

Digital Transformation (DX) initiatives in a chemical company

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Chief Digital Officer
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Self Introduction

- Spent 25 years in IBM Research – NLP, AI, Web, and Security
- Spent 2 years in IBM Garage – Design Thinking and Agile Development
- Spent 3 years in chemical industry – DX

- President of Japanese Society of Artificial Intelligence (2018-2020)
- Visiting professor for several universities



Current environment that we are facing

Society

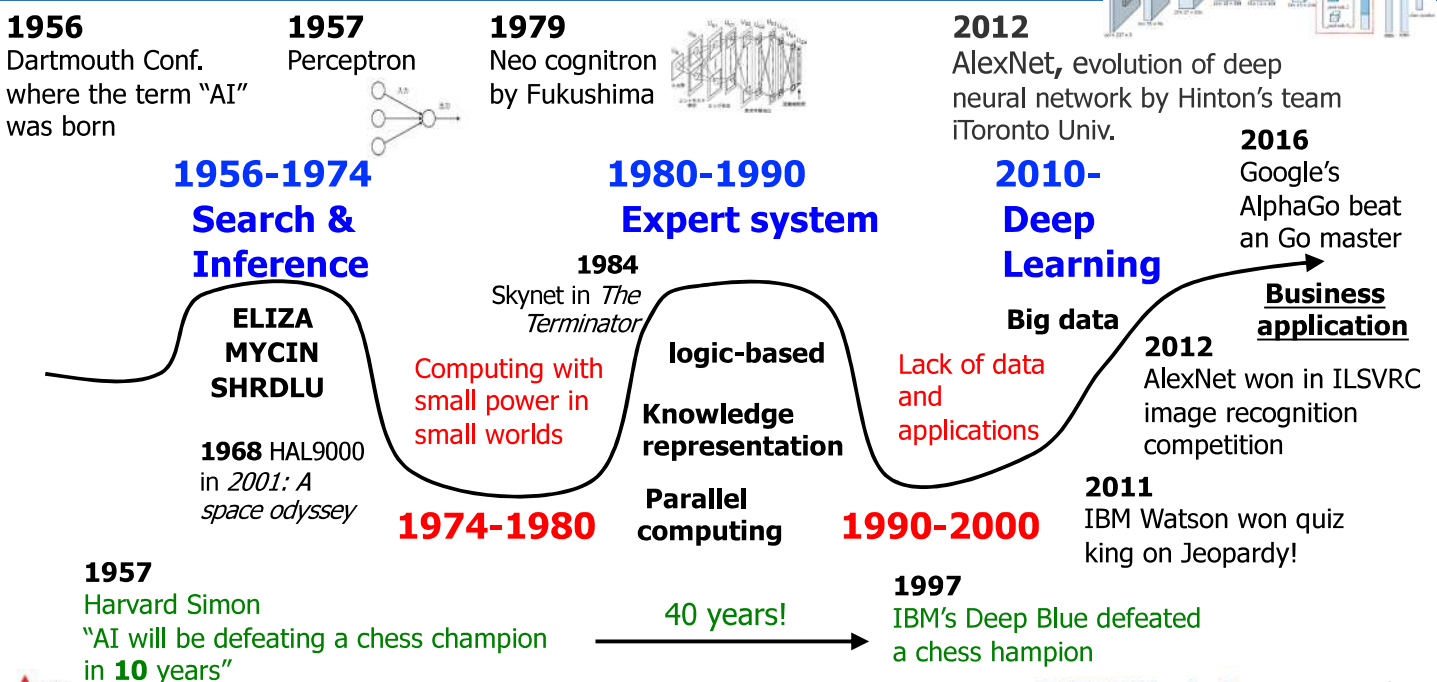
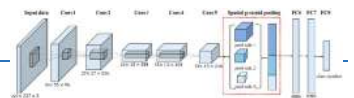
- Declining the working population due to aging
- New competition, new values (e.g., intangible assets, customer values, and social values)
- Responsibility to society and the future (e.g., commitment to carbon neutral)
- Unpredictable changes that actually happen
- Fragmentation and Solidarity due to COVID
- VUCA (Volatility, Uncertainty, Complexity, Ambiguity)

Technology

- Cyber vs. Physical
 - Virtualization, As a Service
- Human vs. Machines (incl. software)
- Success of data-driven approach (machine learning)
- Emerging technology which may change rules (e.g., quantum computing)
- Increasing importance of technology in business management
- Social issues associated with the increasing complexity of technology

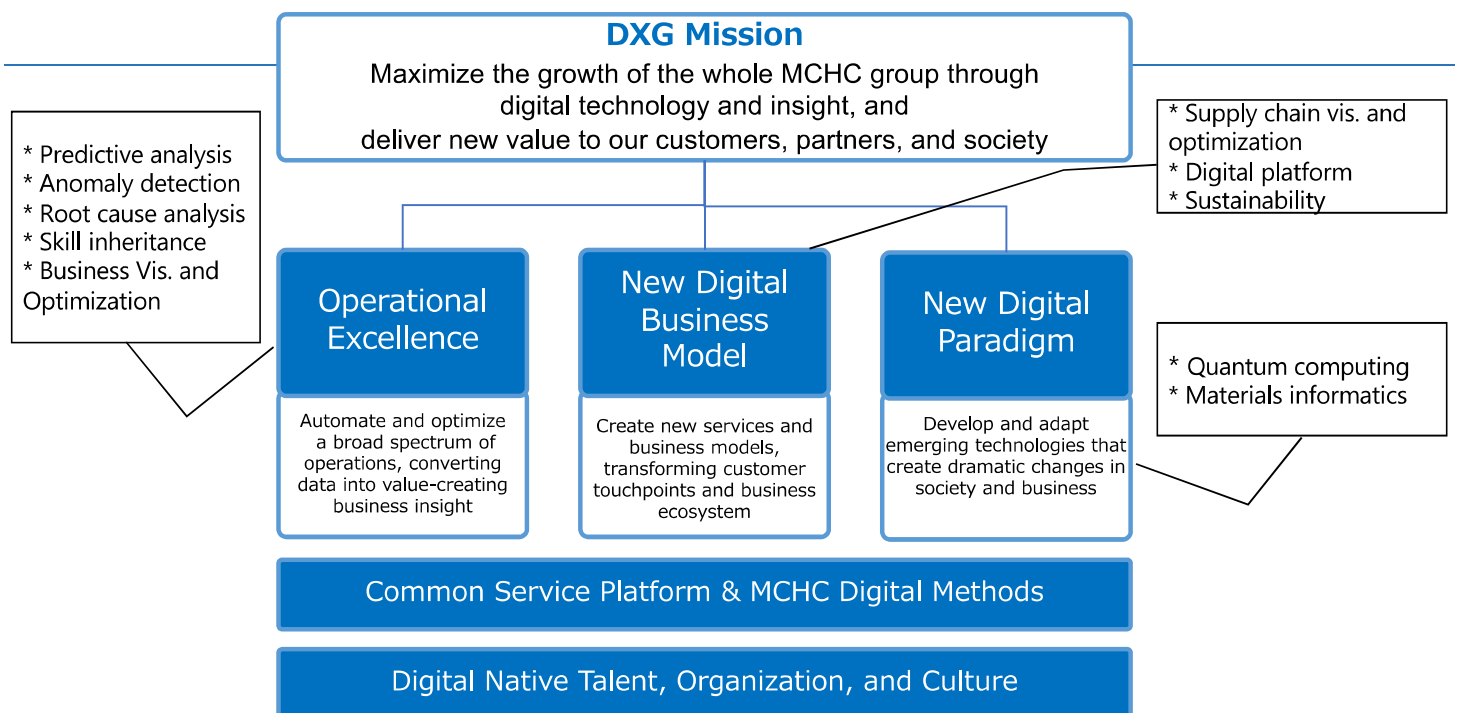


The rise and fall of artificial intelligence research



Digital Transformation Group (DXG) in MCHC

- Established in 2017
 - Keeping diversity by internal and external hiring + supporting staffs
- Teams
 - Technology – data scientist and engineer
 - Business model – business analyst and business development
 - Infrastructure – architect and engineer
- Center of Excellence (CoE)
 - Materials informatics
 - Text mining
 - Mathematical optimization
 - Image Analysis (new!)
- Collaborations
 - Other DX organizations in operating companies
 - Internal and external development teams



Case1: Predictive Detection in manufacturing process



Issue

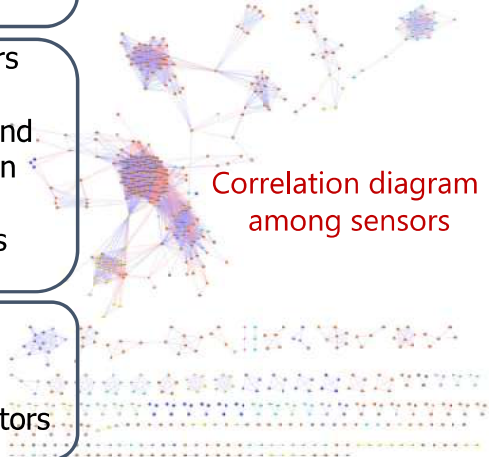
- Occurrence of an anomaly state in a chemical plant causes a significant loss of production.
- We have worked with chemical engineering for many years but accurate prediction is difficult, since such a state only occurs at once or twice in a year.

Solution

- Collect continuous state data from thousands of sensors (tags) in the plant.
- Apply machine learning algorithms, and identified around 100 tags which are critical for prediction without human knowledge
- Elaborate the algorithm and reduce the number of tags with human experts

Results

- Achieved practical prediction mechanism with machine learning approach
- Deployed to a production site and using by plant operators



Correlation diagram among sensors

Case2: Identification of out-of-spec products

Issue

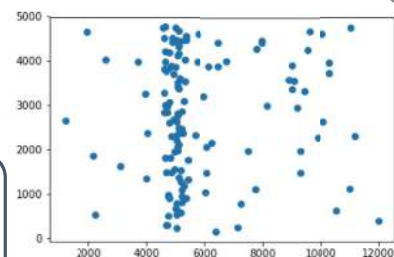
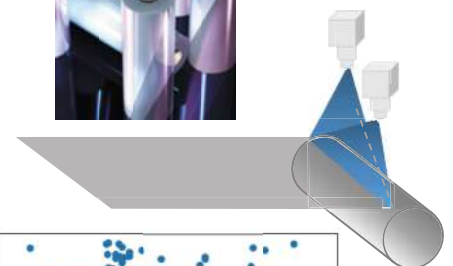
- Film products should be checked if its quality meets predefined criteria in the final phase.
- The checking are done by human since conventional automated image analysis is not enough

Solution

- Multiple solutions including deep learning are examined.
- Finally employed the best approach in terms of classification performance and consistency with human expert's decisions

Results

- Implemented in the actual quality management phase in production lines
- Will be expanded to all production lines



Automated final product checking

Case2: Text Analytics for knowledge inheritance

Issue

- Customers want to have the right answer for a question for products.
- Domain experts who answers the question are going to retire, but their experience and insight are not externalized.

Solution

- Analyse existing QA pairs and product manuals to develop a QA system.
- Build deep knowledge (wisdom) from these text, information and interviews from human experts.
- Provide a visualization of the wisdom.

Results

- Improved quality and speed of response to customers.
- Started using not only by customers but also internal sales persons and agents.

Materials Informatics (MI)

- New approach for material discovery powered by data science
- Materials Genome Initiative (MGI) launched on 2012
- Becoming hot among academia and industry

Direct problem (Deductive)



Inverse problem (Inductive)



Main Research Topics

- Discovering algorithms with data science (inverse problem is still very challenging)
- Building knowledge base from structured and unstructured data sources

Toward DX Methodology - MCHC Digital Methods

Digital University

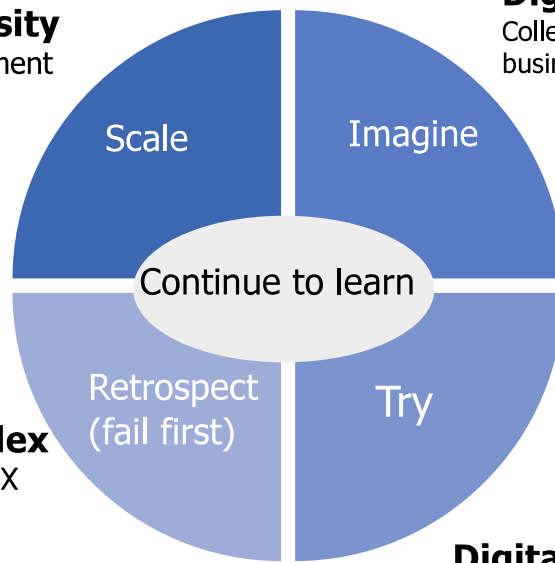
DX Talent development program

Community

CoE, Data Scientist Network (glass root community)
Internal "Kaggle"

Digital Maturity Index

Indicators for evaluating DX initiatives from multiple perspectives



Digital Playbook

Collection of basic components for building business models

Digital Technology Outlook

Assessment of technical impacts and implications of digital technologies to define our strategy

Machine Learning Project Campus

Understanding of guidelines when conducting data analysis projects

Digital Project Recipe

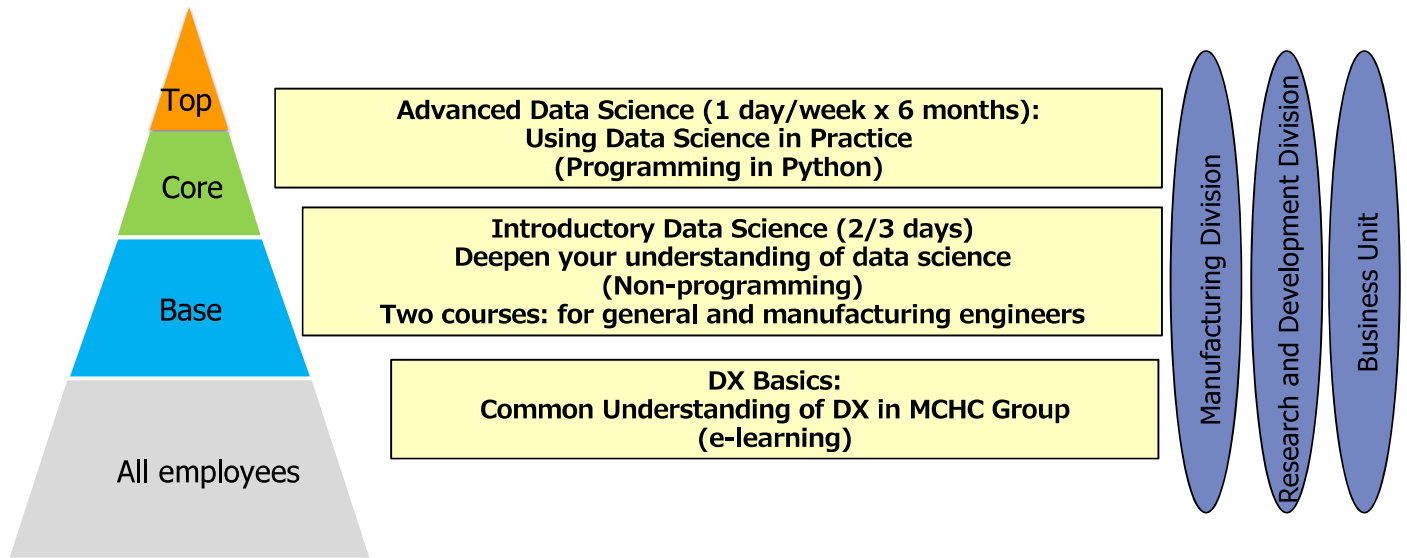
Sharing of technical best practices

機械学習プロジェクトキャンバス Machine Learning Project Canvas

目的・目標 Purpose/Goal		展開性・副次的な効果 Expansion/Secondary Goal		
データ Data • Labeled • Unlabeled	検討時の計算手法・インフラ Algorithms/Infrastructure for Trial <i>fx</i>	成功の指標 Metrics of Success	予測の利用法 Actions Based on the Prediction	利用者 User Segments
	データ補強 Data Enhancement • Annotation • Simulation		最終システム形 UI/Systems for End Users	
オープン戦略 Open Strategy • Open data • Trained models • Communities	過去の知見・アドバイザー Past Knowledge/Professional Advisors	モデル更新・メンテナンス Model Update/Maintenance		

Digital University

- Multiple level DX talent development according job roles



“Ambidextrous” DX

“Persistent” DX

- Big improvement of current business models and operations (visualization, automation, optimization, data analysis, etc.)
- Example:
 - Anomaly detection in plants
 - Business process optimization
 - Lab automation

“Disruptive” DX

- New value creation by drastically changing current business models and operations
- Applying game-changing technologies
- Example:
 - Product and service offering on digital platform
 - Precision medicine
 - Quantum computing

“Becoming like Uber or Amazon” is so hard for us, while us, but transformation is the key

- **Do both!!**

The KAITEKI Challenge - Reimagining Proteins, Plastics, and Packaging -



Reimagining Proteins, Plastics, and Packaging



Greentown Labs



Mitsubishi Chemical Holdings

APPLICATION DEADLINE

FEBRUARY 10

Check details in Request For Proposal:

<https://www.mitsubishichem-hd.co.jp/information/00994.html>

 Mitsubishi Chemical Holdings

Program Scope

Alternative Proteins	Plastics Recycling	Preventing Food Waste
Plant & Fungi-Based Protein Cell Agriculture	Recycling Technologies Design for Recycling Management Systems	Packaging Preservatives Alternative Food Processing

Benefits



Partnership with MCHC

A structured platform for a Proof of Concept (POC) project with MCHC using its group wide resources & network. Access to executives



Support of Greentown Labs

Mentorship, networking opportunities, and partnership-focused programming from Greentown Labs, the largest climatetech incubator in North America



Grant

Get \$25K in non-dilutive grant funding to cover a proof of concept project
 ※Funding beyond \$25,000 is available and will be evaluated on a case-by-case basis



Engagement & Investment

Follow-on partnerships like joint development, pilots, licensing agreements, manufacturing collaborations, and more. Investment from MCHC's CVC arms

KAITEKI Value for Tomorrow

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Thank you for listening!