

New role of national metrology institutes by the coverage expansion of measurement standard in digital transformation

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Abstract

Background and motivation

Change of measurement and demands for new business model

- In digital transformation, the importance of data exchange is increasing as a key for communication between machines, and both the production and utilization of measurement data are also increasing dramatically.
- In this progress, it is necessary to establish a new system to ensure the reliability of this rapidly increased data to ensure the quality of measured data, although the change of measurement due to increase of its amount and anonymity.
- Currently, the distance between measurement standards and industrial applications is becoming departed as the progress of digital transformation because detailed specific business model or success story has not been presented yet.

Challenges for national metrology institute

Establishment of an assurance system based on digital traceability

- Method for securing traceability in real and virtual domain should be presented.
- The redefinition of unit based on physical constants can be the basis for providing traceability in digital domain.
- It is necessary to establish a metrology system that considers efficiency and economy rather than focusing on only precision.

Development of business model based on the digital transformation

- To disseminate a digital-based measurement standard system, a driving force is needed to drive demand from industry.
- In existing business areas, it presents tangible results such as maximizing efficiency through automation of calibration and testing.
- Furthermore, it provides examples of business areas that have never existed before, allowing industrial demand to be derived.

Implementation of a machine-based data distribution/exchange/transaction platform.

- Measurement automations in whole cycle, transmission/reception of measurement results, and semantic-based metadata labeling for related information are necessary.
- Ultimately, a sustainable measurement network that can maintain the quality system and share results while performing continuous measurement should be realized.

Background

Digital Transformation in Metrology

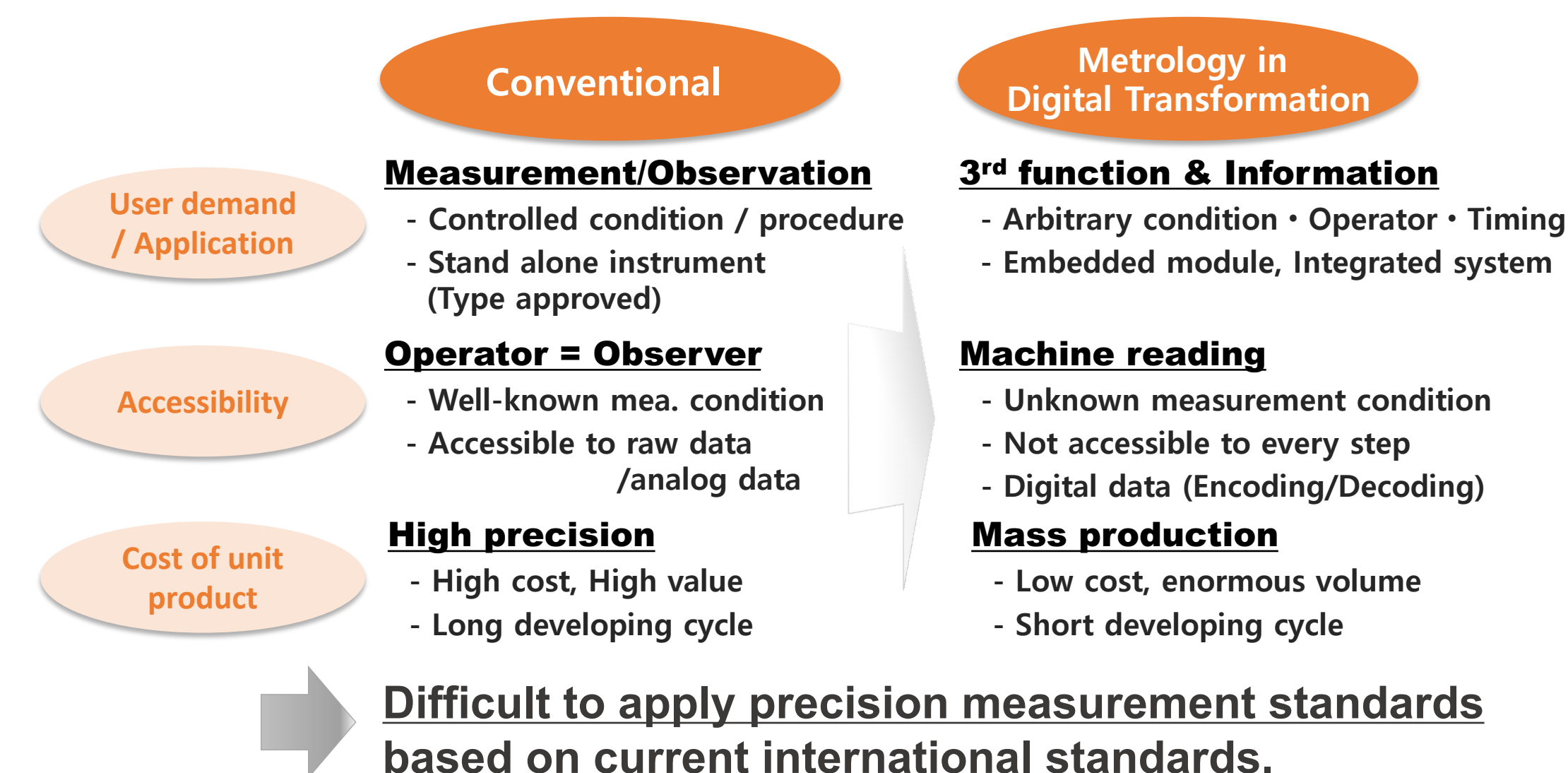
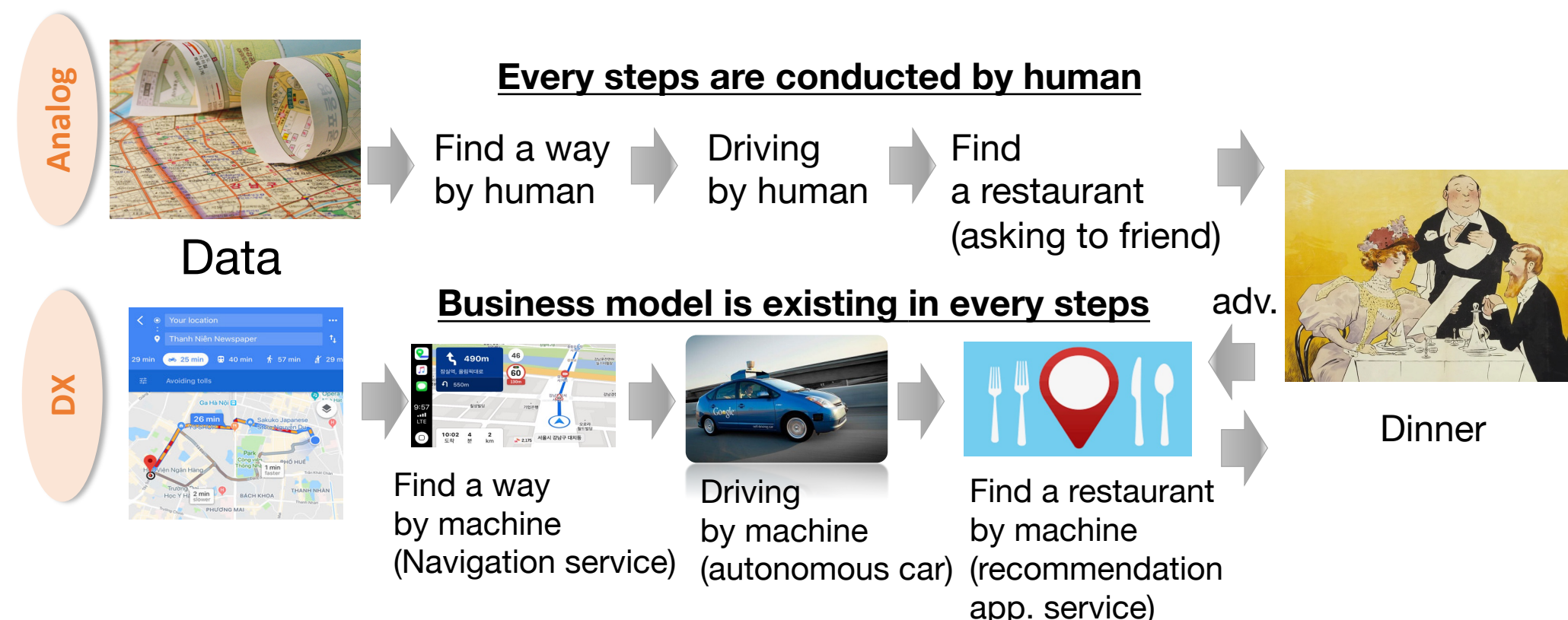
Change of measurement

- Conventionally, the purpose was observation itself, but with digital transformation, the purpose is to derive new information.
- Previously, measurement data was collected by qualified individuals, but anonymously collected data was shared.
- Bulk measurements are becoming more common as measurement-related costs reduced.

Demands for new business model

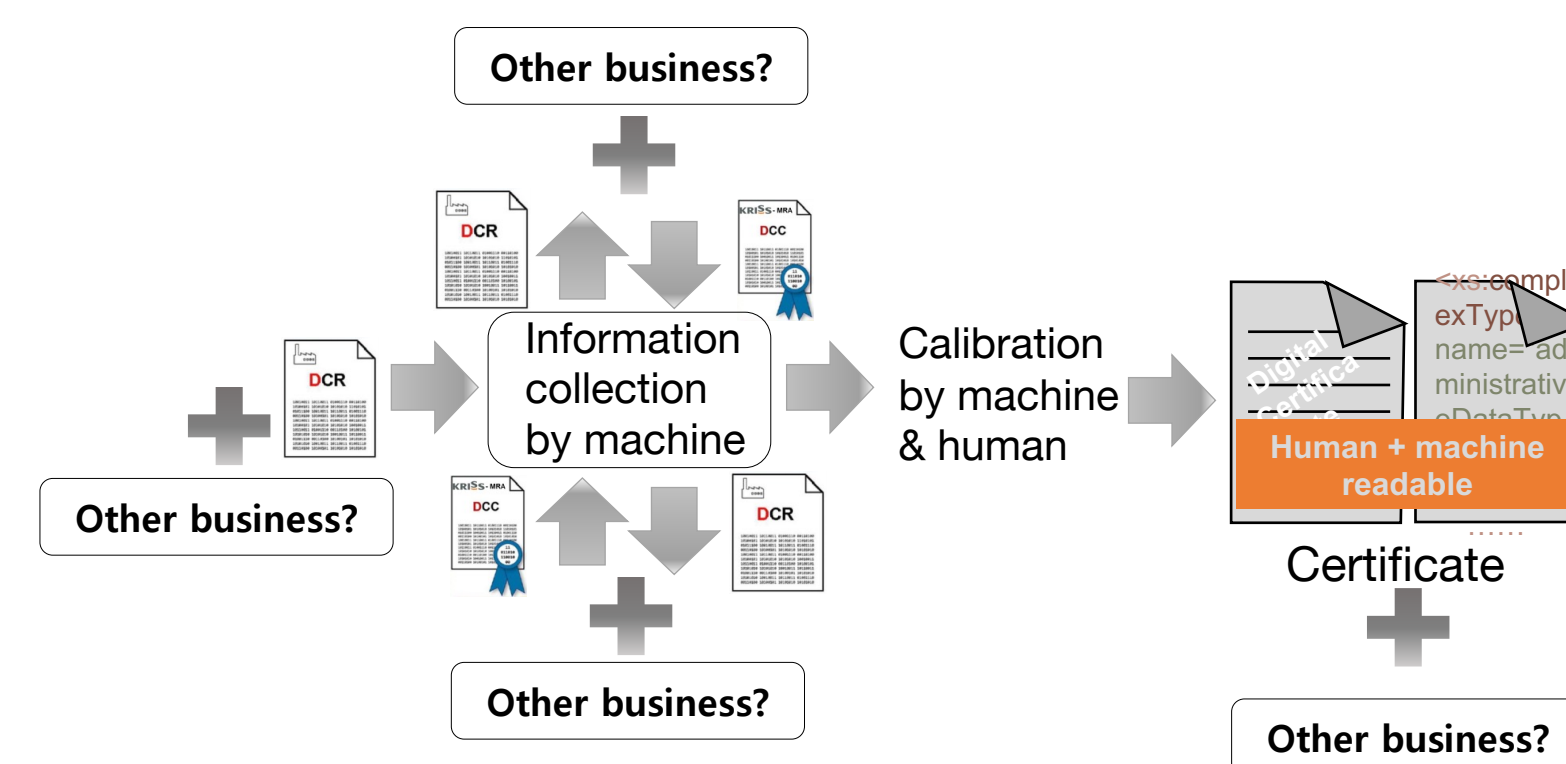
General expectation on the digital transformation

- A new business model that could not exist before is created.
- E.g., case of digitalized map



How about DCC?

- Limited to the aspects of efficiency increase and cost reduction
- Need to develop a business model that did not exist before



Challenges

Establishment of an assurance system based on digital traceability

Area traceable by current system

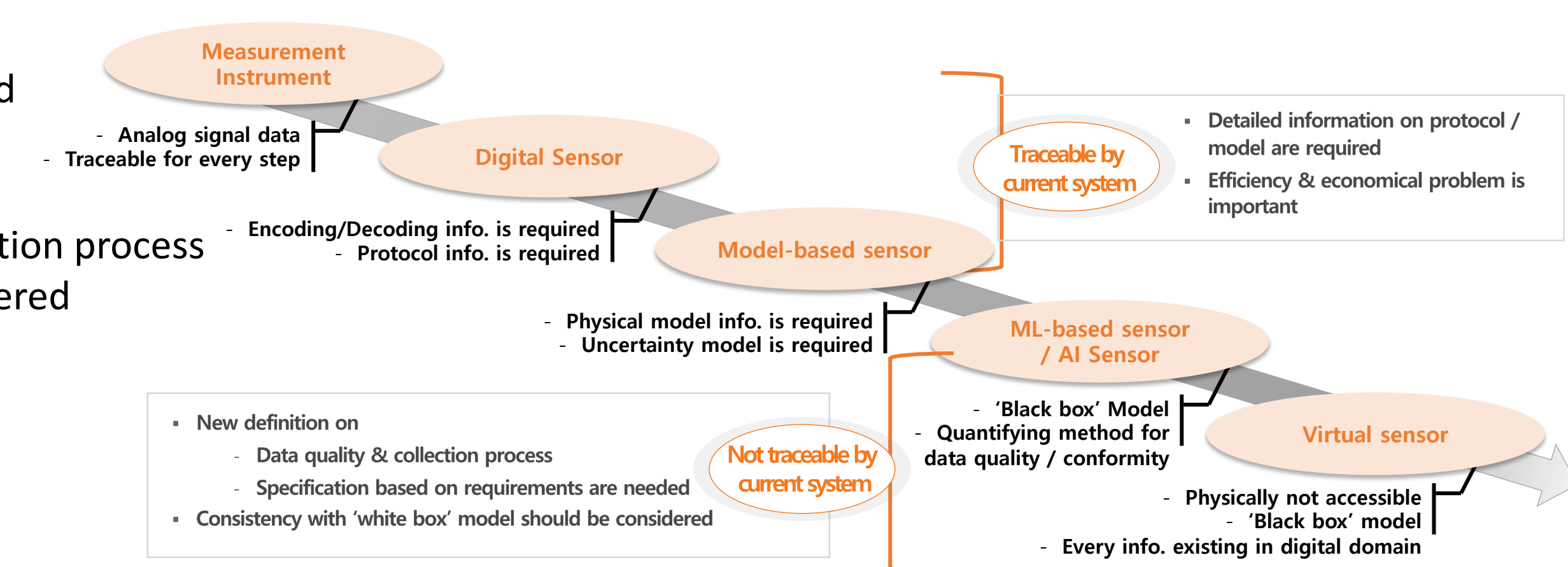
- Detailed information on protocol / model are required
- Efficiency & economical problem is important

Area not traceable by current system

- New definitions are required for data quality & collection process
- Consistency with 'white box' model should be considered

→ Redefinition of SI base unit is key

- No physical reference are needed anymore
- Expansion to derived unit should be progressed
- e.g.) Acoustic pascal (Koukoulas & Piper, APL, 2015; Cho & Koukoulas IEEE TIM, 2020)



Development of business model based on the digital transformation

For calibration/testing laboratory

- Currently, most institute are very passive stance.
- It is necessary to provide direct support from NMI for detailed application. (Training, API development, and so on.)

Serves as an important link between industry and metrology

For general industry

- It is necessary to quickly create success stories through collaboration.

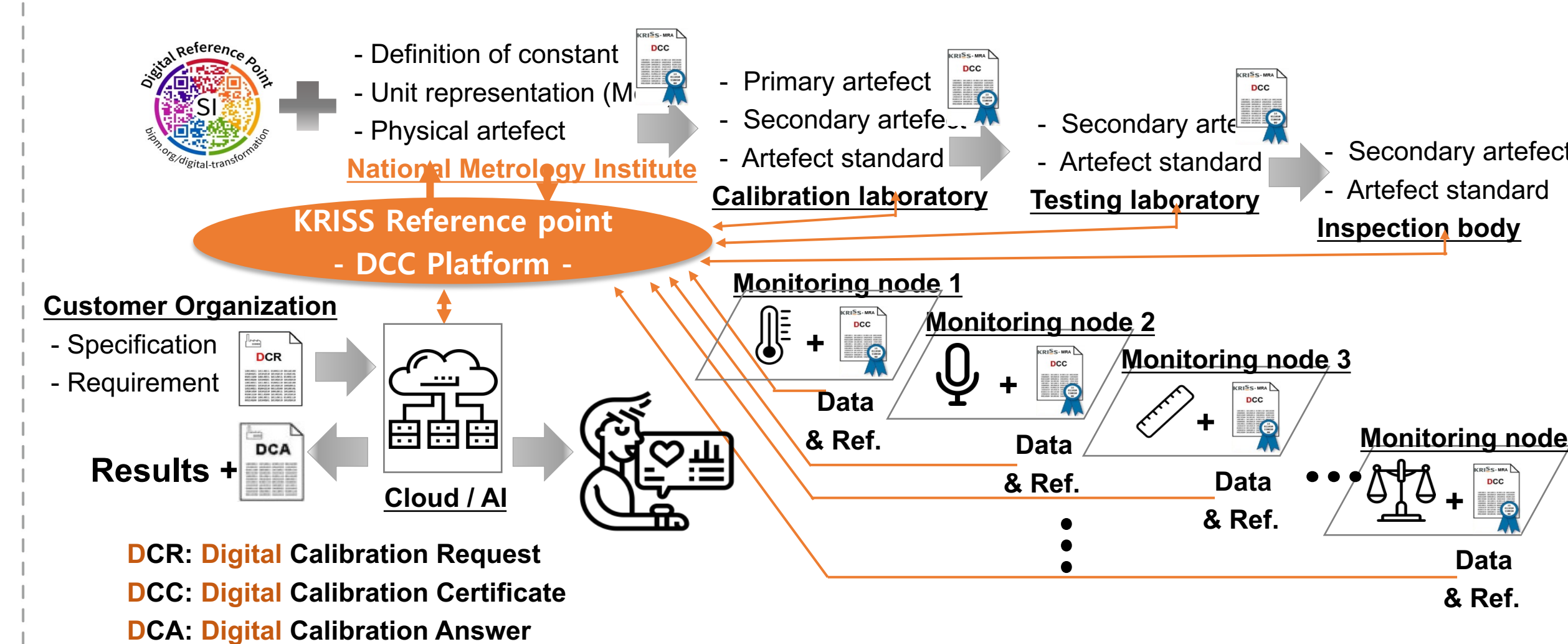
Implementation of a machine-based data distribution/exchange/transaction platform.

DCC-based data production/utilization system

- Measurement automations in whole cycle of measurement including sharing and quality assurance
- Transmission/reception of measurement results, and semantic-based metadata labeling for related information are necessary

Sustainable measurement network

- The direction that sensor network research should pursue is the implementation of a sustainable sensor network.
- Related challenges include the development of technologies for constant/on-site calibration and self diagnosis/calibration



Expected impact

Measurement standard quality assurance system in the digital domain

- A quality assurance system can be established for newly generated data in digital domain, and the role of NMI can be expanded to the virtual domain as well as the physical domain.

Creation of new industries/markets through measurement standards in the Digital Transformation

- Expanding the coverage of measurement standards can create new business models and markets, and lead to an expansion of demand for measurement standards through new industrial opportunities.

Establishment of a machine-based automated measurement standard ecosystem

- The dissemination and maintenance of a sustainable quality system can be achieved through the establishment of a new measurement standard ecosystem that provides and shares quality control, such as calibration without human calibration, and measurement results with secured traceability for a constantly operating measurement network.