits.
- Conduct site visits to potential site(s) for establishing a community-based slaughterhouse and meat facility in Bayantumen soum.
- Meet with aimag officials, soum officials, bagh representatives and stakeholders to discuss meat processing options within the local context.
- Present findings, conclusions and recommendations with stakeholders and officials at a Stakeholder meeting/training event.

2 Analysis of present situation

The precise analysis of the present situation is a prerequisite for the long-term success of a small, community-scale slaughtering and meatpacking and processing centre in Bayantumen soum. To make the right decisions, local conditions and opportunities, different sites, geographical, environmental, and socio-economic conditions of the target area must be considered.

To find out the best conceptual design for the community-scale slaughterhouse, investigations were made regarding competition in the market, the supply chain, technology used, marketing concepts and expectations for the future. In addition, important criteria such as market situation, customer demands, infrastructure issues like land, power, water, feed, roads, electricity, and human resources were considered to find the most effective business-model and the best associated technical options available.

2.1 Consultations with shareholders and site visits

To get an impression of the local market situation, various companies were visited, and their strengths and weaknesses analysed. Furthermore, many consultations and discussions were held with organisations, authorities and ministries. The aim was to present the project on the one hand and to find out how the project as a whole and its implementation was assessed on the other.

Site visit to meat processing companies

- Emeelt Market (Agro negtgel LLC), Ulaanbaatar: Director Mr. Nyamsuren
- Meat "Lavai" market (whole and retail sales) Ulaanbaatar: B. Dumee Director
- Rosewood's Butcher Fritz and Emart Butcher shop, Ulaanbaatar
- Jargalant meat processing factory (Erdenet city), UB: J. Ankhbayar (Director)
- Dornod aimag small butchery and local meat markets, Choibalsan
- Nomin supermarket and other, Choibalsan
- Khaan Foods LLC, Choibalsan, Mr. B. Bat-Erdene, Executive Director
- Dornod Meat LLC, branch of Dornod Makh Market, Mr. T. Battur, Factory director

Meetings with representatives of meat companies and consultants

- Meat Processing factory independent consultant Mrs. Enkhtuya, Ulaanbaatar
- Bayandelger foods LLC: Mrs. Gantuya (Consultant), Ulaanbaatar

Meetings with representatives of organisations

- Mongolian meat association (MMA), Ulaanbaatar: Mr. Battogtokh (Manager of MMA)
- WB livestock commercialization project, Ulaanbaatar: Mr. Vanchin (Project Manager)
- Meetings with Representatives of authorities
- Veterinary Medicine Department: Mrs. Ch. Ayushmaa, Head of Department, Choibalsan
- Agriculture and Animal Husbandry Division: Mr. D. Narankhuu, Head of Division, Choibalsan
- Environment and Tourism Department: Mr. A. Gantulga, Head of Department, Choibalsan

- Bayantumen soum officials: E. Narangarav, Governor; D. Tumentsetseg, Specialist of Agriculture Division; M. Battugs, Specialist of Agriculture (cropland); Kh. Enkhkherlen, Environmental Inspector; Gantulga, Bagh Governor

Stakeholder Meeting (Minutes of meeting presented separately in Deliverable 3.3)

- Meeting with Stakeholders, Presentation of project and discussion, Choibalsan

The visits to meat-plants, slaughterhouses and meat-processors, and the consultations and discussions with herders, directors of slaughterhouses, meat-plants, meat processing companies and retailer gave a deep insight into the existing market structures, their business models, and the opportunities for the future. The opportunities and risks were discussed and informed the Conceptual Design of Community-Based Slaughterhouse. The visits to meat-plants, slaughterhouses and retail-shops, as well as the discussions with stakeholders, took place in an open atmosphere and the willingness to cooperate. Technical details, general market conditions, prices, the competition in the meat industry, chances and risks were discussed regarding business models and meat-plant.

2.2 Competitive environment

In general, there are three different business-models recognizable in the Mongolian meat-market. This is important to understand in view of establishing a new community-scaled small slaughterhouse in Bayantumen soum.

2.2.1 Traditional slaughtering

Traditional slaughtering is the most important type of slaughtering and marketing of animals. It is carried out by herders themselves near their pastures (pasture-slaughtering), without any technical equipment. Alternatively, the live animals (mainly sheep and goat) are delivered to small markets. Customers have the possibility to buy a certain animal, and it got slaughtered by butchers for a fee and the customers take the meat at home. Middlemen also buy the animals and deliver the meat to wholesales, meat-companies, markets, and customers. The slaughtering is done in a traditional way with very limited equipment and is a completely manual process. Usually, there is no fresh water, no hygiene-cloth, and no meat-inspection (post- and ante-mortem). Disposal of waste is unclear.

The traditional slaughter approach does not fit the Mongolian requirements, laid down at the *Technical Regulations for Production and Trade of Meat and Meat Products*. Those regulations correspond to international standards, like Codex Alimentarius or European Hygiene Regulations, and are necessary for international trade and export. According to the regulations, abattoirs must have many rooms or in some cases, areas, for different stages of processing such as stunning, bleeding, dehiding, evisceration, suspect carcasses, offal and so on but this is not achievable in the situation and the needs of small slaughter or processing establishments with just local or domestic distribution. Therefore, in Europe, the regulations allow derogations, as long as the aim of the regulations, namely the perfect and unobjectionable hygienic quality of the meat, is achieved. This means, in practice, all activities can be carried out in a single room, if the activities take place at different times or in different places within that room (“one-room-slaughterhouse”).

Interview informants said that all slaughterhouses must follow the Mongolian *Technical Regulations for Production and Trade of Meat and Meat Products* as of 2025. To keep small slaughterhouses with traditional slaughtering or pasture-slaughtering by herders in business, customized regulation must be established, similar to what has been done in Europe.

Despite the simple procedure of the traditional slaughtering, when meat is slaughtered and consumed locally, the risk for human health seems to be limited, because of minor contamination of the meat, direct distribution, short storage, simple handling and generations of experience. In addition, customers take care about hygiene transportation to their homes and meat is heated adequately.

Issues with traditional slaughter become more severe when livestock and meat is marketed outside of the local area. There are long transportations with risks of spreading contagious animal diseases and meat which is delivered to wholesalers, meat-processors, butchers, restaurants, or consumers is often in poor hygiene condition because there is no appropriate transportation and a lack of cooling. Therefore, an increase in technology, standard of hygiene, management, transportation and cooling is necessary, especially because consumers have an increasing understanding and expectation about hygiene and quality.

Another problem in the traditional system is that the prices and incomes of farmers are limited, and that middleman prevent transparency in pricing along the supply chain.

Pictures show decisive steps in traditional slaughtering

2.2.2 Industrialized slaughterhouses

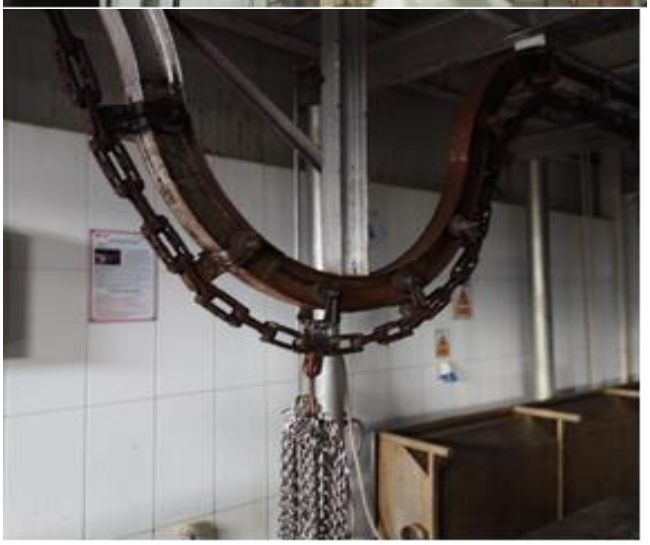
The second business model are industrialized slaughterhouses. They are owned mostly by investors, have professional management and good financial resources. They use modern equipment like electrical stunning, elevators, tubular tracks, lifting platforms and cooling and freezing rooms. Their capacity is up to 1500 sheep and / or 500 cattle per day, but many of them are suffering low utilization. Some have their own feedlots to increase weight and fatting the animals. Equipment is mostly from China and in various condition. They also debone and deliver the meat to wholesales, meat-processors, butchers or for export.

It should be mentioned that export markets are very sensitive and risky. Companies exporting meat from Mongolia are dependent on importers and must compete on both price and quality with other exporters from all over the world. At the same time, animal disease outbreaks in Mongolia can lead to an instant import-ban.

It is to be assumed that those slaughterhouses largely fit the Mongolian requirements, laid down at the *Technical Regulations for Production and Trade of Meat and Meat Products*. Meat-inspection (ante- and pot-mortem) is carried out. Animal welfare could not be finally clarified. Sheep are slaughtered usually without stunning (halal-style).





2.2.3 Integrated meat plants and meat-processors

Integrated meat plants are vertically integrated, which means they try to keep the entire value chain in their hand. They run crop production, grassland, breeding, feedlots, slaughterhouses, cutting facilities, and meat-processing. For slaughtering, they use electrical stunning, elevators, tubular tracks, lifting platforms, cooling and freezing rooms. For producing meat-products like dumplings, sausages or ham, they use appropriate machinery. They deliver the meat to butchers, their own shops, domestic super- or hypermarkets as fresh or frozen, unpacked or prepacked. They are also exporting. They have a good management and good systems of training their staff.

Because of their feedlots, they get animals in good condition to produce marbled meat and can slaughter during the whole year.

Some companies limit their business to manufacturing meat-products like dumplings, sausages or ham. They buy the meat from different suppliers.

3 Conceptual design of community-based slaughterhouse

As already mentioned, the visits to meat-plants, slaughterhouses and meat-processors, and the consultations and discussions with herders, directors of slaughterhouses, meat-plants, meat processing companies and retailer gave a deep insight into the existing market structures, their business models, and the opportunities for the future.

The traditional slaughtering is carried out without any meat-inspection (post- and ante-mortem) and simple equipment. Despite the simple procedure, the risk for human health may be limited. But the lack of fresh water, hygiene-cloth, unclear disposal of waste and the absence of ante- and postmortem veterinary inspections could mean that this type of traditional slaughtering could no longer be accepted by consumers in the future.

Further unsolved problems are low prices, low income for the farmers, the role of middleman, the lack of transparency and tracing-back, long transportation distances and times with risks of spreading contagious animal diseases. The seasonal slaughtering means that the utilization of the slaughterhouses is low, making economic operation very difficult.

So, the previous traditional slaughter by herders does not appear to be a future-oriented model to ensure the herders' livelihood and income. As described in many publications and reports, incomes and distribution options are limited. Due to the change in climatic conditions and social changes it is to be feared that the herders' economic situation could get even worse in the future.

Based on this information, the design of a community-based slaughterhouse was developed. The aim was to establish a model for a small slaughterhouse with:

- a capacity or 50 sheep (or 40 sheep and 2 cattle) a day
- limited investments
- traditional technology as far as possible but to improvements on the traditional slaughtering
- no expensive, maintenance-intensive equipment like electrical stunning, elevators, tubular tracks, lifting platforms and IT-based controlling-systems
- effective use of electricity and water
- a location close to herders
- distribution on local or domestic market
- lean management
- enhanced hygiene level with better shelf life
- cooling facilities
- a possible feedlot to supply the slaughterhouse over the whole year with animals and to increase weights and conditions

In addition, the income of herders should be increased and the negative impact of animal husbandry on the environment should be limited.

3. Conceptual design of community-based slaughterhouse

Species and Capacity

At the first step there should be slaughtered about 40 sheep and 2 cattle per day. In the long term, increase should be possible.

Degree of processing

At the first step slaughtering, cutting, deboning, cooling, freezing, packing (vacuum) will be carried out.

Labor requirements

The slaughterhouse could run at capacity with a staff of three to five butchers. Mongolian regulation states that the company must have a veterinarian on staff for inspections. A driver would be required for product delivery. Management and administrative staff would include an operations manager with experience running a meat plant and an accountant/office manager. If the two management/admin staff do not have marketing experience, a marketing person may also be required. Total staff would range from seven minimum to a maximum of ten.

Electrical requirements

The aim is to use as little electrical energy as possible. Therefore, there are no conveyers or lifting platforms. However, the carcasses must be cooled down within 24 hours down to 2 °C. The required energy depends on the outside temperature, the insulation, the opening times of the doors, the cooling technology, and many other things. In comparable slaughterhouses there is an electrical power of 30 to 40 KW specified. But the actual amount of energy must be calculated by a specialist in air conditioning technology. It is critical that the energy is always available without interruption and all over the year.

40 KW solar grids are available for industrial purposes. In the United States, a 40kW solar panel ground mount installation kit system may cost between $63,000 and $79,000 USD excluding labour[1]. China is building renewable capacity faster than any other country and similar units can be obtain at a much lower price, in the range of $12,000 USD before shipping and installation[2]. Similar products available in Mongolia based on Chinese prices plus transport, taxes and mark-ups.

Management requirement

The most important factor is that there is somebody who is responsible for the whole project and takes care about the entire process from beginning to end. This person should have experience in leading and maintaining a meat-company. To ensure the engagement, this person should invest their own money and must be reliable. A business plan and financial calculation about the necessary investments are essential.

It is essential that financial resources are available for construction, start-up and ongoing costs. The needs must be calculated during the planning stage.

Regulatory requirements

Regulations on environmental protection, occupational safety, working hours and approval procedures must be observed.

[1] https://www.gogreensolar.com/products/40kw-40000w-solar-panel-ground-mount-installation-kit
[2] https://www.alibaba.com/product-detail/Greensun-Complete-Off-Grid-Solar-System_1600132957148.html

Hygiene, hygiene and food regulations, food safety

The hygiene requirements for slaughtering, cutting and processing are laid down by the *Technical Regulations for Production and Trade of Meat and Meat Products* (Draft document, Ulaanbaatar 2021). Accordingly, abattoirs must have several rooms, beginning with a crowding pen, animal stunning and bleeding room/area, rooms for de-hiding, pelting, scalding, storage of skins, evisceration, a room for suspect carcasses, edible offal, laundry, and workers changing and break rooms. There are further rooms necessary for meat processing establishments. These requirements correspond to international standards like the Codex Alimentarius or hygiene regulations issued by European Community.

Those requirements may be necessary to avoid risks in slaughterhouse with high throughput and capacity, long shelf life, international trade, export and different levels of trade, but for the slaughtering by herders themselves, or the slaughtering in small establishments with low throughput and capacity, using mainly manpower and local distribution, those far-reaching requirements are not necessary. Local meat plants have short transports, are located near the farmers to support local consumers, focus on domestic or local market and do not want to take part in international trade or export. For small or medium-sized establishments the responsibility for all operations by single person, trained staff, ongoing monitoring, and compliance with good hygiene practices is much more important.

Therefore, the slaughtering of a limited number of animals in an effective and hygiene way can be carried out in one room, possibly in different places or animal by animal at different times. Therefore, customized regulations for small slaughterhouse must be established. This question is particularly for small slaughterhouse very important.

Additional discussions with meat industry specialists in December 2022 provided information on the regulatory environment with specific information for small slaughterhouses:

- As of January 2023, all soums will have to use meat from the industrial meat plants or from small soum meat plants for all their local institutional uses (schools, hospitals etc). As of January 2025, all markets in the country will have to do this.
- According to the law on ensuring the safety of food products, there is no license to operate in the food sector, only registration with the inspection body is required. In the case of meat and meat product producers, it is required that the supervisory body issues a conclusion within 30 days on whether the requirements specified in the Law on Food and the Law on Ensuring Food Safety are met.
- HACCP is not required for a small slaughterhouse but GMPs must be followed. However, since there is no program for its introduction and no monitoring system has been established, it has not been determined which factories have introduced it and which have not. There are guidelines issued by regulatory bodies but implementation has not been done.
- It is not necessary to have a resident veterinarian. It is recommended to have a contracted veterinarian.

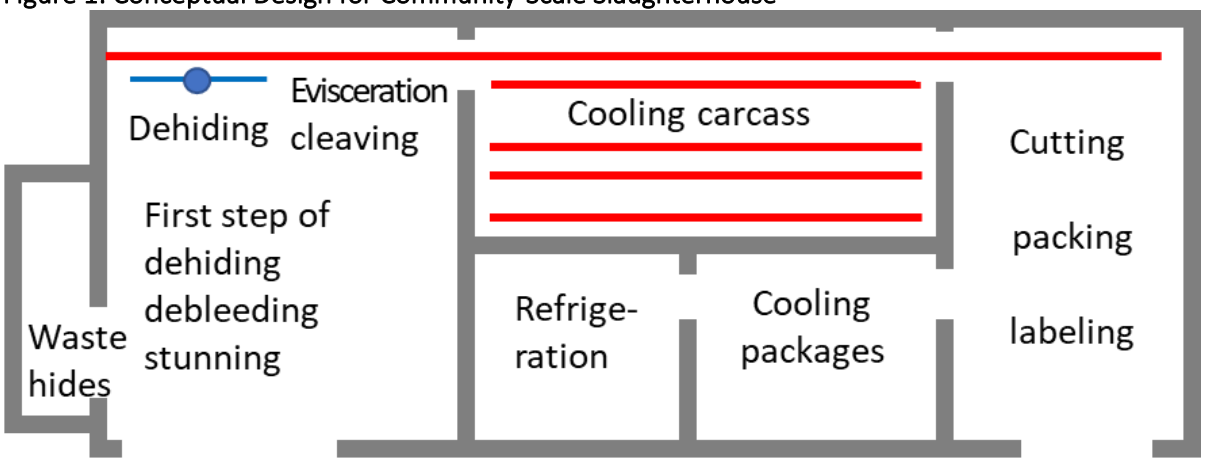
Building requirements, slaughtering facilities

To save investments and other expenditures, and to make the process effective, the small-scale slaughterhouse consists just of three rooms: slaughterhouse, cooling room and a room for cutting, packing and labelling.

With this design, it is possible to slaughter one or two cattle at the same time. When the first carcass is on the tubular track for evisceration, the next one is brought into the slaughter room to get stunned. In the case of sheep, three sheep can be processed at the same time, but the different steps like stunning, bleeding, de-hiding and evisceration are carried out at different places within the slaughter room. In that case no contamination is possible, and slaughtering is going continuously and fast.

When animals come in, they are stunned and bled. First step of dehiding can made on ground or on a special device that prevents the cattle from tipping over on their sides. After that, the hind legs of the cattle are fixed on a bar and lifted by elevator. The skin will be removed and the body eviscerated. In the case of sheep, they also will be raised up, dehided and eviscerated. The individual steps are shown schematically in the following Figure 1.

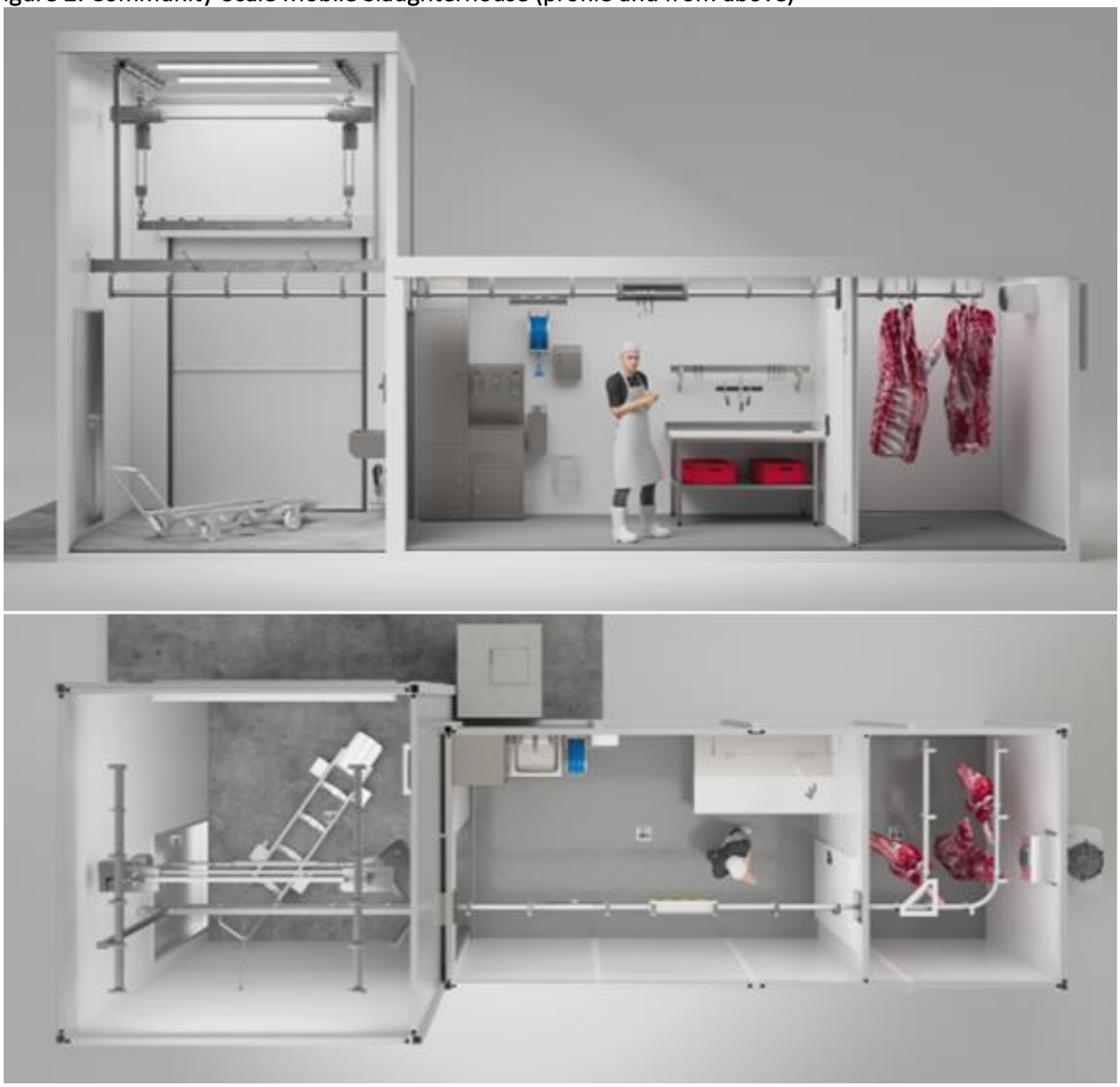
Figure 1: Conceptual Design for Community-Scale Slaughterhouse



Mobile slaughterhouses

For small slaughterhouses there are also mobile units available. They work on the same technology mentioned above. Slaughterhouse, room for cooling the carcasses and cold storage of meat and room for deboning, packing and labeling are housed in a container. This system is very flexible because containers for processing and other functions can be added. The containers are ready for use with everything such as water pipes or electricity installed. The containers are quickly installed and have the advantage that prices are fixed. They can be removed quickly or other modules, like a container for producing meat-products like dumplings, are easily added.

Figure 2: Community-Scale Mobile Slaughterhouse (profile and from above)



3. Conceptual design of community-based slaughterhouse

Mobile slaughterhouses are available not only for small slaughterhouse, but even for slaughterhouse with an increased capacity (see picture below, IFFA 2022).

Figure 3: Mobile Slaughterhouse

Energy Efficiency Potential in Meat Processing

Meat processing can be divided into four stages: i) slaughter and carcass preparation, ii) deboning and trimming, iii) preservation and storage, and iv) processing, packaging and distribution. Energy savings and GHG reduction can be achieved at each stage using energy efficient technologies and/or using renewable energy sources that replace the use of fossil fuel-based energy. The amount of energy that can be saved at each stage can vary depending on the specific technologies used, the size of the facility, and the level of energy efficiency already in place. Refrigeration is a major use of energy (60% to 70%)[3] in meat processing followed by air conditioning systems, hot water/boiler systems and compressors[4]. Energy savings can be achieved through improved processes, design and maintenance and/or investment in new technologies. The following table summarizes the potential savings at each stage of meat processing.

Table 1: Potential Energy Saving in Meat Processing

	Slaughtering and carcass preparation	Deboning and trimming	Preservation and storage	Processing packaging distribution
A. Energy Efficient Technologies				
High-efficiency lighting systems	x*)	x	x	x
Automated deboning and trimming		xx		
Efficient refrigeration and cooling systems			xxx	xxx
Energy-efficient processing equipment, such as meat grinders and mixers				x
Heat recovery systems (Heat exchanger): waste heat from cooling/heating systems, hot sewage from processing products	xxx	x	x	xxx
Electric stunners and pneumatic systems versus traditional mechanical methods	xx	x		
Disclaim or reduction of air conditioning, cooling, heating and ventilation systems	xx	xx	xx	xx
Regional origin of animals and regional distribution to save fuel in transportation	xxx			xx
Use of natural climate: especially cold winter temperatures for cooling carcasses	xx	x	x	x
B. Renewal Energy Technologies				
Recovery of waste heat from refrigeration systems or hot water	xx	x	xx	xx
Solar power systems to produce electricity	xxx	x	xx	xxx
Wind turbines to produce electricity	?	?	?	?
Biogas plants: use of slaughterhouse and other agricultural waste	xx	x	x	xxx
Combined heat and power plant to produce heat and electricity (co-generation)	xx	x	x	xxx

*Legend: *)* ***x*** *Low impact* ***xx*** *Medium impact* ***xxx*** *High impact*

[3] "Energy Efficiency Opportunities in Meat Processing" by the Australian Government Department of Industry, Science, Energy and Resources

[4] "Saving energy in abattoirs & meat processing facilities", Australian Industry Group

4 Feasibility assessment

4.1 Introduction

The aim of the assessment is to determine if a small community-scale slaughterhouse can be realized in Bayantumen soum considering the local situation, the interests of herders and employees, the change in climate, the demands of customers and environment. In addition, food safety and quality are essential components of the assessment.

4.2 Preparatory documents

To carry out the feasibility assessment full information about the project must be available: project location, address of the project implementer, project capacity, introduction, information on amount and source of road, electricity, heating, and water required for the project operation, plus information on classification, recycling, and removal of waste.

4.2.1 Business plans

A complete and believable business plan is a fundamental requirement for any feasibility assessment. No business plans were made available from NEAARC. The alternative site at the soum centre has no project proponent and no business plans exist.

4.2.2 Development permits

The current land designation at NEAARC is for agricultural/pasture use. No development permit has been granted for the proposed slaughterhouse feedlot complex at NEAARC at this time. Variations on land use can be permitted by the Soum Khural based on the review of required documentation submitted by the applicant. Application for a land use variation and development permit needs to be submitted to the Soum Khural in October each year.

The alternative site at the soum center is already located in a zoned industrial area for which a slaughterhouse is pre-approved enterprise. A feedlot is not allowed within this zone and would need to be sited elsewhere.

4.2.3 Environmental impact assessment

According to a paper of the *Governor Office of Dornod Province and Department of Environment and Tourism of Dornod Province*, following documents are required for general environmental impact assessment for slaughterhouses:

1. Official letter by the citizen, enterprise, or organization to request to have general impact assessment conducted /full contact information of address and phone number needs to be clear.
2. Feasibility study and design approved by related authorized organization.
3. Official letter of support from local Governor of the soum.

4. Brief description of the project / project location, address of the project implementer, project capacity, introduction, information on amount and source of road, electricity, heating, and water required for the project operation, plus information on classification, recycling, and removal of waste of the project is required.
5. Degree of Governor of province and/or soum on land owning and utilizing.
6. Map sketch of the surrounding area where the project will be implemented.
7. Report and Determination/Description of Environmental Status of the area where the project will be implemented.
8. Technology solutions to be used for the project / technologies to be used for the project must be decided after study conducted on environmentally friendly technologies such as efficient use of natural resources and less waste production.
9. Whether included in the land management plan for the related year / land permission or copy of the contract with the renter organization, copy of land cadastral map, license of land use in protected area.
10. Information of suppliers of the raw materials to be used for the project and copy of the contract if concluded a contract must be enclosed.
11. Copy of the license of enterprise and/or organization / notarized.
12. Copy of ID.

4.3 Development of checklist to assess small-scale meat plant feasibility

An assessment-tool was developed to allow a standardized analysis that would provide transparency when considering the decision to select a preferred project from a range of options. This generic tool can be used to complete a similar analysis in any location.

a) Structure of checklist

The assessment tool is based on a checklist of success factors considered at two levels: current conditions and potential future conditions. The **checklist** consists of 10 categories. **Each category** consists of several sub-categories (e.g., general, business-plan, financial resources). Each **sub-category** consists of several **criteria**.

Criteria must be checked according to the description of project, the supporting documents and, if necessary, by interview with the applicant. The criteria are divided in two parts:

i. current fulfilment of the requirement (fulfilled or not)
ii. if measures to increase the status are possible or not.

b) Gradation of criteria - assessment of criteria

The checklist is constructed on a five-point scale versus a “yes” or “not possible“ approach.

Table 2: Checklist Grading Scale

Requirements currently fulfilled	Potential to improve
⑤ completely	⑤ easily possible
④ mostly	④ possible
③ partially	③ uncertain
② low	② hardly possible
① very low	① at present stage not possible
⓪ none	⓪ not possible

c) Criteria checklist

The full checklist is provided in Table 3.

Table 3: Slaughterhouse Feasibility Checklist

		Requirements Fulfilled	Increasing Measures Possible	Remarks
1	Management			
	General • Is there somebody who is responsible for the whole project? • Does this person have experience in leading and maintaining a meat-company? • Does this person invest their own money? • Is this person reliable?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Business plan • Is the business plan complete and believable? • Is it likely that the project described in business plan or another document will work?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Financial resources • Have investment costs been calculated? • Are the financial resources sufficient? • Is there a calculation about the ongoing costs?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Points			
	Score = Points / rated categories			
2	Site			
	Locations • Does the size of the plot allow the construction of the corresponding establishments? • Is that plot intended for a meat plant? • Is there official permission to build a meat-plant? • Is there any opposition against the project? • Is there community acceptance to build a meat-plant? • Will neighbouring residents accept the facility? • Are there any neighbours who might fight against the project? • Are there any other people affected by the	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	

		Requirements Fulfilled	Increasing Measures Possible	Remarks
	meat plant?			
	Infrastructure • Is it ensured that there is enough drinking quality water to run the meat-plan? • Is it ensured that there is enough uninterrupted electricity (amperage, power output) to run the meat-plant? • Is there a road to bring the animals and deliver the products? Is it ensured that there are no damages because of heavy rain etc.)?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
d	**Environmental Management** • Are there suitable plans and conditions for water sanitation? • Are there suitable plans and conditions for the disposal of slaughterhouse waste?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Points			
	Score = Points / rated categories			
3	**Staff, employees**			
	Number of employees • Are there enough employees indicated in the plan and available? • Are the employees free of communicable diseases?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Training • Did the employees already work in a meat-facility? • Are they trained in that duties they must do? • Are the employees trained in hygiene issues? • Is the person who trained the employees competent?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Points			
	Score = Points / rated categories			
4	**Food health, legislation**			
	Legislation requirements • Is it ensured, that the hygiene requirements, laid down in the *Technical Regulation on Production and Trade of Meat and Meat Products* are respected? • Is there a valid Hazard and Critical Control Point (HACCP) System? • Are critical control points (CCP) defined? • Is the staff trained to work according HAACP / CCP? • Is it ensured, that Good Hygiene Practices (GHP) and GMP are respected?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Veterinary service Veterinary checks • Is ante mortem and post-mortem meat inspection according to Mongolian law ensured?	⑤ ④ ③ ② ①	⑤ ④ ③ ② ①	

		Requirements Fulfilled	Increasing Measures Possible	Remarks
	• Is it possible to relocate the ante-mortem-inspection to the farmers-sites?	⓪	⓪	
	Traceback and labeling • Is the traceback from the meat and the meat-products to the animals and farm of origin ensured? • Is there a system for labelling the packages?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Points			
	Score = Points / rated categories			
5	**Energy, water, environmental**			
	Supply • Is the supply of energy sufficient all over the year? • Is renewable energy used? • **Has the water drinking water quality and free from** Is the water free from bacterial contamination? • Is there hot water for cleaning and disinfection? • Will the sewage be properly deposed?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
1.1	**Safeguards** • Is there an awareness of environmental risks? • Is there a system to protect the environment?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Points			
	Score = Points / rated categories			
6	**Animals**			
	Number of animals for slaughtering • Is it ensured that the number of animals to be slaughtered fit the equipment capacity? • Is it ensured that slaughtering in ongoing during all seasons?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Livestock transport • Is it ensured that livestock transportation fit the regulations laid down in Technical Regulation on Production and Trade of Meat and Meat Products, especially in view of space, rest periods, watering and feeding?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	

		Requirements Fulfilled	Increasing Measures Possible	Remarks
	Animal treatment and animal health • Is it ensured that the well-being of the animals is not impaired during unloading and keeping in stall (no hits or kicks)? • Is it ensured that no animals are slaughtered which are sick, weak or suffer from infections disease? • Is it ensured that no animals are delivered to the slaughterhouse with contagious animal diseases? • The well-being of the animals is not impaired during unloading and keeping in stall (no hits or kicks)?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Points			
	Score = Points / rated categories			
7	**Slaughtering facilities**			
	Building • Are there sufficient rooms and facilities to run the facility? • Is it ensured that floors, walls and equipment is in good condition and maintained? • Is it ensured that electricity is available in necessary scope (voltage, time) • Are there efforts to use energy efficiently? • Is it ensured, that hot and cold water is available in necessary volumes?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Equipment and handling • Is sufficient electrical or mechanical stunning secured? • Is it ensured that animal do not suffer avoidable pain (animal welfare)? • Is bleeding, removal of stomach and chest organs and animal carcass spitting under hygiene conditions ensured?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Cooling facilities / equipment • Is the size of the cooling room sufficient for the number of animals slaughtered? • Is the cooling performance sufficient to reduce the temperature of the carcases/meat to 2°C within 24 hours? • Is the size and capacity of the freezing room sufficient for intended purpose?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Staff • Is each member of staff provided with adequate protective and hygiene clothing? • Are all staff trained in their duties and trained in hygiene?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Hygiene • Is it ensured, that sufficient cleaning and disinfection are performed?	⑤ ④ ③	⑤ ④ ③	

		Requirements Fulfilled	Increasing Measures Possible	Remarks
	• Is it ensured, that sufficient pest control is performed and that no other animals like dogs can enter the facility? • Is it ensured that all rooms in which food is stored, prepared, treated or processed are well maintained and clean?	② ① ⓪	② ① ⓪	
	Points			
	Score = Points / rated categories			
8	Cutting, Deboning and Packing			
	Building • Are there sufficient rooms and facilities to run the facility? • Is it ensured that floors, walls and equipment is in good condition and maintained? • Is it ensured that electricity is available in necessary scope (voltage, time)? • Are there efforts to use energy efficiently? • Is it ensured, that hot and cold water is available in necessary scope?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Staff • Is each member of staff provided with adequate protective and hygiene clothing? • Are all staff trained in their duties and trained in hygiene?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Hygiene • Is it ensured, that sufficient cleaning and disinfection are performed? • Is it ensured, that sufficient pest control is performed and that no other animals like dogs can enter the facility? • Is it ensured that all rooms in which food is stored, prepared, treated or processed are well maintained and clean?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Points			
	Score = Points / rated categories			
9	Processing			
	Building • Are there sufficient rooms and facilities appropriate to produce meat-products? • Is it ensured that floors, walls and equipment is in good condition and maintained? • Is it ensured that electricity is available in necessary scope (voltage, time)? • Are there efforts to use energy efficiently? • Is it ensured, that hot and cold water is available in necessary volume?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	

		Requirements Fulfilled	Increasing Measures Possible	Remarks
	Staff • Is each member of staff provided with adequate protective and hygiene clothing? • Are all staff trained in their duties and trained in hygiene?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Hygiene • Is it ensured, that sufficient cleaning and disinfection are performed? • Is it ensured, that sufficient pest control is performed and that no other animals like dogs can enter the facility? • Is it ensured, that all rooms in which food is stored, prepared, treated or processed are well maintained and clean?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Points			
	Score = Points / rated categories			
10	**Selling facilities and selling possibilities**			
	Building • Are there appropriate facilities? • Is it ensured, that floors, walls and equipment is in good condition and maintained?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Staff • Are all staff trained in their duties and trained in hygiene?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Hygiene • Is it ensured, that sufficient cleaning and disinfection are performed? • Is it ensured, that sufficient pest control is performed and that no other animals like dogs can enter the facility? • Is it ensured, that all rooms in which food is stored, prepared, treated or processed are well maintained and clean?	⑤ ④ ③ ② ① ⓪	⑤ ④ ③ ② ① ⓪	
	Points			
	Score = Points / rated categories			
	TOTAL SCORE			
	% Score			

4.4 Evaluation and scoring

Within each category, the number of points is added up and divided by the number of categories that were rated. This produces the "score" for each category. The maximum score possible in any category is 5 points. The total score possible over the 10 categories is 50.

Table 4: Example of Category Scoring using Project Site

	Category	Current score	Potential to Improve	
	Locations • …	4	4	
	Infrastructure • …	4	3	
	Environmental Management • …	5	2	
	Total Points	13	9	
	Score = Points / rated categories	4.3	3	

To get an over-all evaluation, the score from each of the 10 categories are totalled. The maximum possible score over the 10 categories is 50. To convert this to a percentage score, the number is multiplied by 2.

This system makes it possible for a responsible persons, institution, or authority to compare different projects, which differ in the various criteria.

Example:
Maximum possible score over 10 categories = 50
Actual score out of 10 categories = 39
Percentage score: 39 * 2 = 78 %
That means, that the project is scored with 78 % from a maximum of 100.

5 Site-specific analysis

A "site-neutral" approach was used to compare the pros and cons of a central and a remote (bagh) facility location, include the analysis of the on-grid and off-grid options, against a set of objective feasibility criteria. The two sites assessed included one at the soum centre and a remote site at NEAARC. Rather than giving a simple "yes/no" answer regarding the feasibility of a specific side, a graduated approach was used that indicated i) feasibility or readiness at the current time, and ii) the potential to achieve feasibility in the future. Recommendations and a pathway to feasibility were provided.

The checklist is best suited for when a slaughterhouse is already in operation or when a detailed business plan is available for review. Because of a lack of information and data on the proposed sites and business plans, only the potential physical sites (category 2) could be used in the evaluation plus some management criteria (category 1) and information on the supply of animals (category 6). Based on the information available, the following opportunities and challenges facing each of the sites have been identified.

Table 5: Summary Comparison of Opportunities and Challenges for Two Potential Project Sites

Site near NEARC	Site near soum-centre
Positive: • Applicant was very engaged in project and should be responsible • Has experience in slaughtering • Takes care about herders • Site available • Size allows establishing meat plan • Unpaved road must be maintained	Positive: • Energy-supply already available • Site available • Community supports project • Plot intended to build meat plant (Community) • Plot accepted by community to build meat plant • Site was formerly used a slaughtering area • Residents accept the plant if there are no negative effects (Information by Officials) • Size allows establishing meat plan • Unpaved road must be maintained
Unclear: • Electricity line already established but functionality is unclear • Plot intended to build meat plant (Community) • Plot accepted by community to build meat plant • Chance to get realized • Chance to be successful in future • Own investment • Financial resources • Accessibility to reliable, trained labour force • There is an adequate supply of livestock in the soum, but it is very seasonal. Providing a stable supply of consistent animals all year round will require accessibility to feedlot cattle.	Unclear: • All issues concerning the company running the facility since there is no applicant • There is an adequate supply of livestock in the soum, but it is very season. Providing a stable supply of consistent animals all year round will require accessibility to feedlot cattle. The site at the soum is not approved for feedlot so it would need to be sited in a different location.

Site near NEARC	Site near soum-centre
Negative: • No specific infrastructure for meat pant at present stage available	**Negative**: • Water-supply must be established • No specific infrastructure for meat pant at present stage available
Problem • No further information available (business plan, financial resources, marketing, distribution, energy)	**Problem** • No further information available (business plan, financial resources, marketing, distribution, energy) • No interested applicant yet available

To provide a full illustrative example of how the checklist can be used, the comparative examination of the two sites has been completed and is provided in on the next page in Table 6. As mentioned in the summary, there was limited information available about the business plans, but both sites are basically suited to the physical construction of the plant. The soum site has a slight advantage in terms of infrastructure and access to labour while the remote site has the advantage of an engaged champion for the project.

Both sites face serious challenges regarding: i) access to finance, ii) maintain a steady supply of animals throughout the year, and iii) dealing with quality control issues in terms of the expense of running HACCP systems and the uncertainty related to external factors of animal health (disease outbreaks), the adequacy of veterinary services and the incomplete system of livestock traceability in Mongolia.

Regardless of the size of a slaughterhouse or meat-plant, a valid HACCP-System is essential (development, implementation, verification). In addition, a manual for Good Hygiene Practice GHP must be developed, implemented, and verified and the employees must be trained according to their duties. Implementing HACCP, GHP and training will arise additional costs (one-time and ongoing). In small sized slaughterhouses or meat-plants those duties could be solved by the vet (depending on knowledge) or must be done by external consultants.

Conclusion

Both sites are basically suitable to establish a meat plan. However, because there is a lack of data and documented business plans, a complete scoring could not be carried out. To complete an assessment of either project to a degree usable to seek financing, further information is necessary.

In the accompanying report, “4.2 Business Models”, projections of product flows, revenue and expenses and investment requirements are provided, which provide additional information about the feasibility and challenges of the proposed plant. However, these models provide a generalized analysis and are not directly representative of one or the other specific sites.

Table 6: Slaughterhouse Feasibility Checklist Comparing Two Potential Project Sites, Current and Future Potential Scores

		Site 1 – Soum Center			Site 2 – Remote Location		
		Req Fulfilled	Improv. Possible	Remarks	Req Fulfilled	Improv. Possible	Remarks
1	Management						
	General	0	4	No person identified.	4	4	Person identified but has not run
	Business plan	0	4	No plan.	0	4	a meat plant. No plan shared.
	Financial resources	0	4	Will need finance.	2	4	Finance required.
	Points	0	12		6	12	
	Score = Points / rated categories	0	4		2	4	
2	Site						
	Location	5	5	Size adequate. Already approved	3	5	Land size adequate but not yet
	Infrastructure	4	5	in soum plan.	3	4	approved. Grid uncertain. Water
	Environmental Management	3	5	Needs water.	3	5	unknown. Poor road.
	Points	12	15		9	14	
	Score = Points / rated categories	4	5		3	4.7	
3	Staff, employees						
	Number of employees	0	5	Staff available in town.	0	4	Staff would have to drive.
	Training	0	5	Training required.	0	5	Training required.
	Points	0	10		0	9	
	Score = Points / rated categories	0	5		0	4.5	
4	Food health, legislation						
	Legislation requirements	0	5	Possible with conceptual design.	0	5	Possible with conceptual design.
	Veterinary service Veterinary checks	0	4	Management critical. HACCP is	0	4	Management critical. HACCP is
	Traceback and labeling	0	4	costly. Vet/traceback weak.	0	4	costly. Vet/traceback weak.
	Points	0	13		0	13	
	Score = Points / rated categories	0	4.3		0	4.3	
5	Energy, water, environmental						
	Supply	3	5	Power in place. Water well	2	4	Power unreliable. Water well
	Safeguards	0	5	required. Safeguards can be met.	0	5	required. Safeguards can be met.
	Points	3	10		3	9	
	Score = Points / rated categories	1.5	5		1.5	4.5	
6	Animals						
	Number of animals for slaughtering	3	4	Adequate number of animals in	3	4	Adequate number of animals in
	Livestock transport	3	4	the soum. Seasonality a problem.	3	4	the soum. Seasonality a problem.
	Animal treatment and animal health	2	4		2	4	
	Points	8	12		8	12	
	Score = Points / rated categories	2.7	4		2.7	4	

5. Site specific analysis

		Site 1 – Soum Center			Site 2 – Remote Location		
		Req Fulfilled	Improv. Possible	Remarks	Req Fulfilled	Improv. Possible	Remarks
7	Slaughtering facilities						
	Building	0	4	The conceptual design provided would meet the requirements, given proper management and training.	0	4	The conceptual design provided would meet the requirements, given proper management and training.
	Equipment and handling	0	4		0	4	
	Cooling facilities / equipment	0	4		0	4	
	Staff	0	4		0	4	
	Hygiene	0	4		0	4	
	Points	0	20		0	20	
	Score = Points / rated categories	0	4		0	4	
8	Cutting, Deboning and Packing						
	Building	0	4	The conceptual design provided would meet the requirements, given proper management and training.	0	4	The conceptual design provided would meet the requirements, given proper management and training.
	Staff	0	4		0	4	
	Hygiene	0	4		0	4	
	Points	0	12		0	12	
	Score = Points / rated categories	0	4		0	4	
9	Processing						
	Building	0	4	Not in the current design. Could be added meeting requirements.	0	4	Not in the current design. Could be added meeting requirements.
	Staff	0	4		0	4	
	Hygiene	0	4		0	4	
	Points	0	12		0	12	
	Score = Points / rated categories	0	4		0	4	
10	Selling facilities and selling possibilities						
	Building	0	4	Not in the current design. Could be added meeting requirements.	0	4	Not in the current design. Could be added meeting requirements.
	Staff	0	4		0	4	
	Hygiene	0	4		0	4	
	Points	0	12		0	12	
	Score = Points / rated categories	0	4		0	4	
	TOTAL SCORE OUT OF 50	8.2	43.3		9.2	42.0	
	Percentage score	16.4	86.6		18.4	84.0	

6 Summary of findings and recommendations

1 Present situation

Mongolia faces challenges throughout the meat value chain. Increasing numbers of animals have a negative impact on vegetation and the sustainability of animal husbandry and cattle grazing. In many cases, there is a strong focus on export. However, strengthening national and regional marketing and economic cycles are crucial for increasing the incomes of the rural population and herders. Transboundary animal diseases are widespread, and the veterinary system has not been able to deal effectively with outbreaks. Food hygiene practices and hygiene standards also fall short of international standards.

To achieve highest possible prices, herders sell their animals preferable in the late autumn and early winter period. Because of lack of feed, suboptimal genetics and ineffective management animals have low weight and are sometimes in poor physical condition. In order to improve the precarious financial situation of the herders, it is necessary to improve national or regional marketing and extend it throughout the year.

2 In general, there are different business-models in the Mongolian meat-market recognizable.

- Traditional slaughtering
- Industrialized slaughterhouses
- Integrated meat plants
- Meat-processors

The traditional way of slaughtering is being surpassed by more industrialized plants due to legislative changes, new investments by companies seeking urban and export markets and greater consumer awareness of food quality and safety concerns. Any new plant will need to be able to meet new industrial and health standards and remain price competitive.

3 A Feasibility assessment-tool was established. Use of a Checklist with categories, sub-categories and criteria.

- Under current conditions, the assessment form could not be fully completed for the two sites due to information shortages. On the criteria that could be evaluated there is little significant difference between the two locations. Each has relative strengths and weaknesses. Both face significant external challenges in the year-round supply of livestock, animal health, veterinary services and traceback systems.

- However, it was possible to consider future potential to meet feasibility requirements:
  Site near NEARC: Advantages for this site appears the long-term engagement of the applicant and owner for the social situation of the herders and his efforts to increase the income of the herders and to enable a good future in their traditional circumstances. In interviews he mentioned that he has experience in slaughtering and was working in slaughterhouses in USA

and Germany. His purpose and philosophy are to establish a small slaughterhouse to improve the hygiene and professionalism in slaughtering, to improve the quality of the meat and to develop new marketing opportunities. Ultimately the income of the herders should be improved and secured. Since he is the owner of the site, it will be possible to start to establish the slaughterhouse soon.

Site near soum-center: very positive support of the Community and the already completed energy-supply.

4 For both sites there are still a lot of challenges for management and ownership. To enable and secure the construction and long-term operation of the slaughterhouse, financial resources must be available. Furthermore, clear specifications and ideas are necessary for the origin of the animals and for the year-round supply in good physical condition and weight. This can only be guaranteed by appropriate feedlots and the associated facilities.

In addition, a stringent, realistic, sustainable and viable concept for marketing is required. Because of the small size of the meat-plant it seems to be risky to sell the meat or meat products only to middleman or wholesalers, because they might have the option to determine the prices and the amount of purchased meat. To reduce dependency on those customers, there is the possibility to establish own marketing chain with direct sales to end customer in the region or perhaps in Ulaanbaatar, preferably in cooperation with a reliable partner. But it must be mentioned that own marketing and own sales facilities are associated with considerable logistical difficulties. Therefore, a detailed business plan including information about financial resources, sales channels, customers, supply chain, suppliers of animals, feedlot (who is running) and feed gain is essential.

Despite all the difficulties, it must be stressed that a smaller meat center can offer many opportunities and advantages for the herders, the local people, the community and local customers. Therefore, it seems reasonable and expedient to pursue the project further. With the appropriate commitment, know-how and engagement, it is very possible to overcome the difficulties mentioned.

5 At present time, competitiveness cannot be verified, because there is no business plan and no concept how slaughterhouse will work and stay in business. With professional management, creative marketing with focus on regional origin, animal welfare and natural rearing, with fresh products in good quality and fair prices, it will be possible to find a market niche and appropriate customers who are willing and able to enjoy the meat.