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Is precision livestock farming a way to improve farmers' working conditions?

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EAAP, Session 58, PLF for social, environmental and ethical impact

Significant working time, a factor explaining the development of new technologies

Context and expectations expressed by farmers to save time on farm:

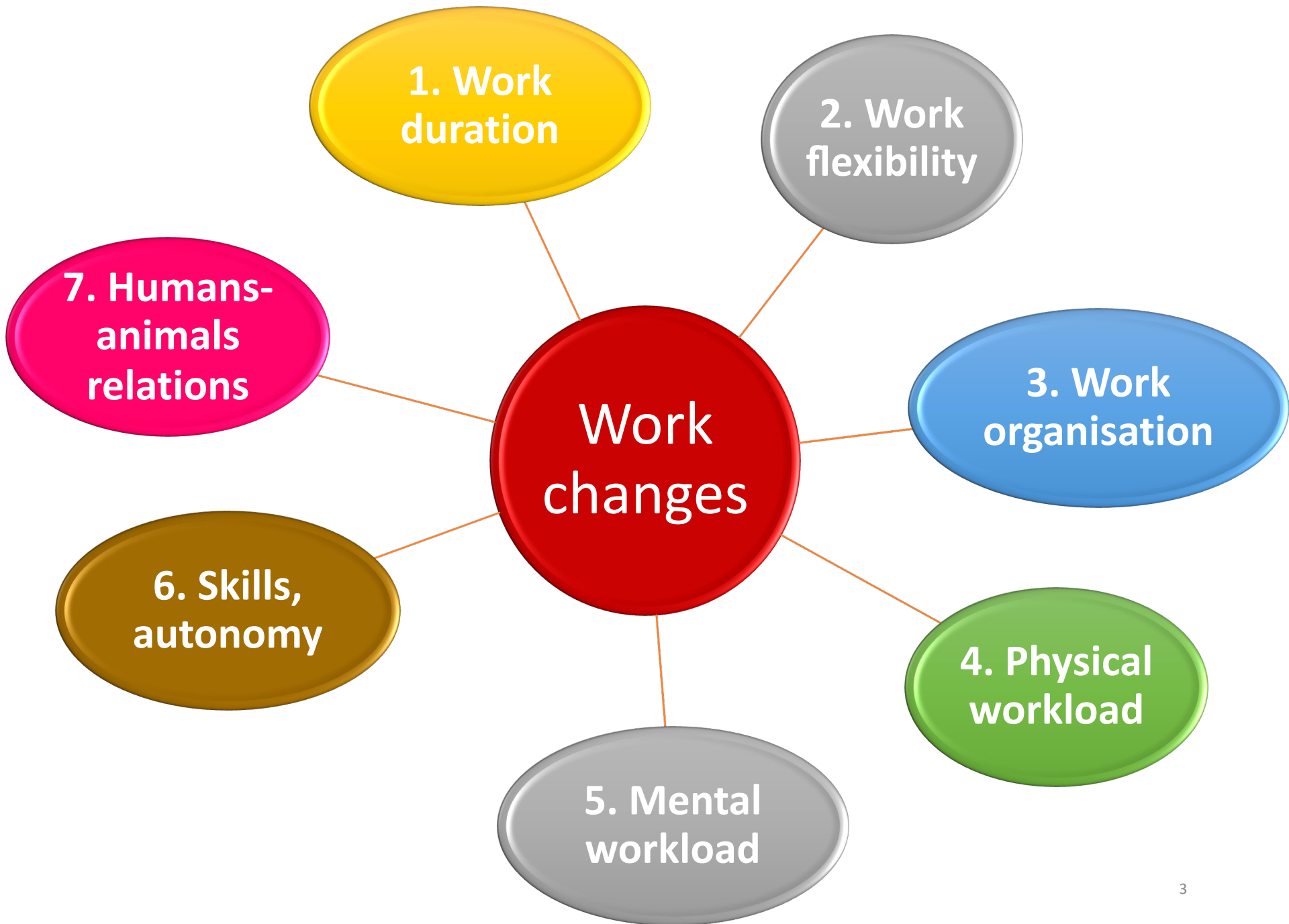
- Increased herd size and agricultural area in average, on farm
- Reduction of family labour on farms

⇒ Labour pressure increase due to the declining workforces available

⇒ Looking for solutions

- to increase labour productivity
- to work on their quality of life too

What are the implications of new technologies on farmers' working conditions?



1. Work duration

Saving time on specific activities

Physical execution of the task by an automaton (e.g. milking)

Automated information collection by sensors, easy storage and fast centralized processing

Faster decision making (feedback facilitated with the use of alerts or summary reports)

Possibility to focus only on animals requiring special attention



1. Work duration

Objectively measured time savings for some technologies

No assessment of time savings for all PLF tools

Great variations in working times: from a few minutes to several hours

- Feeding robot : up to 3 h/day for 60 dairy cows (Nydeggeret and Grothmann, 2009) ; 1 h/d for 280 animals (cattle)
- Milking robot: 20% to 50% of routine work (Billon et Pomiès, 2006; de Koning, 2011; Martin et al 2022)
- Sensors for heat detection: few minutes to 2 h/day for a herd of 400 dairy cows in grouped calving (Jago, 2011)

A diversity of time savings **depending on the condition of the initial equipment**

Sometimes **difficulties to quantify time savings** (monitoring, decision)

1. Work duration

Different uses of time savings by farmers

Management of alarms on equipments and alerts on animals requiring special attention (e.g. animals with health problems)

Observations / monitoring / **herd care**

Development of animal production (increasing herd size)

Development or creation of other productions (crops, livestock) or agricultural activities (direct selling, transformation)

Spend more time with family/friends outside

1. Work duration

Towards an increase of work duration ?

Sometimes **no time saved** and farmers' perception is **to work more**

The case of automatic milking robot:

- the working day is no longer structured around milking activities in the morning and in the evening, to conclude the day
- a feeling of being permanently called/connected to the farm due to alerts on animals and alarms on equipments
- A strategy to increase herd size

« I work more now, than before, without PLF on my farm »

2. Work flexibility

Unanimous support for work flexibility

No more fixed hours for some tasks (milking, feeding)

= Easier to **manage absences** from the farm and to reduce time pressure

Performing tasks at other times of the day (animal monitoring,...),

= better timing and mindset for the farmer and the animals

Decrease work at night

(detection of calvings using camera or heat detector)



3. Work organisation

New tasks

- **Daily routine tasks:** data consultation on computer, to search/find animals with alerts and then react (e.g. to push cows to the robot if too little milked)
- **Occasional tasks:** maintenance of the equipment



3. Work organisation

New tasks

- *Daily: data consultation, push the cows to the robot*
- *Occasional: maintenance of the equipment*



Modification of tasks

- Animals' observations
- Preparation of silos / feed storage location with feeding robot



3. Work organisation

Need to reorganise routine and seasonal work

New tasks

- *Daily: data consultation, act with animals (push the cow to the robot)*
- *Occasional: maintenance of the equipment*



Modification of tasks

- *Animals' observations*
- *Feeding preparation*



Disappearance of tasks

- *Daily work: milking or feeding*
- *Weighing of poultry*



Work duration / flexibility / organisation :

Questions for further research

- How to **better understand** and **assess** the real change in working time and to identify its **determinants & variability**?
 - For each equipment developed by different companies and available on the market? Often updated.
 - Without the same type of equipment and level of optimisation /saturation in each farm before /after investment?
- How are **tasks reorganised within the work group/ workforces** on farm considering particular skills, interests, hierarchy, status among workers... ?

4. Physical workload

Reduction of the physical workload

= physical substitution of the task when using automatons

Milking robot:

- replacement of physical work related to milking by animal monitoring & management of information provided by the computer (de Koning 2010)

In pig farming:

- use of sensors to measure the feed level in silos, instead of climbing to the top to see by yourself
- communication network allowing remote control of the automatons (soup, ventilation) and limiting displacements of workers between remote sites

5. Mental workload

Two different views:

1. Stress reduction by delegating responsibility to detect the event (heat, calving, health,...) and to anticipate interventions

Physiological signs that are not well or not visible to the human eye and that are **more detectable by these new technologies**

=> Anticipation +++

For instance:

Detection of 50% to 55% of heat by an experienced cowherd
vs 59 to 99% by an automated detector (Rutten et al 2013)

5. Mental workload

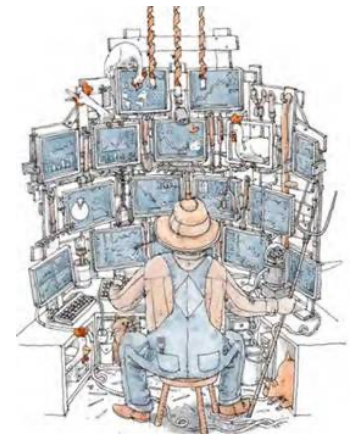
2. Increasing stress in front of the quantity and complexity of information to be selected and analysed

A lot of information and data produced by sensors

- It makes difficult to select useful information for right decision-making

How to **be confident enough** in the messages delivered by the « secret » algorithms

- It takes time for some farmers **to experiment and compare by themselves the efficiency of these technologies**



5. Mental workload

2. Alarm management = a source of stress?

Stress if alarms:

- Are too frequent,
- at any time of the day and night,
- disruption of other activities (multiple calls when farmers are not in the barn with the animals),
- when equipment set-up stage

=> Learn to select the **most useful** and **important alerts**



Physical and mental workload :

Questions for further research

- **How to reduce mental workload and improve the efficiency of alerts** to help farmers decision making?
- **How to choose the relevant data to be monitored?**
 - Which information are useful?
 - Prioritization connected to main farmers' objectives?
 - When can the information be translated into alerts?
- **How to develop skills** to manage data?

6. Autonomy

To carry out the work

Worker's specialisation

(one worker dedicated to the management of PLF)

Efficient but could be a weakness sources?

"Stéphanie is the only one who knows how to use the robot properly. The other two partners would not be able to manage in case of absence. They will manage but it is risky and they don't know how to do everything. They are versatile except for the robot".

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Workers' exclusion from the farms' activities

If they don't know how to use them, they may feel useless, excluded as unpaid worker, or retired parents...

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To carry out the work

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Workers' exclusion from the farm

Difficulty to replace workers

(temporarily for holidays or definitely when employees or partner leave the farm)

"Marie-Hélène's absence is difficult to replace because she has a very good technical mastery of monitoring milking robots and calves".

6. Autonomy

To take decision

Risk of **dispossessing the know-how of farmer** with tools, technologies and algorithms ("no longer deciding by himself")

- On such point, are there differences among farmers
- who worked on farm before/after investment in PLF
 - who started to work only with PLF

Or a possibility to find solutions using the data (handle with the complexity) => to have more information is better to decide

« *With data, I know my herd better and more deeply to react* »



6. Skills

To improve skills

Due to the new tasks associated to PLF (sensor and automaton maintenance, working organisation, data management...), it's important **to understand and build appropriate communication and training channels** used by farmers to reach self-sufficiency.

For **farmers** but also **all partners** (advisors, vets, researchers, teachers) to be able to support farmers



Autonomy/skills : Questions for further research

- How does decision-making autonomy and information control **evolve after the adoption of PLF?**
- How is **PLF changing the dependence** of farm workers on employers and industrial firms?
 - How to build confident relationships to trust company working on algorithms?
 - Do they want to produce data and delegate analysis or retain analytical/strategic skills within their workforce?
- Is it more difficult **to replace farmers** in case of absences and to find skilled workforce to manage these precision tools (by wage earners, others family workers, etc.)?

7. Changes in human-animal relationship

A diversity of practices among farmers

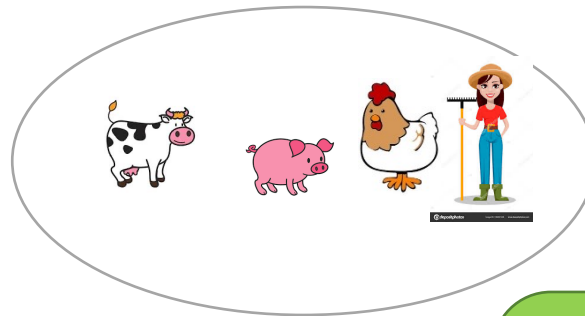
- **Full delegation of the task or the decision**
 - no more contact between the farmer and his animals for this task
 - No more observation for decision (artificial insemination)
- **Partial delegation**, the farmer verifies the data, or manually carries out certain tasks
 - contact kept between the farmer and his animals (e.g. manual weighing + automatic weighing ; manual milking + milking robot)



7. Changes in human-animal relationship



Some farmers express some reservations :
The tools **cannot replace farmers' eye**
Risk of loss of skills ?
Loss of autonomy?



Broad satisfaction of the farmers with PLF :
work easier and greater control



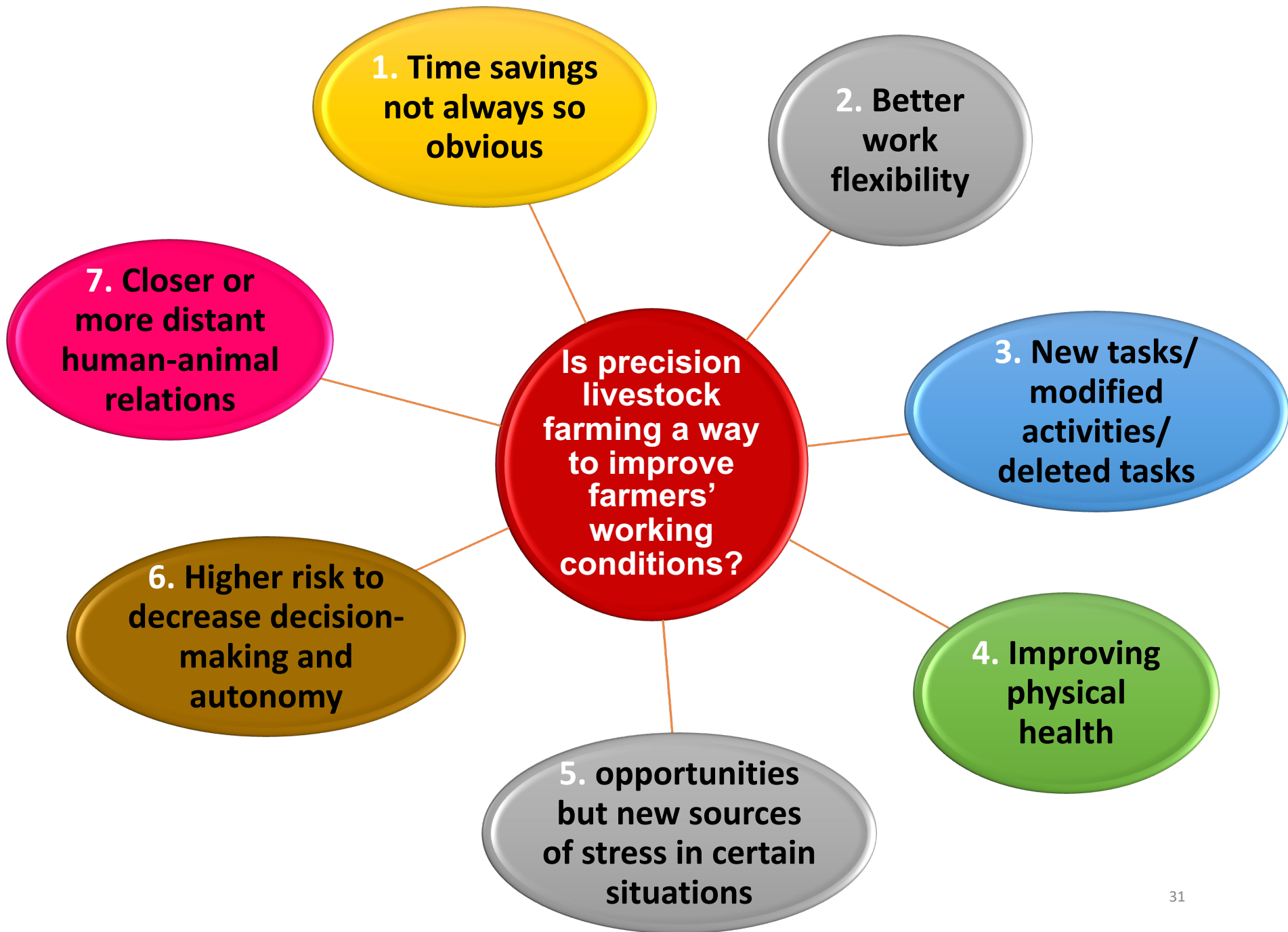
Farmers have room to manoeuvre in how they use the equipment, e.g. :
- Delegation total or partial
- Strategies to work with the animals



No degradation of Human animals relations but **fewer constraints on themselves and on animals**



TO CONCLUDE



- Due to the **investments** required to deploy these technologies, the costs/benefits analysis must take into account the labour and its various connected dimensions.
- **Need to clarify and objectify the consequences of PLF on:**
 - **work** (duration, organisation, productivity, physical and mental health, new tasks and skills)
 - **the farmers' profession representations & relations with the animal**
- **Renewed attractiveness?**
 - Vision of young people attracted by these technologies or industrial livestock representation?
 - Partners or employees attractiveness in such farm?






Thank you

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Surveys in farms in Brittany

											
< 245 TRUIES		> 300 TRUIES		< 85 PRIM'HOLSTEIN		> 105 PRIM'HOLSTEIN			< 25000 POULETS		> 40000 POULETS
DAC	SELFIFEEDER	DAC	SELFIFEEDER	ROBOT	DC	ROBOT	DC	ROBOT+ DC	BOÎTIER RÉGUL.	PESON AUTO + BOÎTIER RÉGUL.	PESON AUTO + BOÎTIER RÉGUL.
8 ÉLEVAGES				10 ÉLEVAGES					7 ÉLEVAGES		



Individual feeding
(free-access stalls)

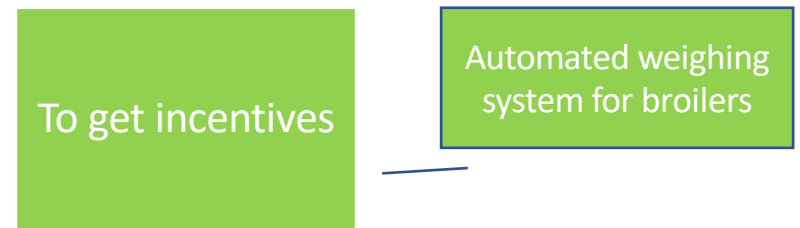
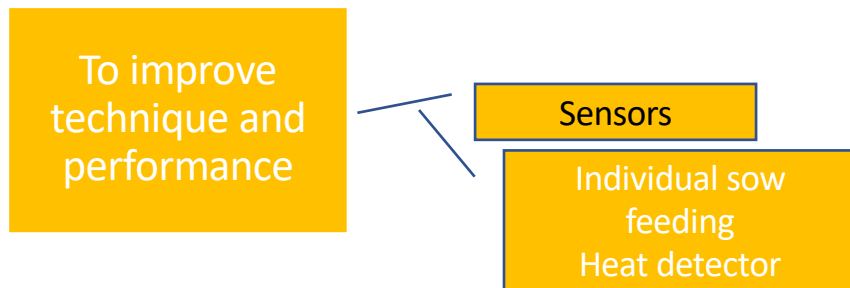
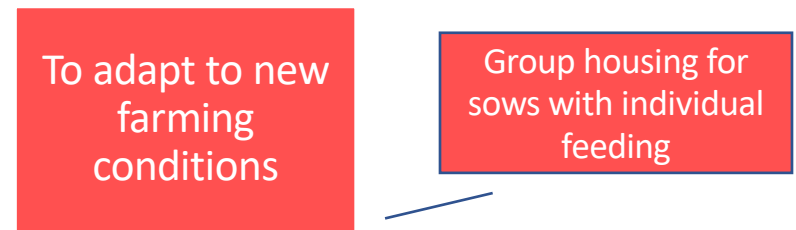
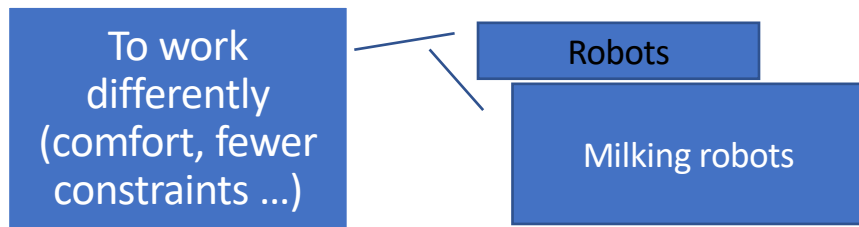


Automatic milking
robot, heat
detector

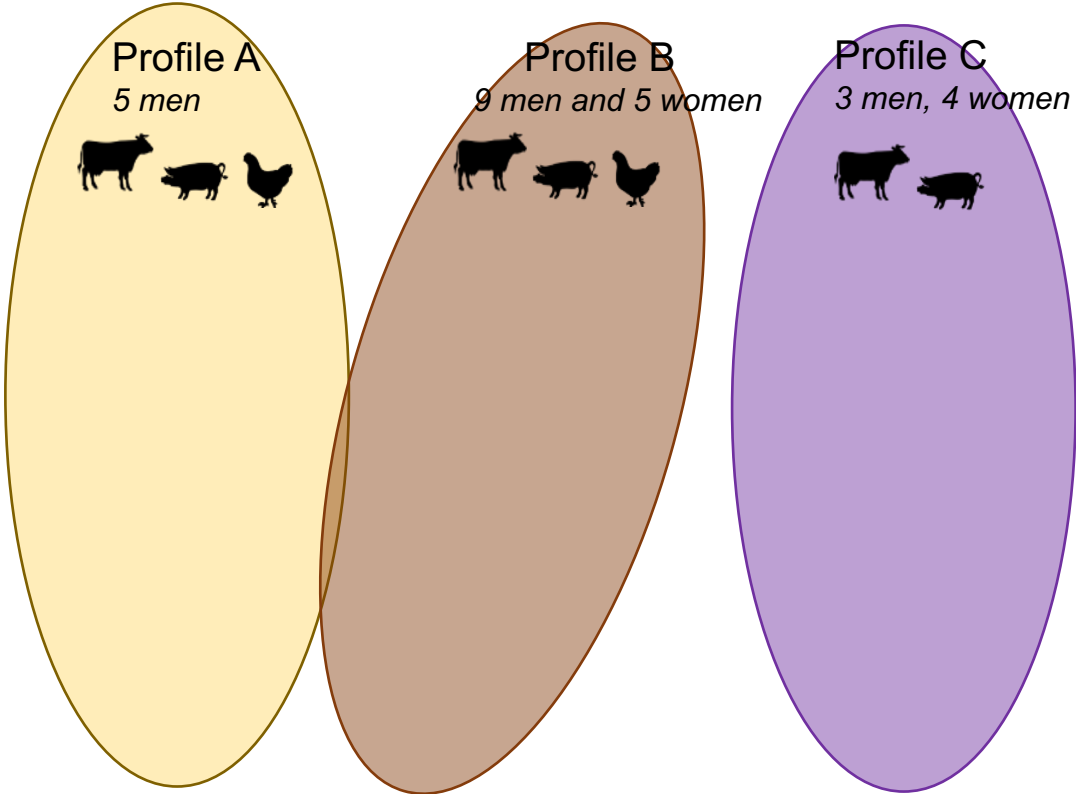


Barn electronic
controllers ;
Automatic weighing
device

Setting up precision farming tools on farm ...



Results : 3 types of farmers



3 types of farmers

