

Applications of Infrared Thermography for bovine mastitis prevention and sustainable dairy cattle production in Romania

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ABSTRACT

Romania has a long history in milk production, but in spite of its great potential, the entrance into the E.U represented a vivid challenge for the dairy livestock, composed of millions of small family farms, lacking modern technology. In these farms the incidence of bovine mastitis is very common. Studies carried out previously have shown that keeping bovine mastitis under very strict control may be achieved by implementing early detection tools such as infrared thermography (IRT). Although the results have been extremely promising, the cost of the equipment used in those studies limits their use in family-type farms. Therefore, the aim of our study was to evaluate the possibility of using less expensive equipment, more precisely, a portable phone-connected infrared thermal vision camera (Flir One Pro) for the early detection of bovine mastitis in Romanian Black and White cows and compare thermography and somatic cell counts results. To our knowledge, this type of approach has not been tested previously. The study was carried out on 5 different family-sized farms from the northeast of Romania, in the period July-September 2021. The Infrared images were taken from a number of 21 cows, before milking, in the early morning. Milk was collected from each quarter and the somatic cell count was determined in the Laboratory of Food Safety and Animal Biology within SCDCB DANCU. The number of somatic cells correlated positively ($r = .709$, $p < .001$) with the infrared thermography results measuring the skin surface temperature of teat sphincters in both healthy and cows with subclinical mastitis. Small-scale farms are vital to the rural economy, particularly for small and marginal farmers, thereby it is imperative for these cattle breeders and the Romanian economy to obtain milk according to E.U. standards, in order to valorize it at an advantageous, competitive price. The use of a low-cost non-invasive tool such as a phone-connected infrared thermal vision camera may be a feasible solution for small farmers since it enables them to monitor the udder health status, cow-side, in an easy, rapid manner, with lower costs.

Key words: dairy cattle; mastitis; infrared thermography; somatic cells count

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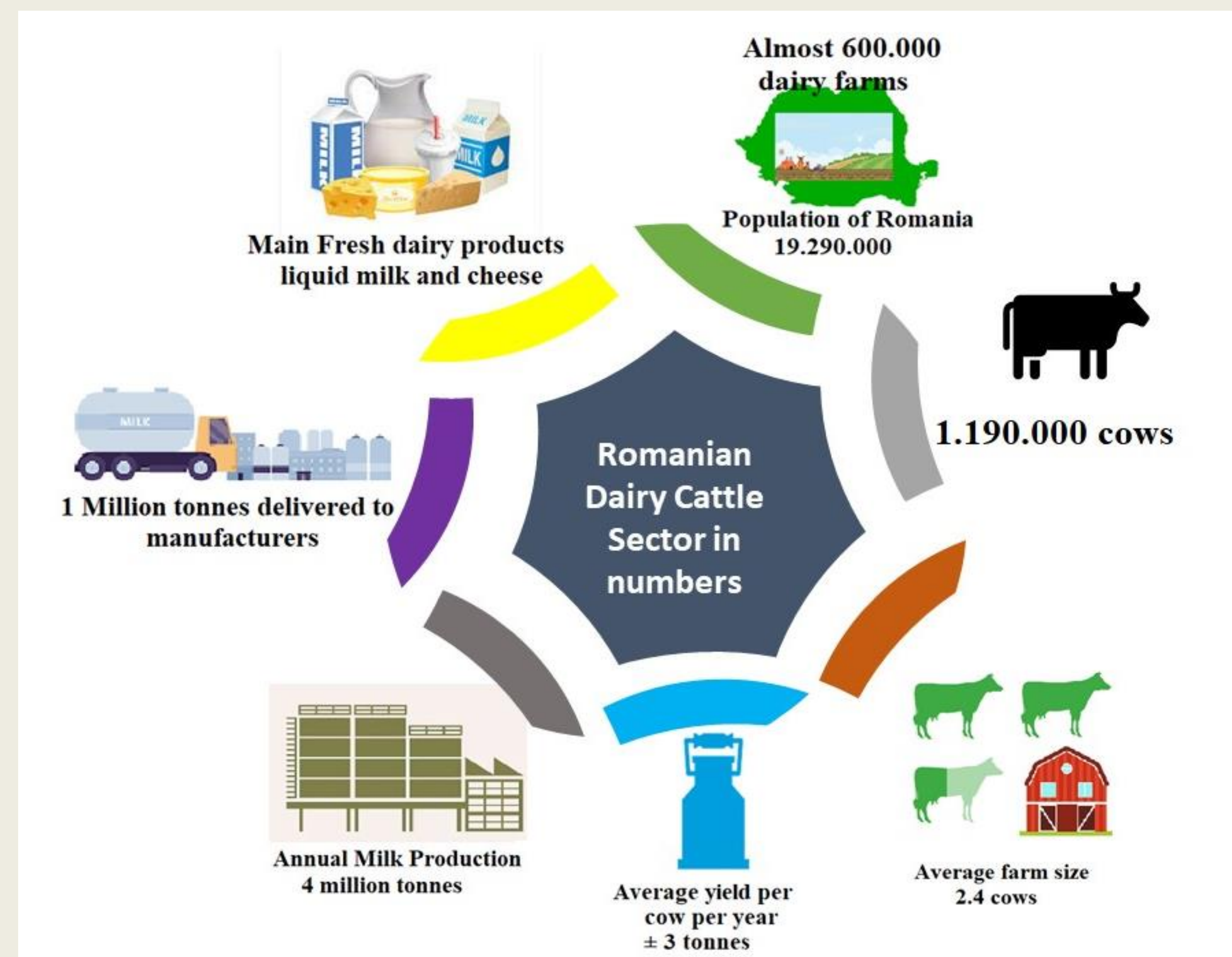
INTRODUCTION

The Romanian dairy cattle system in Romania is composed of almost 600,000 farms scattered throughout the territory. Most of the cattle population of (around 1.190.000 million cows) is found in family farms, the average number of cows per household being 2.4 animals (Figure 1). Strengthening the family farming system, as a guarantee for food security and for the maintenance of rural social structures is essential in Romania and other countries in the similar situation [1].

Family farms may contribute to the dynamics of the territory, the valorisation of the vulnerable spaces, the promotion of the local knowledge and the preservation of the cultural and biological patrimony. Family farms thus remain the best means of ensuring the viability of food production, the sustainable management of natural resources and biodiversity and the preservation of an authentic rural life. In order for these farms to be able to develop sustainably in the future, education and to produce milk at European standards, keeping bovine mastitis under control and ensuring hygiene standards is essential.

Aim of our study was to evaluate the possibility of using less expensive equipment, more precisely, a portable phone-connected infrared thermal vision camera (Flir One Pro) for the early detection of bovine mastitis in Romanian Black and White cows and compare thermography and somatic cell counts results.

Figure 1. The Romanian Dairy Cattle system in numbers



METHODS AND MATERIALS

- The study was carried out on 5 different family-sized farms from the northeast of Romania (Iasi and Vaslui counties) in the period June-September 2021.
- A total number of 21 cows were included in the study (Romanian Spotted Black and White and crossbreed).
- The Infrared images were taken using a phone-connected infrared camera (Flir, Pro) before milking, in the early morning.
- Milk was collected from each quarter, in sterile recipients and the quantitative assessment of the somatic cell number was determined in the Laboratory of Food Safety and Animal Biology within SCDCB DANCU, according to *SR EN ISO 13366-2:2007*
- The cut-off limit for the detection of bovine subclinical mastitis was set at 200×10^3 per milliliter [2].

RESULTS AND DISCUSSION

- The number of somatic cells correlated positively ($r = .709$, $p < .001$) with the infrared thermography results measuring the skin surface temperature of teat sphincters in both healthy and cows with subclinical mastitis.
- The somatic cells count varied between 60×10^3 and 198×10^3 per milliliter in healthy cows, while in cows with mastitis, the average somatic count was 1689×10^3 .
- A 1.3°C difference was observed between healthy quarters and mastitis affected quarters

Figure. 2 Infrared thermogram of udder quarters from the lateral side. Red arrows indicates elevated temperature (38°C)

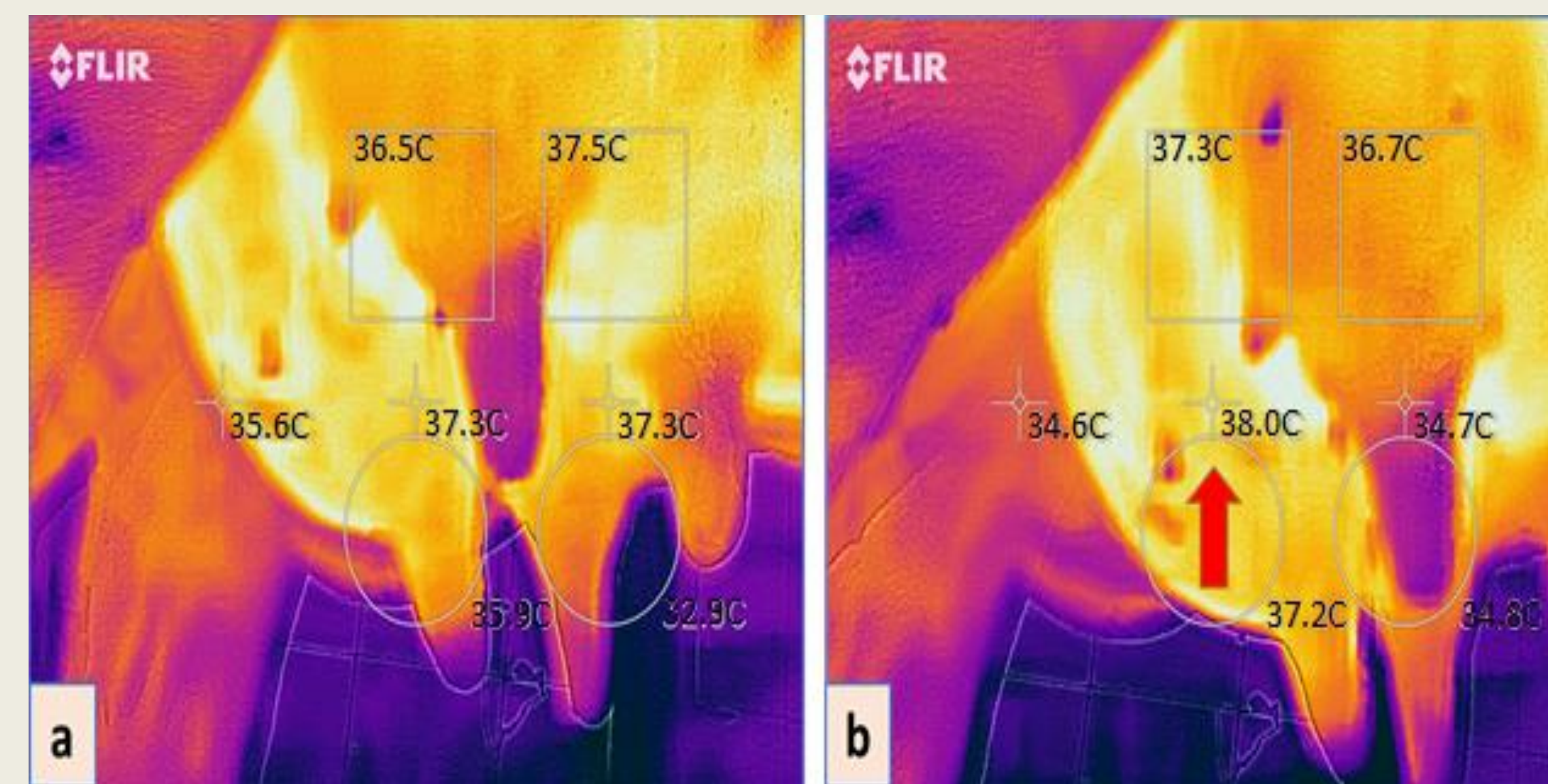


Table 1. Descriptive statistics of somatic cell count and udder skin temperature ($^\circ\text{C}$)

	Normal (n= 13)		Mastitis (n= 8)	
	SCC x 1000 cells/ml	Udder Skin Surface temperature (USST) ($^\circ\text{C}$)	SCC	Udder Skin Surface temperature (USST) ($^\circ\text{C}$)
Minimum	60	34,3	211	37,6
Maximum	198	37,1	7904	38,7
Media	117	36,6	1689	37.9
StdDev	27	0,4	278	0,4

CONCLUSIONS

- Dairy farming in Romania is small-scale but offers good prospects.
- The level of agricultural and technological knowledge among farmers, especially small ones, is still low, thereby the transfer of knowledge may be more challenging
- Infrared thermal imaging using phone-connected camera could be used as a potential noninvasive, quick cow-side diagnostic method for monitoring udder health and improvement of milk quality in family-sized farms

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