

CTBT: SCIENCE AND TECHNOLOGY

2017 CONFERENCE

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Creating A 'Digital Twin'
for use in Systems Design and Support



System Hardware is tested - why not Support?



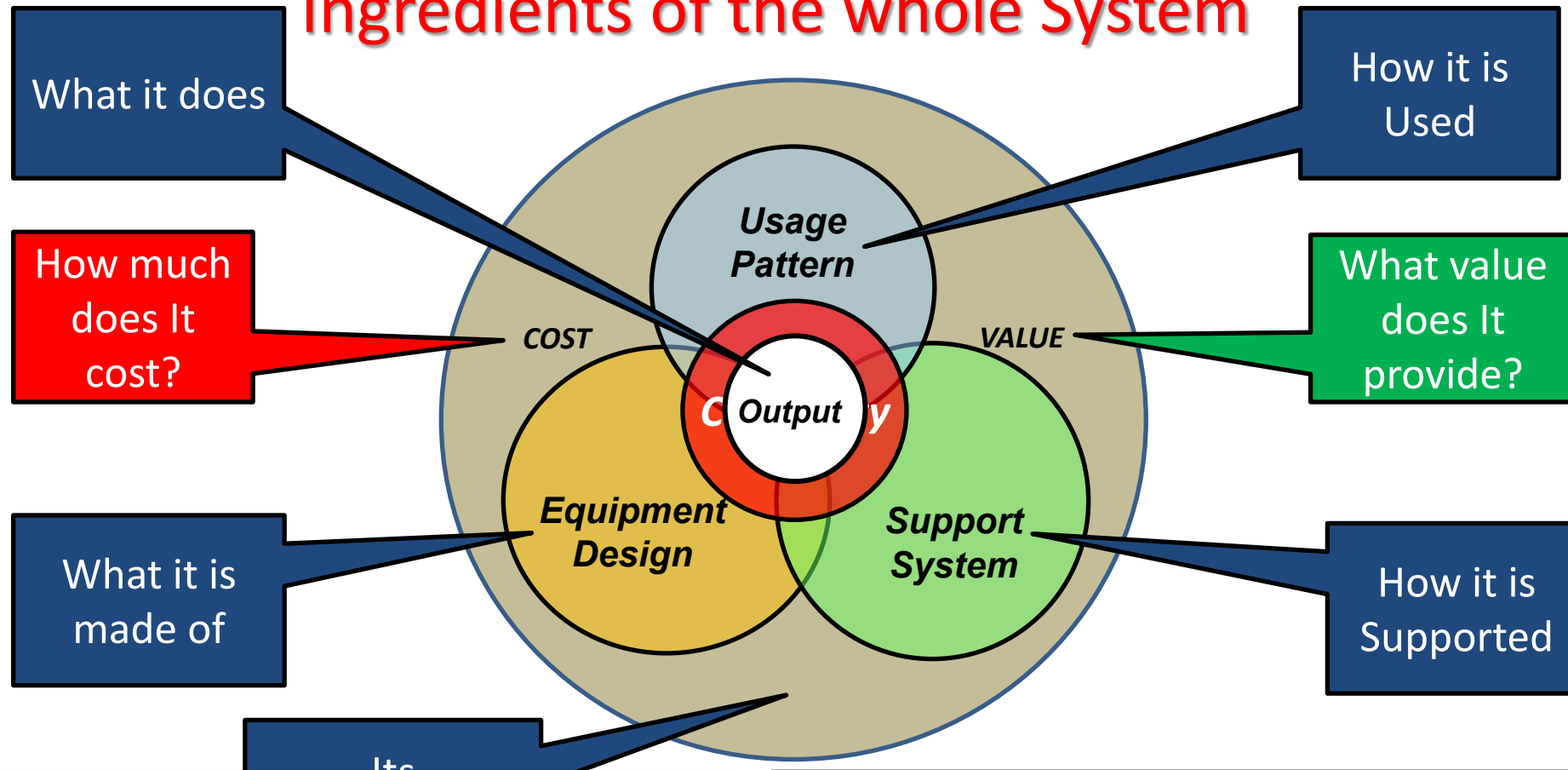
Boeing 787 Full Scale Structural Test Specimen



Aerodynamic Model Test Specimen

A Systems Approach to *Capability*

Ingredients of the whole System

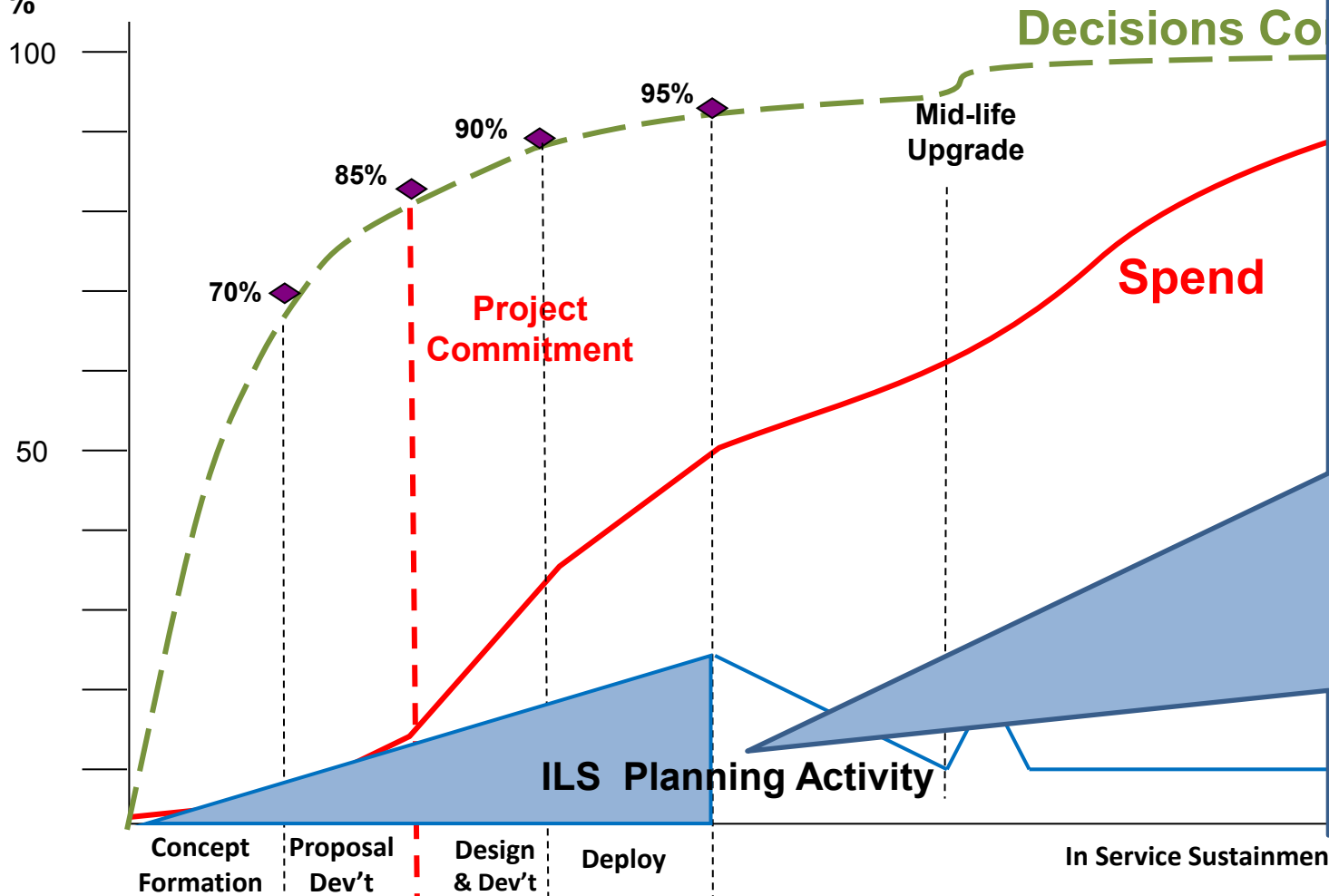


Cost and Value are **outcomes** dependant upon the specific mix of these ingredients

Design, Use, Support & Environment are **essential** and **independent** contributors to a capability

Life Cycle Cost - Typical Project Funding Profiles

Cumulative %
Cost and
Committed
Funds



- Reliability engineering, maintainability engineering and maintenance (preventive, predictive and corrective) planning
- Supply (spare parts) support
- Support and test equipment
- Manpower and personnel
- Training
- Technical data/publications
- Computer resources
- Facilities
- Packaging, handling, storage and transportation (PHS&T)
- Design interface

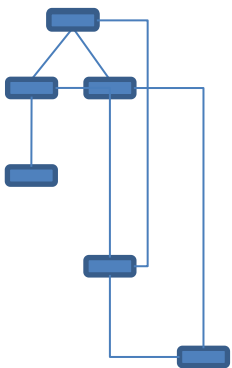
Logistic Support Planning must be addressed right from the concept phase, and then continue throughout the programme

Through-Life Management

What is a 'Digital Twin'

A mathematical representation of the hardware
AND the support system

Support



Model of a Hardware Breakdown Structure

Indenture Level

Level 0 – System Overall

System #01

Level 1 – First sub-system to System#01

Part 01-01

Level 2 – First sub-system to Sub-System#01-01

Part 01-01-01

Part 01-02

Part 01-02-01

Level 3 - etc

Part 01-02-01-01

Part 01-02-01-02

Part 01-02-01

Part 01-03

Without a **Breakdown Structure** all we have is a Bill of Materials with no way to understand which parts are good or bad and how each contributes to system performance

Model of a Support Network

SUPPORT ECHELON

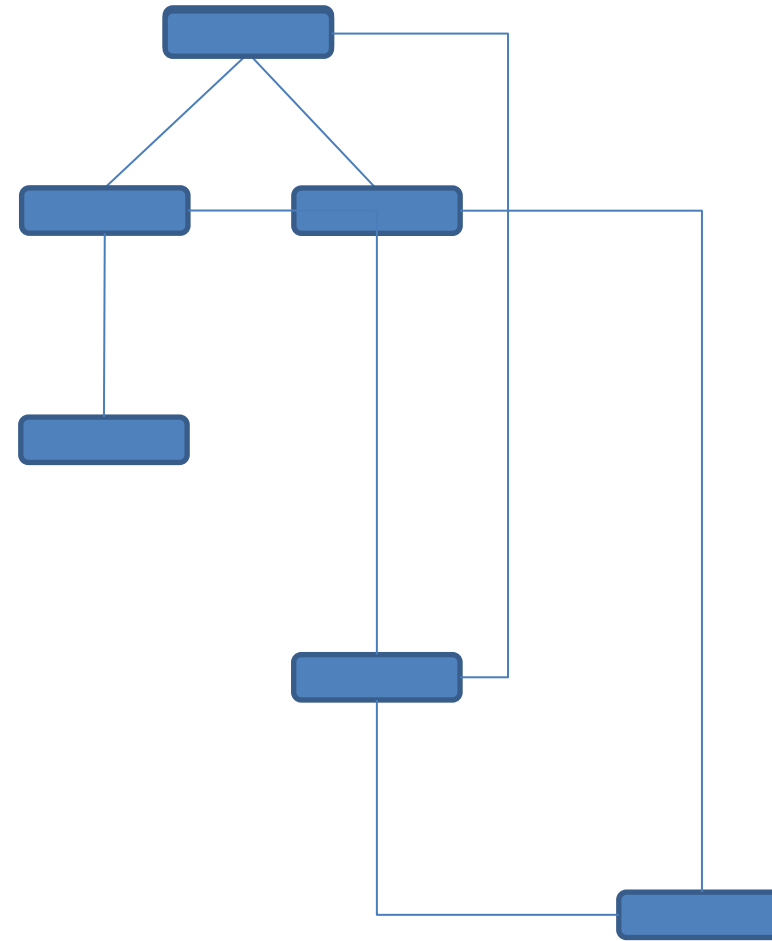
Level 1 - Station Site

Level 2 - Support Site

Level 2A – Support Depot

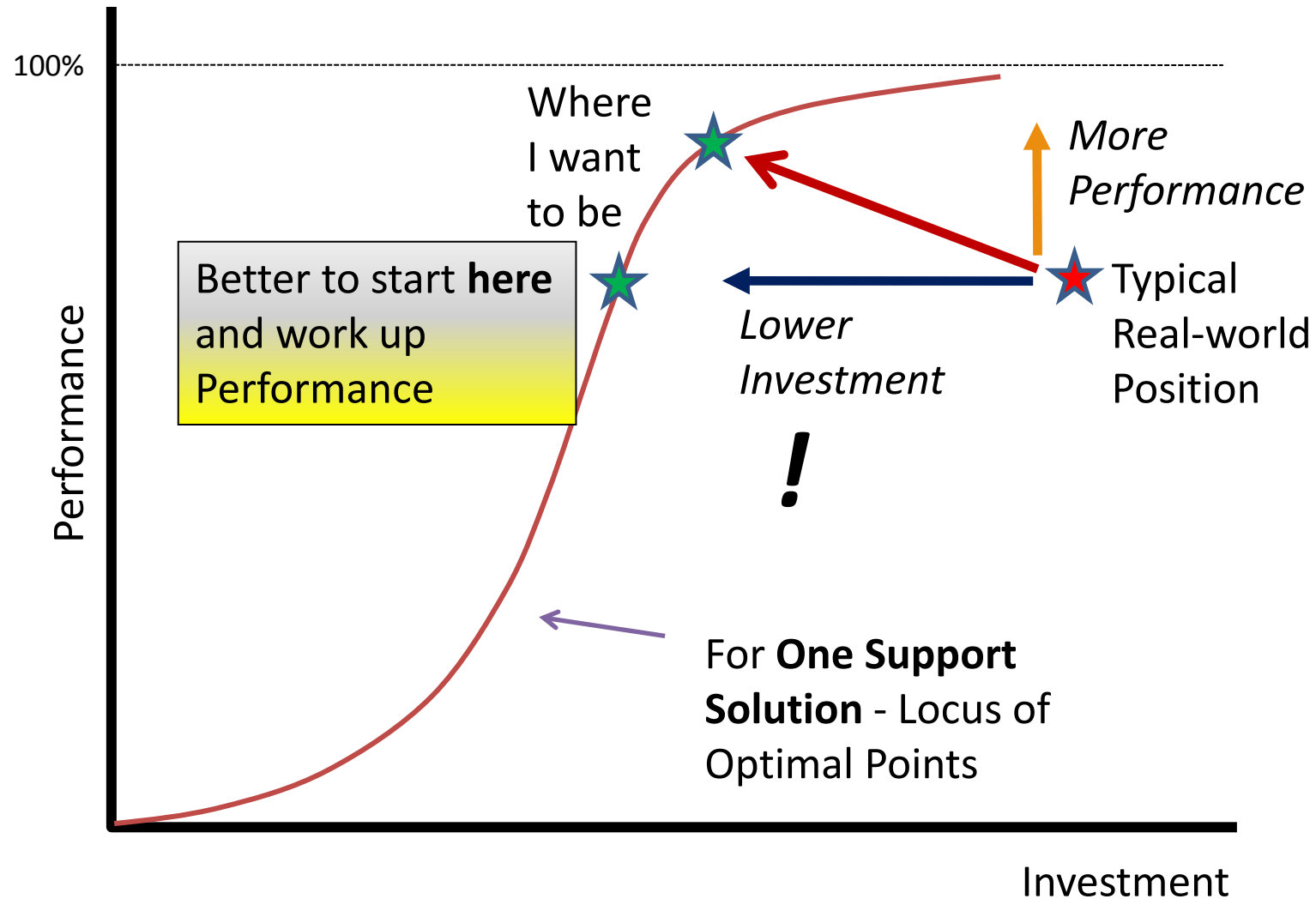
Level 3 - Main Base

Level 4 - Industry



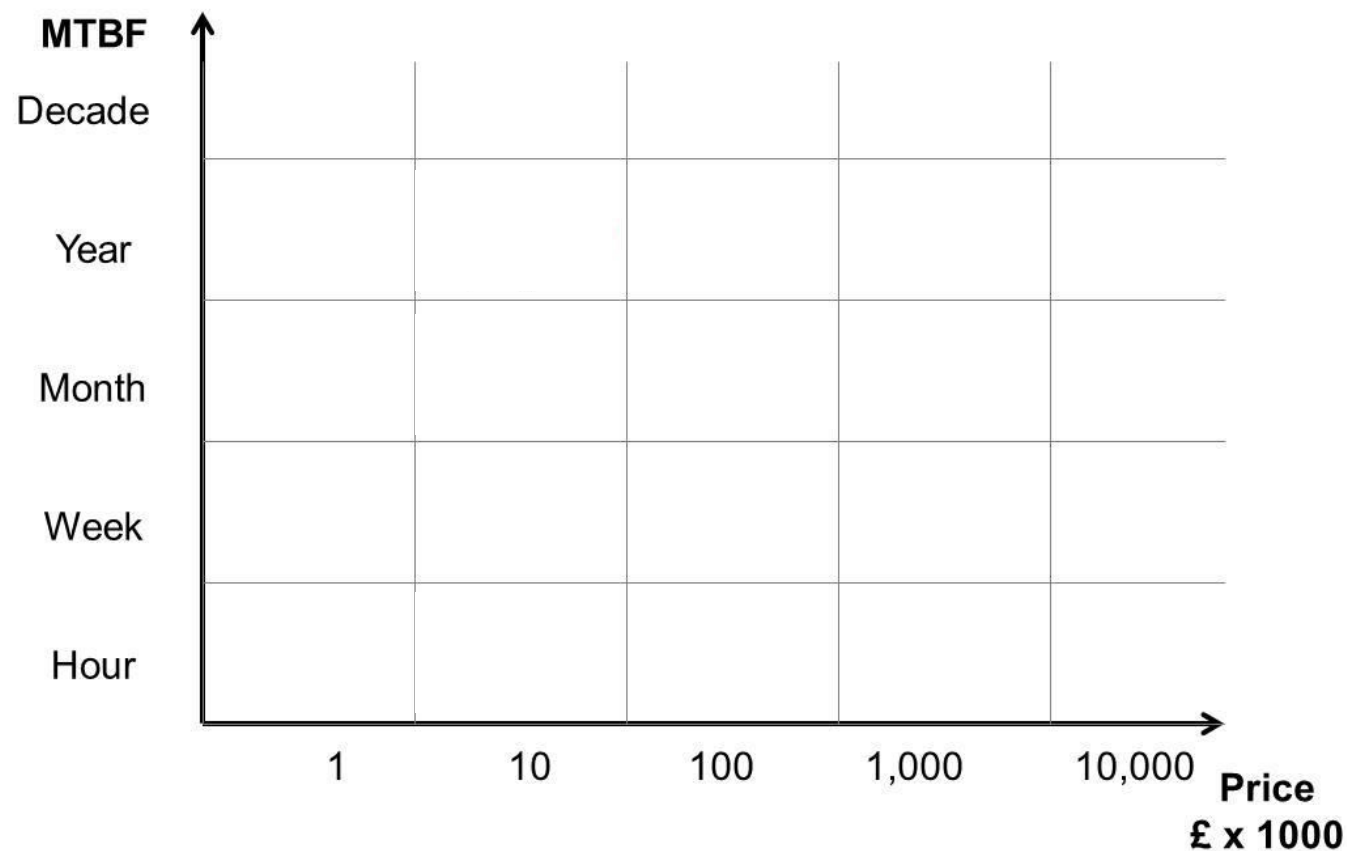
What the model can tell us

Investment Versus Performance for each “Ingredient mix”



Data Creation

There is usually more data available than you think
Qualified estimates are **not** “Garbage”



***Absolute** data quality is less important than doing the best with what you have*

*Modelling with **some** data is better than not modelling*

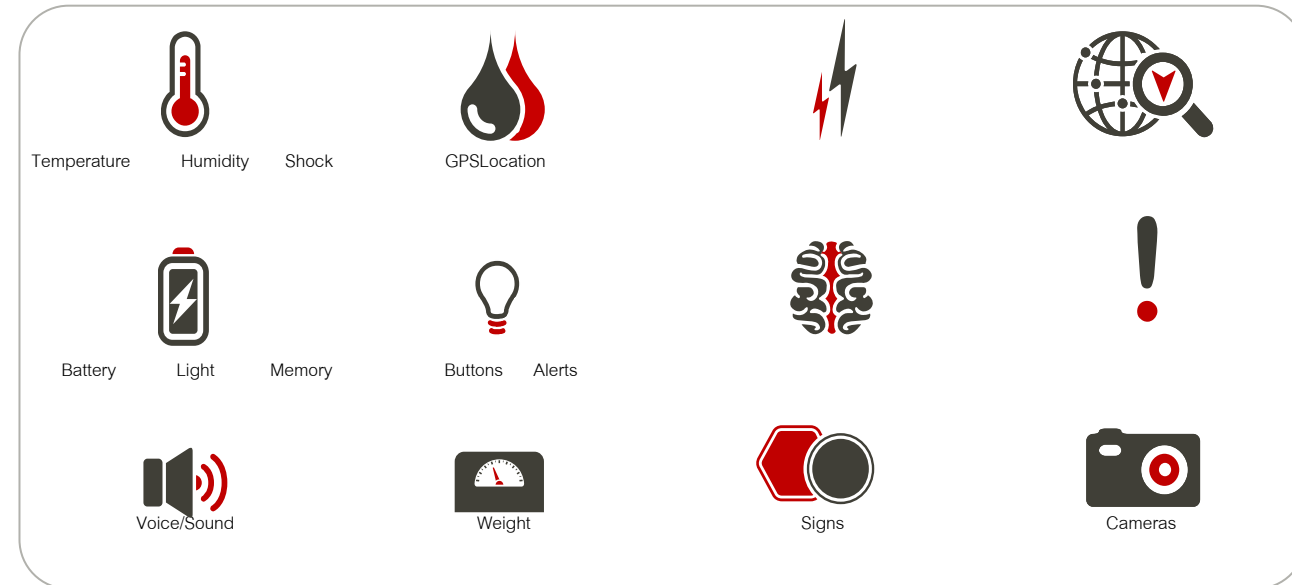
How to improve data quality

Using The Internet of Things to improve data & model quality

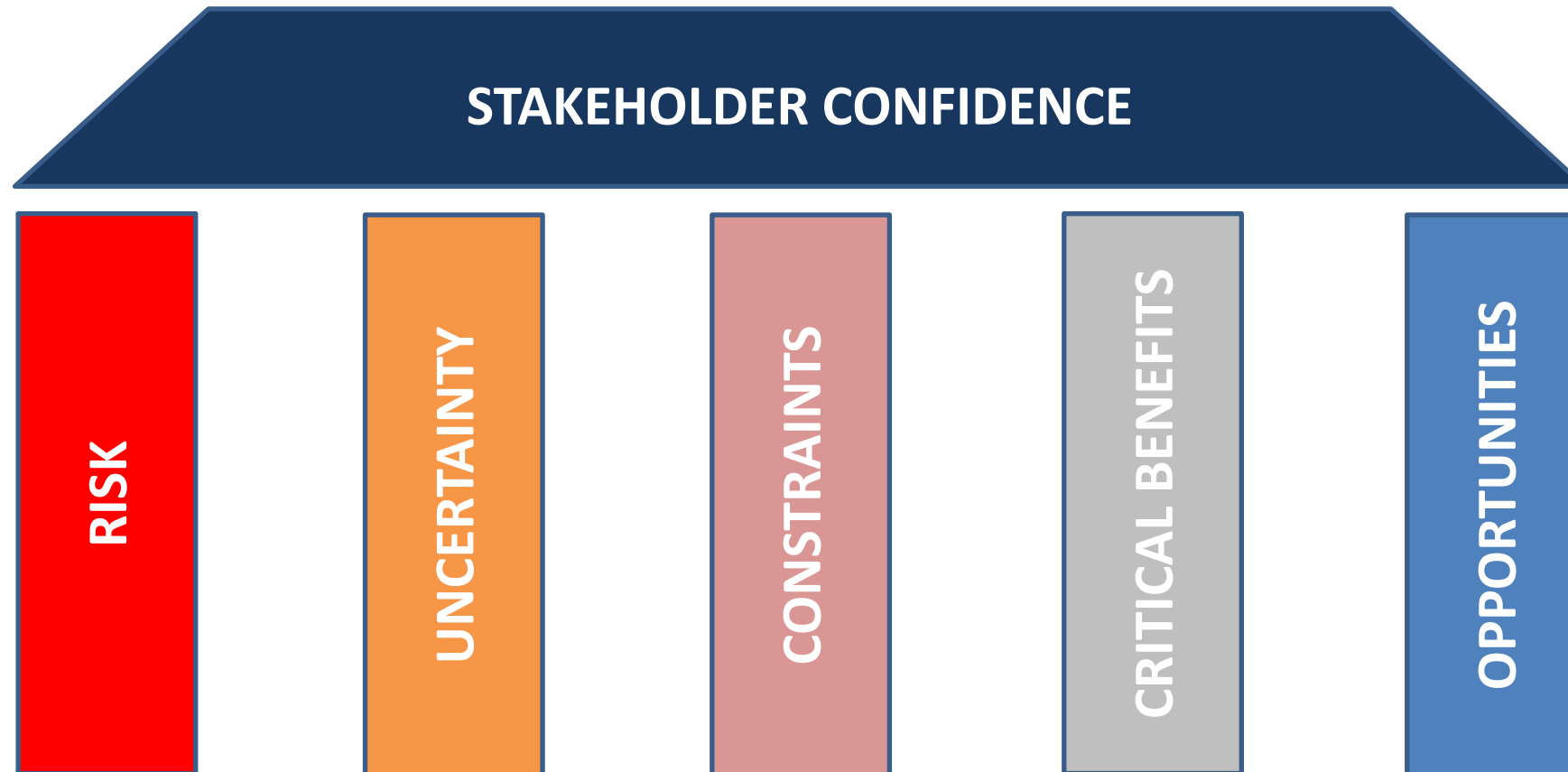
Edgeware – an integrated set of software tools that enable use of the IoT:

- by connecting the world of sensors, assets, devices, networks, and enterprise systems and
- by feeding **real-time** information to supply chain, engineering management and modelling applications

Makes data capture automatic so removing human error and enhancing model accuracy



ILS + A Digital Twin Model = *Confidence*



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THANK YOU

