Impact of alternative feed technology utilization, between the increase in feed cost and revenue on rural cattle farming

R E M F Osak, T F D Lumy and M L Rundengan
Faculty of Animal Science, University of Sam Ratulangi

Email : richard.osak@unsrat.ac.id

Abstract. The research aims to study the effect of alternative feed technology utilization include costs of alternative feed technology and added labor costs to the value added or revenue added of cattle farming. The aims for search the effort the development of beef cattle feed technology utilization in increasing household income, improving production yields and can reduce the cost factors needed in cattle farming. The study was conducted in the Minahasa Regency of North Sulawesi Province, Indonesia. The research method that has been used is a survey method to cattle farmers with an interview approach based on a list of questions (questionnaires). The research sample are cattle farmers household with the criteria: a minimum of one year experience in cattle farm, and using alternative feeds such as hay, silage, ammonia of crop waste, urea molasses block and dry straw tower. Alternative feed technology cost and alternative feed technology workflow costs in cattle farming have a significant effect on value added cattle. Allocation of farmer workforce after using feed technology is actually higher than before they use feed technology, but the parameter coefficient of alternative feed technology cost has a positive sign indicate that even though production costs increase but produce greater additional revenue cattle farming.

1. Introduction
The major sources of cattle feed in rural cattle farming in developing countries besides conventional feed are forages and concentrate, there are also crop residues and by-products. Farmers use crop residues and by-products feed depending upon their direct impact on production, economics and alternative technology. Farmers usually besides cattle farming also cultivate food crops or plantation through mixed farming systems or livestock-crop integration systems. Mixed farming systems comprising crops and livestock have traditionally been developed by farmers in a way to be complimentary. This system indirectly produces additional work for family labor, and minimizes the risks associated with conventional agricultural systems [1,2]

The main problem of cattle feed in developing countries as in Minahasa Regency, Indonesia is the gap between demand (the needs) and supply (availability) of either concentrate or forages and fodder crops. For this reason, it is necessary to increase the availability of feed for the different or alternative production for the cattle. One of the solutions is the utilization of feed technology by using non-conventional or alternative feed sources (NC/AFR).

The challenge is to ensure that technologies are used to enable or make more efficient, economic and practical are urgently required [3,4]. Technology is the method of rationally analyzing how to simplify or combine various elements and factors, technology concerns the application of science to
the needs of man and society [5], include in the cattle farming. The types of technology consist of
traditional technology or hereditary technology, middle technology and advanced technology, even
now emerging digital technology (industrial era 4.0). Agriculture 4.0 according to Beddington [6], the
coming agricultural practice, using technology not simply for the sake of innovation but to improve
and address the real needs of household income.
However, the use of alternative feed processing technologies in developing countries is generally
still simple or appropriate technology, cattle farming still uses non-conventional or alternative feed
resources (NC/AFR). Allocation of farmer workforce after using feed technology is actually higher
than before they use feed technology. The technology in the study area only uses traditional or
appropriate technology with a high allocation of labor time for household human labor[7]. Some of the
potentially available non-conventional or alternative feed resources in the study area are through feed
processing such as hay, silage, ammonia of crop waste, urea molasses block (UMB) and dry straw on
tower.
The use of alternative feed technology greatly affects household decisions in conducting production
activities, so it is necessary to conduct research on the relationship of the use of alternative feed
technology with cattle farm production costs and productivity, and household income in cattle farming
that is still traditional. Cattle farm in this area is a part-time business, so the income is lower than other
farms. Although using technology, livestock farming income has increased compared without using
technology [7], but is it alternative feed technology utilization can increase farming revenue and
family income farmer or actually increase feed costs and reduce agricultural income.
The research aims to study the effect of alternative feed technology utilization include costs of
alternative feed technology and added labor costs to the value added or revenue added of cattle
farming. The aims for search the effort the development of beef cattle feed technology utilization in
increasing household income, improving production yields and can reduce the cost factors needed in
cattle farming.

2. Materials and Methods

2.1. Research Approach.
The research method that has been used is a survey method to cattle farmers with an interview
approach based on a list of questions (questionnaires). The study was conducted in the Minahasa
Regency of North Sulawesi Province, Indonesia. The study sample was selected by purposive
sampling, where elements selected for the sample are chosen by the judgment of the researcher.
Researchers often believe that they can obtain a representative sample by using a sound judgment. The
research sample are cattle farmers household with the criteria of raising cattle at least 2 heads, a
minimum of one year experience in cattle farm, and using and processing alternative feeds such as
hay, silage, ammonia of crop waste, urea molasses block (UMB) and dry straw tower.

2.2. The operational definition of variables.
(1) Alternative feed technology is alternative feeds such as hay, silage, ammonia of crop waste, urea
molasses block (UMB) and dry straw tower (kg/year/respondent); (2) The cost of alternative feed
technology is the additional cost of using the technology incurred based on the processing of feed as
hay, silage, ammonia of crop waste, urea molasses block (UMB) and dry straw tower
(IDR/year/respondent); (3) Forage investment is calculated based on the cost of introducing the
production of superior forage (Rp/year/respondent); (4) Cattle production is calculated based on unit
cattle according to Gittinger [8], namely adult cattle aged > 2 years equal to 1.2 AU (animal unit),
cattle age 1-2 years equal to 0.8 AU and cattle <1 year equal to 0.3 AU; (5) Outflow of labor in beef
cattle business is outpouring of work hours on agricultural business management work measured from
working hours equivalent to men (hours/year/respondent); (6) Income of beef cattle farmer household
is income of farmer household family that is obtained from cattle business, non-cattle farming, use of
non-farm labor (IDR/year/respondent); and (7) Beef cattle farm income is net income obtained by the
household of beef cattle farmers from the sale of cattle minus the cost of production (IDR/year/respondent).

2.3. Data analysis.
To describe the condition of the beef cattle farming in the study area, descriptive analysis with tabulation, table analysis, frequency distribution and percentage of each variable will be used. Cow production is measured by the Value Added of Cattle (VAc) variable, which is thought to be influenced by Alternative Feed Technology Costs (AFTC) and Alternative Feed Technology Workflow Costs (AFTWC), which are formulated as follows:

\[ VAc = f(AFTC, AFTWC) \]  
\[ VAc = a_0 + a_1 AFTC + a_2 AFTWC + e_i \]

Hypothesis : \( a_0, a_1, a_2, > 0 \)
Notes:
VAc : Value Added Cattle, i.e. the additional amount of value of cattle, both from the sale of cattle and the value (market price) of cattle that are still being kept for a year (IDR/year/respondent)
AFTC : Alternative Feed Technology Cost is the cost of materials and tools for implementing alternative feed technology for a year (Hours / Years / Respondents)
AFTWC : Alternative Feed Technology Workflow Costs, which is the cost of paying labor costs on the application of alternative feed processing technologies for a year (IDR/year/respondent).
a_0 : Coefficient of the constant
a_1 and a_2 : The parameter coefficients of each independent variable.

3. Results and Discussion
Cattle farming in the study area is generally still appropriate technology, so the adopted technology is simple. The technology analyzed in this study is feed technology that has been used by farmers, as processing of hay, silage, ammonia of crop waste, urea molasses block (UMB) and dry straw tower. Adoption of technology is an important effort to increase productivity in various production systems, namely producers benefit from the application of technology either through opportunities to reduce production costs, increase output from the same input, or by keeping the same output from input reduced.

| Description                        | Before Alternative Feed Technology | After Alternative Feed Technology |
|------------------------------------|------------------------------------|----------------------------------|
| Total Labor Allocation (hours/year)| 107,591                            | 215,182                          |
| Average Labor Allocation (hours/year/respondent) | 1,655 | 3,310 |
| Total Revenue (IDR/year)           | 323,444,552.9                       | 392,500,004.9                    |
| Average Revenue (IDR/year/respondent) | 4,976,070.0 | 6,038,462.0 |

The analysis results as shown in Table 1 indicate that with the adoption of technology causes an increase in the average labor supply of 1,655 hours/year before using feed technology to 3,310 hours/year after using feed technology, thereby increasing wage costs. Increased labor expenditure is
The use of feed technology causes more expensive expenses in the quantity and quality of feed. The respondents theoretically the increase in production lies in the improvement in productivity, namely cattle weight gain and increase in income, so that farmers prefer to use feed technology even though production costs increase but produce greater additional income. This means that even though the use of feed technology causes more expensive production costs, it is accompanied by a significant increase in cattle farm business revenue so that it can earn a greater profit or income than without using feed technology.

Utilization of feed technology by the respondent farmer aims to increase cattle farming productivity, namely cattle weight gain and increase in income, so that farmers prefer to use feed technology even though production costs increase but produce greater additional income.

The results of the analysis as shown in table 2 show that with the adoption of technology an average production cost increased from IDR21,066,045 before using feed technology to IDR27,366,346 after using feed technology, but also an increase in the average profit from IDR26,042,115 before using feed technology to IDR33,404,808 after using feed technology, resulting in an increase in profit from IDR4,976,070 before using feed technology to IDR6,038,462 after using feed technology. This means that even though the use of feed technology causes more expensive production costs, it is accompanied by a significant increase in cattle farm business revenue so that it can earn a greater profit or income than without using feed technology.

Probability analysis results F<0.05 means that simultaneously variables consisting of Alternative Feed Technology Cost (AFTC) and Alternative Feed Technology Workflow Costs (AFTWC) in Cattle Farming can be seen as follows:

\[ V_{Ac} = 40.09 + 0.32 \text{AFTC} + 0.03 \text{AFTWC} + e_i \]

The results of the analysis as shown in table 2 show that with the adoption of technology an average production cost increased from IDR21,066,045 before using feed technology to IDR27,366,346 after using feed technology, but also an increase in the average profit from IDR26,042,115 before using feed technology to IDR33,404,808 after using feed technology, resulting in an increase in profit from IDR4,976,070 before using feed technology to IDR6,038,462 after using feed technology. These results showed that the more cattles are maintained, the more efficient outflow of labor[9]. The parameter coefficient of alternative feed technology cost (AFTC) has a positive sign indicate that if the expenses for feed is raised, it will lead to an increase in cattle production or an value added of beef cattle. The results of this study indicate the role of feed technology utilization, because the feed given has been done by technology to improve quality. This means that the increase in livestock production will increase if an increase in the quantity and quality of feed. This result showed that theoretically the increase in production lies in the improvement in the quantity and quality of feed used.

### Table 2. Costs, Revenues, and Profit of Cattle Farming without Feed Technology or Using Feed Technology

| Description | Before Feed Technology | After Feed Technology |
|-------------|------------------------|-----------------------|
| 1 Total Cost (IDR/year) | 1,369,292,947.1 | 1,778,812,495.1 |
| Average Cost (IDR/year/ Respondent) | 21,066.045,0 | 27,366.346,0 |
| 2 Total Revenue (IDR/year) | 1,692,737,500.0 | 2,171,312,500.0 |
| Average Revenue (IDR/year/ Respondent) | 26,042,115.0 | 33,404,808,0 |
| 3 Total Profit (IDR/year) | 323,444,552.9 | 392,500,004.9 |
| Average Profit (IDR/year/ Respondent) | 4,976,070.0 | 6,038,462.0 |
The results of the analysis on the equation show that the average number of labor allocation is 107.590.75 hours per year or with an average of 1.655.24 hours/year each respondent for a year or 4.5 hours/day per respondent. This means that the average amount of labor allocation per animal unit (AU) is 607 hours of cattle each year or 1.66 hours per AU/day.

Allocation of farmer labor after using feed technology is actually higher than before they use alternative feed technology, which seems different from Chayanov's theory, where using a technology will reduce the allocation of farmer labor or family work hours on his farm, so as to provide leisure or leisure time for family members to recreation or other activities. This difference is due to the different characteristics of technology and employment opportunities in the Chayanov area in this research area, where technology in the study area only uses traditional technology or traditional technology with a high allocation of labor time for family human labor.

5. Conclusion

Alternative feed technology cost and alternative feed technology workflow costs in cattle farming have a significant effect on value added cattle. Allocation of farmer workforce after using feed technology is actually higher than before they use feed technology, but the parameter coefficient of alternative feed technology cost has a positive sign indicate that even though production costs increase but produce greater additional revenue cattle farming.

Acknowledgements

We thank the Directorate of Research and Community Service (DRPM), the Directorate General of Research and Development Strengthening, Ministry of Research, Technology and Higher Education of the Republic of Indonesia for the RD-KN Research Grant in 2019 which has funded the research that produced this paper. We thank the PMC of Hasanuddin University for feedback for the manuscript.

References

[1] Biradar N, Ramesh C and Pathak P 2007 Traditional livestock feeding practices in Northern Karnataka Indian J. Tradit. Knowl. 06 459–62
[2] Osak R E M F, Lumy T D F and Oroh F N S 2019 Cattle Density Analysis for Development of Cattle Farming in Coconut Land Area in South Minahasa Regency , Indonesia 370–3
[3] Areaya A N 2018 Major Non-Conventional Feed Resources of Livestock 6 786–9
[4] Higgins S, Xiao Z and Katsipataki M The Impact of Digital Technology on Learning : A Summary for the Education Endowment Foundation Full Report
[5] Deitrich R A 1998 Bulletin of SCIENCE, TECHNOLOGY & SOCIETY Bull. Sci. Technol. Soc. 18 313–313
[6] Beddington J 2010 Food security : contributions from science to a new and greener revolution 61–71
[7] Lumy T F D, Rundengan M L, Rintjap A K and Osak R E M F 2018 Issn : 0975-833x Research Article The Role Of Feed Technology In Increasing Cattle Productivity Insoins Minahasa Regency , North Sulawesi Indonesia
[8] OF F and Analysis F Financial analysis in agricultural project · preparation
[9] Wantasen E, Hartono B, Hanani N and Panelewen V V J 2014 Household Economic Behavior of Traditional Cattle Farmers in Utilizing Artificial Insemination Technology · A Case Study in Village of Kanonang III , Minahasa Regency of Indonesia 2 141–52