



THE GLOBAL STANDARD  
FOR LIVESTOCK DATA

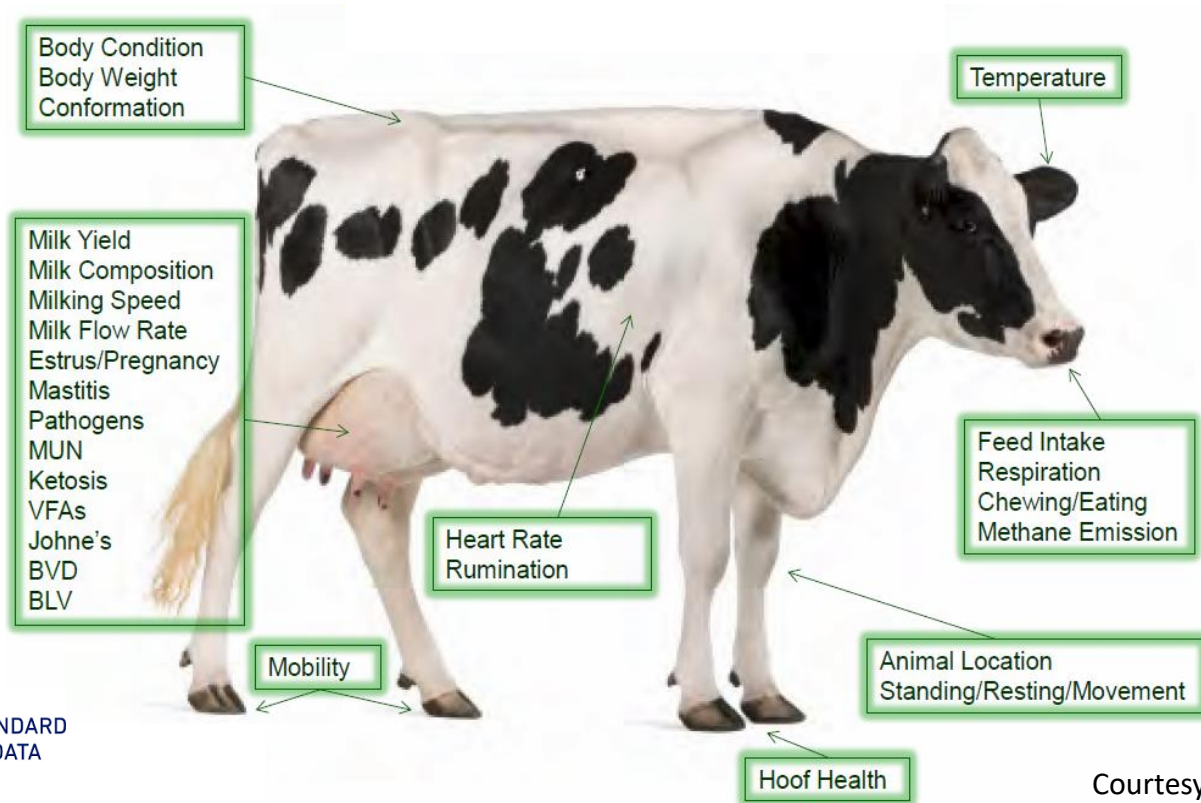
Network. Guidelines. Certification.

# Update on Development of Criteria, Protocols and Guidelines for Sensor Devices

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*Auckland, 11<sup>th</sup> February 2018*

# What can be measured?



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# ICAR initiatives

## Accuracy Task Force (2013-2016)

- Provide sound basis for establishing required accuracy in collection of animal recording data that is incorporated in information services

## Sensor Device Task Force (2016 - )

- Provide guidelines/methodology to help classify and qualify sensor devices
- Development and dissemination of QA/best practices with data collection from sensors
- Dissemination of recording guidelines using sensor data



# 'Eggs to be laid....'

## Use of sensors in practice

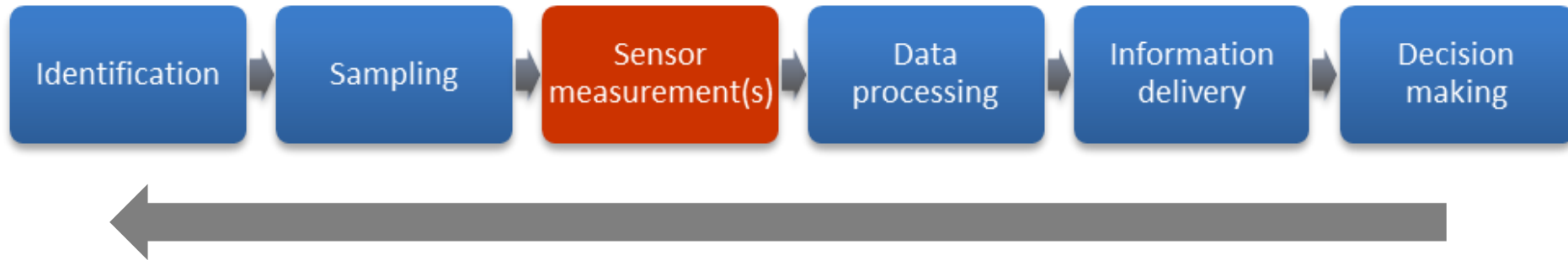
- Guidelines on QA/  
best practices
- Recording guidelines using  
sensor data

## Performance validation

- Criteria
- Protocols
- Certification



# The process....



The aimed at quality of the information in decision making is at the basis of the required performance level in the preceding steps



**Key  
questions in  
determining  
applicable  
validation  
criteria for  
sensor  
devices**

**1.** What is the trait?

**2.** What is the purpose of the sensor measurement?

**3.** What is the type of data?

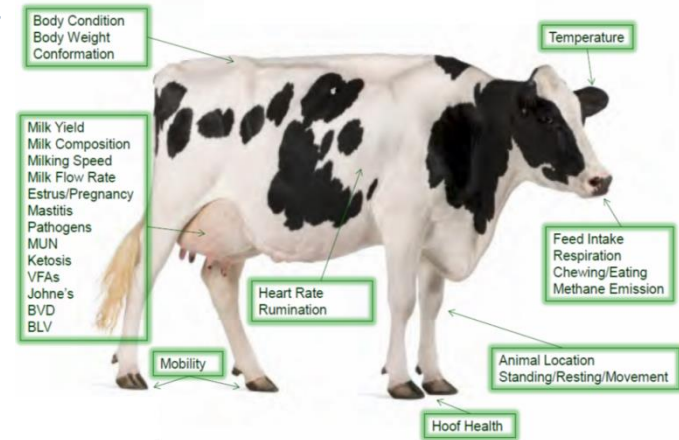
**4.** What is the 'golden standard' (if one)?

**5.** Single or multiple measurements?



# Inventory of sensor devices

- Build database with sensor devices in the market
  - Aimed at trait
  - Purposes of the measurement
  - 'Gold standard/reference method/other
  - Measurement matrix
  - Method principle
  - Performance information with source



- Validated information to be published on Sensor page on ICAR website



# Key performance parameters (1)

Qualitative data	
Sensitivity	The ability to detect the analyte compared to the reference = true positive rate
Specificity	The ability not to detect the analyte when it is not detected by the reference = true negative rate
Robustness	Vulnerability to interferences (shocks/vibrations, humidity, cleaning chemicals, temperature, milk flow speed)



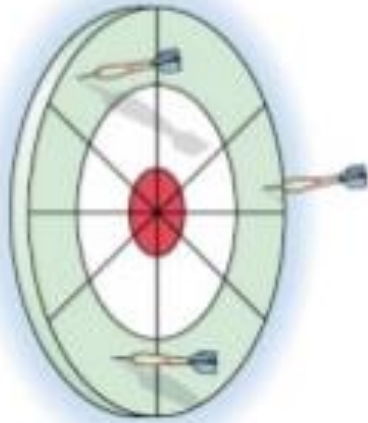


# Key performance parameters (2)

Quantitative data	
Repeatability $r$	The ability to produce the same result over and over under the same conditions
Reproducibility $R$	The ability to produce the same result at different places and/or at different times, e.g. under different conditions
Accuracy	Closeness of agreement between a measured quantity value and a true quantity value of a measurand, which is a result from both random error and systematic error
Robustness	Vulnerability to interferences (shocks/vibrations, humidity, cleaning chemicals, temperature, milk flow speed)



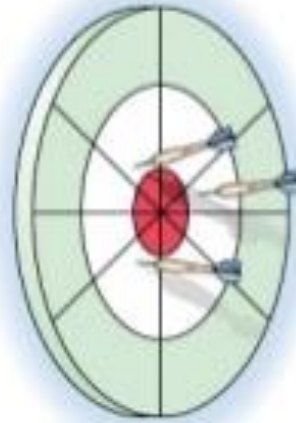
# Precision (r, R) and accuracy



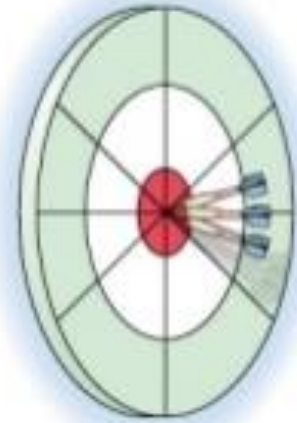
**(a)** Low accuracy  
Low precision



**(b)** Low accuracy  
High precision



**(c)** High accuracy  
Low precision



**(d)** High accuracy  
High precision

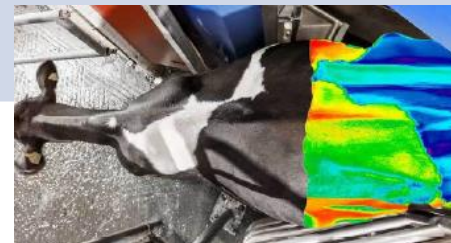
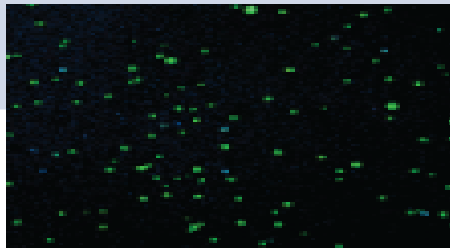
# But that is laboratory talk.....



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# Is it? SCC and BCS are not that different.....

	SCC	BCS
Target	Cell	Cow
Gold Standard	Human eye (through microscope lens)	Human Eye
Alternative method	Flow or image cytometry	Image analysis
Scale	Scale 0 - > 10.000.000	Scale 1 - 10
Applicable performance parameters	r, R, accuracy, robustness	r, R, accuracy, robustness



# Key questions in determining applicable validation criteria for sensor devices

1. What is the trait? Udder health
2. What is the purpose of the sensor measurement?  
Signalling infected udders/quarters for farm management purposes
3. What is the type of data? Qualitative data
4. What is the 'golden standard' (if one)?  
No clear golden standard, infected udder/quarter
5. Single or multiple measurements? Single measurement

# Next steps

- Extending the sensor device database → Sensor page on ICAR website
- Developing sensor validation criteria for different purposes based on checklist with key questions
- Developing validation protocols and approval protocols
- Developing recording guidelines using sensor data
- Best practices for data collection and related QA

**All traits at once?.... NO ....One trait at a time!**





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Thank you to ICAR Sensor Device Task Force!

Thank you for your attention!