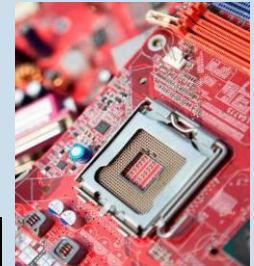


The Minimalist Approach

A Umicore case study

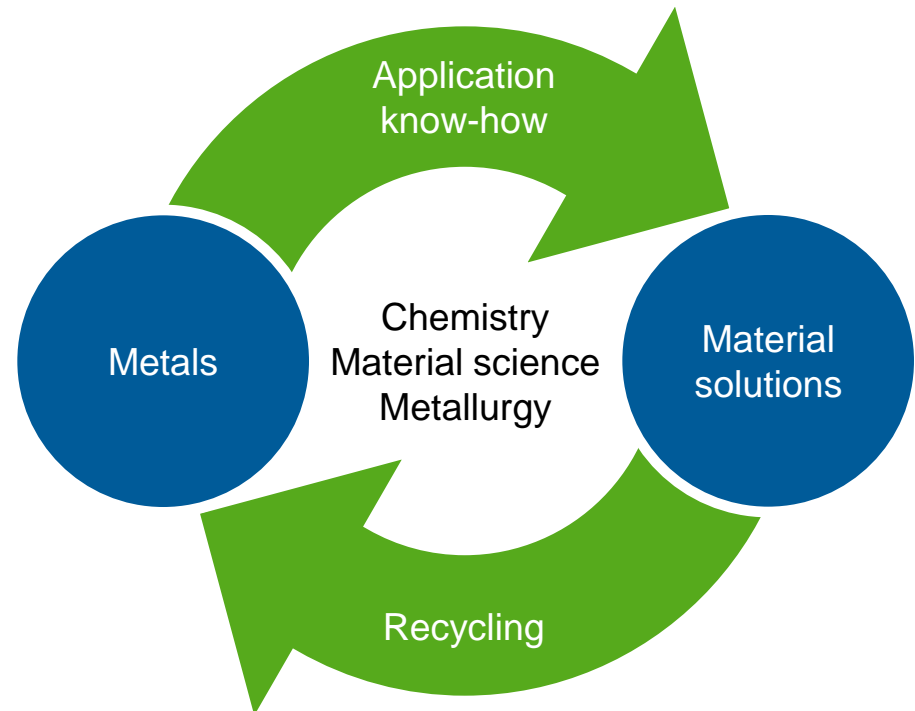


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 - Who is Prof. Jaikumar and Prof. Bohn ?
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 - Knowledge Management
 - Modeling

Umicore's business approach

- We transform metals into hi-tech materials
- We use application know-how to create tailor-made solutions in close collaboration with our customers
- We close the loop and secure supply by recycling production scrap and end-of-life materials
- We aim to minimize our environmental impact and be the best employer and neighbour



Key megatrends for Umicore



Umicore fit with megatrends

**Electrification
of the automobile**



We are a leading producer of key materials for rechargeable batteries for laptops, mobile phones as well as electrified vehicles



**Resource
scarcity**



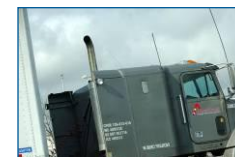
We are the largest recycler of precious metals; we are able to recycle more than 20 different metals



**More stringent
emission control**



We provide catalysts for 1 out of 3 cars in the world as well as for trucks & non-road vehicles



**Renewable
energy**



We supply key innovative materials for high-efficiency solar cells and other photovoltaic applications



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Why Minimalist Approach ?

We live in a complex world !

- Bottom line focus, budgets, plant availability, metal prices, dollar value, environmental legislation, commodities, product specification, Corporate demands, Energy, HR, risks, feed specs, disturbances, breakdowns, immissions, emissions, customer demands, research and development, innovation breakthroughs, investments, capital employed, safety, security, Umicore way, sustainability, competence management, market share, China, India, Legislation, CE, Reach, ISO 9001, ISO 14001, QEHS, EFQM, 5S, priorities, control, SAP, P&T, IT, time, crisis,.....

Murphy's Law

- Anything that can go wrong, will go wrong
- How to beat Murphy's Law ?

Definition of Minimalism:

“Being or providing a bare minimum of what is necessary”

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Some answers ...



Roger E. Bohn



Ramchandran Jaikumar

From Art to Science...

How to learn fast...

How to control complex systems...

How to avoid fire fighting...

How to organise workforce...

What are the stages of knowledge...

How to involve people in learning...

How to reduce problems...

The Minimalist Approach.

Information management

Problem reduction

Focus on disruptions

Knowledge management

(also people issues)

Learning cycle

Knowledge base

Managing the learning speed

Injecting Life into Information through modeling

Business models

Physical models

Control models

Statistical models

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Information Management (1)

How to solve a case ?

Problem reduction

- Define key problem areas (families)
- 10 projects with 10 problem families not 100! problems
- Knowledge on problem families has to be validated turned into science and made available

Focus on disruptions

- Stability in the ideal case, equates with zero disruptions
- Removing the root causes of disruption will lead to a more failure free operation

Reducing uncertainty through experiments

Information Management (2)

The essence of Minimalism

Guidelines on how to eliminate disruptions are threefold.

- Prevent the propagation of disruptions.
- Manage the difference between actual performance and what is theoretically possible, which might be termed the "competitive gap."
- Resolve this difference in performance by the application of scientific methods.



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Knowledge Management (1)

The Learning Cycle

Save knowledge

- control models
- physical models
- statistical models
- business models

Improvements

New knowledge

Learning process

- process team, operators, experts, ...
- experimental design, statistics, ...

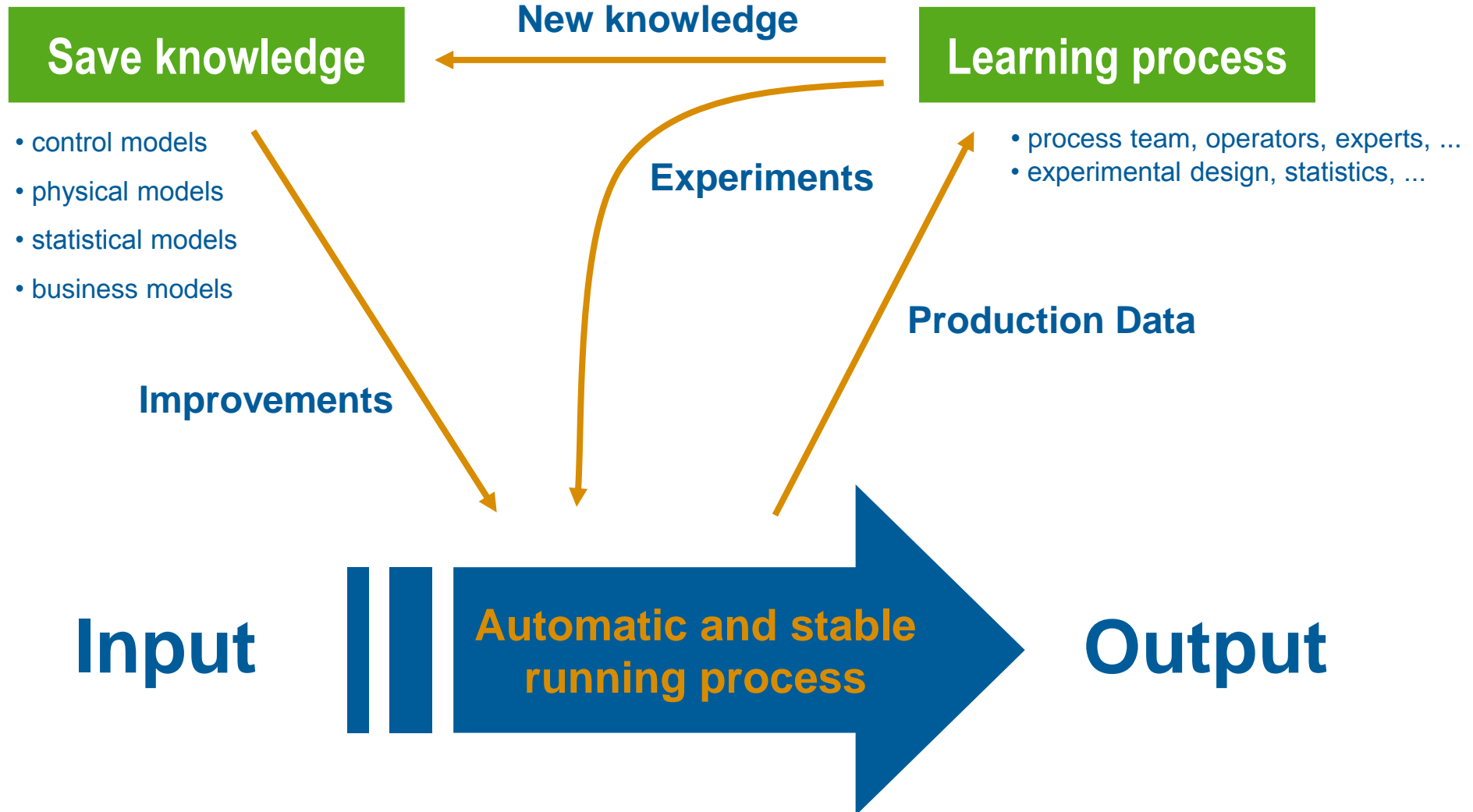
Experiments

Production Data

Input

Automatic and stable
running process

Output



Knowledge Management (2)

The Learning Cycle

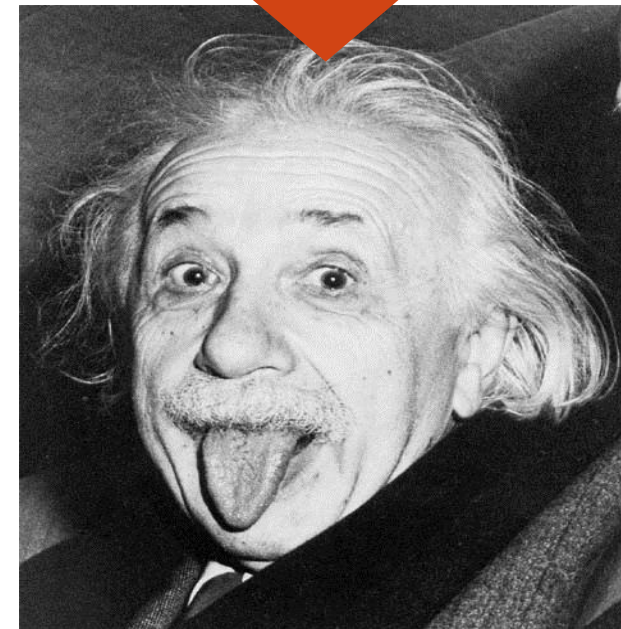
Adapting the learning cycle scheme of Prof. Bohn to R&D processes as well as production processes

- Stresses position of all people as learners in a learning process
- Stresses the generation of knowledge
- Improvements are derived from the expanding knowledge base
- Stresses stability
- Considers competence as a dynamic force in knowledge management

Knowledge Management (3)

The Stages of Knowledge

1. We do know nothing.
2. We have an idea but can't measure it
3. We have an idea and can measure some variables.
4. We can measure the main variables and can control some
5. Recipe level: measurement and control of main variables
6. First order effects
7. Interactions
8. Know it all



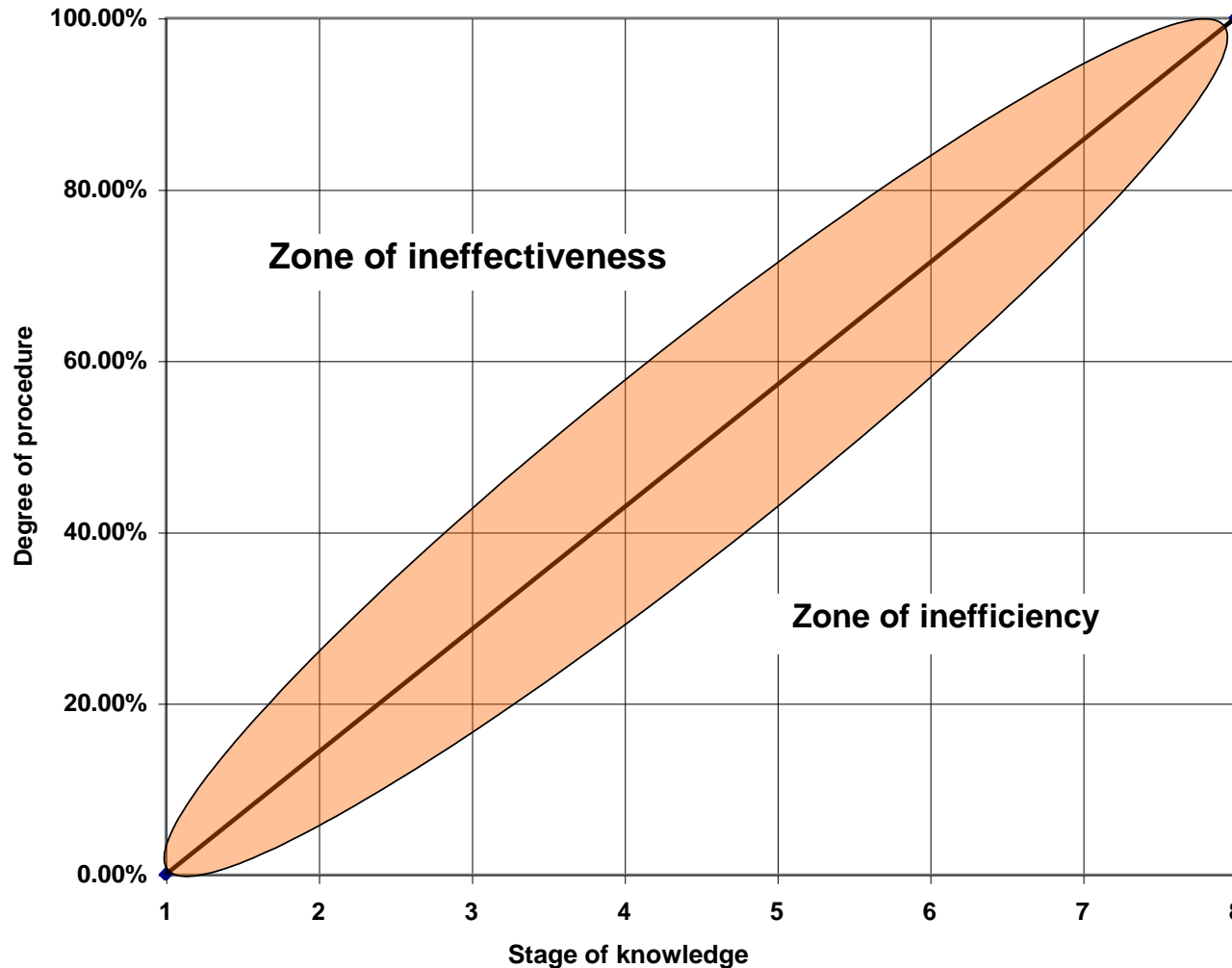
Knowledge Management (4)

The Stages of Knowledge

From Art to Science

Knowledge at stage	1	2	3	4	5	6	7	8
Nature of production	Expertise based		←-----→				Procedure based	
Role of workers	Everything		Problem solving				Learning and improving	
Location of knowledge	Workers' head		Written and Oral				In database or software	
Nature of learning	Artistic		Natural experiments				Controlled experiments simulations	
Nature of problem solving	Trial and error		Scientific method				Table look up	
Method of training new workers	Apprenticeship coaching		←-----→				Classroom Teaching	
Natural type of organization	Organic		Mechanistic				Learning oriented	
Suitability of automation	None		←-----→				high	
Ease of transfer to another site	Low		←-----→				high	
Feasible product variety	High		Low				high	
Quality control approach	Sorting		Statistical				Feed forward	

Knowledge Management (5) Procedures and Knowledge



Knowledge Management (6)

Managing the Speed of Learning

Requires managing:

- Signal noise ratio
- Information cycle time
- Fidelity
- People, people, people



Knowledge Management (7)

Signal Noise Ratio

Avoid Confusion !

- Noise is only reduced with the SQR of the # of experiments
- Promote the use of a data historian in production and R&D to enable data reconciliation. (Umicore time, calibration, units avoiding confusion)
- Promote learning cycle
- Promote modeling with inherent low noise
- Bring equipment up to today's standard:
 - New equipment
 - Equipment upgrade
- Use ISO, TQM etc.

Knowledge Management (8)

Information Cycle Time

Shorten total information time: from initial problem proposal including communication time

- If one does not understand the message the information cycle time takes forever

Shorten access/setup time

Shorten analytical response time

- 15days – 10 days – 24hrs – overnight – 1/hr- on line

Promote modeling

"High Throughput Methodologies"

- Calculations
- Experiments

Specific management for long cycle time projects

Knowledge Management (9)

Fidelity

Imbedding of learning and knowledge-building within operations and management processes

- The Industrial operation = reality by definition

Investment in large scale pilot plant or R&D in the Plant

Promote dynamic modeling

- Gives the feeling of a real plant before the plant is build

Promote modeling with high fidelity

- Aimed for solutions, not modeling
- Fluent (CFD), Flow sheeting, Thermodynamics

Business modeling will help you understand the bigger picture

“Reality brings focus. Be also prepared for the reality of tomorrow: foresight”

Knowledge Management (10)

People and competences



Dr. Ir. Mieke Campforts – The Minimalist Approach 25

Never forget, the world is driven by people

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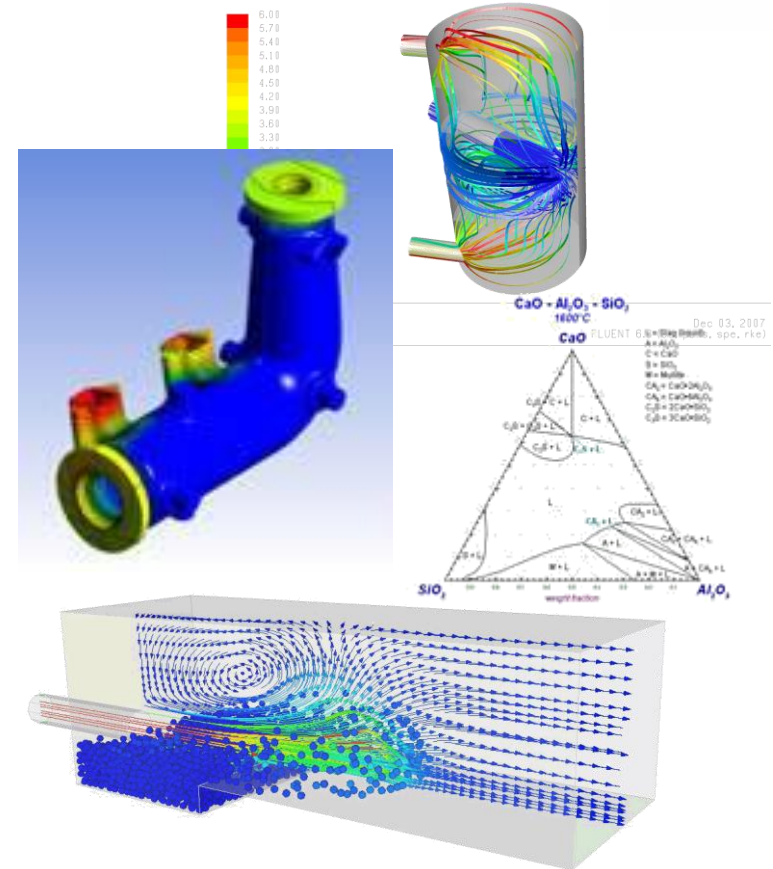
Injecting Life into Information through modeling

Control models

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“Modeling makes integration of knowledge possible”



Q & A

