

Scalability of Digital Twins: Challenges and possibilities for efficient implementation

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Content

- Potential scalability of DTs for company operations
 - IoT Strategy as basis
 - DTs in company IT solution
 - Usage scenarios
 - DTs in ecosystems
- Challenges
 - Fragmented install base
 - Cost of DT
 - DT upkeep through it's lifecycle
 - Culture of traditional data sources usage
 - Process of IoT data usage missing
 - Others

Potential scalability of
DTs for company
operations

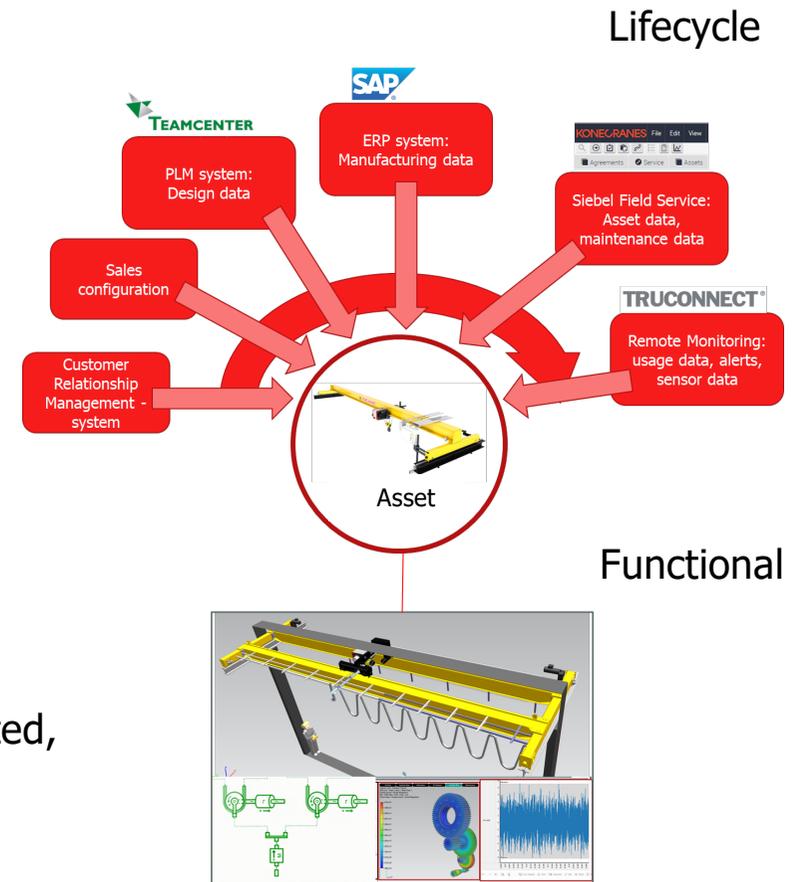
IoT Strategy as basis

- Scalability comes by “Plug and play”
- IoT Strategy is necessary to form stable long term company level development direction and usage model for DTs
 - How DTs are **created**
 - Creation and maintenance of DTs (for which products, how, who, in which systems)
 - Requirements for data sources connected to DTs (hw, sw)
 - Requirements for datasets (formats, analytics, reporting)
 - Data security and ownership management
 - How DTs are **used**
 - Business usage scenarios (main processes)
 - Availability and access rights policy
 - IoT initiative **ownership**



DTs in company IT solution

- Integral part of company other data and systems
- **Asset master** combines data access to many systems together
 - to DT's lifecycle
 - Sales info (... , customer, application, location, ...)
 - Supply data
 - Service data
 - After sales data
 - to DT's functional content
 - Structural data, design data, analyses, simulation models
 - IoT Data
- Asset management system needs to be global, easy to get integrated, flexible UIs, long term, close to main usage of DTs, ~ **PLM**

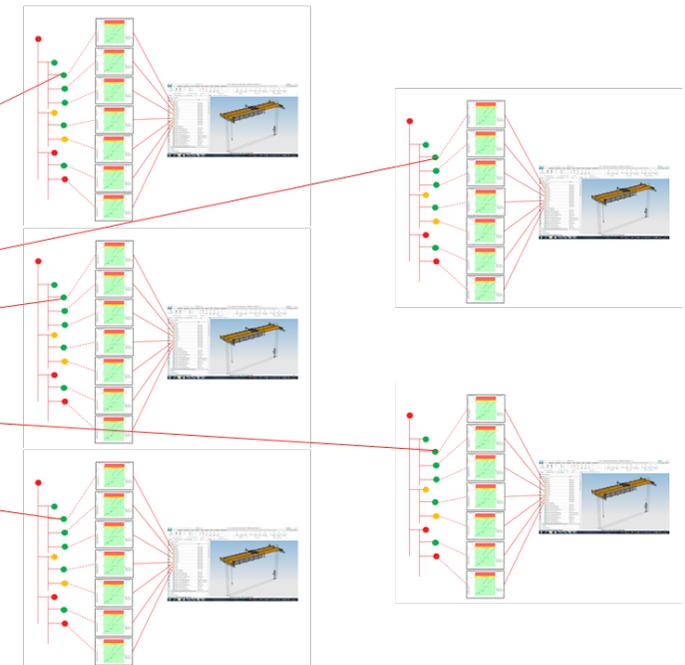
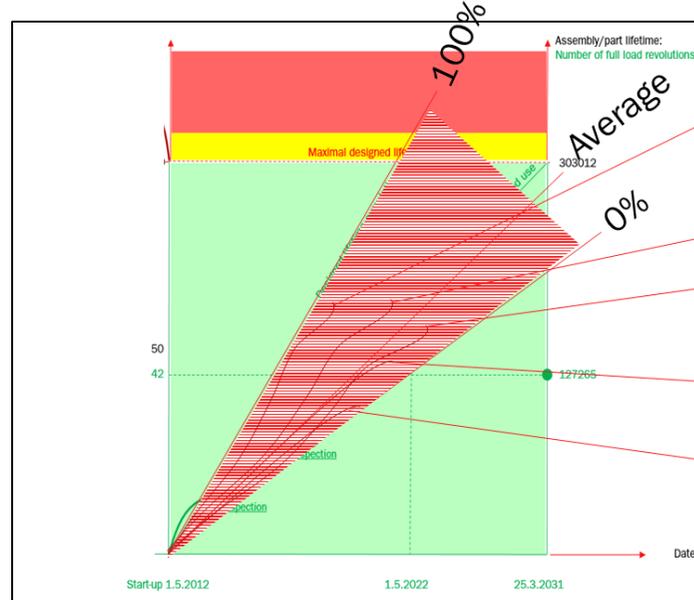


Usage scenarios

- Data for **new product development** specification
- **New equipment sales** – choice of product to fit customer application

Summary of usage, measurements, inspections, durability

Cranes of similar customer applications

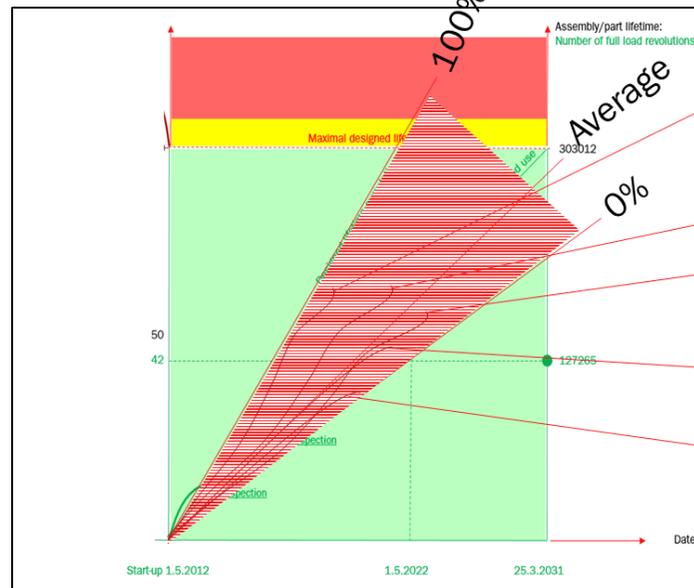


Usage scenarios

- Data for **new product development** specification
- **New equipment sales** – choice of product to fit customer application
- **Service** – equipment service optimization

Summary of usage, measurements, inspections, durability

Cranes of similar customer applications



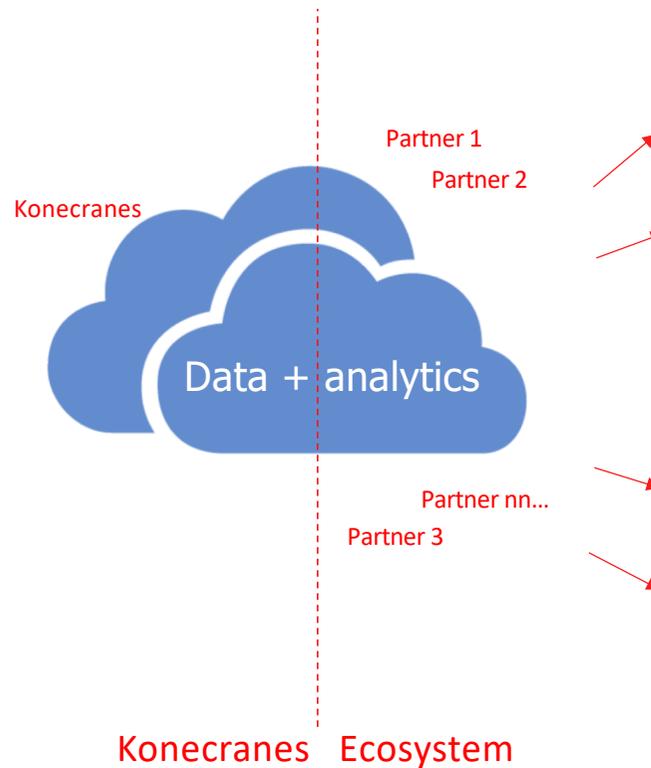
Info of individual equipment

DT information for ecosystems

Digital twin data



Easy data sharing to partners



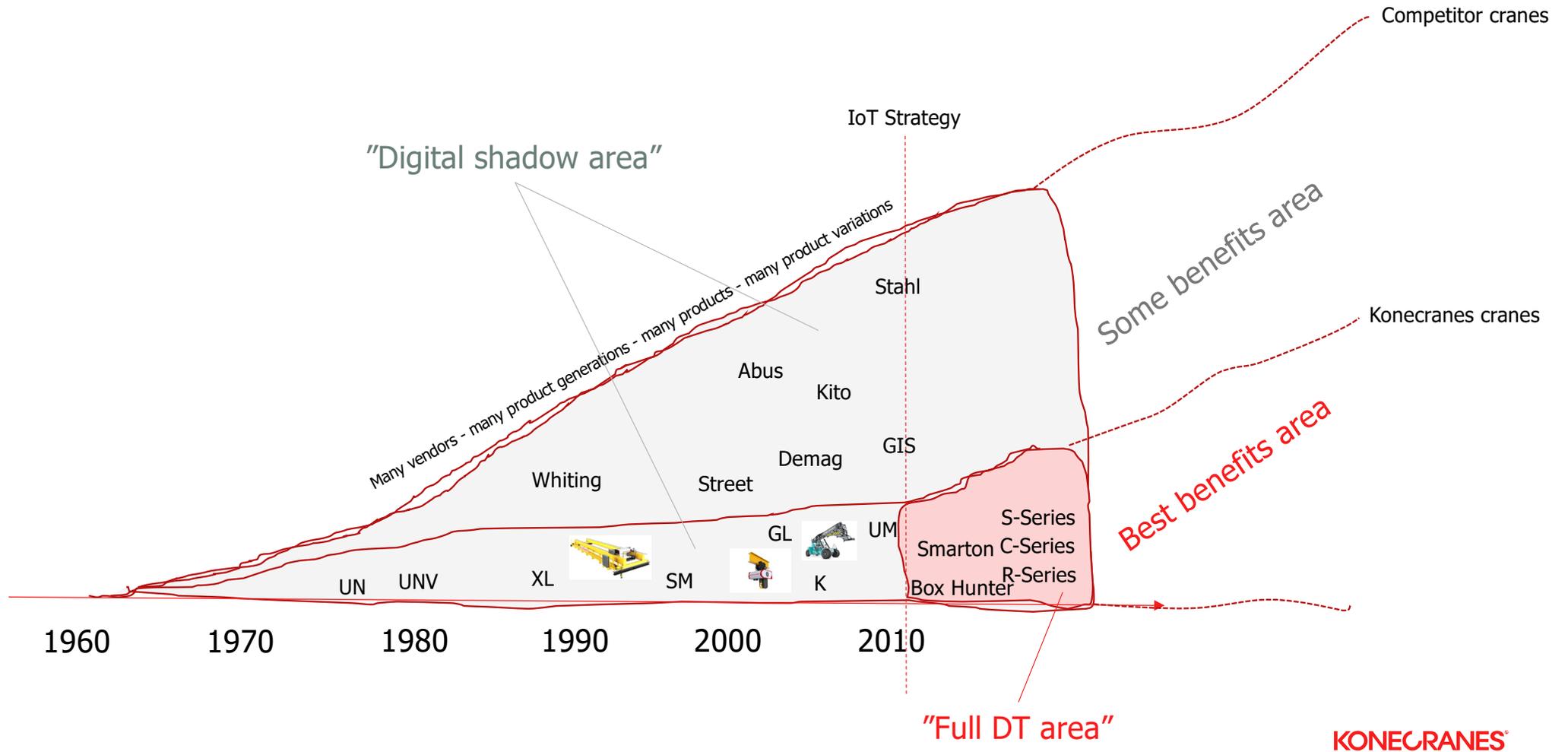
Possible actions

- Fire detection ->112+first actions
- Facility access control -> facility security company
- Air cleanliness detection -> Alarms
- Noise detection -> Protection recommendations
- Material stream path -> Consultancy
- Material stock view -> Supplier
- Artificial intelligence to analyse open data...



Challenges

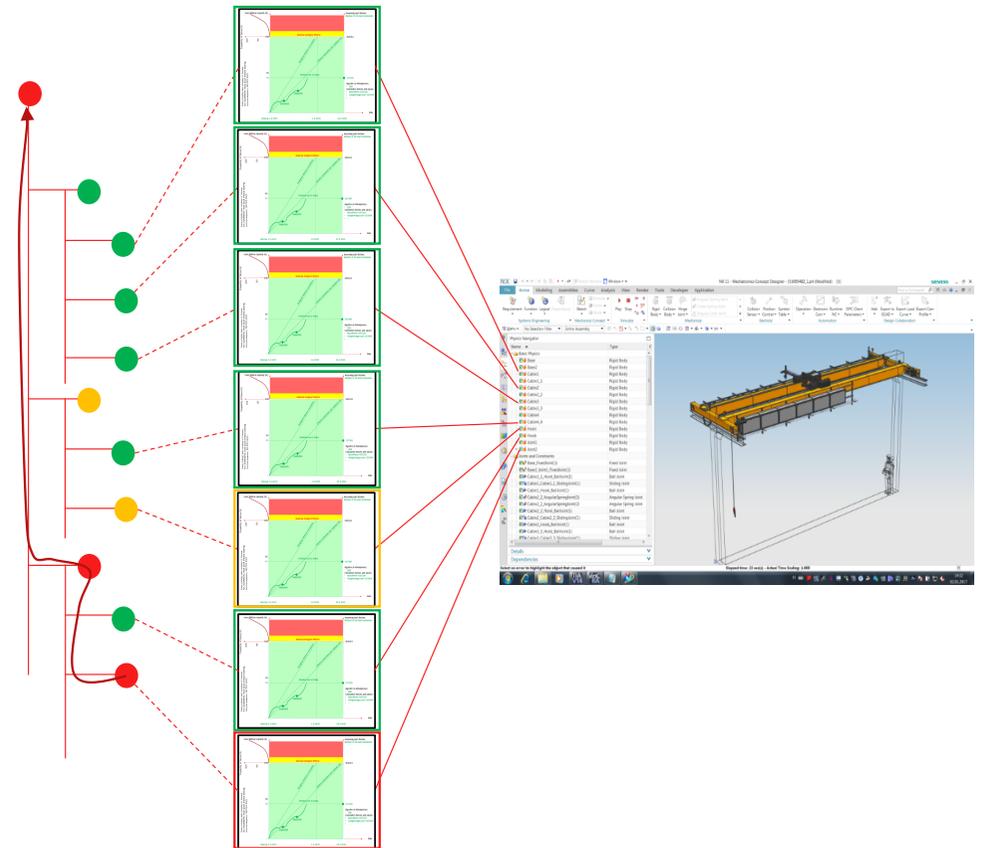
Available data for DTs is partly fragmented (format, quality) – benefits require high volume of good quality DTs



Cost of DT

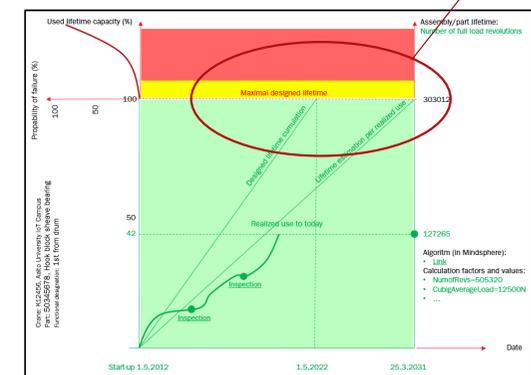
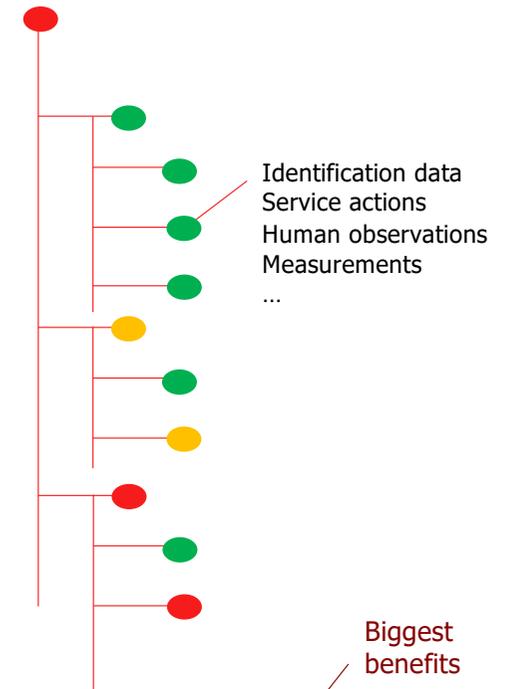
- Costs of DTs
 - Creation (automatic, manual) cost of each DT
 - Sensoring
 - DT structure maintenance (as-maintained)
 - Service actions listings
 - Modernizations actions listings
 - Data stream from equipment to it's digital twin
 - Analytics + reporting infra (automatic, manual)
 - Distribution of reports
- ..vs. savings and added sales

Return of investment, and who owns it



DT upkeep during its lifecycle

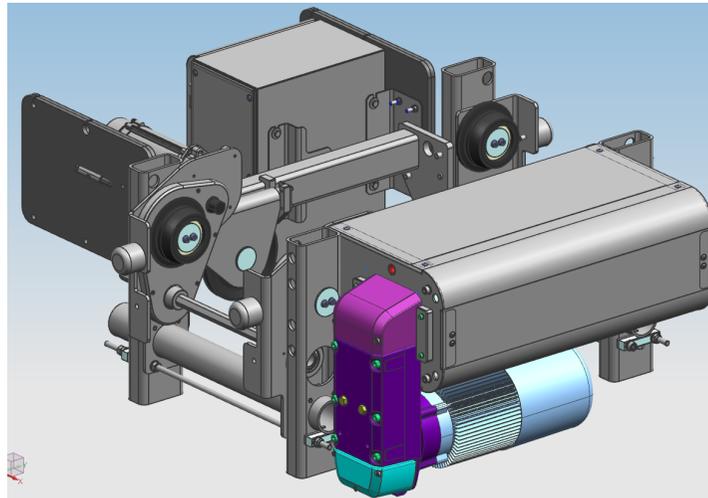
- Elements to maintain **systematically** in DT
 - Replacements of parts in structure (broken parts, worn out parts, modernizations) – done by service provider and users/owner
 - Service actions per part/sub-assembly/assembly
 - Human observations
- Life cycle of DT 10...30 years
 - Long lasting IT systems
 - Significant amount of benefits come in the end of equipment life cycle



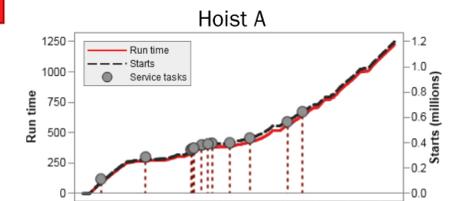
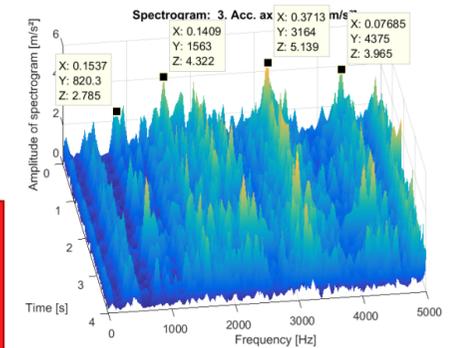
Culture of traditional data usage very strong

$$a+b=c$$
$$c < c_{lim}$$

Traditional
criteria from
"books"



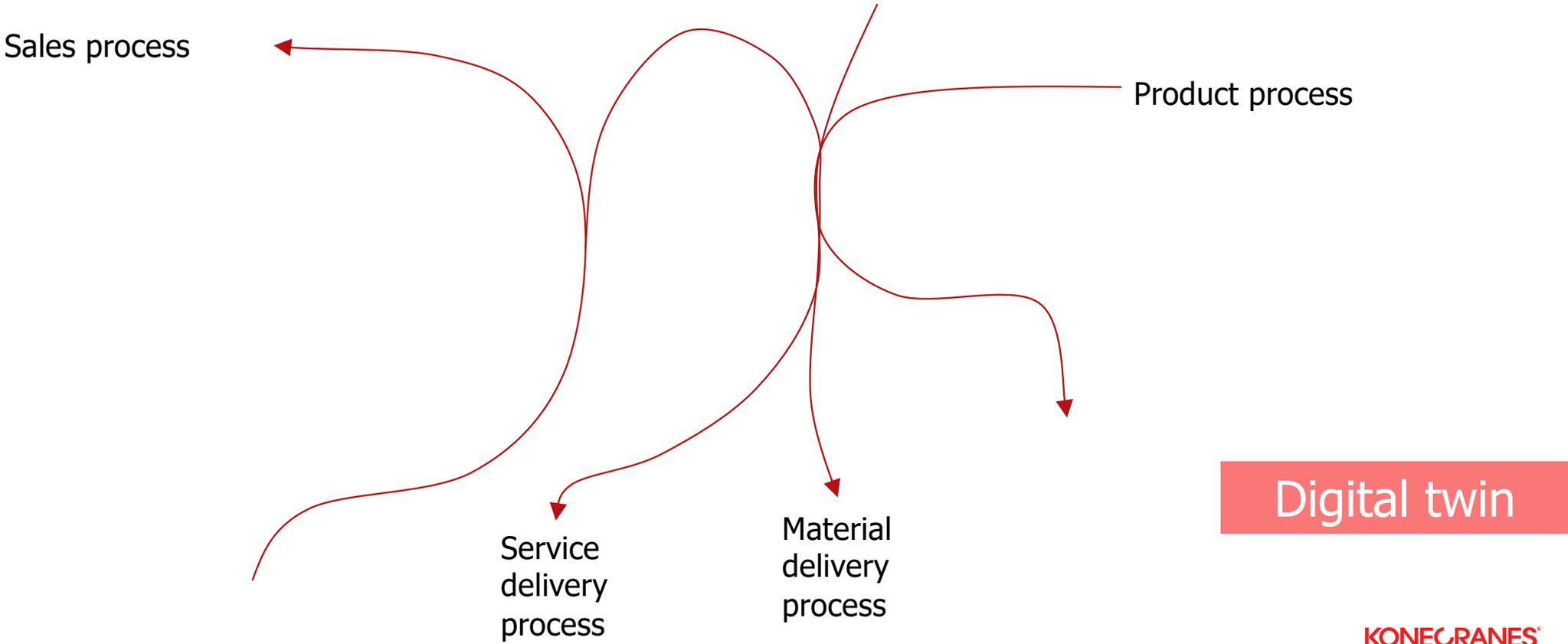
New criteria
from customer
usage
measurements



Transformation to be done

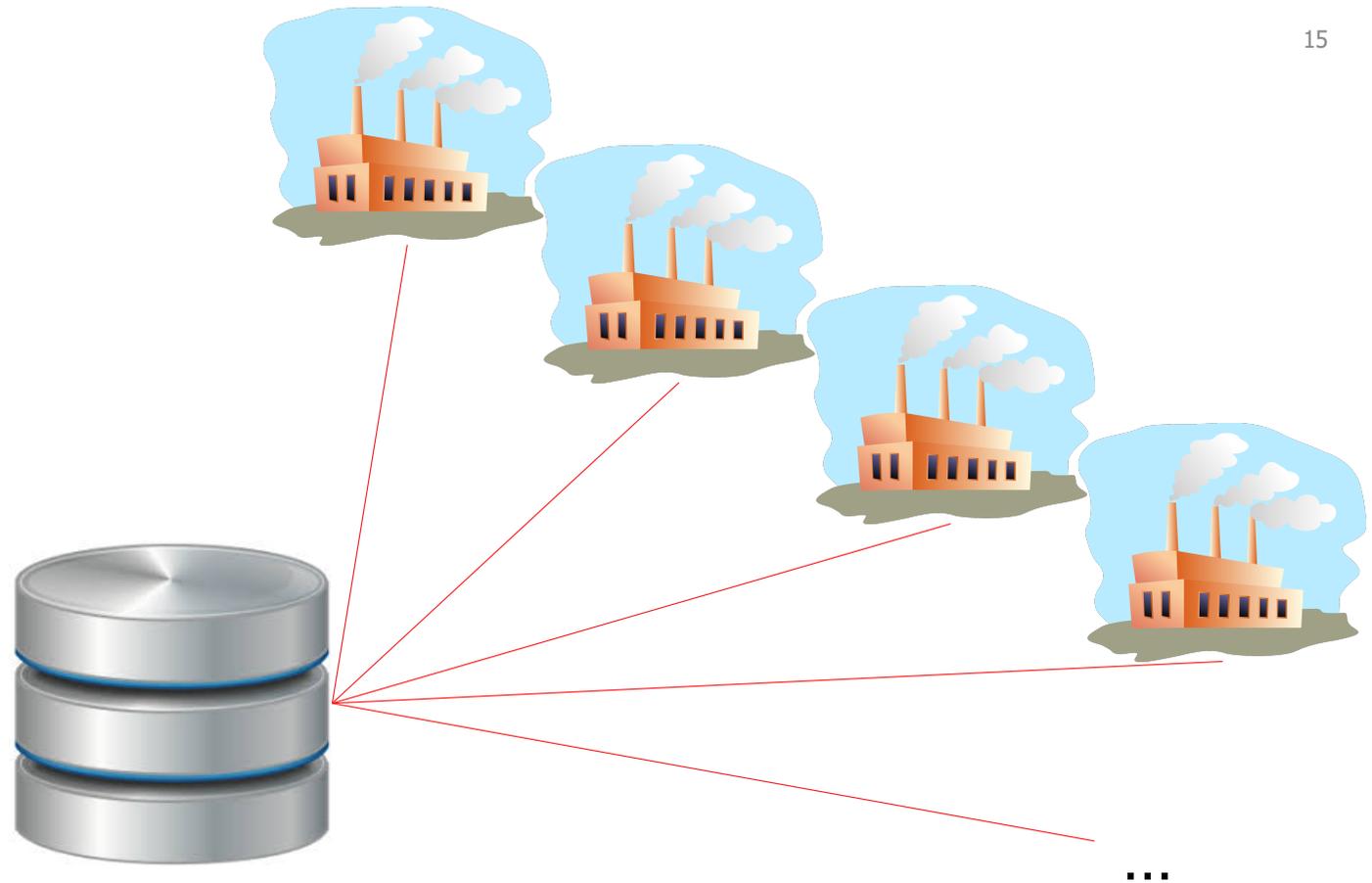
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Process of IoT data usage missing



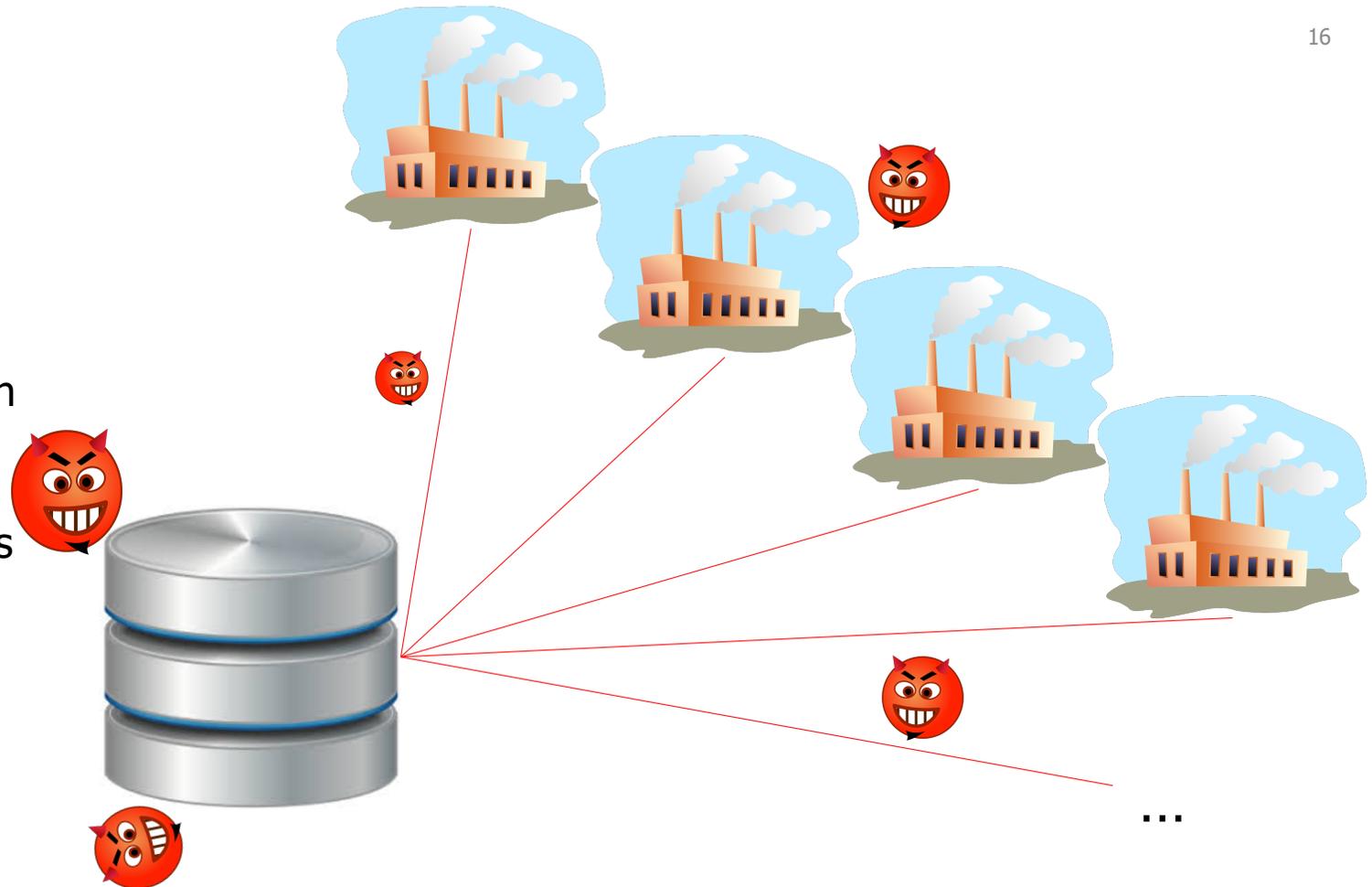
Other challenges

- Data ownership
 - Our customers are competitors to each other
 - Data creator vs. ecosystem interests
 - Legal aspects on global level



Other challenges

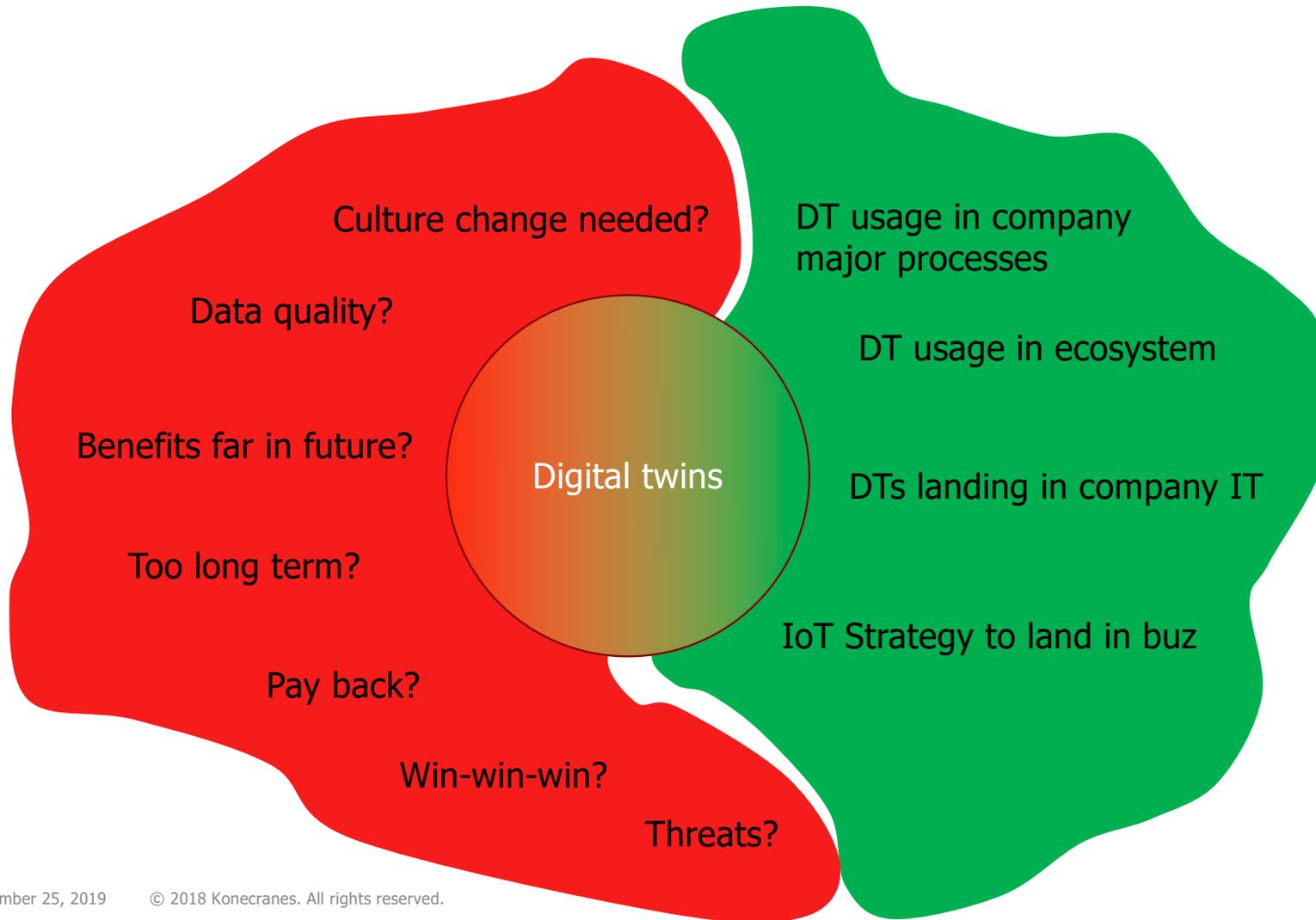
- Data ownership
 - Our customers are competitors to each other
 - Data creator vs. ecosystem interests
 - Legal aspects on global level
- Cyber security



Summary

Challenge vs. Potential

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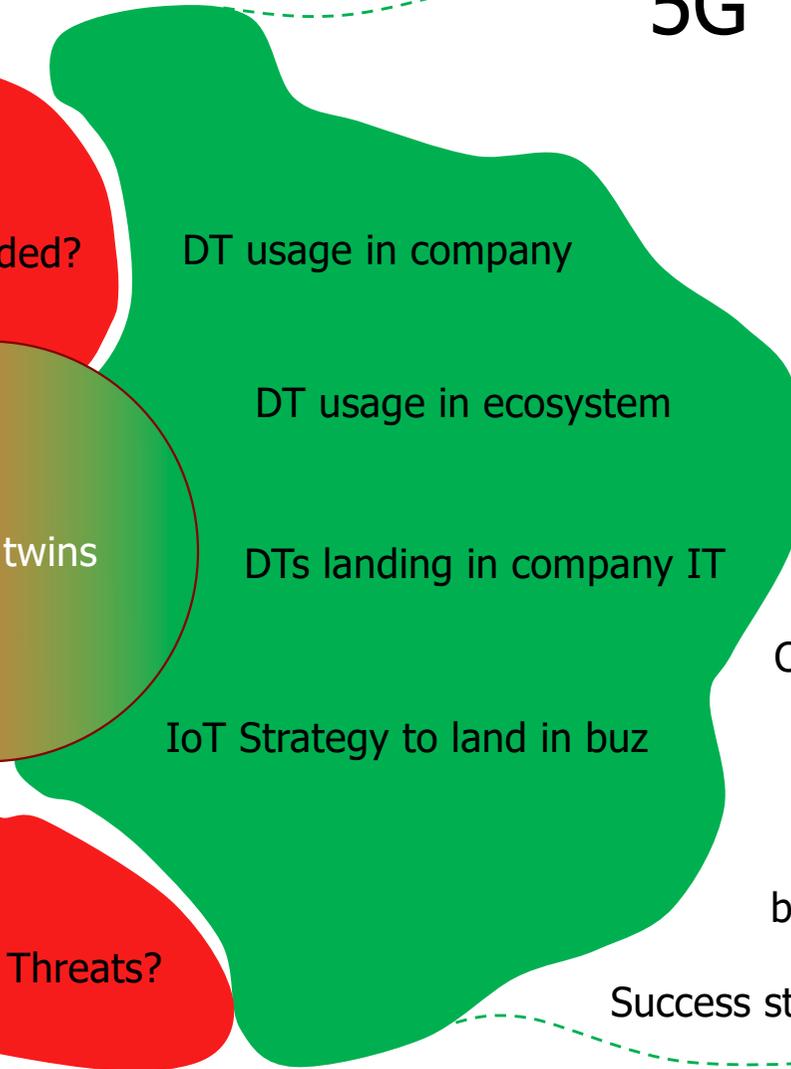
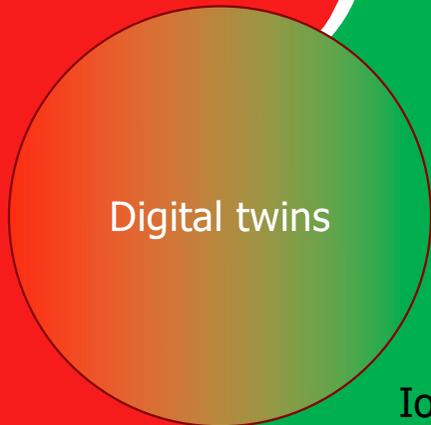
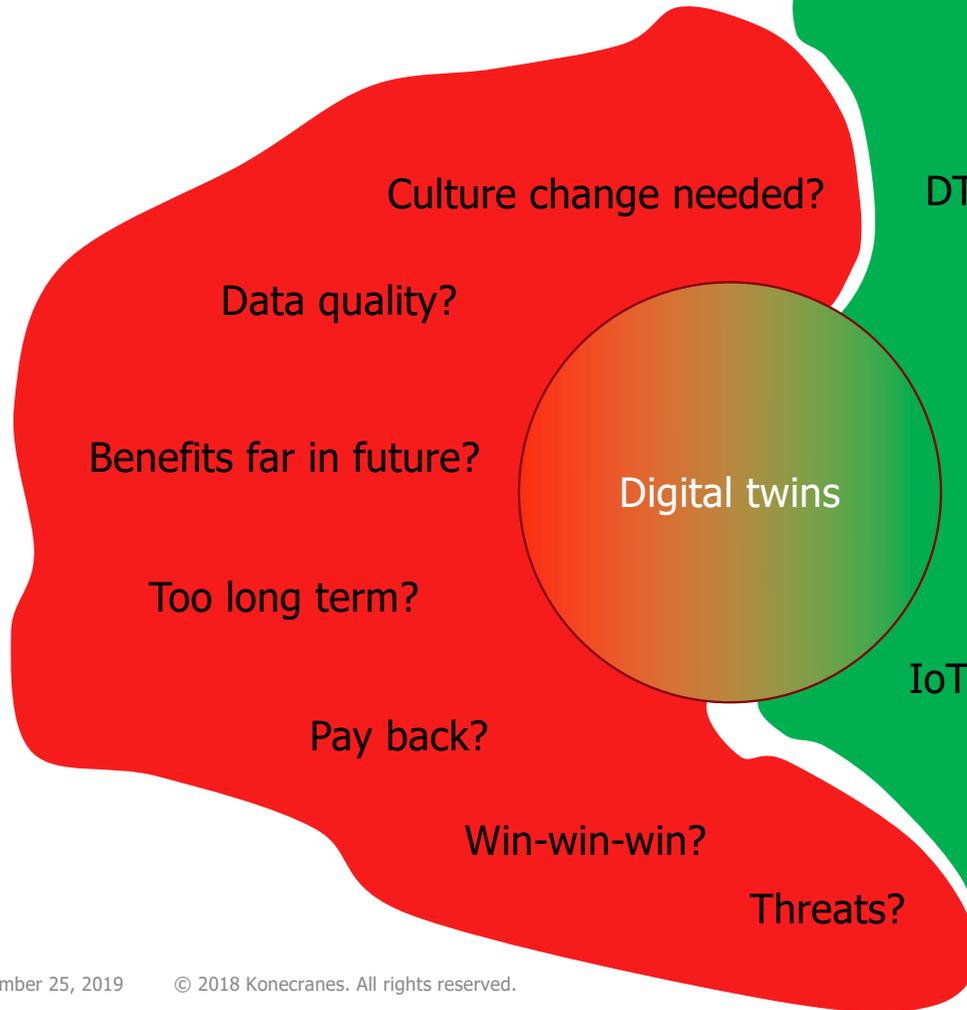
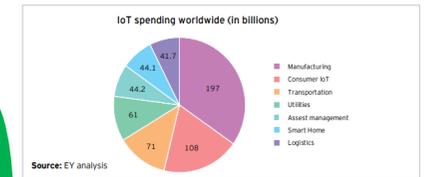
Summary

Challenge vs. Potential

5G

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New level of computing power



Cheapening IoT infra
Turn-key sw solutions
b2c