

**A Pilot Model of Straw Management in the Form of Nutrient Rich
Compressed Straw Fodder Block and Demonstration of Straw
Harvesting Technology in Province No. 1, Nepal.**

**Department of Agricultural Engineering
Institute of Engineering
Purwanchal Campus, Dharan
Province 1
Nepal**



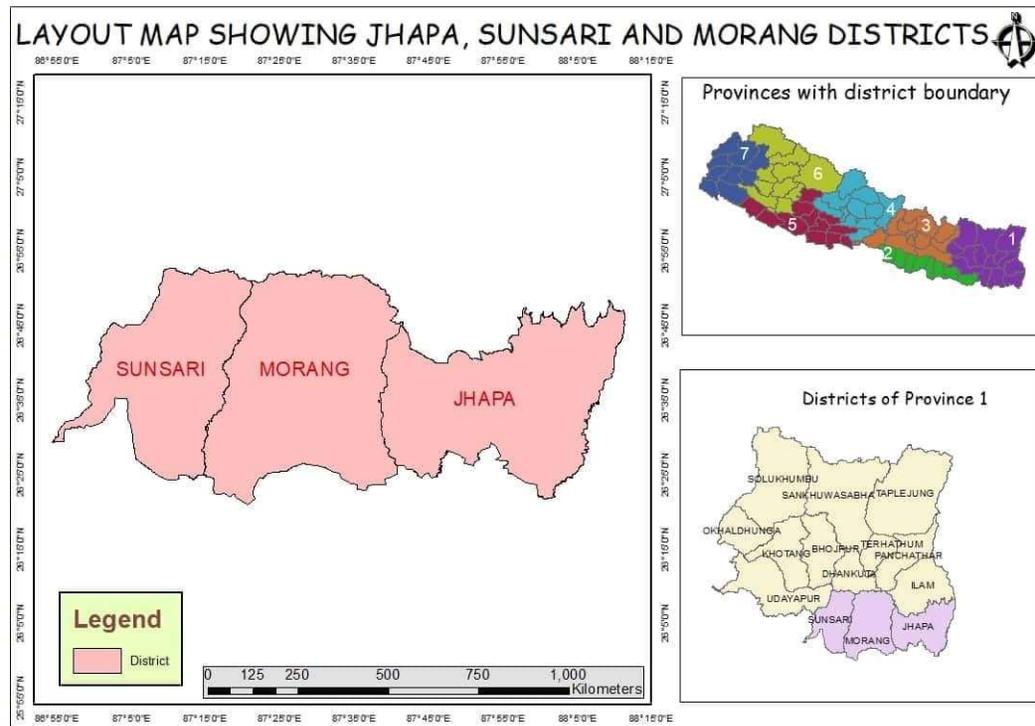
Principal Implementing Office

Department of Agricultural Engineering
Institute of Engineering
Purwanchal Campus, Dharan
Province 1
Nepal



Target sub-region of the country

Province No 1, Nepal



Target Group

- ✓ **Krishna Dana Udhyog**
- ✓ **Feed industry & Cattle husbandry owners**
- ✓ **AEPHS for extension of technology**
- ✓ **Livestock and cereal crop farmers**
- ✓ **Manufacturers of block making machine**

Background

Context and strategic alignment

- Nepal has been identified as one of the country to **pilot integrated straw management at the Regional Workshop on Integrated Straw Management of Centre for Sustainable Agricultural Mechanization (CSAM) held at Kathmandu on 12-14 December, 2017.**
- Hence as a priority issue, previous organization Directorate of Agricultural Engineering (DoAEngg), now **Agricultural Engineering and Post Harvest Section (AEPHS) of Department of Agriculture (DoA) along with Department of Agricultural Engineering (DoAE), Institute of Engineering (IOE), Purwanchal Campus, Dharan** has pledge to work on straw management, one of the growing concern in the field of **agriculture in the present context.**
- Nepal produces enough quantity of straw as bi-product from major cereal crop production, but in absence of alternate utilization they are **usually burnt up which causes pollution and loss of valuable natural resources.**

Background

Target areas and groups

- **Jhapa district of Province No.1 has been declared as the rice super zone of the country by the Prime Minister Agriculture Modernization Project (PMAMP).**
- **Not only the rice super zone district, other two terai districts Sunsari and Morang of the Province also produce rice and thus straw production is also high.**
- **The three districts of province 1 Jhapa 87,500 ha, Morang 88,000 ha and Sunsari 44,900 ha of rice cultivated area from which 338,000, 325,800 and 184,250 metric ton of rice was produced respectively in 2016/17.**
- **The total annual potential straw production of these three districts is 1.490 million metric tons.**
- **The study target area is potential for piloting integrated straw management.**

Background

Target areas and groups

- Krishna Daana Udhyog (KDU) is straw blocks making feed industry in Jhorahat, Biratnagar of Morang district.
- Straw blocks are compressed straw in a ratio of almost 6:1 with added nutrition and binding materials which can overcome the problem of bulk transportation and management of straw.
- KDU have 2 hectare of land with some machinery and workers to produce 15 Tons of straw blocks per day.
- The KDU will be the pilot site for integrated straw management.

Background

- ❖ Department of Agricultural Engineering (DoAE), Institute of Engineering (IOE), Purwanchal Campus, Dharan of Sunsari District is the only Agricultural Engineering academic institute in the country, having 25 academic and supporting staffs, 192 students each year with necessary facilities.
- ❖ DoAE will work as the principal stakeholder involving academic personals and students for demonstration of straw harvesting technologies, identifying the straw yield, develop efficient straw block compressing or auxiliary machine, impact in milk quality and production.
- ❖ Formal Directorate of Agricultural Engineering (DoAEngg), now Agricultural Engineering and Post Harvest Section (AEPHS) of Department of Agriculture (DoA), under Ministry of Agriculture and Livestock Development, will work to disseminate proven technology of straw block and auxiliary machine manufactures, straw block making industries, commercial livestock farmers, individual farmers of Province 1 and other Provinces with necessary coordination among concern line agencies.

Problem analysis

Problem identification

- ✓ Straw management is one of the big issue and great challenge of the developing countries, where Nepal is not aside.
- ✓ Terai districts of Province 1 are considered as the hub for cereal crop production of the nation, considering only rice, the production is 0.84905 million metric tons of which 1.49 million metric ton is straw.
- ✓ Where straw management technologies are lacking and are not considered important.
- ✓ The spatial disparity as a bi-product of cereal crop between Terai and Hills is a major problem of bulk volume of storage and transportation cost.
- ✓ Harvesting of straw after use of combine and threshing is tedious task; hence it is left out in the field to dry.
- ✓ Some quantity of straw are being sold to paper making industries.

Problem analysis

Problem identification

- Surplus straw after domestic use (feed/fodder) are preferred burning rather than finding alternate market to sell them.
- Availability of fodder for livestock all the year round is another major challenge.
- Storage of straw for lean season feeding is another problem due to its bulkiness.
- Straw block can address these problems of storage and transportation.
- Straw are generally chopped into smaller pieces with the help of chaff cutter are mixed with rice/wheat bran or grass to supplement the feed demands of the livestock.
- The fodder management for livestock in general is the responsibility of the female member of the family.

Problem analysis

Problem identification

- Seminar on the importance of straw and demonstration of straw harvesting technology will create awareness to concern personal and farmers.
- Availability of compressed straw blocks in province 1 can address these problems by proper/alternate use of straw, no burning, ease transportation, women drudgery, feed supplement, etc.
- Ultimately this will help to reduce burning, enhance straw market and finally enhance the socio-economic condition of the society.

Problem analysis

Stakeholder analysis and capacity assessment

Stakeholders	Type and level of involvement in the project	Capacity assets	Capacity Gaps	Desired future outcomes	Incentives
Department of Agricultural Engineering (DoAE), Purwanchal Campus, Institute of Engineering (IoE), Tribhuvan University (Stakeholder I)	<ul style="list-style-type: none"> - Type: Academic & Public organization -Level: The main stakeholder and project coordinator. 	<ul style="list-style-type: none"> - 25 academic and supporting staffs in the fields of agricultural engineering & related fields. - Well established related labs. -Internally linked up with mechanical engineering department. -MoU with IIT Kharagpur and has good relationships with national leading agricultural research center, NARC. -DoA 	<ul style="list-style-type: none"> - Up gradation of existing labs with modern equipments. -Dissemination of the findings needs to reach the grass root level farmers. -Coordination with international organization of relevant fields. 	<ul style="list-style-type: none"> - A new efficient straw compressing or auxiliary machine will be developed . -Modified block making industry/factory to be established -Departmental labs and capacity will be enhanced. -The findings from DoAE will be disseminated among the straw block compressing machine manufacturers, block making factory and the straw block to livestock farmers. 	<ul style="list-style-type: none"> - Straw management expertise at DoAE. - It can create more opportunity. - It can improve knowledge and experience in aspects of scientific research, technological transfer and international collaboration.

Problem analysis

Stakeholder analysis and capacity assessment

Stakeholders	Type and level of involvement in the project	Capacity assets	Capacity Gaps	Desired future outcomes	Incentives
Krishna Daana Udhyog (KDU) (Jhorahat, Biratnagar) (Stakeholder II)	<ul style="list-style-type: none"> - Type: Feed industry. - Level: Key stakeholder as demo site. 	<ul style="list-style-type: none"> - 15 tons/per day feed production capacity. - It has 2 straw bailers and 2 straw pressing machines with a total capacity of 4 tons capacity per hour - It has 30 working staffs. 	<ul style="list-style-type: none"> - It has semi automatic machines. - Intensive use of human labours. - It has problem of storing its finished straw blocks. - It's production capacity is less than the demand of the local market. 	<ul style="list-style-type: none"> - Up gradation of semi automatic machine. - Less number of human labours. - Attraction of people towards commercial livestock rising will be increased. 	<ul style="list-style-type: none"> - Industry will be upgraded. - Consumer level will be increased. - Expansion of straw block market

Problem analysis

Stakeholder analysis and capacity assessment

Stakeholders	Type and level of involvement in the project	Capacity assets	Capacity Gaps	Desired future outcomes	Incentives
Former Directorate of Agricultural Engineering (DoAEngg) now Agricultural Engineering and Post Harvest Section (AEPHS), Department of Agriculture (DoA) under Ministry of Agriculture and Livestock Development (Stakeholder III)	<ul style="list-style-type: none"> Type: Government of Nepal (GoN) Level: Supporting stakeholders of the project to develop appropriate machine and to establish straw blocks factory and to disseminate the technology to farmers. 	<ul style="list-style-type: none"> DoA have different agricultural disciplinary employee. Main role is policy formulation, extension of technology in the country. 	<ul style="list-style-type: none"> Mechanism linking research, education and extension organization. Generally top-down approach in planning, program and implementation. 	<ul style="list-style-type: none"> Capacity building of DoA and AEPHS staff. Will learn better/alternate utilization of straw. Next level of technology extension. 	<ul style="list-style-type: none"> Necessary information for policy, program design and implementation.

Problem analysis

Stakeholder analysis and capacity assessment

Stakeholders	Type and level of involvement in the project	Capacity assets	Capacity Gaps	Desired future outcomes	Incentives
Independent National Consultant (Stakeholder IV)	Specialized and expert as needed	Experts experiences	-	Quality results	According to Project fund

Project Strategy

Project objectives

- ✓ **Awareness** in importance of straw and demonstration of straw harvesting technologies.
- ✓ **Develop pilot site** for integrated straw management for alternative utilization of straw and to conserve valuable natural resource.
- ✓ **Develop modified/upgraded straw compressing or auxiliary machine and create straw as marketable commodity.**
- ✓ **Awareness in environmental issue** of burning of straw in field cause air pollution, destroy soil organism and destroy valuable natural resource.
- ✓ **Uplift socio-economic condition of the farmers** by selling straw and utilizing straw as nutrient rich feed block to enhance quality and quantity of milk.

Project Strategy

Project design and Implementation plan

Project results	Indicators	Means of Verification
<p>Project outcome 1: Awareness in importance of straw and straw harvesting technologies in terai districts of province 1</p>		
<p>Output 1 Importance of straw and straw harvesting technology will be demonstrated</p>	<ul style="list-style-type: none"> - Farmers knowledge will be enhanced - Stop burning and start preserving & collecting - Adaptation of Straw harvesting technology 	<ul style="list-style-type: none"> - Baseline report - Periodical reports - Project completion report
<p>Key activities:</p> <p>1.1 Consulting and contracting agricultural engineer specialists (Stakeholder IV)</p> <p>1.2: Seminar, presentation and discussion on importance of straw for multiple utilization in different country (Stakeholder I, II, III & IV)</p> <p>1.3: Demonstration of available straw harvesting technology (straw reaper, bailer etc.) in Morang district of Province No. 1 (Stakeholder I, II, III & IV)</p> <p>1.4: Five member coordination committee of the stakeholder will be formed to guide the project. Periodical coordination meeting will be held to discuss the plan and progress, and any amendment needed during the implementation of the project</p>		

Project Strategy

Project design and Implementation plan

Project results	Indicators	Means of Verification
Project outcome 2:		
Establishment of pilot site for integrated straw management in Morang district of province 1		
Output 2.1 Pilot site for making nutrients rich compressed straw block at KDU.	<ul style="list-style-type: none"> -Quality straw block production -Economic analysis of compressed straw block vs. traditional feed -Less storage space required vs loose straw -Ease transport vs loose straw 	<ul style="list-style-type: none"> - Signing of contract - Training of workers - Number of visitor - Periodical reports - Economic analysis - Project completion report
Key activities:		
2.1.1: Survey on Straw Management in Province No. 1 (Stakeholder I)		
2.1.2: Consulting and contracting cattle feed specialists (Stakeholder IV)		
2.1.3: Organize meetings with KDU; discussion and signing of contract for collaboration in study. (Stakeholders I & II).		
2.1.4: Design experiment with different ratio of straw and nutrient supplement for compressed straw block to feed different growth stage of the cattle, feed cost, production cost, economic analysis.(Stakeholders I, II & IV).		
2.1.5: Train KDU workers involved in the experiment (Stakeholders I, II & IV).		
2.1.6: Data collection, analysis, evaluation and recommendation (Stakeholders I, II& IV).		

Project Strategy

Project design and Implementation plan

Project results	Indicators	Means of Verification
<p><u>Project outcome 2:</u> Establishment of pilot site for integrated straw management in Morang district of province 1</p>		
<p><u>Output 2.2:</u> Demonstration site for farmer, researcher, academician, policy maker, politician of Province 1 and other part of the country</p>	<p>-Good example of Integrated straw management site</p>	<ul style="list-style-type: none"> - Increase production capacity by new machine - Periodical reports -Number of visitors - Project completion report
<p><u>Key activities:</u> 2.2.1 Add new or modified semi/automatic straw compressing or efficient auxiliary machine developed by DoAE.</p>		

Project Strategy

Project design and Implementation plan

Project results	Indicators	Means of Verification
<p>Project outcome 3: Development/modification of semi/automatic straw compressing or auxiliary machine.</p>		-
<p>Output 3: Labour saving and efficient machine will be developed</p>	<ul style="list-style-type: none"> -Production capacity increase -Labour saving -Good quality and efficient production of compressed straw blocks 	<ul style="list-style-type: none"> - Adaptation and increase in the number of user of the machine - Periodical reports - Project completion report
<p><u>Key activities:</u></p> <p>3.1 Literature review and study of existing straw compressing and auxiliary machine in Nepal, China and India (Stakeholder I, II, III & IV).</p> <p>3.2 Study team visit India to identify best technologies (Stakeholder I, II, III & IV).</p> <p>3.3 Design/modification and testing of straw compressing or auxiliary machine (Stakeholder I, II, III & IV).</p> <p>3.4 Develop best model of semi or automatic straw compressing or auxiliary machine. (Stakeholder I, II & IV).</p> <p>3.5 Seek manufacture for fabricating best model at the local market (Stakeholder I, & IV).</p>		

Project Strategy

Project design and Implementation plan

Project results	Indicators	Means of Verification
<p>Project outcome 4: Nutrient rich straw block feed enhance the quality and quantity of milk.</p>		
<p>Output 4: The quality and quantity of milk production from demonstration site (KDU) cattle will be better than normal feed cattle</p>	<p>-Volume of milk production -Lactose, fat, protein and minerals concentration of milk</p>	<p>- Lab Reports - Periodical reports - Project completion report</p>
<p><u>Key activities:</u></p> <p>4.1 Literature review and study the existing quantity and quality of milk (Stakeholder I, & IV).</p> <p>4.2 Comparative study of milk production of the cattle from demonstration site feed with nutrient rich compressed straw block with normal feed (Stakeholder I & IV).</p> <p>4.3 Laboratory analysis of significant number of milk samples from both feed (Stakeholder I & IV).</p>		

Project Strategy

Project design and Implementation plan

Project results	Indicators	Means of Verification
Project outcome 5: Startup compressed straw block industry and/or initiation straw harvesting technologies in Province 1.		
Output 5: Number of commercial production of straw block will increase.	<ul style="list-style-type: none"> -Increase in the number of straw block producing factory -Economic benefit from commercial production -Reduce in straw burning and improve soil health -Reduce women drudgery -Improve socio-economic condition of the farmers 	<ul style="list-style-type: none"> -Increase in the number of manufacture of the block making industries. - Interviews - Periodical report - Economic benefit - Project completion report
Key activities:		
5.1: Consulting and contracting agricultural economist specialists (Stakeholder IV)		
5.2: Organize training course and seminars to livestock farmers, machine manufacture to introduce the benefit of compressed straw block against burning. (Stakeholders I, II, III & IV).		
5.3: Organize study tours to livestock farmers and machine manufacture of the province to the pilot site (KDU) (Stakeholders I, II, III & IV).		
5.4: Identify and technology transfer to local manufactures to fabricate straw compressing and auxiliary machine. (Stakeholders I, III & IV).		

Project Strategy

Project design and Implementation plan

Project results	Indicators	Means of Verification
Project outcome 6: Scale up proven technology		
Output 6.1: Availability of livestock feed of compressed nutrients straw block in the lean season encourage farmers to start commercial livestock farming.	<ul style="list-style-type: none"> - Changes in knowledge, attitude and awareness on the benefit of compressed nutrients straw block for lean season -Reduce burning and proper utilization of valuable natural resource -Reduce women drudgery -Improve socio-economic condition of the farmers 	<ul style="list-style-type: none"> - Interviews -Periodical report -Economic benefit - Project completion report
<u>Key activities:</u>		
6.1.1: Organize study tour and seminar to introduce the benefit of compressed straw block to province farmers to the pilot site (KDU) (Stakeholders I, II, III & IV).		

Project Strategy

Project design and Implementation plan

Project results	Indicators	Means of Verification
Project outcome 6: Scale up proven technology		
Output 6.2: Study tour and seminar on utilizing straw as compressed nutrient feed block and straw harvesting technologies for farmers, researchers, academician, policy maker, politician with in the country and aboard.	<ul style="list-style-type: none"> - Transformative changes in knowledge, awareness and attitude of the visitors -Adaptation in other province and country 	<ul style="list-style-type: none"> - Interviews and practice -Report -Investigations, interviews and analyses - Project completion report
<p><u>Key activities:</u></p> <p>6.2.1: Organizing study tours and seminars for livestock farmers, manufacture and business community interested to produce feed industries. (Stakeholders I, II,III & IV)</p> <p>6.2.2: Organizing a study tour and seminar for national researchers, academician, policy maker, politician and international visitors (Stakeholders I, II, III, IV & CSAM)</p>		

Project Strategy

Indicators:

- Enhance knowledge in straw harvesting technologies and utilization of straw.
- Development of efficient semi/automatic compressed straw block or auxiliary machine to increase production capacity.
- Production of quality compressed nutrient straw block in the pilot site.
- Reduce straw burning and proper utilization of valuable natural resource.
- Availability straw block in the market will encourage farmers for commercial livestock farming.
- Improve socio-economic condition of the farmers by quality/quantity of milk production.

Partnership and coordination arrangements

- ▶ International partnership agreement will be between CSAM and DoAE (Stakeholder I) of the project.
- ▶ The DoAE will work as the focal point of the project and coordinating agency among national stakeholder,
- ▶ KDU (Stakeholder II), AEPHS (Stakeholder III) and national consultant (Stakeholder IV).
- ▶ The 75 % funding of the project will be arranged from CSAM and matching fund of 25 % from DoAE.
- ▶ DoAE will use its staff, student, and facilities for successful implementation and meet the objective of the pilot project.

Partnership and coordination arrangements

- ▶ The collaborative agreement will be done between DoAE and target project pilot site KDU (stakeholder II).
- ▶ KDU will provide necessary facility and space for project work to develop as pilot site.
- ▶ DoAE will work in close collaboration with AEPHS (Stakeholder III) for promotion of the technology.
- ▶ Knowledge and guidance from national consultant (Stakeholder IV) will work as the technical advisor of the project.
- ▶ A team of 5 member coordination committee of the stakeholder will be arranged to guide the project.
- ▶ The periodical coordination meeting will be held to discuss the plan and progress, and any amendment needed during the implementation of the project.

Sustainability

- ▶ The sustainability of this pilot project depends upon the funding and willingness of the principal partners.
- ▶ The project outcome and output depends upon the effective implementation of the activities by the stakeholders, strong commitment is essential for sustainability of the project.
- ▶ Startup and scaling up the finding of the project depends upon the economic benefit of the business.
- ▶ The sustainability of the project outcome depends upon the socio-economic benefit of the livestock farmers, which will create the demand of straw block, which will simultaneously create the demand of straw block making machine, ultimately straw will get the commercial value, which will reduce burning of straw and conserving the nature.

Monitoring and evaluation

- ▶ Periodical monitoring by CSAM is essential for successful completion of the project.
- ▶ Besides, results of the project activities, outputs and outcomes will also be evaluated every 6 months and annually based on criteria, indicators.

Reporting

- ▶ Annual reports of the project will be submitted to CSAM by 31st of March each year and the final report after completion.
- ▶ These reports will cover all activities, outputs and outcomes of the project carried out or achieved from January to December of the previous calendar year.

Work and monitoring plan

	Key Activities	Year 1				Year 2				Year 3				Responsible
		1	2	3	4	1	2	3	4	1	2	3	4	
	Quarter													
2.1.5	Train KDU workers involved in the experiment (Stakeholders I & II)			*										
2.1.6	Data collection, analysis, evaluation and recommendation (Stakeholders I & II)	*	*	*		*	*	*			*	*	*	

	Key Activities	Year 1				Year 2				Year 3				Responsible
		1	2	3	4	1	2	3	4	1	2	3	4	
	Quarter													
	Output 2.2: Demonstration site for farmer, researcher, academician, policy maker, politician of Province 1 and other part of the country													
2.2.1	Add new or modified semi/ automatic straw compressing or efficient machine developed by DoAE				*	*	*							

Work and monitoring plan

Key Activities		Year 1				Year 2				Year 3				Responsible
Quarter		1	2	3	4	1	2	3	4	1	2	3	4	
Output 3: Labour saving and efficient machine will be developed														
3.1	Literature review and study of existing straw compressing and auxiliary machine in Nepal, China and India (Stakeholder I,II,III & IV)	*	*	*										
3.2	Study team visit India to identify best technologies (Stakeholder I,II,III & IV)		*											
3.3	Design/modification and testing of straw compressing or auxiliary machine (Stakeholder I,II & IV)			*	*	*	*							
3.4	Develop best model of semi or automatic straw compressing or auxiliary machine (Stakeholder I,II & IV)				*	*	*	*						

Work and monitoring plan

	Key Activities	Year 1				Year 2				Year 3				Responsible
		1	2	3	4	1	2	3	4	1	2	3	4	
	Quarter													
	Output 4: The quality and quantity of milk production from demonstration site (KDU) cattle will be better than normal feed cattle													
4.1	Literature review and study the existing quantity and quality of milk (Stakeholder I & IV)					*	*	*	*					
4.2	Comparative study of milk production of the cattle from demonstration site feed with nutrient rich compressed straw block with normal feed (Stakeholder I & IV)						*	*	*	*				
4.3	Laboratory analysis of significant number of milk samples from both feed (Stakeholder I & IV)						*	*	*	*				

Work and monitoring plan

	Key Activities	Year 1				Year 2				Year 3				Responsible
		1	2	3	4	1	2	3	4	1	2	3	4	
	Output 5 : Number of commercial production of straw block will increase													
5.1	Consulting and contracting agricultural economist specialists (Stakeholder IV)				*	*	*	*						
5.2	Organize training course and seminars to livestock farmers, machine manufacture to introduce the benefit of compressed straw block against burning. (Stakeholders I, II, III & IV)						*		*		*			
5.3	Organize study tours to livestock farmers and machine manufacture of the province to the pilot site (KDU) (Stakeholders I, II, III & IV)							*	*	*	*			
5.4	Identify and technology transfer to local manufactures to fabricate compressing and auxiliary machine. (Stakeholders I, III & IV)									*	*	*		

Work and monitoring plan

Key Activities	Year 1				Year 2				Year 3				Responsible	
	1	2	3	4	1	2	3	4	1	2	3	4		
Output 6.1 : Availability of livestock feed of compressed nutrients straw block in the lean season encourage farmers to start commercial livestock farming														
6.1.1 Organize study tour and seminar to introduce the benefit of compressed straw block to province farmers to the pilot site (KDU) (Stakeholders I, II, III & IV)								*		*				
6.1.2 Organize study tours to livestock farmers of the province to the pilot site (KDU) and awareness of Straw harvest equipments.(Stakeholders I, II, III & IV)									*		*			

Work and monitoring plan

Key Activities		Year 1				Year 2				Year 3				Responsible
Quarter		1	2	3	4	1	2	3	4	1	2	3	4	
Output 6.2: Study tour and seminar on utilizing straw as compressed nutrient feed block and straw harvest technologies for farmers, researchers, academician, policy maker, politician with in the country and aboard														
6.2.1	Organizing study tours and seminars for livestock farmers, manufacture, and business community interested to produce feed industries (Stakeholders I, II,III & IV)									*	*	*	*	
6.2.2	Organizing a study tour and seminar for national researchers, academician, policy maker, politician and international visitors (Stakeholders I, II, III, IV & CSAM)									*	*	*	*	

Budget

Commitment item class and description	2019	2020	2021	Total (USD)
FT_CLASS_010 Staff and other personnel costs	10500	16500	17000	44000
FT_CLASS_130 Supplies, Commodities and Materials	17000	5000	4000	26000
FT_CLASS_135 Equipment, Vehicles and Furniture	2000	3500	3500	9000
FT_CLASS_160 Travel	11000	3000	2000	16000
FT_CLASS_125 General operating and other direct costs	3000	10000	12000	25000
Total Cost	38300	39350	42350	120000

Thank you for your attention

