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DIPARTIMENTO DI MEDICINA
VETERINARIA E SCIENZE ANIMALI

Efficient use of artificial lighting and intensive use of natural light in milking parlours: the MUNGILUX project

Tangorra F.M.¹, Zucali M.², Calcante A.²

¹ Dept. of Veterinary Medicine and Animal Sciences (DIVAS)

² Dept of Agricultural and Environmental Sciences - Production, Landscape, Agroenergy (DISAA)

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RESEARCH TEAM



Prof. F.M. Tangorra

Project leader



Prof. A. Costa

Dr. Gaia Pirovano

Prof. A. Calcante

Innovation Sub-project Coordinator



Prof. M. Zucali

Dissemination Sub-project Coordinator



Prof. A. Sandrucci

Prof. L. Bava

Prof. A. Tamburini

Prof. R. Oberti

Dairy farms partner

Fogliata Farm

Giacomelli Farm



MILKING AND MILKING PARLOURS

- Milking is a crucial phase in dairy cattle farm management:
 - most of the dairy farmers' income
 - milk quality
 - animal healthare strictly connected to milking parlour management and maintenance
- In modern dairy farms, milking is usually carried out in milking parlours where cows are milked in groups at fixed times;



Tandem



Herringbone



Parallel



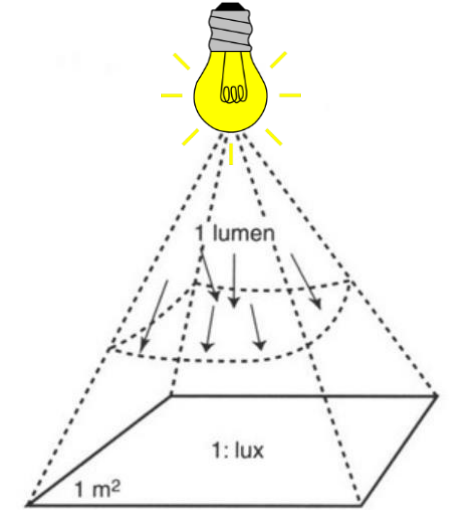
Rotary



LIGHTING STANDARD AND RECOMMENDATION FOR MILKING PARLOURS

- Reference technical standards (UNI EN 12464/1 2021): 200 lx illumination
- Rajaniemi et al. (2015)
- Clarke and House (2016)
- Harner and Smith (2008)

milking parlour lighting intensities of 200-250 lx



- American Society of Agricultural and Biological Engineers (ASABE, 2014)

500 lx to ensure adequate lighting for checking udder hygiene, milk alterations and attaching milking clusters



“A good tip: Sufficient lighting means you should be able to read easily anywhere”

<https://www.dairyglobal.net/dairy/milking/how-to-ensure-lighting-is-sufficient/>



THE REAL SITUATION

- Celozzi et al. (2021), in a study on milking performance and microclimatic conditions of dairy farms, highlighted milking parlour as the area with the worst light intensity during the whole day in the different seasons (winter and summer).
- Tangorra and Costa (2022), in a study aimed to assess the milking parlour lighting during a milking session, found light power density <6 W/m², while only 20 % of the analysed milking parlours had illuminance and illuminance uniformity compatible with the standard (UNI EN 12464/1, 2021) of 200 lx and 0.6 respectively.



PROJECT OBJECTIVES

- Studying and improving milking parlour lighting by implementing alternative, energy-saving and low-cost lighting solutions to illuminate properly the **milker's visual task area**.

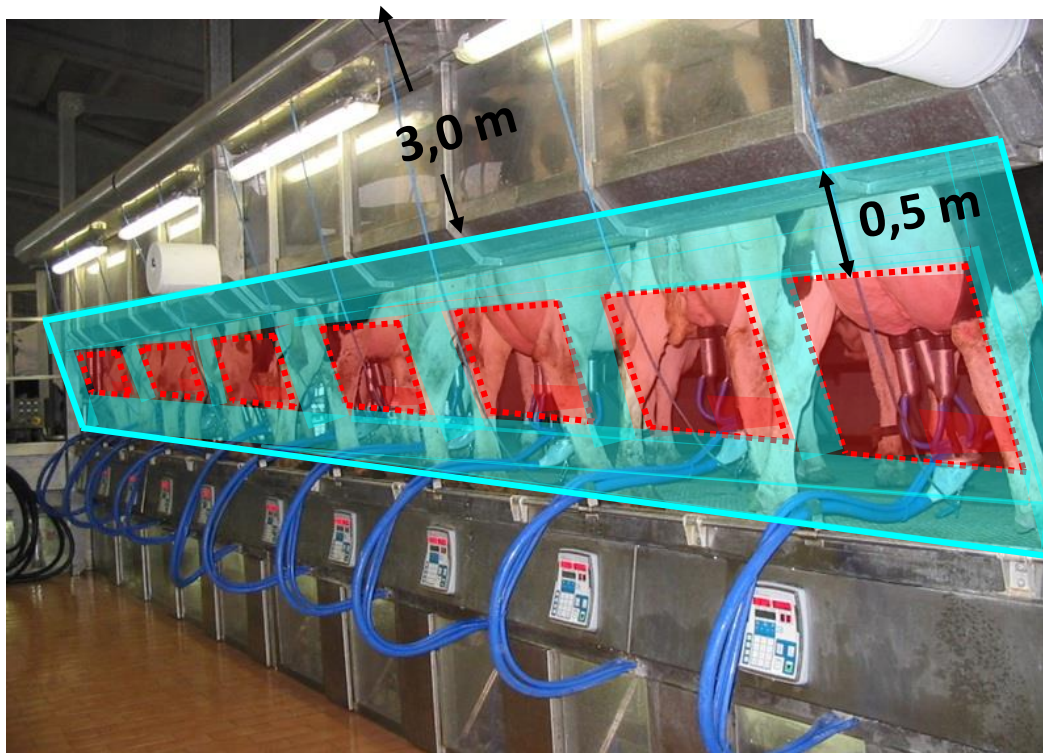
RESEARCH IPOTESIS

- Ensuring adequate lighting for humans and animals can:
 - increase labour productivity and work safety;
 - improve cow management;
 - improve hygienic-sanitary milk quality;
 - reduce energy consumption with a greater economic and environmental sustainability of the whole production process.



MILKER'S VISUAL TASK AREA: THE KEY CONCEPT

- **VISUAL TASK** = set of elements that the milker must correctly and clearly distinguish to perform his tasks
- **SET OF ELEMENTS** = udder, teats, forestripping milk, milking cluster $E_m = 200 \text{ lx}$



VISUAL TASK AREA

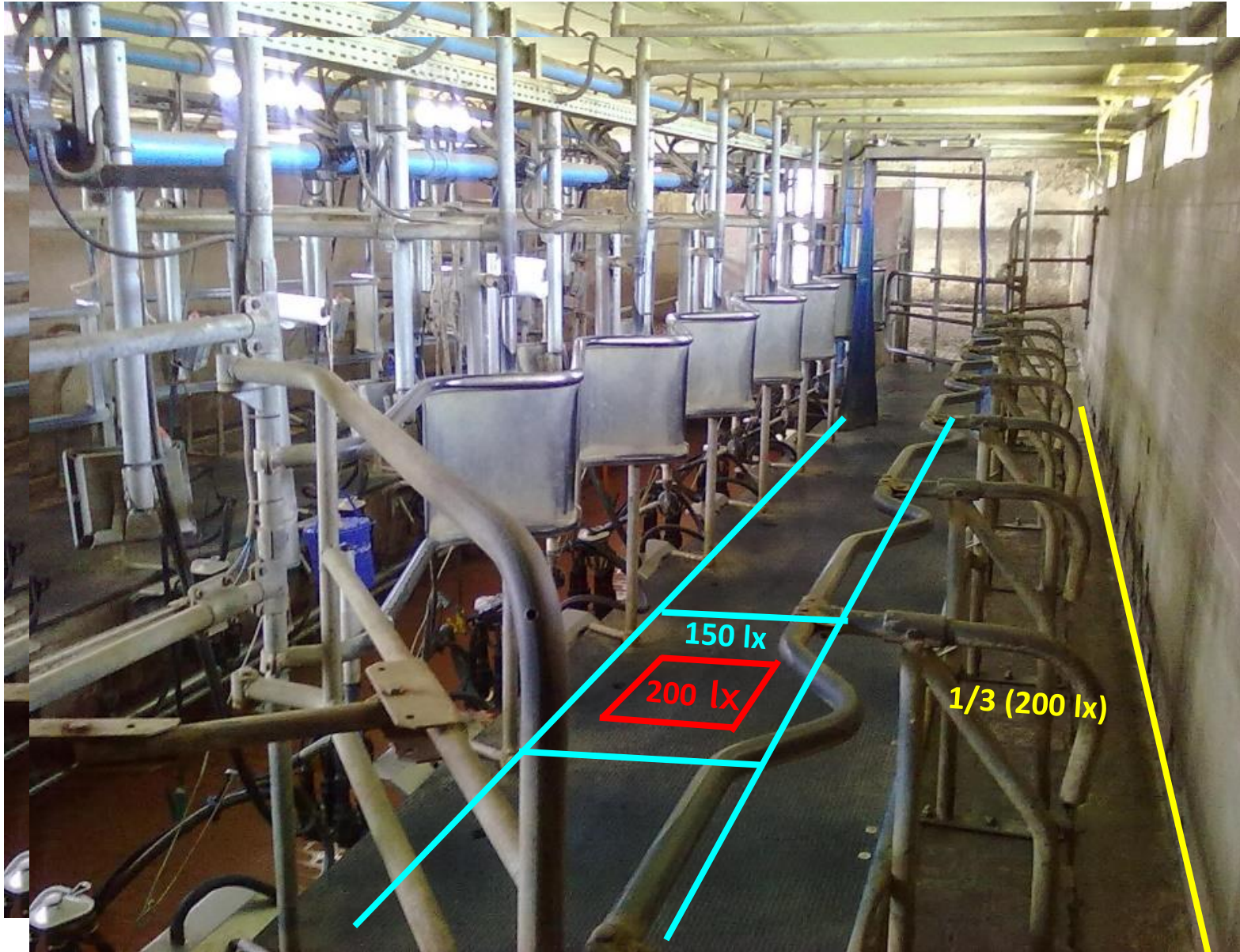
- **Minimum average maintained illuminance (E_m) = 200 lx.** It should never fall below this value and approaching it indicates the need for maintenance of the lighting system.

IMMEDIATE SURROUNDING AREA (a strip around the working area with a width of at least 0.5 m)

- $E_m = 150 \text{ lx}$

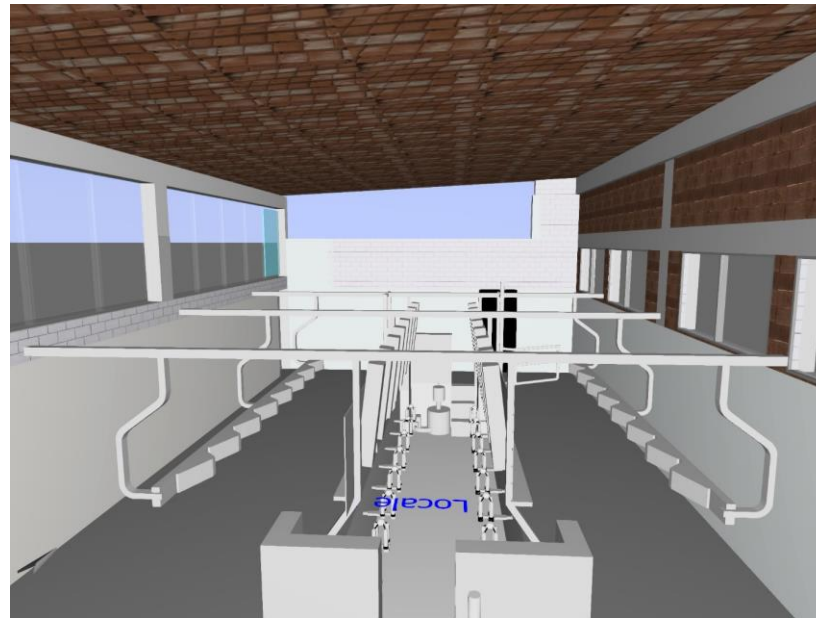
BACKGROUND AREA (a strip at least 3 m around the immediate surrounding area or up to the walls of the room)

- $E_m = 1/3$ of surrounding area illuminance

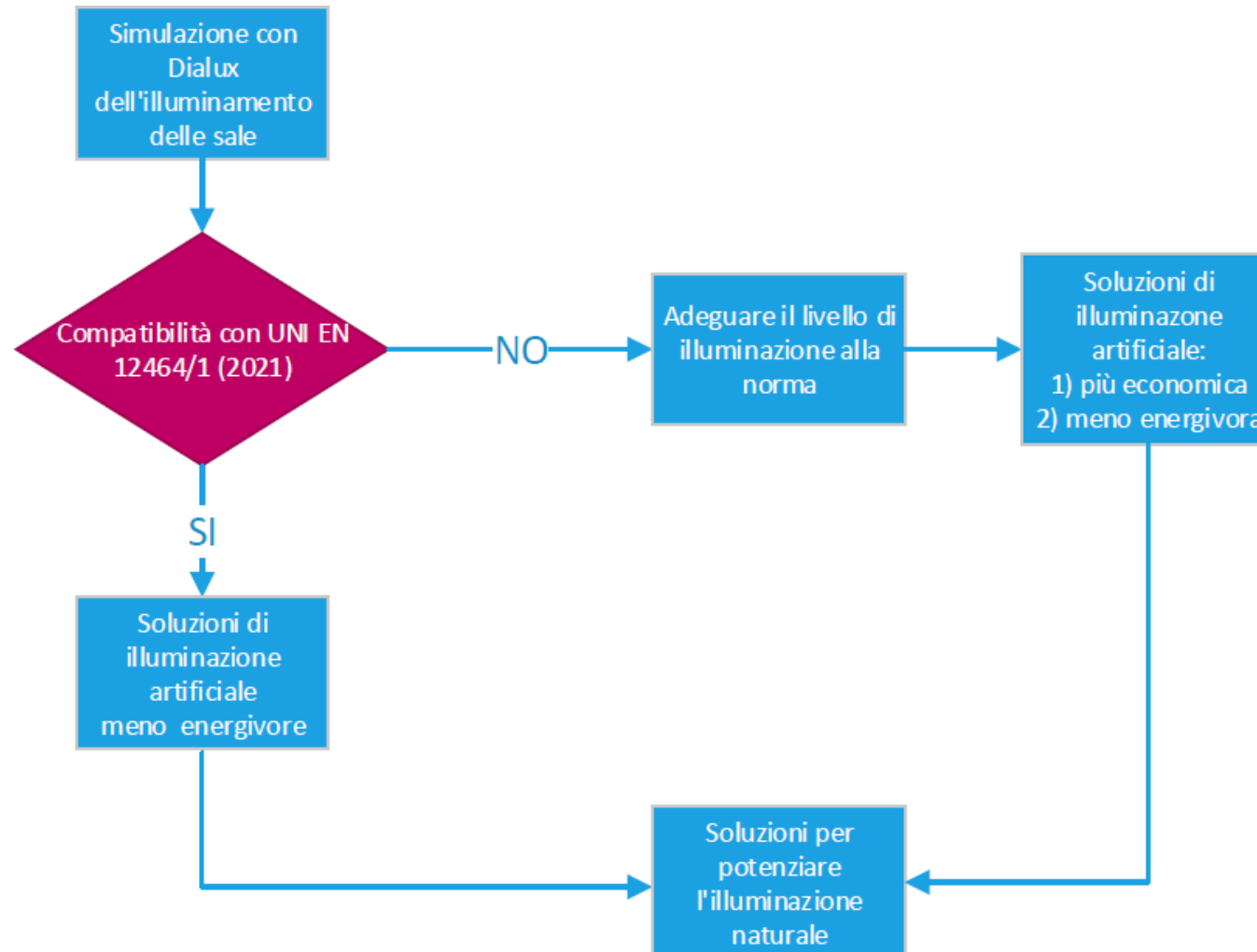


METHODS

1. Milking parlour digital modelling, with the layout of glazed surfaces and luminaires, and the creation of external scenarios to assess any obstacles obstructing the entrance of natural lighting by using a free lighting design software (Dialux)



2. Simulation of the milking parlour illuminance values by the lighting design software and assessing their compatibility with the reference technical standard UNI EN 12464/1 (2021):



3. Estimation of the energy consumption of the lighting solutions based on LENI (Lighting Energy Numeric Indicator, kWh/m²) and calculation of the payback time;
4. Quantification of the direct and indirect benefits achievable with milking parlour lighting optimisation.



EXPECTED RESULTS

1. Providing a method to objectively evaluate the lighting conditions of existing milking parlours and to simulate improvements to the lighting system in terms of energy saving and visual comfort;
2. Generating alternative lighting scenarios and quantifying their energy consumption and payback time allowing better investment;
3. Defining guidelines to properly manage milking parlour lighting with the aim of improving the visibility of the milkers' area of responsibility in order to:
 - guarantee hygienic and safe working conditions;
 - increase the effectiveness of pre-milking activities;
 - reduce the possibility of accidents and fatigue that can lead to chronic problems;
 - improve the quality and productivity of work;
 - reduce animal stress in all milking related activities



THANK YOU

