International Conference on "Industry 4.0"
cum SMART Seminars Proceedings

Industry-wide Promotional Campaign and Strategy Mapping Towards “Industry 4.0”
– The Time to Act by Hong Kong Industry is Now!

Industrial Supporting Party(ies):

Funding Organization:
Organisation:
Sponsor:

此紀要乃屬由香港特別行政區政府創新及科技基金撥款資助。「工業 4.0」之全面推廣計劃及策略部署 - 香港工業革新時代現在開始！』項目小組成員
在此刊物上表達的任何意見、研究成果、結論或建議，並不代表香港特別行政區政府、創科署的觀點。

This Proceeding is one of the publication of the project "Industry-wide Promotional Campaign and Strategy Mapping Towards "Industry 4.0" - The Time to Act by Hong Kong Industry is Now!" which is funded by Innovation and Technology Commission Innovation and Technology Fund. Any opinions, findings, conclusions or recommendations expressed in this material (by member of the Project}
Forward

Hong Kong is an international city, with well-developed information and communication technology. Our unique advantages can support the China government policy called “Made-in-China 2025” development and gain opportunities in the current strategic plan. This project aims to promote and strategically deploy "Industrial 4.0", in which Hong Kong can be a platform to test the international market’s response to Smart manufacturing.

In the development of Smart manufacturing and robot automation technology, several leading Industrial countries have vigorously promoted "Industrial 4.0" to enhance the manufacturing capacity in recent years. Through the Internet and Internet of things (IoT) to establish efficient and flexible Smart factory. i4. 0 will connect equipment, advanced robot, worker, human machine interface and digital data in the factory by the network. The system will analyze the received orders, and then arrange purchase process of raw materials and components intelligently. The product will be assembled by the robot and delivery out automatically. Furthermore, Smart system equips self-monitoring and error corrective action. Smart factory can optimize production goals and processes to meet the market demand. The United States, the European Union and Japan have also proposed to launch "fourth industrial revolution." Manufacturing is on the brink of the Fourth Industrial Revolution (Industry 4.0).

We would like to express my sincere gratitude for your support and assistance in making the project a very successful conference and seminars.

Sincerely hope that you will continue to support the project held by Smart Manufacturing and Materials Division (SMD) of the Hong Kong Productivity Council

Smart Manufacturing & Materials Division (SMD)
Mr. Lee Kwok Keung, Thomas
Introduction

The term “Industry 4.0” was originated and coined by a group of scientists, business/industry executives that proposed the German government on how to develop its high-tech strategy in order to maintain the global manufacturing share and its leading industrial country status. Because of the utmost importance to the global economy, the Industry 4.0 has been rapidly spreading over the world. All the industrial countries and cities are engaging in upfront technological study and industry analysis for paving the way along this direction. In China, there is a national-wide government policy called “Made-in-China 2025” that is presided by Premier Li Keqiang on 25 March, 2015, key points of the State Council’s legislative work of the implementation of “Made-in-China 2025” were confirmed and the strategy will be accelerated to realize the upgrade of the manufacturing industry to become Industry 4.0 enabled manufacturing.

In Germany, a leading technology institution, RWTH Aachen University successfully built up an “Industry 4.0 Demonstration Factory” together with world renowned Fraunhofer Institute of Production Technology (IPT) to illustrate the concept, working principle and benefits of “Industry 4.0 – Smart Factory” for industry reference in 2015. Similar Industry 4.0 centers have also been established in USA, UK, while 『工業4.0 智能工廠試驗室』 was recently set up in Shanghai Tonggi University to illustrate the similar concept in line with the national-wide initiative of Made-in-China 2025”.

In sight of the trend, HKPC is organizing an “International Conference on “Industry 4.0” in Hong Kong cum the seminars and workshop” for industry-wide promotion towards Industrialists, Directors and Senior Managers of Manufacturers and Emerging Technological Enterprises as well as Universities Staff to gain awareness and concepts of I4.0. Three seminars in HK covers "Smart Manufacturing", "Smart Product" and "Smart Services" and a seminar in ShenZhen addressing "Made-in-China 2025" will be held respectively to foster communication regarding on the Industry 4.0 topic. Besides, two workshops and a concurrent technology showcase are included. It targets for manager, engineers and technological professions to gain in-depth knowledge on implementation of I4.0 as well as the enabling technologies and solution providers.

This proceeding is a compilation of the "Industry 4.0" international conference papers and workshops, which includes the following items:
- International Conference on "Industry 4.0"
- Seminar: Smart Manufacturing
- Seminar: Smart Product
- Seminar: Smart Services
- Seminar: “Made in China 2025”
- Seminar: Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0”
- Workshop: Enabling Manufacturing Systems for Implementing “Industry 4.0”
- Workshop: Enabling Manufacturing Technologies for Implementing Industry 4.0
Table of content

Forward .................................................................................................................................................. 1
Introduction ........................................................................................................................................... 2
Table of content .................................................................................................................................. 3

1 International Conference “Industry 4.0” in Hong Kong「工業 4.0」國際研討會

1.1 Motivation of “Industrie 4.0” 策動「工業 4.0」之市場要素
Speaker: Head of Technology Management Department, Fraunhofer IPT, Germany; Mr. Toni Drescher . . 8

1.2 Grasping Opportunities of “Made-in-China 2025” National Policy 把握「中國製造 2025」國家戰略機遇
Speaker: Academician of China Engineering Academy; Dr. Jian-Rong Tan ........................................... 24

1.3 Deployment of “Industrial Internet” in USA 美國企業採納工業互聯網之概況
Speaker: Director, Global Industry Marketing, Moxa Inc. and Industrial Internet Consortium (IIC), USA; Mr. Eddie Lee .................................................................................................................. 26

1.4 Preparing Strategy for The Fourth Industrial Revolution in South Korea: Beyond Manufacturing 3.0 策略性應對全球工業革命—韓國「超越製造創新 3.0」
Speaker: Senior Research fellow, Leading Industry Research Division, Korea Institute of International Economics & Trade (KIET); Dr. Suk-In Chang .................................................................................. 39

1.5 Overview on “Innovation Fields in Smart Production/Products/Services and Enabling Technologies” for Realizing Industrie 4.0 實現「工業 4.0」智能製造，產品，服務之創新策略及技術概覽
Speaker: Partner and Technology Manager, KEX Knowledge Exchange AG, Germany; Mr. Myron Graw .. .47

1.6 Initiative of “Industry 4.1J” in Japan and Strategic Adoption of Intelligent Production Planning System for Smart Manufacturing 日本「工業 4.1J」策略及應用智能生產排單系統進行智能製造之要訣
Speaker: APS Specialist, International Consulting Division, Asprova Corporation; Mr. Eiji Yoshikawa............60

1.7 “Digitalization” — Industry Case of Factory of the Future 數碼化未來工廠個案
Speaker: Digital Factory Specialist for I4.0, Siemens GmbH; Mr. Sun Feng ..............................................64

1.8 Transformation Towards Smart Enterprises in Hong Kong 香港企業轉型智能企業之路
Speaker: Under Secretary, Innovation and Technology Bureau, HKSAR; Dr. David Chung .......................73
# Table of content

2  「中國製造 2025」研討會“Made-in-China2025” Seminars .................................81

2.1 成立數位工廠與迎接中國製造 2025 及「工業 4.0」之時代  
Speaker: Head of Digital Factory & Process Industries and Drives, Siemens Ltd., PRC; 朱初陽先生........82

2.2 中國製造 2025 和「工業 4.0」政策解讀及帶來的機遇與挑戰  
Speaker: Academician of China Engineering Academy; Dr. Jian-Rong Tan........................................83

2.3 珠三角企業提升至「工業 4.0」差距分析案例及評估方法與服務  
Speaker: Consultant , Smart Manufacturing and Materials Division - Hong Kong Productivity Council; Mr. Lyan Law ..............................................................................................................................84

2.4 3D 打印拉動先進製造業創新  
Speaker: Director of Guangzhou Institute of Electronic Technology, Chinese Academy of Sciences; Dr. Yao-tang Li ..................................................................................................................................................85

2.5 有效地採用 MES 及 ERP 先進系統，以實現「工業 4.0」及中國製造 2025  
Speaker: Epicor Software (North Asia) Ltd., PRC; Senior Regional Manager, Mr. Thomas Hung & Senior Solutions Manager, Ms. Gina Au ..............................................................................................................86

2.6 從「工業 4.0」、工業互聯網到中國製造 2025  
Speaker: Executive Vice President, Tongji University TaiCang High-Tech Institute, Professor Hai-jang Liu 87

3 "Smart Production" Seminar 智能製造研討會  
Speaker: Head of Technology Management Department, Fraunhofer IPT, Germany; Mr. Toni Drescher ..............................................................................................................................................88

4 Smart Service" Seminar 智能產品研討會  
Speaker: Head of Technology Management Department, Fraunhofer IPT, Germany; Mr. Toni Drescher ..............................................................................................................................................114

5 "Smart Product" Seminar 智能服務研討會  
Speaker: Partner and Technology Manager, KEX Knowledge Exchange AG, Germany; Mr. Myron Graw .........................................................................................................................................................136
Table of content

6 Workshop on Enabling Manufacturing Systems for Implementing "Industry 4.0"

6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics

Speaker: Partner and Technology Manager, KEX Knowledge Exchange AG, Germany; Mr. Myron Graw

6.2 Increase Business Responsiveness with Integrated ERP and MES system

Speaker: Senior Solutions Manager, Epicor Software (North Asia) Ltd., PRC; Ms. Gina Au

6.3 I4.0 Smart Operation, Manufacturing and Factory Upgrading

Speaker: Consultant, Smart Manufacturing and Materials Division - Hong Kong Productivity Council; Mr. Horace Leung

6.4 Advanced Planning & Scheduling (APS)

Speaker: General Manager, Asprova Software Technology Co. Ltd. Japan, Asprova; Mr. Jia Liang Xu

6.5 Manufacturing Execution System and Overall Equipment Efficiency

Speaker: Managing Director of FORCAM in CHINA, FORCAM Shanghai Software Technology Co., Ltd., Germany, FORCAM; Mr. Bernd Michel

6.6 Connected Industrial 4.0

Speaker: Solutions Architect, CISCO System (HK) Ltd., USA, CISCO; Mr. Raymond Poon

7 Workshop on Enabling Manufacturing Technologies for Implementing "Industry 4.0"

7.1 Motivation of “Industrie 4.0”

Speaker: Head of Technology Management Department, Fraunhofer IPT, Germany; Mr. Toni Drescher

7.2 Grasping the opportunities of “Made-in-China 2025” National Policy

Speaker: Academician of China Engineering Academy; Dr. Jian-Rong Tan

7.3 I4.0 Smart Operation, Manufacturing and Factory Upgrading

Speaker: Consultant, Smart Manufacturing and Materials Division - Hong Kong Productivity Council; Mr. Horace Leung
Table of content

Speaker: Consultant, Smart Manufacturing and Materials Division - Hong Kong Productivity Council; Mr. Horace Leung ................................................................. 219

7.4 Collaborative Robotics with Artificial Intelligence Embedded 人工智能嵌入式協作機器人
Speaker: Founder, F&P Robotics, Switzerland; F&P Robotics; Dr. Hansruedi Früh ............................................ 220

7.5 人機協作智造未來
Speaker: Vice President, Human Cothink Robotics Tech. Co. Ltd.; Mr. Allen Liang ........................................... 221

8  Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0”
Seminar ......................................................................................................................................................... 222

8.1 Industrie 4.0 – The 4th Industrial Revolution, Facing the Smart Future！「工業 4.0」全面推廣計劃成果
Speaker: Principal Consultant, HKPC - Hong Kong Productivity Council; Raymond SHAN ............................... 223

8.2 Case Study and sharing – Shing Hing Plastic Manufacturing Limited 業界分享 – 成興塑膠製品有限公司
Speaker: General Manager, Shing Hing Plastic Manufacturing Limited; Calvin Wu ........................................ 231
The term “Industry 4.0” was originated and coined by a group of German scientists and business/industry executives that proposed the German government on how to develop its high-tech strategy in order to maintain the global manufacturing share and its leading industrial country status. Understanding the utmost importance to the global economy, Industry 4.0 has been rapidly spreading over the world. Industrial countries and cities are engaging in upfront technological study and industry analysis for paving the way along this direction. In China, there is a national-wide government policy called “Made-in-China 2025” that at the recent State Council Executive Meeting presided by Premier Li Keqiang on 25 March, 2015, key points of the State Council’s legislation work of the implementation of “Made-in-China 2025” were confirmed and the strategy will be accelerated to realize the upgrade of the manufacturing industry to become Industry 4.0 enabled manufacturing.
Topic: 1.1 Motivation of “Industrie 4.0”

Mr. Toni Drescher

Head of Technology Management Department, Chief Digital Officer
Fraunhofer IPT, Germany

• 10 years’ experience in technology and innovations management
• Expertise in Industry 4.0 consultancy and its’ enabling technologies
• Advisor of Industrie 4.0 Taskforce

The Fraunhofer IPT is the largest research institute in Europe. It operates around 80 research institutes and has 12,500+ scientists and engineers. The Fraunhofer IPT develops systems solutions for production. It focuses on the topics of process technology, production machines, mechatronics, production quality and metrology as well as technology management.
Activity 1.1 Motivation of “Industrie 4.0”
Motivation of “Industrie 4.0”

More than 60% of companies will have digitized their value chains in the next five years.

By 2020, European industrial companies will invest €140 billion annually in Industrial Internet applications.
Activity 1.1 Motivation of “Industrie 4.0”

- Reduction of costs
- Time saving
- Increase of safety
- Increase of comfort and well-being
- Digitized products and services generate approximately an additional € 110 billion per year for European industry.
- Increase market share and open new markets
- Increase margin of products and services
Activity 1.1 Motivation of "Industrie 4.0"

- Increase of flexibility
- Increase of individuality

**Benefits of Industrie 4.0**

- Enrichment for most human needs
  - Individualization
  - Reputation
  - Social community
  - Safety
  - Health

**Top of the hype cycle**

- **Vital analysis**
  - Food/Fitness Coach
  - Pyramide of needs, Maslow

- **Geo-Tracking**
  - Self Fulfillment
  - Self-esteem
  - Love/Belonging
  - Safety
  - Physiological needs

**Source:** Knowledge Exchange
Activity 1.1 Motivation of “Industrie 4.0”
Activity 1.1 Motivation of "Industrie 4.0"
Activity 1.1. Motivation of "Industrie 4.0"
Activity 1.1 Motivation of “Industrie 4.0”
Activity 1.1 Motivation of “Industrie 4.0”
Activity 1.1 Motivation of “Industrie 4.0”

**Smart Process**

**Decentral Production Steering**

**Motivation of “Industrie 4.0”**

**Data driven operative excellence**

**Real time transparency**

A price for machine processing times including setup costs can then be calculated, including e.g. expected sales revenue or delivery dates. CPPS can therefore quickly make a point about optimization of production schedules.

**Introduction Agenda**

1. Motivation and benefits
2. Origin and definition
3. Opportunities and risks
4. Enabler and challenges

**Industrie 4.0 – the digitalization of manufacturing – is a global trend**

**Engineering excellence**

Bringing engineering excellence to the digital world

Visionary concepts integrating technology, society, and industry in the digital world

**Ability to scale**

Innovation through adoption

Massive build-up of smart factories and very large OEMs building up business through own demand

**Opportunity and risks of “Industrie 4.0”**

Specific German view

**Opportunity**

**Risks**

- Company oriented
  - Resilience of production processes
  - Efficient production of individualized products (flexibility vs. automation)

- Macro-economic oriented
  - Empowerment of skilled work force, e.g. production planning, decision making and safety
  - Leveraging of production competencies
  - Differentiation potential by label a Industrie 4.0, esp. machine building industry

- Macro-economic oriented
  - Protection of data privacy
  - Low technical acceptance

**Speed**

- Data security
- New disruptive business models
  - Data as the new capital asset
  - Erosion of core competencies
  - (Global) competitors from new market arenas

**Radical innovation**

- Start-ups for the Internet of Things and a renaissance of manufacturing
- Pragmatic adoption of potentials and long-term strategy
  - Use of existing technologies and strategic development of selected key technologies

- Bringing digital innovation to the physical world
Activity 1.1: Motivation of "Industrie 4.0"

**Introduction Agenda**

1. Motivation and benefits
2. Origin and definition
3. Opportunities and risks
4. Enablers and challenges

**Industry 4.0 – the digitalization of manufacturing – is a global trend**

**Engineering excellence**
- Bringing engineering excellence to the digital world
- Visionary concepts integrating technology, society, and industry in the digital world

**Ability to scale**
- Innovation through adoption
- Massive buildup of smart factories and very large OEMs building up business through own demand

**Radical innovation**
- Bringing digital innovation to the physical world
- Start-ups for the Internet of Things and a renaissance of manufacturing

**Speed**
- Pragmatic adoption of potentials and long-term strategy
- Use of existing technologies and strategic development of selected key technologies
Motivation of "Industrie 4.0"

Activity 1.1

**From Big Data to Smart Data**
- Linked data from heterogeneous sources
- Descriptive analytics (generation of information)
- Diagnostic analytics (pattern recognition)
- Predictive analytics (prognosis)
- Prescriptive analytics (decision-making)
- Semantic analysis

**Ad-hoc networks**
- Automated recognition, utilization, build-up and re-group of networks
- Significant increased data transfer rates
- Increasing number of network partners
- Increasing robustness of wireless networks
- Low energy applications (bluetooth)
- Resources are on demand available (cloud)
Activity 1.1 Motivation of "Industrie 4.0"
Activity 1.1: Motivation of "Industrie 4.0"

Challenges
Assurance of security

- Increased data streams enable more ways to hijack confidential data
- Increased digitalization enables increased cyber sabotage

Adoption of Industrie 4.0
Drivers and challenges

<table>
<thead>
<tr>
<th>Drivers</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits is the biggest driver, e.g., Semiconductor industry was an early adopter of Industrie 4.0 elements</td>
<td>Estimation of (hidden) potential or low cost-benefit ratio</td>
</tr>
<tr>
<td>Legislative regulations (esp. sustainability)</td>
<td>Lack of standards</td>
</tr>
<tr>
<td>Open standards (open source) on systems and platforms</td>
<td>- Lack of standards hamper efficiency, usability, and a fast implementation</td>
</tr>
<tr>
<td>Planned investments on greenfield sites and references</td>
<td>- To many isolated solutions</td>
</tr>
<tr>
<td></td>
<td>- High cost for adaptation or interfacing tasks</td>
</tr>
</tbody>
</table>

Assurance of security
Preoccupations by value chain partners

Adoption of Industrie 4.0
Key players and best practices

Key players (Examples)
- SAP
- SIEMENS
- FESTO
- BOSCH
- RATIONAL
- nobilia
- PTC
- Fraunhofer
- Consortium

Best practices (Examples)
- It's owl
- Industrial Internet
- Cloud
- Plug and Work
- MES
- S-CPS
- Cybersecurity Connector
- KARIS PRO
- MEG pro2
- WePro
- SmartTool
- SMT
- BAZ MOD
- Smart industry
- ProModel

Research projects on Industrie 4.0

Ongoing research activities
(selection)
- Federally funded projects (Avg: ~1M EUR) for developing...
  - ...standards for tool management
  - ...“plug and play” for machines
  - ...self-documenting production setup
  - ...flexible autonomous material flow systems
  - ...security frameworks for production systems
  - ...demonstrations for prototyping and testing Industrie 4.0 solutions in a production setting
  - ...business model templates for Industrie 4.0 solutions
  - ...
Activity 1.1 Motivation of “Industrie 4.0”
Topic: 1.2 Grasping the Opportunities of ’’Made-in-China 2025’’ National Policy
把握「中國製造 2025」國家戰略機遇
(The National Strategy on Made-in-China 2025 and Way to Ride on the Policy for Enterprises Upgrading)

Dr. Jian-Rong Tan 譚建榮博士

Academician of China Engineering Academy
Dean of School of Mechanical Engineering of Zhe Jiang University

• Chinese Academy Engineering is the official supporting organization of “Made-in-China 2025”

• Advisor of national policy of “MIC 2025”

• Chief scientist of 973 national projects
Activity 1.2 Grasping the Opportunities of "Made-in-China 2025" National Policy

In China, there is a national-wide government policy called “Made-in-China 2025” that at the recent State Council Executive Meeting presided by Premier Li Keqiang on 25 March, 2015, key points of the State Council’s legislation work of the implementation of “Made-in-China 2025” were confirmed and the strategy will be accelerated to realize the upgrade of the manufacturing industry to become Industry 4.0 enabled manufacturing.
Topic: 1.3 Deployment of “Industrial Internet” in USA

Mr. Eddie Lee
Director, Global Industry Marketing
Moxa Inc. and Industrial Internet Consortium (IIC), USA

• Proactive in research concerning “industrial internet” application in smart manufacturing in USA

• Over 24 years experiences in Industrial Automation and Digitalization


Things are coming together.

www.iiconsortium.org
eddie.lee@moxa.com
Activity 1.3 Deployment of “Industrial Internet” in USA

"A fundamental new rule for business is that the Internet changes everything.

- Bill Gates, 1999

Or has it?

Discrete Manufacturing

1980
Programming a PLC
Programmable Controller

2016
Programming a PLC
Programmable Controller

The Industrial Internet of Things in the United States

Eddie M. Lee
Director – Global Industry Marketing
Moxa
26 July 2016

Where We’ve Been
Activity 1.3 Deployment of “Industrial Internet” in USA

**1950**
- Jet performance data is downloaded by hand.

**2016**
- Jet performance data is downloaded by USB.

**Aviation**
- Industrial Internet is leading the next economic revolution.

**Energy Management**
- Energy grids deliver power from a small number of plants to millions of businesses & homes.

**No, the Internet Didn’t Change Everything**
- There’s much more to be done:
  - Oil & Gas Exploration
  - Smart Manufacturing
  - Smart Connected Products

**GDP Per Capita**
- Industrial Internet.

**Internet Thinking**: Key to Smart Manufacturing, Smart Connected Products, and Smart Product Design.
Activity 1.3 Deployment of "Industrial Internet" in USA
Activity 1.3 Deployment of “Industrial Internet” in USA
Activity 1.3 Deployment of “Industrial Internet” in USA
Activity 1.3 Deployment of “Industrial Internet” in USA
### Activity 1.3 Deployment of "Industrial Internet" in USA

#### The Future

- How will we reduce jet engine failure & maintenance costs?
- How will we minimize unplanned factory downtime?
- How will we minimize unplanned factory downtime?
- How will we save lives through better patient care?
- How will we reduce waste of natural resources?

**Things are coming together.**

#### Business Benefits for Driving Adoption

- Reduce operational cost
- Improve worker productivity
- Reduce inventory
- Improve sustainability
- Increase customer experience

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>29%</td>
<td></td>
</tr>
<tr>
<td>25%</td>
<td></td>
</tr>
</tbody>
</table>

#### Predictive Maintenance: IIoT & Analytics

<table>
<thead>
<tr>
<th>Approach</th>
<th>Method</th>
<th>Applicability</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive</td>
<td>Run to failure and then repair</td>
<td>Non-critical assets with low impact from failure</td>
<td>10X plus when failure occurs</td>
</tr>
<tr>
<td>Preventive</td>
<td>Service in a fixed time or cycle interval</td>
<td>Failures increase with age or usage</td>
<td>2X maintenance costs</td>
</tr>
<tr>
<td>Predictive (condition monitoring)</td>
<td>Monitor process data, identify bad trends, &amp; alert prior to failure</td>
<td>Simple systems where single variable math predicts a failure</td>
<td>1X maintenance costs</td>
</tr>
<tr>
<td>Proactive (analytics &amp; multiple variables)</td>
<td>Equipment-specific data acquisition with algorithms, analytics, and/or a model</td>
<td>Complex systems where multiple variables and analytics can predict failure</td>
<td>Unscheduled downtime approaches zero</td>
</tr>
</tbody>
</table>

#### Duke Energy SmartGen Program

"Application of IIoT for Predictive Maintenance"

- **Barrie Cook**
  - Director – Maintenance & Diagnostics
  - Central Engineering
Activity 1.3 Deployment of “Industrial Internet” in USA
Activity 1.3 Deployment of “Industrial Internet” in USA
Activity 1.3 Deployment of "Industrial Internet" in USA

Sample Government Funding for Smart Cities & Advanced Manufacturing

Summer 2016

The IoT Public Sector Market 4.6 Trillion Opportunity

- IoT: A $4.6 Trillion GLOBAL Public-Sector Opportunity
- IoT helps governments make big advances in citizen services.
- 70% of public sector’s IoT Value at Stake will come from agency-specific implementations, while 30% from cross-agency adoption of IoT

70% from agency-specific use cases such as connected education, healthcare, and defense
30% from cross-agency use cases (fraud prevention, urban analytics, smart buildings)

$4.6 Trillion “up for grabs” over 10 years (2013-2023)

Source: Cisco Consulting Services Whitepaper

US Smart Cities Initiatives $160M - Winners

- Smart Cities IoT $160M Challenge: $160 million in federal research will be given to technology collaborations to help local communities tackle key Smart cities challenges:

- City of Columbus, OH wins $40M (best 77 other submissions) for Smart Cities challenge. Other finalists will receive funding and assistance in locating other grants.

US IoT Grant Winners

- We Care Transportation of Western NY receives 1M to help convert a fleet of vehicles to Natural Gas, May 2014

- Nexus Natural Gas in Tonawanda (Erie County), NY receives 570K to construct new Natural Gas filling station for their fleet of trucks.

- IBM Chooses 16 Cities and Counties for SmartCity Projects: Dallas, Baton Rouge, La.; Birmingham, Ala.; and Suffolk County, N.Y. Outside the U.S., cities included Abuja, Nigeria; Ballarat, Australia; Brussels, Belgium; Dublin, Ireland; Durban, South Africa; Jinan, China; Mombasa County, Kenya; Niigata, Japan; Perth, Australia; Tainan, Taiwan; Vilnius, Lithuania and Zapopan, Mexico.
Activity 1.3 Deployment of “Industrial Internet” in USA

- The National Science Foundation announced in June 2016 that it has awarded $6 million in grants to fund separate IoT Security projects at Stanford University and the University of Pennsylvania.
- NSF Awards $6M Grants for Internet of Things Security. See more at https://wp.me/p3AUX-TMr
<table>
<thead>
<tr>
<th>Activity 1.3 Deployment of &quot;Industrial Internet&quot; in USA</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Title</th>
<th>Agency</th>
<th>FSTD</th>
<th>LUDD</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMUNITY, COLLABORATION, CONVERGENCE. Things are coming together.</td>
<td><a href="http://www.iiconsortium.org">www.iiconsortium.org</a></td>
<td><a href="mailto:eddie.lee@moxa.com">eddie.lee@moxa.com</a></td>
<td></td>
</tr>
</tbody>
</table>

*Note: The table contains information about various activities and their respective agencies, FSTD, and LUDD dates.*
Topic: 1.4 Preparing Strategy for the Fourth Industrial Revolution in South Korea: Beyond Manufacturing 3.0

Dr. Suk-In Chang
Senior Research fellow, Leading Industry Research Division

Korea Institute of International Economics & Trade (KIET)

產業研究院全球戰略研究團

前任研究委員、前主力產業研究中心所長

- The leading expert in convergence in Korea
- Industry Innovation 3.0
- Korea deployment on smart industry
Activity 1.4 Preparing Strategy for The Fourth Industrial Revolution in South Korea: Beyond Manufacturing 3.0

The Mfg. Innovation Strategy 3.0 (June 2014)

- The strategy 3.0 consisted of three sub-strategies including:
  - (i) the creation of new advanced manufacturing featuring industrial convergence
  - (ii) enhancement of the major segments such as materials, components, and equipment, engineering, design and software segments and
  - (iii) advancement of industrial infrastructure for innovation

The Mfg. Innovation Strategy 3.0 (June 2014)

- The purpose of strategy 3.0 was:
  - to introduce innovation to the manufacturing process, including expanding the use of smart factories and developing core technologies related to the Internet of Things (IoT), 3-D printing and Big Data
  - To foster the growth of those segments combining manufacturing with information technology, examples of which include the incorporation of information technology into the energy management and industrial safety sectors
### The Mfg. Innovation Strategy 3.0 (June 2014)

- Given the discrepancy in innovation capacity between large companies and their secondary and tertiary subcontractors in Korea, the Strategy 3.0 puts special emphasis on...
  - setting up 10,000 smart factories by 2020 to facilitate convergence between software and hardware technologies with raising 1 trillion won (US$972 million)
  - the growth of the latter to spread innovation capacity and wealth, going beyond a mere focus on the enhanced automatization of manufacturing

### Why did Korean government initiate the Strategy 3.0 at that time?

- Externally, Korea’s major manufacturing sectors of shipbuilding, automotive, electronics, chemicals and steel had been faced with challenges such as the rise of China as a manufacturing powerhouse and the weakening of the Japanese yen.
- Internally, many local Korean manufacturing companies had suffered from low productivity and efficiency.
  - Korea’s labor productivity rose at an annual rate of 4.6% over 1995-2014, nearly three times the OECD average. However, the level of productivity per hour of labor input was only 35% of the top half of OECD countries in 2014

### The Mfg. Innovation Strategy 3.0 (March 2015)

- In March 2015, the Korean government announced the Action Plan for the Manufacturing Innovation 3.0 Strategy (henceafter, Action Plan for the Strategy 3.0), after further complement and improvement of the Strategy 3.0.
- The Action Plan for Strategy 3.0 has four sub-strategies:
  - (i) spreading of smart manufacturing process which has detailed plan such as spread Smart Factory, development of core technologies (sensors, IoT, 3D printing, holograms, etc.), strengthening the software power (engineering, Design, Embedded SW, etc.) for the manufacturing management, promotion of investing in enhanced production facilities.
  - (ii) creating representative new industry including early visualization of converged facilities for smart factory, commercialization and development of intelligent materials and components, promotion of private investment and R&D.
Activity 1.4 Preparing Strategy for The Fourth Industrial Revolution in South Korea: Beyond Manufacturing 3.0

The Mfg. Innovation Strategy 3.0 (March 2015)

- The Action Plan for the Strategy 3.0 has four sub-strategies:
  - (iii) Smart Innovation in regional manufacturing industry which has detailed plan such as activation of start-ups via Creative Economy Innovation Centers, utilization of local strategic point to become smart industrial regions, and development of smart industry according to regional industrial strengths.
  - (iv) Construction of innovation infrastructure & restructuring of the corporate including promotion of restructuring the business among the private sectors, improvement of regulation and system of new technologies and cultivation of technology manpower in the smart factory.

Beyond the Strategy 3.0 & Action Plan (2014-16)

- In 2013, President Park launched the ‘Creative Economy’ Initiative, aiming to generate new jobs and markets through creativity and innovation, to strengthen the country’s global leadership in the creative economy, and to promote creativity more generally in Korean society.
- The Korean government has moved forward with the ‘Three-year Plan for Economic Innovation’ since 2014, as a part of its effort to secure the growth potential.
  - Three Year Plan is aimed at revitalizing the Korean economy and achieving 4% potential growth, 70% employment rate and $40 thousand per capita GDP (compared to $26 thousand in 2013).
  - In fact, under the ‘Three-Year Plan for Economic Innovation’, Korean government has already taken several actions which can be regarded as action program of the Manufacturing Innovation Strategy 3.0 from 2014 to present.

Beyond the Strategy 3.0 & Action Plan (2014-16)

- The background of the Three-year Plan
  - The Plan comes after several years of sluggish growth. Decisive measures were needed to establish a more dynamic and innovative economy through structural reforms to avoid falling into a low-growth path.
  - The government acknowledges that the traditional growth strategy, which focused on exports by large companies and depended on imports of technology, has reached its limit. Moreover, it has led to imbalances, for example between exports and domestic demand, manufacturing and services, chaebols and SMEs, and regular and non-regular workers.
  - The government that took office in 2013 was seeking a new paradigm based on creativity and innovation. To achieve this objective, the government launched its ‘Creative Economy’ initiative in 2013 and more specific measures are now fleshed out in the broader and more detailed Three-year Plan.

Beyond the Strategy 3.0 & Action Plan (2014-16)

- The main contents of the ‘Three-year Plan’
  - Among three Strategies, the second strategy, a dynamic economy based on innovation is more relevant to the Manufacturing Innovation Strategy 3.0 we discussed:
    - The goal is to change Korea’s economic paradigm by developing creative industries, investing in the future and expanding Korea’s presence in overseas markets.
    - The Plan addresses many longstanding problems in the Korean economy that have not been solved due to strong resistance from interest groups.
Beyond the Strategy 3.0 & Action Plan (2014-16)

Activity 1.4 Preparing Strategy for The Fourth Industrial Revolution in South Korea: Beyond Manufacturing 3.0

Beyond the Strategy 3.0 & Action Plan (2014-16)

- Actions taken since June 2014:
  - Promote the venture business sector and new start-ups
    - In the new directions announced, the government launched a strategy in 2015 to revitalize KONEX by expanding incentives for individual investors, other than professional investors, strengthening investor protection through designated advisors, and easing listing requirements for SMEs by replacing quantitative standards with qualitative indicators.
    - To increase the number of technology-based start-ups, the government in 2014 launched the Tech Incubator Program for Start-ups, which was modelled after Israel’s Technological Incubator. It provides start-ups with R&D grants from the private and public sectors. R&D grants for promising start-ups with high-level technologies increased from KRW 141.4 billion in 2014 to KRW 185.8 billion (USD 165 million) in 2016.
    - Restrictions on private equity funds’ M&A activities were relaxed and the M&A fund in the Growth Ladder Fund is being expanded to meet the M&A needs of mid-sized firms. The criteria for tax support for M&As aimed at acquiring technology were relaxed and the deadline extended from 2015 to 2016. The number of M&As rose from 73 in 2015 to 97 in 2016.

Beyond the Strategy 3.0 & Action Plan (2014-16)

- Actions taken since 2014:
  - Make SMEs part of the creative economy:
    - In the new directions announced in late 2015, the government expanded funding support for start-ups, with assistance limited to firms with a credit rating of over BB and listed firms. At the same time, support for firms more than five years old is being limited. For example, firms over five years old cannot receive government policy funds more than twice in one year.
    - The 2015 plan to foster Korean “hidden champions” to transform “high potential enterprises” into globalized enterprises chooses firms based on their competitiveness and technological capacity.
    - The government is promoting the growth of SMEs into “high potential enterprises” by providing support for exports, financing, R&D, etc. Their growth into globalized enterprises is promoted through a 2015 plan to foster Korean “hidden champions.” The plan, “Implementing World Class 300 Project,” included 196 firms in 2015.
Beyond the Strategy 3.0 & Action Plan (2014-16)

➢ The background of the recent changes;
  ✓ As entering the New Year, the Korean economy finds itself besieged by a
    complex set of external and internal risks that threaten to continuously
    hamper its growth.
  ✓ Externally, China’s deepening slowdown and the Korean won’s
    appreciation against major currencies aside from the U.S. dollar will
    continue to hamper a recovery in the country’s exports.
  ✓ The growing volatility in emerging market economies hit by a fall in
    commodity prices and exposed to the possibility of massive capital
    outflows amid U.S. interest rate hikes may amplify unfavorable
    external conditions for Korean manufacturing exporters.
  ✓ Turning around the downward trend in exports will take a drastic
    restructuring of industries to foster new growth engines and close
    down uncompetitive companies saddled with overcapacity and
    mounting debt

Beyond the Strategy 3.0 & Action Plan (2014-16)

➢ The background of the recent changes (continued)
  ✓ Internally, the Bank of Korea forecast the country’s potential growth rate would
    remain at 3.2 percent for 2015-16, down from 3.3 percent in 2014-14. An
    earlier study by the RBI predicted the rate would fall from 3.1 percent in 2011-15
    to 3 percent in 2016-18, 2.5 percent in 2017-21, and go down to the 1
    percentage range from 2026.
  ✓ As mounting household debt, an increasing number of loanmaking and heavily indebted
    companies and other internal risks pose more critical challenges for the Korean economy.
  ✓ They indicate these problems should be addressed in a more urgent and persistent manner to
    prevent them from blowing up into an economic crisis, perhaps triggered by external shocks.
  ✓ Mounting household debt, an increasing number of loanmaking and heavily indebted
    companies and other internal risks pose more critical challenges for the Korean economy.
  ✓ These problems should be addressed in a more urgent and persistent manner to prevent them
    from blowing up into an economic crisis, perhaps triggered by external shocks.
  ✓ From this viewpoint, the most immediate and foremost task for policymakers should be
    restructuring companies saddled with overcapacity and massive debt and putting the brakes
    on the steep rise in household debt, which is estimated to have surpassed 1.2 quadrillion won
    ($1 trillion) last year.

Beyond the Strategy 3.0 & Action Plan (2014-16)

➢ How, then, the industrial restructuring is implemented?
  ✓ According to the recently announced Economic Policy Directions for the
    Second Half of the year, Korean government plan to implement the
    industrial restructuring by
    ✓ (1) Corporate and Industrial Restructuring through
      • regularly holding ministerial meetings to check corporate and industrial
        restructuring from a macroeconomic point of view, whether they are
        being carried out in a way to enhance industrial competitiveness and
      • by establishing a comprehensive road map to successful industrial
        restructuring and providing support for voluntary restructuring based
        on the Corporate Revitalization Act; the government will unveil plans in
        September to increase competitiveness of the shipbuilding, shipping, steel
        and oil refining industries, all of which are suffering from oversupply, and
        will develop programs to support voluntary restructuring by July, which
        will include financial, tax and R&D support

Beyond the Strategy 3.0 & Action Plan (2014-16)

➢ How, then, the industrial restructuring is implemented? (continued)
  ✓ According to the recently announced Economic Policy Directions for the
    Second Half of the year, Korean government plan to implement the
    industrial restructuring by
    ✓ (2) Develop New Growth Engines through
      • Designating 11 new growth engines, which government support will
        focus on adding about $70 trillion won of investment is expected to be made
        by 2018; these new growth engines will receive up to 40 percent tax deduction
        for R&D investment and up to 70 percent tax deduction of facility investment,
        and the government will reduce tax support given to companies with a large foreign shareholder (more than
        10 percent), as a way for the new growth engines to benefit from
      • Conducting a zero base review of the current R&D projects (12.8 trillion won)
        and redistribute 15 percent of the budget to the nine growth engines,
        while aggressively raising investment rules with the private sector, through the New Growth Engine Fund,
        in which the government is the first to take lower or losses
      • Future care, AI technology, next generation SNS and security, context, next generation electronic
        devices and information security, next generation broadcasting and communications, bio- and
        health industries, energy and environment industries, material science and engineering, robotics,
        aerospace engineering,
Beyond the Strategy 3.0 & Action Plan (2014-16)

- How then, the industrial restructuring is implemented? (continued)
  - According to the recently announced Economic Policy Directions for the Second Half of the year, the Korean government plan to implement the industrial restructuring by
    1. (2) Develop New Growth Engines through
       - Using the Creative Economy Centers as a startup hub, in particular high-tech ventures, and improve tax support for venture investment.
       - Introducing corporate tax deduction for venture investment and expand tax support for technology M&As.
       - Including new services, in particular the sharing economy, in the venture business list.
       - Drawing up a Mid- to Long-term Service Industry Development Plan by July, which includes eliminating regulatory discrimination against the service sector compared with the manufacturing sector, adopting a negative approach to giving tax support, increasing financial support, easing regulations, expanding R&D investment, growing qualified workforce, helping the private sector commercialize their R&D outcomes.

Next Steps:

- South Korea should be ready for what is to come which entails some very serious challenges
  - Shifting towards Manufacturing Capabilities (UNIDO, 2016)
    1. As the manufacturing sector is subject to transitions as economies develop, public policy attention need to be shifting from the promotion of competitiveness to the development of capabilities, which is perceived as a more effective strategy to improve competitiveness.
    2. The main rationale is that, competitiveness tends to focus on decreasing different costs, while capabilities focus on increasing the added value provided by manufacturing.

Beyond the Strategy 3.0 & Action Plan (2014-16)

- How then, the industrial restructuring is implemented? (continued)
  - According to the recently announced Economic Policy Directions for the Second Half of the year, the Korean government plan to implement the industrial restructuring by
    1. (2) Develop New Growth Engines through
       - Continuing to grow the 7 promising service industries of healthcare, tourism, contents, education, finance, SW and logistics.
       - Continuing to work on improving regulations: Enact the Special Act on Regulatory Reform and adopting a negative list approach, introduce the regulatory system which puts a limit on the total amount of regulations, enact the Special Act on Regulation Free Zones, ease the

Next Steps:

- South Korea should be ready for what is to come which entails some very serious challenges
  - Expanding the country’s growth potential with a set of comprehensive, far-sighted and substantial measure that could resolve socioeconomic structural problems.
    1. Taxic deregulation and effective support for research and development are needed to help local corporations become more competitive and innovative.
    2. The services sector, in which productivity has stalled, should be further advanced.
    3. The immigration policy needs to focus on attracting highly skilled young workers who can make more contributions to boosting the country’s competitiveness and easing pressures on its welfare system.
    4. Housing and education costs should be reduced as an essential part of efforts to boost the country’s fertility rate, which has been stuck at around 1.2 percent—among the lowest in the world—over the past several years.
    5. Boosting employment is necessary for increasing household income, which they say will be more instrumental over the long term in sustaining growth than measures to encourage consumer spending.
Next Steps:

➢ South Korea should be ready for what is to come which entails some very serious challenges
➢ Preparing the changing role of manufacturing sector in job creation
   ✓ Manufacturing’s role in job creation shifts over time as manufacturing’s share of output falls and as companies invest in technological and process improvements that raise productivity
   ✓ Hiring patterns within manufacturing also change, with hiring skewed toward high-skill production jobs and both high-and low-skill service jobs, as hiring in production overall slows

Thank You for Your Attentions
Topic: 1.5 Overview on “Innovation Fields in Smart Production /Products /Services and Enabling Technologies” for Realizing Industrie 4.0

Mr. Myron Graw
Partner and Technology Manager
KEX Knowledge Exchange AG, Germany

• Expertise in latest technology and market research and consultancy on Industrie 4.0
• Proactive on Smart Products, Smart Manufacturing and Smart Service implementation in Germany and Europe
Overview on "Innovation Fields in Smart Production/Products/Services and Enabling Technologies" for Realizing Industrie 4.0

Defining requirements and functions should start with a trend analysis! Why?

Who needs a tablet?

If Apple had asked customers, an iPad would not exist today since notebooks covered seemingly all customer requirements for mobility.

Who needs a bad camera?

In the year of 1975

- Weight: 81½ US-Pounds (ca. 3.9 kg)
- Size: 8⅝ x 6 x 9 inches (ca. 22 x 15 x 23 cm)
- Picture quality: 100 x 100 Pixel (0.01 Megapixel, black/white)
- Save pic to tape: 23 Sek per pic
- Pic to TV: 30 Sek per pic

If consumer electronics industry had asked customers a digital camera would not exist today.
Activity 1.5 Overview on “Innovation Fields in Smart Production/Products/Services and Enabling Technologies” for Realizing Industrie 4.0
Activity 1.5 Overview on “Innovation Fields in Smart Production/Products/Services and Enabling Technologies” for Realizing Industrie 4.0
Activity 1.5 Overview on “Innovation Fields in Smart Production/Products/Services and Enabling Technologies” for Realizing Industrie 4.0
Activity 1.5 Overview on “Innovation Fields in Smart Production/Products/Services and Enabling Technologies” for Realizing Industrie 4.0
Activity 1.5 Overview on “Innovation Fields in Smart Production/Products/Services and Enabling Technologies” for Realizing Industrie 4.0
Activity 1.5 Overview on “Innovation Fields in Smart Production/Products/Services and Enabling Technologies” for Realizing Industrie 4.0
Activity 1.5  Overview on “Innovation Fields in Smart Production/Products/Services and Enabling Technologies” for Realizing Industrie 4.0
Activity 1.5 Overview on “Innovation Fields in Smart Production/Products/Services and Enabling Technologies” for Realizing Industrie 4.0
Example: next generation music experience

Smart Solution
Integrate with Social Networks

- Share playlists on Facebook or similar platforms
- Receive recommendations on new music by friends
- Algorithms identify patterns to automatically propose alternatives

What companies should do?

- Jobs to be done
- Audit situation
- Identify solutions
- Business case

Value analysis
Fields of observation

Business case calculation

Smart functions
Technology fields
Technologies

Business Case I
- Decide actions
- Control systems
- Enhancements

Business Case II
- Decide actions
- Control systems
- Devices/Robots

Business Case III
- Decide Actions
- Control Systems
- Textile-Sensor Systems

New Business
Music Flatfates and music networks

- Pandora
- Spotify
- Apple Music

Solutions over time
Activity 1.5 Overview on “Innovation Fields in Smart Production/Products/Services and Enabling Technologies” for Realizing Industrie 4.0
Activity 1.5 Overview on “Innovation Fields in Smart Production/Products/Services and Enabling Technologies” for Realizing Industrie 4.0
Topic: 1.6 Initiative of “Industry 4.1J” in Japan and Strategic Adoption of Intelligent Production Planning System for Smart Manufacturing

Mr. Eiji Yoshikawa

APS Specialist, International Consulting Division
Asprova Corporation (Japan)

- Japan’s No.1 scheduling software cop.
- Expertise in Integration of sensors, PLC, SCADA, MES and ERP systems, and application to - Cyber Physical System actively involved in intelligent planning and scheduling software for “Industry 4.1J”
Activity 1.6 Initiative of “Industry 4.1J” in Japan and Strategic Adoption of Intelligent Production Planning System for Smart Manufacturing

Agenda
1. Who am I, Who is Asprova
2. What is the Intelligent Production Planning System?
3. “Industry 4.0” and “Industry 4.1J”
4. Industry 4.0/IOT and Asprova.
5. Cyber Physical System and Asprova
6. Smart factory and Asprova
7. Case study of Industry 4.0/IOT
8. Conclusions

Who am I
I am a Senior Consultant of SCM in Asprova corporation.
I have experience working both in shop floor and an ERP company.
I can consult on integration of sensor, PLC, SCADA, MES and ERP systems.

<table>
<thead>
<tr>
<th>Period</th>
<th>Role</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982/4-1987/7</td>
<td>Electric equipment maintenance engineer of the steel manufacturing company</td>
<td>PLC, Robot, NC, Sensor Equipment diagnosis</td>
</tr>
<tr>
<td>1987/8-2001/12</td>
<td>System engineer of UNIX applications System engineer of ERP applications System engineer of Manufacturing applications Management of System integration business</td>
<td>UNIX,UNIX, ERPS, MES,SCM</td>
</tr>
<tr>
<td>2002/1-2011/9</td>
<td>MFG Solution architect in ERP company</td>
<td>ERP,SCM,MES</td>
</tr>
<tr>
<td>2011/10</td>
<td>Senior Consultant of Asprova</td>
<td>SCP,APS</td>
</tr>
</tbody>
</table>

Asprova Corporation
Senior Consultant
Eiji Yoshikawa
e-mail: yoshikawa@asprova.com

Who is Asprova

Company Name: Asprova Corporation
Established: February 1, 1994
Capital: 20 million yen
Address: Gotanda T8 Building 8F, 7-9-2 Nishigotanda Shinagawa-ku, Tokyo 141-0031 Japan
Telephone: +81 3-6303-9933
FAX: +81 3-6303-9930
Director: Kunio Ishikawa, Representative Director
Business Contents: Researching, developing and selling the production and SC scheduling system Asprova APS and SCP as well as system integration and system consultation.
Homepage: www.asprova.jp
Global Office: Europe, China, Korea, America, Asia, Thailand

APS: Advanced Planning and Scheduling
SCP: Supply Chain Planning
Activity 1.6 Initiative of "Industry 4.1J" in Japan and Strategic Adoption of Intelligent Production Planning System for Smart Manufacturing

**What is the Intelligent Production Planning System?**

Asprova is the Intelligent Production Planning System.

**Feature**

1. High function & Flexibility
2. High performance & Scalability
3. Connectivity
4. Usability
5. Globalization

**Ultra-High Speed Logic**

You can create schedules at ultra-high speed using Finite Capacity Scheduling.

**Visual Management**

You can check graphically future BS, CF, on-time delivery rate, Inventory Load and etc.

Inventory and Lead Times Reduction

Inventory is reduced naturally when production lead times are shortened.

**Next step (Industry4.0/IOT)**

- Auto tuning
- Optimization

**“Industry4.1J” Demonstration project**

- Secure cloud environment “Biz Hosting Enterprise Cloud”
- Secure VPN (Virtual Private Network) “Arisstar Universal One”
- “4.0 → 4.1” One step up in secure level

Sponsor member: NTT communications
Regular Member: FA vender, FA software, SI, etc. 12 companies

**Proof of Concept**

1. Adoption of security quality in excellent latest protocol "OPC-UA"
2. Real-time and, realization of a large-capacity, high-speed communication
3. Normal operation of the monitoring system on the cloud
4. The application of the monitoring system to the facilities and machinery in the field

**“Industry 4.0” and “Industry 4.1J”**

- IoT Acceleration Consortium  
  Member 924

- Robot revolution Initiative  
  Member 421
  WG1: The Manufacturing Business Reform through IoT

- Industrial Value Chain Initiative  
  Member 162
  Loose Standard – Reference Model

- “Industry4.1J” PoC project  
  Member 13

---

**Industry4.0/IOT and Asprova**

- PLM
- CRM
- ERP
- SRM
- MES
- SCADA
- PLC
- I/O・センサー

- IOT
  - PLM
  - ERP
  - CRM
  - MES
  - SCADA
Activity 1.6 Initiative of “Industry 4.1J” in Japan and Strategic Adoption of Intelligent Production Planning System for Smart Manufacturing
Activity 1.6 Initiative of “Industry 4.1J” in Japan and Strategic Adoption of Intelligent Production Planning System for Smart Manufacturing
Activity 1.6 Initiative of “Industry 4.1J” in Japan and Strategic Adoption of Intelligent Production Planning System for Smart Manufacturing
Topic: 1.7 “Digitalization” – Industry Case of Factory of the Future

Mr. Sun Feng (Erik)

Digital Factory Specialist for I4.0

Siemens GmbH

• Familiar with Siemens Simatic business a

• Excellent knowledge about the I4.0 activities in Siemens.
Activity 1.7 “Digitalization” – Industry Case of Factory of the Future
Activity 1.7 “Digitalization” – Industry Case of Factory of the Future
In order to remain competitive manufacturing companies need to achieve enormous improvements in their processes.

- Reducing the time to market
  - Shorter innovation cycles
  - More complex products
  - Larger data volumes
  - Product and production integrated

- Enhancing flexibility
  - Individualized mass production
  - Volatile markets
  - High productivity
  - Flexible production

- Increasing Quality
  - Closed loop quality processes
  - Traceability and Integrated genealogy
  - Full process transparency

- Increasing efficiency
  - Energy efficiency and resource efficiency as key competitive factors
  - Optimized production resources

Only a holistic automation approach including the whole value add chain will yield sustainable competitiveness.

Digital Enterprise Software Suite – The Siemens answer to Industrie 4.0 requirements

1. Cornerstones Digitalization – Industrie 4.0
2. Siemens approach towards Industrie 4.0 – the Digital Enterprise
3. Digital Enterprise Software Suite
4. Digitalization Usecases
Activity 1.7 “Digitalization” – Industry Case of Factory of the Future

Product Lifecycle Management (PLM)
Connectivity and productivity across the entire lifecycle

Digital Enterprise Software Suite – The Siemens answer to Industry 4.0 requirements

MES/MOM: Comprehensive software portfolio to efficiently connect and manage operations

TIA: Siemens portfolio

Manufacturing Execution System (MES/MOM)

Increase Manufacturing Performance

Benefits:
- Real-time and efficient performance monitoring
- Improved schedule adherence
- Quality management
- In-plant and plant-wide visibility
- Integration with PLM and specialized applications

References:
- Real-time data for efficient production
- Integration with PLM and specialized applications
- In-plant and plant-wide visibility
- Quality management
Activity 1.7 “Digitalization” – Industry Case of Factory of the Future
Value through digitalization
Different starting positions... , substantial results

**Competitiveness**
- Siemens Factory Amberg, Germany
  - Automated production of SIMATIC:
    - Machines handle 75% of the value
    - Chain on their own while >1000 product
      variants can be manufactured
  - Low defect rate
  - Product quality is at 99,998%

**Shorten time to market**
- Canon EOS 20D, Japan
  - Digital twin simulation helps reduce the time from
    concept to production by >90%
  - ~300 TB of data converted throughout
    the entire development; 200 times
    more compared to 0 years before

**Flexibility**
- BMW Brilliance Shenyang, China
  - Flexibility enables individualized mass production;
    5 different types of cars in 1 production line
  - Real-time monitoring with 99% availability avoids bottlenecks

---

**Thank You**

*Erik Feng Sun*
Siemens AG
DP FA S MP IIE
Gleiwitzerstrasse 555
90475 Nürnberg
E-mail: sunfeng@siemens.com

siemens.com/oem
As regards technological support by Innovation and Technology Bureau, the Innovation and Technology Fund (ITF) aims to encourage more R&D from universities and enterprises and promote re-industrialisation of Hong Kong. Promoting re-industrialisation means to develop high value-added industries or manufacturing processes that are suitable for Hong Kong, promoting smart production, thereby bringing HK’s industrial development to new heights in Robotics, Smart City, Healthy Ageing. With the assistance of the HKPC, it will inaugurate the "Industry 4.0" technology demonstration center this year to showcase and promote information exchange on the concept and smart features of "Industry 4.0".
Activity 1.8 Transformation Towards Smart Enterprises in Hong Kong

Mission

- The HKSAR Government is determined to develop the local innovation and technology ("I&T") industries to:
  - drive the upgrading and transformation of our overall economic structure;
  - develop Hong Kong into a knowledge-based economy;
  - raise Hong Kong’s competitiveness and improve the people’s quality of life; and
  - create a vibrant ecosystem for our stakeholders.

Innovation and Technology Bureau
July 2016

Hong Kong’s advantages

- Strategic location in the Asia-Pacific region
- Proximity to the huge Mainland market
- Intellectual property protection regime of international standards
- Sound legal system and independent judiciary
- Comprehensive information technology infrastructure
- International financial centre
- Ranked 11th on the Global Innovation Index

Institutional set-up

- Innovation and Technology Bureau
- Innovation and Technology Commission
- Office of the Government Chief Information Officer
- Innovation and Technology Fund
  - Over 5,000 projects
  - Total commitment of HK$11 billion (USD 1.4 billion)
Activity 1.8 Transformation Towards Smart Enterprises in Hong Kong

I&T Infrastructure

- The Academy of Sciences of Hong Kong
  - Established in December 2015
  - 27 distinguished scientists as founding members
  - To advance the development and promote the education of science and technology in Hong Kong, and foster Hong Kong as a centre of scientific excellence

Universities

- The Chinese University of Hong Kong
- The Hong Kong University of Science and Technology
- The Hong Kong Polytechnic University
- The Baptist University of Hong Kong

R&D Centres

- HK R&D Centre for Information and Computing Technologies
- HK R&D Centre for Supply Chain Management
- Enabling Technologies (LSGM)
- HK R&D Centre for Automotive Parts and Accessory Systems (APAS)
- Hong Kong Research Institute of Textiles and Apparel (HKRITA)
- Nano and Advanced Materials Institute (NAMI)
Activity 1.8 Transformation Towards Smart Enterprises in Hong Kong

Four key factors for success
- R&D investment
- Nurturing of talents
- Market expansion
- Stakeholders collaboration

Promote R&D

<table>
<thead>
<tr>
<th>Place</th>
<th>Approximate Ratio of public and private Investment in R&amp;D in 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong</td>
<td>6:4</td>
</tr>
<tr>
<td>France</td>
<td>4:6</td>
</tr>
<tr>
<td>Singapore</td>
<td>4:6</td>
</tr>
<tr>
<td>Finland</td>
<td>3:7</td>
</tr>
<tr>
<td>Sweden</td>
<td>3:7</td>
</tr>
<tr>
<td>Germany</td>
<td>1:3</td>
</tr>
<tr>
<td>China</td>
<td>1:3</td>
</tr>
<tr>
<td>Taiwan</td>
<td>1:3</td>
</tr>
<tr>
<td>South Korea</td>
<td>1:3</td>
</tr>
<tr>
<td>United States</td>
<td>1:3</td>
</tr>
</tbody>
</table>

Source: E. Carley, Agency for Science, Technology and Research (A*STAR), Singapore; OSIRIS-Monte Carlo Simulation Foundation, USA.

I&T infrastructure
- Industrial Estates
- Tai Po
- Tseung Kwan O

Yuen Long

Work priorities
- Promote R&D
- Promote "re-industrialisation"
- Support I&T start-ups
- Support I&T and daily living
  - Smart City development
  - Wi-Fi Connected City
  - Address social issues
- Promote the use of local technology products and services
- Nurture talents
Promote R&D

- Programmes under Innovation and Technology Fund
  - Innovation and Technology Support Programme
  - University-Industry Collaboration Programme
  - Enterprise Support Scheme
  - R&D Cash Rebate Scheme

Promote R&D

- Promote collaboration between Hong Kong and the world's top-notch scientific research institutes
  - Karolinska Institutet: first overseas research facility
  - Massachusetts Institute of Technology: first overseas Innovation Node

Promote R&D

- Strengthen collaboration with the Mainland
  - 16 Partner State Key Laboratories
  - 6 Hong Kong Branches of Chinese National Engineering Research Centres

- Set aside over HK$100 million every year to support these institutions

New measures in 2016

- HK$2 billion (USD 250M) Midstream Research Fund
- Increasing the cash rebate level of the R&D Cash Rebate Scheme to 40%
Promote “re-industrialisation”

- Develop high value-added industries and manufacturing processes to promote smart manufacturing in –
  - Robotics
  - Smart City
  - Healthy Ageing
- Attract high value-added industries
  - Science Park expansion
  - New industrial estate policy
- Overseas experience
  - Advanced Manufacturing Partnership of the United States
  - Industry 4.0 of Germany
  - Made in China 2025

New measures in 2016

- Carry out Stage 1 of the Science Park Expansion Programme at an estimated cost of $4.4 billion
- Develop two projects of multi-storey high-efficiency buildings in Tseung Kwan O Industrial Estate. Estimated costs of HK$3.2 billion
- Identify new sites near Liantang / Heung Yuen Wai Boundary Control Point for long-term development

Support I&T start-ups

- Encourage private organisations, venture capital funds and angel investors to invest in local I&T start-ups

New measures in 2016

- HK$2B (USD 250M) Innovation and Technology Venture Fund
  - Cyberport
    - Increase the quota of its incubation programmes and its Smart-Space small offices and workstations by 50%
    - HK$200M (USD 26M) Cyberport Macro Fund
  - Science Park
    - HK$50M(USD 6.4M) Corporate Venture Fund
    - Incubation programmes e.g. Incu-app, Incu-bio, Incu-tech
I&T and daily living

**Smart City development**

- **Smart City** refers to the adoption of technologies such as the Internet of Things and Big Data analysis in promoting city planning, construction, management, services, development, etc., with a view to building a compact, livable, environmental friendly and sustainable city.

- Formulate a digital framework and standards for the development of Smart City.

- Encourage public service bodies and commercial organisations to open up more data.

---

**Wi-Fi connected city**

- Taking advantage of the advanced information and communications technology (ICT) infrastructure in HK, we will build HK into a **Wi-Fi connected city**.

- Increase Wi-Fi HK hotspots from 17,000 to 34,000 within the coming three years through public-private partnership.

---

**Address social issues**

- Study and promote the adoption of I&T in assisting to **address social issues**, e.g. serving the elderly and underprivileged groups, promoting healthy ageing.

- Support R&D centres in applying their R&D outcomes in public sector organisations.

- Encourage the use of ICT among the underprivileged, promoting digital inclusion.

---

**New measures in 2016**

- HK$500 million (USD 64M) **Innovation and Technology Fund for Better Living**.
Nurture talents

- Talents are the most crucial success factor in developing I&T
- Existing measures
  - Schemes under ITF that encourage young people to undertake innovative and entrepreneurial activities
  - Incubation programmes under Science Park and Cyberport
  - Enrichment programmes and various activities in the school sector
- Through attracting top-notch international scientific research institutions in Hong Kong, we hope to inspire young people to join the I&T force

New measures in 2016

- Increasing the monthly allowances of interns under the Internship Programme and extending it to cover incubatees and SME tenants of Cyberport and Science Park
Activity 2 "中國製造 2025" 研討會
“Made-in-China2025” Seminars
在香港政府創新科技署的大力支持下，生產力局舉辦這次研討會的目的，是希望通過解讀國家對「中國製造 2025」發展策略及措施，啟發企業在部署改革方向，以及提供實際執行的方案。本研討會很榮幸集合各大企業中工業 4.0 的專家以及國家級學術界的代表，分享工業 4.0 和中國製造 2025 的概念、實際執行及改革方案，為各大中小企業提供智慧時代新概念的交流平臺！這次會議得到了香港創新科技署、美國EPOCOR 公司、國際技術轉移協作網路公司、中城新產業公司的友情贊助，以及香港工業總會、香港汽車零部件工業協會等香港各大商、協會，深圳市商業聯合會等機構的大力支持。
Activity 2 "Made-in-China 2025" Seminars

主題演講一：成立數位工廠與迎接中國製造 2025 及工業 4.0 之時代

(Speaker: Head of Digital Factory & Process Industries and Drives, Siemens Ltd., PRC)

Regarding to the Germany’s industry 4.0, SIEMENS acts as the pioneering role. At the meanwhile, SIEMENS is a manufacturing enterprise that operates around 300 major production and manufacturing plants worldwide. It concerns a lot onto the product / production life span. Among them, SIEMENS automated technological product—Amberg, Germany and Digital Factory, China Chengdu had been the showcase in global.
Activity 2 "中國製造 2025" 研討會
“Made-in-China2025” Seminars
主題演講二：中國製造 2025 和工業 4.0 政策解讀及帶來的機遇與挑戰

(講者：中國工程院院士譚建榮教授)
(Speaker: Dr. Jian- Rong Tan, Academician of China Engineering Academy)

Chinese Academy Engineering is the official supporting organization of “Made-in-China 2025”; He is Advisor of national policy of “MIC 2025” and the chief scientist of 973 national projects.
Activity 2 "中國製造 2025" 研討會
“Made-in-China2025” Seminars

主題演講三: 珠三角企業提升至工業 4.0 差距分析案例及評估方法與服務

(講者：香港生產力促進局顧問羅立仁先生)

(Speaker: Mr. Lyan Law, Consultant, Smart Manufacturing and Materials Division - Hong Kong Productivity Council)

Member of HKPC Industry 4.0 Project team that is committed to promoting and providing advisory services to come up a holistic strategic roadmap and landscape towards Industry 4.0 in Hong Kong Industry. Responsible for Industry 4.0 enabling technologies and cyber manufacturing solutions to provide project management, implementation, consultancy of Product Life-cycle Management (PLM), Enterprise Resource Planning (ERP), Intelligent Production Scheduling (i-PS) and Manufacturing Execution Solutions (MES).
Activity 2 "Made-in-China 2025" Seminars

主題演講四：3D 打印拉動先進製造業創新

(講者：中國科學院廣州電子技術研究所所長李耀棠先生)

(Speaker: Dr. Yao-tang Li Director of Guangzhou Institute of Electronic Technology, Chinese Academy of Sciences)
Activity 2 "中國製造 2025" 研討會
“Made-in-China2025” Seminars
主題演講五：有效地採用 MES 及 ERP 先進系統，以實現工業 4.0 及中國製造 2025

(Speaker: Mr. Thomas Hung, Senior Regional Manager, Ms. Gina Au, Senior Solutions Manager, Epicor Software (North Asia) Ltd., PRC)

Epicor Software Corporation provides industry-specific business software designed around the needs of manufacturing, distribution, retail, and services organizations.

• Automated production monitoring
• Automated monitoring for process parameters
• Cost reporting for scrap and machine downtime
• Evaluate schedule conformance
• Automatic part qualification/rejection
• Statistical quality control and statistical process control
• Machine and tool preventive maintenance (PM)
Activity 2 "中國製造 2025" 研討會
“Made-in-China2025” Seminars
主題演講六： 從工業 4.0、工業互聯網到中國製造 2025

(講者：同濟大學劉海江教授)
(Speaker: Professor Hai-jang Liu, Executive Vice President, Tongji University TaiCang High-Tech Institute, Shanghai, PRC)
Activity 3 "Smart Production" Seminar

Mr. Toni Drescher

Head of Department, Industrie 4.0 & Technology Management, Fraunhofer Institute of Production Technology (IPT) Germany

- 10 years experience in technology and innovations management
- Expertise in Industry 4.0 consultancy and its’ enabling technologies
- Advisor of Industrie 4.0 Taskforce
Activity 3 "Smart Production" Seminar

From the innovation principle to the technological solution

Individualization

Integrate with social networks

Trends

Innovation principles

Smart products

Transfer data

Link systems

Smart functions

Technological solution

What companies should do?

"Jobs to be done"

Auditing situation

Technology

Identify solutions

Business case

Rationalization

Fraunhofer

SEMINAR ON INDUSTRY 4.0
Smart Production

Toni Drescher

CEO | KEX Knowledge Exchange AG

Hong Kong | July 27th, 2016

KEX Knowledge Exchange

Activity 3 "Smart Production" Seminar

Agenda

1. Introduction to smart production 09:30 – 10:30
2. Tea break 10:30 – 10:50
3. Examples from Industry 4.0 production 10:50 – 12:30
4. Lunch break 12:30 – 14:00
5. Experience: Deriving a smart production (Use Case) 14:00 – 16:35
6. Lessons learned 16:35 – 17:00

Theory and simulation still do not completely explain production behaviour

Planning and simulation → methodology → production → Reality

- Increase in efficiency [%]
  - 50% after 3 days
  - 75% after 16 days

Companies fail to further increase their efficiency with lean methodologies

Forecast horizon [%]

Planning quality decreases with increasing planning horizon

The fourth industrial revolution cannot be prevented

- Markets: Once markets turn digital and connected, they will be disrupted
- Yesterdays B2C, cyber technologies
- Todays B2B, physical systems and services?

Capacity to use large quantities of data to optimize physical services (supply chains configurations, mobility, ...)

Technology: The evolution of microchips (and now sensors?)

- Moore's Law 1.0 – More complex and powerful at the same price
- Moore's Law 2.0 – As powerful, but smaller and (now) cheaper, using less energy
- Moore's Law 3.0 – Inclusion of sensors and physical aspects at some price?

Enabling Technology 5G Networks

Key requirements towards the 5G standard focusing on industrial applications

- High packet delivery rate
- Low latency
- High reliability
- High capacity
- Low energy consumption

Routinely regarding the launch of 5G networks shared by one of the world's largest mobile communications suppliers in the world
Activity 3 "Smart Production" Seminar
Sensor-based studies have shown the influence of communication patterns on success.

**Example: reorganization of workroom architecture**

The reorganization of workroom architecture is able to improve communication and by that the performance of shop floor management.

Source: Alen (1956), Reisland (2012)

---

**The learning company in the stages of Industrie 4.0**

- Descriptive Analytics
- Diagnostic Analytics
- Predictive Analytics
- Prescriptive Analytics

- Increase of data availability
- Increase the interpretability of large amounts of data (Big data)
- Extension of the forecasting ability by recognizing data-pattern and realistic models
- Decisions on the basis of Smart Data

---

**Agenda**

1. Introduction to smart production 09:30 – 10:30
2. Tea break 10:30 – 10:50
3. Examples from Industry 4.0 production 10:50 – 12:30
4. Lunch break 12:30 – 14:00
5. Experience: Deriving a smart production (Use Case) 14:00 – 16:35
6. Lessons learned 16:35 – 17:00
Activity 3 "Smart Production" Seminar

**Agenda**

1. Introduction to smart production 09:30 – 10:30
2. Tea break 10:30 – 10:50
3. Examples from Industry 4.0 production 10:50 – 12:30
4. Lunch break 12:30 – 14:00
5. Experience: Deriving a smart production (Use Case) 14:00 – 16:35
6. Lessons learned 16:35 – 17:00

---

**Smart Production: Operational Excellence**

- **Sense Condition**
- **Connect Network**
- **Visualize & Adopt**
- **Analyze & Predict**

**Smart Production: Operational Excellence**

- **Sense Condition**
- **Connect Network**
- **Visualize & Adopt**
- **Analyze & Predict**

- **"Real time lean production for injection molding"**
- **"Operational Excellence in Logistics"**

Production technologies are equipped with sensors, real-time production performance KPI can be analyzed. Real-time lean production steering and planning possible. Return on Invest < 1 year.

Up to 80% cost improvement due to reduced warehouse capacity (inventory) and simple logistics. Return on Invest < 1 year.
Smart Production: Decentralized Production

Sense & Condition → Automated real-time configuration of machine control → Connect & Network

Visualize & Adopt → Analyze & Predict

Based on analysis of the production variables of machines patterns for rapid configuration of the machines can be derived. ROI <2 year.

Smart Production: Decentralized Production

Sense & Condition → Forecast quality issues and prevent downtimes → Connect & Network

Visualize & Adopt → Analyze & Predict

Production performance and FMEA can be done with real time data measurement. This will enable a better forecast ability for production performance and failure prevention.

Smart Production: Decentralized Production

Sense & Condition → Flexible production real-time planning & control → Connect & Network

Visualize & Adopt → Analyze & Predict

Production machines and processes can be planned and controlled very flexible due to high resolution of production performance and configuration data analysis.

Smart Production: Decentralized Production

Sense & Condition → Self driving part which controls the production → Connect & Network

Visualize & Adopt → Analyze & Predict

The part has all relevant production information on the workpiece carrier. Decision making how to steer through production can be done by the part itself and enables new level of automation.
Three main steps to a digital production:
Examples: Make measurable and predict

Aim of building up a Industry 4.0 Infrastructure is to gain better knowledge of the production.

Smart Production Seminar

Knowing as-is process and assembly times by feedback from integrated sensor systems.

Automatic evaluation of assembly status
- Workpiece center in the assembly line are equipped with RTLS (RFID or Wi-Fi) tags
- Automatic positioning of the workpiece within the assembly line
- Real-time registration of the assembly progress of a specific order
- Feedback if actual progress differs to planned progress

Automatic evaluation of process times
- Workpiece is equipped with mini-computer and sensor connection
- The sensor registers incoming order data sheets when starting the order and when taking the data sheet to the next station for the next process step
- Based on the optical registration of the order data sheets the time per process steps is recognized and stored in the system

Source: http://www.processen.info/Legendre/RTLS-Real-Time-Location-System

Knowing the transition time from different workstations to gain transparency for better production scheduling.

- RFID-tagged workpiece carrier
- Exchange of data between sensor input and ERP-system
- Automatic registration of transport and waiting time linked to orders in ERP-system

Source: RTLS-Real-Time-Location-System
Three main steps to a digital production
Examples: Analyze and predict

Simulation of alternatives based on as-is data enables valid production steering decisions

Aim of building up a Industry 4.0 infrastructure is to gain better knowledge of the production process

Quick overview of order situation to identify bottlenecks in production I/I

Quick overview of order situation to identify bottlenecks in production II/II

1. The production planner identifies that a critical situation concerning machine capacity is upcoming next week. He chooses the critical resource to receive more details.

2. Thursday next week an bottleneck occurs on one machine. He chooses the identified machine for a detailed order overview.

3. The production planner chooses the critical resource and gets a recommended action based on the algorithm of production scheduling.

4. The production planner gets transparency concerning the impact of the action and confirms the chosen action.
Activity 3 "Smart Production" Seminar

In future, automatic production scheduling with Industry 4.0.

Industrial apps refining raw-data and supporting the learning process of a company.

Three main steps to a digital production.

Example: Adaptive optimization.

Aim of building up an Industry 4.0 infrastructure is to gain better knowledge of the production.
Activity 3 "Smart Production" Seminar

Responsive and Decentral Provision of Product Information to Individual Products

Interactive and Intuitive Malfunction Management by Industrial Tablet App

Information Storage on Workpieces to Enable the Machine for Specific Actions

Process Information Stored on the Workpiece Holder

- Engagement in the workforce with a mobile workpiece holder
- Storage of the relevant information for the workpiece holder
- Display of the relevant information on the tablet app
- Provision of additional information through a QR code

Linkage of 3D-CAD Models for Any Machine

- Automatic adaptation of assembly instructions based on 3D-CAD models and component data
- Visualization and simulation of product structure and assembly process
- Integration of quality assurance and validation processes
### Agenda

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Introduction to smart production</td>
<td>Tea break</td>
<td>Examples from Industry 4.0 production</td>
<td>Lunch break</td>
<td>Experience: Deriving a smart production (Use Case)</td>
<td>Lessons learned</td>
</tr>
<tr>
<td></td>
<td>09:30 – 10:30</td>
<td>10:30 – 10:50</td>
<td>10:50 – 12:30</td>
<td>12:30 – 14:00</td>
<td>14:00 – 16:35</td>
<td>16:35 – 17:00</td>
</tr>
<tr>
<td></td>
<td>Introduction to smart production</td>
<td>Tea break</td>
<td>Examples from Industry 4.0 production</td>
<td>Lunch break</td>
<td>Experience: Deriving a smart production (Use Case)</td>
<td>Lessons learned</td>
</tr>
<tr>
<td></td>
<td>09:30 – 10:30</td>
<td>10:30 – 10:50</td>
<td>10:50 – 12:30</td>
<td>12:30 – 14:00</td>
<td>14:00 – 16:35</td>
<td>16:35 – 17:00</td>
</tr>
</tbody>
</table>

The analysis enables the decision for the right strategy which supports the company’s production targets.
How to find smart solutions in production?

Guiding questions: Targets and pain points

What targets and pain points could occur in the production of a smart product...

- Lead time
- Quality control
- Documentation
- Variety of parts, production steps, assembly steps
- Production planning
- Shift planning
- Qualification of workers
- Maintenance
- ...

1. Mapping the basic value chain in production process

<table>
<thead>
<tr>
<th>Production Plant 1</th>
<th>Production Plant 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0. Research &amp; Development</td>
<td>1. Production planning and steering</td>
</tr>
<tr>
<td>2. Logistics (internal, external)</td>
<td></td>
</tr>
<tr>
<td>5. Production</td>
<td></td>
</tr>
<tr>
<td>6. Assembly</td>
<td>7. Goods issue</td>
</tr>
<tr>
<td>8. Customer</td>
<td></td>
</tr>
<tr>
<td>9. Service &amp; Maintenance</td>
<td></td>
</tr>
<tr>
<td>10. Quality control</td>
<td></td>
</tr>
</tbody>
</table>
2. Identifying current and future requirements

A. Pain Points

B. Future Trends

3. Finding Innovation patterns to address the requirements

<table>
<thead>
<tr>
<th>Transparency</th>
<th>Prediction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition monitoring</td>
<td>Process status, condition, position, resource need, conflict, external influences, process indicators, product quality</td>
</tr>
<tr>
<td>Identification of user</td>
<td>Analyze process information</td>
</tr>
<tr>
<td>Identify process state</td>
<td>Identify patterns</td>
</tr>
<tr>
<td>Progress</td>
<td></td>
</tr>
<tr>
<td>Scheduling environment</td>
<td>Automated adoption of process parameters</td>
</tr>
<tr>
<td>Access consistent information</td>
<td>Interact with operator</td>
</tr>
<tr>
<td>Localization of resources</td>
<td>Interact with devices</td>
</tr>
</tbody>
</table>

Connection

Action

4. Deriving smart solutions and technologies

Sensors/Connect/Transport/Data Management/Analysis/Action/Output

Embedded Systems

Agenda

1. Introduction to smart production
   - 09:30 – 10:30
2. Tea break
   - 10:30 – 10:50
3. Examples from Industry 4.0 production
   - 10:50 – 12:30
4. Lunch break
   - 12:30 – 14:00
5. Experience: Deriving a smart production (Use Case)
   - 14:00 – 14:30
   - Derivation of targets and pain points (Use Case)
   - 14:30 – 15:15
   - Mega trends to derive future requirements
   - 15:15 – 15:35
   - Tea break
   - 15:35 – 16:35
   - Innovation principles in smart production
   - 16:35 – 17:00
6. Lessons learned
Activity 3 "Smart Production" Seminar
Activity 3 "Smart Production" Seminar
10. New Work

Solution Worker
Flexibilisation
Talentism
Lack in educated workforce
Empowerment

11. Future Learning

New Learning Formats
Life-Long Learning
Flexibilisation
Shareness
Infodesign

Activity 3 "Smart Production" Seminar

Agenda

1. Introduction to smart production 09:30 – 10:30
2. Tea break 10:30 – 10:50
3. Examples from Industry 4.0 production 10:50 – 12:30
4. Lunch break 12:30 – 14:00
5. Experience: Deriving a smart production (Use Case)
   5.1 Derivation of targets and pain points (Use Case) 14:00 – 14:30
   5.2 Mega trends to derive future requirements 14:30 – 15:15
   5.3 Tea break 15:15 – 15:35
   5.4 Innovation principles in smart production 15:35 – 16:35
6. Lessons learned 16:35 – 17:00

Agenda

1. Introduction to smart production 09:30 – 10:30
2. Tea break 10:30 – 10:50
3. Examples from Industry 4.0 production 10:50 – 12:30
4. Lunch break 12:30 – 14:00
5. Experience: Deriving a smart production (Use Case)
   5.1 Derivation of targets and pain points (Use Case) 14:00 – 14:30
   5.2 Mega trends to derive future requirements 14:30 – 15:15
   5.3 Tea break 15:15 – 15:35
   5.4 Innovation principles in smart production 15:35 – 16:35
6. Lessons learned 16:35 – 17:00
Activity 3 "Smart Production" Seminar

**Working task**
Derivation of requirements to smart production solutions

- Discussion of smart product innovation patterns in the context of the derived requirements of the future
- Generating possible solutions by digitalization for the smart production of the future
- Cluster the ideas for smart solutions and rate them in context of benefit and effort to realization

**Guiding questions**
Translation of requirements to smart production solutions

- For which requirement might digitalization provide a significant benefit?
- Which innovation principle fits in the context of the requirement?
- What might be a more detailed solution?
- Which data, information and interfaces to what kind of system is required?
- Which changes are needed in context of a typical Chinese production facility?

**Smart Production**
Requirements in manufacturing & logistics

- Improve capacity management (non-human resources)
- Increase process efficiency
  - Throughput time
  - Delivery dates
- Improve employee allocation (human resources)
- Integration/Interfacing (Connectivity)
- Employee empowerment
- Safety
- Security
- Increase/assure product quality
- Resilience

**Innovation segments**

- Transparency
- Prediction
- Connection
- Action
Activity 3 "Smart Production" Seminar
Activity 3 "Smart Production" Seminar
**Innovation patterns - smart production**

**Transparency**
- Condition monitoring
- Identification of user
- Identify process state/progress
- Predictive maintenance
- Access control information
- Localization of resources

**Prediction**
- Predict:
  - Process state, condition, position, resource need, conflict, external influences, process indicators, product quality
  - Analyze Process information
  - Identify patterns

**Connection**
- Provide interfaces
- Integrate with systems/personal platforms
- Integrate heterogeneous devices
- Access external data
- Access data across system boundaries

**Action**

**Smart production innovation patterns**

**Connection (I/III)**

**Integrate with systems/personal platforms**
- Machines in production, workforces and databases share, exchange and work on the same data

**Provide interfaces**

**Integrate heterogeneous devices**

**Access data across system boundaries**

**Access external data**

**Smart production innovation patterns**

**Connection (II/III)**

**Vending machines knowing about their filling status and expose interface to trip management system to avoid unnecessary trips**

**Data from different control systems is integrated to analyze process quality**

**Web-service for package tracking is integrated into the production environment to plan capacities**

**Data for new orders can be provided from a mobile device and then accessed again via desktop PC**
Activity 3 "Smart Production" Seminar

Smart production innovation patterns

**Action (iV)**

- Automated adaptation of process parameters
- MIL 68: Milling machine self-optimizes tool path from process data

**Smart production innovation patterns**

**Action (iiV)**

- Distributed tasks
- Different assembly robots coordinate optimum path of a part through the production

**Innovation patterns - smart production**

- **Prediction**
  - Process data, output, solution, quality, machine load, internal, external, availability, production process
  - Identification of patterns
  - Analyze process information
  - Identify patterns

- **Action**
  - Automate adaptation of process parameters
  - MIL 68: Milling machine self-optimizes tool path from process data
  - Notify environment
  - Communicate

- **Notify environment**
  - Provides visible information about an occurring error to production staff

- **Interact with devices**
  - Automatic feeding of a production system by a robot

**Fraunhofer VR**

- KEX Knowledge Exchange
Activity 3 "Smart Production" Seminar
Activity 3 "Smart Production" Seminar

Rating the ideas

Which kind of groups/ clusters can be identified in the requirements?

How can the ideas be ranked for maturity, relevance, actionability?

Can a roadmap concerning time-line, actions and resources be derived?

Working task group your ideas into cluster of requirements

Rating of effort and benefit

Rating of relevance by each participant

Smart Solutions: Analyses between products and production

Prediction

Action

Transparency

Connection

Agenda

1. Introduction to smart production
2. Exemplary from Industry 4.0 production
3. Experience: Deriving a smart production (Use Case)
4. Lessons learned
Activity 3 "Smart Production" Seminar

Lessons learned

What are you taking back home?

What could be better done tomorrow?

What did you particularly like?

Smart Solutions

Differences between products & production

Smart Production

Competitive market effort

More advanced and more implemented smart solutions within the consumer product sector than in the production environment.

Feel free to contact us!

Tom Creasyer
CEG - Managing Director
Tel: +1773-202-5100
www.ceeding.com
Mr. Toni Drescher

Head of Department, Industrie 4.0 & Technology Management, Fraunhofer Institute of Production Technology (IPT) Germany

- 10 years experience in technology and innovations management
- Expertise in Industry 4.0 consultancy and its’ enabling technologies
- Advisor of Industrie 4.0 Taskforce
Seminar on Industry 4.0
Smart Products

Toni Drescher
CEO - KEX Knowledge Exchange AG

HKPC Industrie 4.0 Conference
Hong Kong, July 28th 2016

What companies should do?

From the innovation principle to the technological solution

<table>
<thead>
<tr>
<th>Targets</th>
<th>Jobs to be done</th>
<th>Smart patterns</th>
<th>Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value analysis</td>
<td>Fields of observation</td>
<td>Technology assessment</td>
<td>Business case</td>
</tr>
</tbody>
</table>

| „Jobs to be done” | Audit situation | Identity solutions | Business case |

<table>
<thead>
<tr>
<th>Trends</th>
<th>Individualization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation principles</td>
<td>Smart products</td>
</tr>
<tr>
<td>Integrate with social networks</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Smart functions</th>
<th>Technological solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer data</td>
<td>4G networking</td>
</tr>
<tr>
<td>Link systems</td>
<td>Facebook API via REST web service</td>
</tr>
<tr>
<td>Interact with machines</td>
<td>Smartphone App interface</td>
</tr>
</tbody>
</table>
Activity 4 "Smart Service" Seminar

Agenda
1. Introduction to smart services
2. Lessons learned
3. New business model innovations
4. Innovation principles in smart services

Smart Solution: Smart Service

Connect & Network

Sense & Condition

Visualize & Adopt

Analyse and Predict

Further services based on customer behaviour

Lightening QCM opens up new revenue stream by offering extended services to local authorities by adapting traffic light intensity to regulate traffic flow based on traffic and weather conditions, effectively reducing congestion and fuel consumption.

14:00 – 15:15
15:15 – 16:30
16:30 – 18:15
18:15 – 17:00

Fraunhofer
Activity 4 "Smart Service" Seminar

What is the job of an IoT / 4.0 application (or any other innovation)?

Does 4.0 really consider jobs?

Do we really need this?
The pacifier becomes an open platform... expect 100s of baby apps

A larger shift in innovation landscape
Activity 4 "Smart Service" Seminar

Platforms beat products

From products to platforms... and these want to become a platform

Gillette business
### Why will one win and the other loose

<table>
<thead>
<tr>
<th>Add-on</th>
</tr>
</thead>
</table>

- An integrated, isolated product
- A service ("App") as part of an existing platform

### By the way: For users, Amazon just provided a platform for play

- ![Gillette](image)

### Platform

- A platform is a system that can be adapted to countless needs and niches that the platforms original developers could not possibly contemplated

> Mark Andreessen
So what is the problem?

Current realities drive our thinking about the business model of the future.

- Our picture of the future?
- How will our market look in ten years?
- What are we selling to whom?
- How do I organize the value creation of this offering so that I have a beyond-average profit in the end?
- Our assumptions about change

Corporate history:
- For example...
  - > 150 years
  - largest employer in the region

Competition dynamics:
- For example:
  - Known competitors
  - Potentially new competitors from different regions
  - Potentially new competitors for different industries

If the market will be like this in the future... what do we have to start doing today?

Evolution vs. disruption:
We can see the effects of Industrie 4.0 either as evolution or disruption.

<table>
<thead>
<tr>
<th>Evolution (current business model logic unchanged)</th>
<th>Disruption (strong change of current business model)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on technology-enabled efficiency gains</td>
<td>Radical reinterpretation of value proposition</td>
</tr>
<tr>
<td>Digital enhancement of products and services</td>
<td>Digital products and services as part of an open ecosystem</td>
</tr>
<tr>
<td>Digitalization of data flows in manufacturing</td>
<td>Open manufacturing concepts (cloud-based manufacturing)</td>
</tr>
<tr>
<td>Empowerment of human decision makers and operators</td>
<td>Cyber-physical production system with autonomous, market-driven agents</td>
</tr>
</tbody>
</table>

- 121
Activity 4 "Smart Service" Seminar

Companies need to cope with two distinct challenges at the same time:

- Establishing a business (EXPLORATION)
- Strengthening and extending the core (NEW BUSINESS)

Managing short term profitability
With long term sustainability

Challenge: The more we move to the "white space" (e.g., engage in exploration), the more we have to build and manage assumptions.

So what is the problem?
How to deal with the disruption?

(a) Wait and Double up: The decision Microsoft executed several times successfully: Once it was confirmed that a new technology (WebBrowser, esp. Netscape, Cloud, Gaming) became a core technology, it rapidly placed huge resources into developing its own technology in the center of the company.

(b) Wait and Buy up: The typical pattern executed by many companies who acquire owners (startups) of disruptive technologies. Consider Pharmaceuticals, Energy companies, Automotives (Nokia Navigation).
Activity 4 "Smart Service" Seminar

Proactive strategies

Strategies

(e) Create a separate and independent innovation unit to sense / invent own disruptive technologies at the first place. Many innovations being credited today. Example: Carmila with its broad moves towards mobility services. (With Volvo CAR-CO).

Seperate innovation unit

(c) Wait and give up: Going down gracefully (perhaps Kodak did the right thing, same with Cisco and the Flip).

Reactive strategies

(d) Self-disruption: Cannibalizing one’s own existing products while those are still doing well. E.g. Apple cannibalizing its computers with tables. New York Times cannibalizing its Print paper with digital edition.

Wait and double up

Self-disruption
Building integration capabilities

(f) Building integration capability: Using internal capabilities to create new connections based on old linkages in the organization. Invest in integrated structures that embed architectural knowledge in the minds of as many employees as possible, allow knowledge to continuously evolve and change. Change decision making style. Execute fast!

Implementation

How to implement this mentally into your company

There are different ideas in companies how to organize exploratory activities (BMI) best: in a spin-off, as an consulting capability, as a state of mind

The cooperation with Quirky is just one of GE's Garages Initiative to become more open in times of the "Industrial Internet"
Activity 4 "Smart Service" Seminar

Another project is an open development community for Home Appliances, FirstBuild.

GE's partners are all hotshots of the US "maker:" and open hardware movement.

Organization culture and structure facilitates innovation: Successful firms have a number of "idea hunters," who demonstrate distinctive capabilities to spot, assess and select potential business ideas.

We also need to better connect (broker) knowledge we have internally — across divisions, BUs, sectors, functions...
Activity 4 "Smart Service" Seminar

We can see this competition also differently, however:

"Business as usual"

An ambitious and brave business experiment (from prototype or perish to deploy or die)

Fraunhofer IFF

Challenge

Innovation is not just ideas.

(MIT Media Lab: "publish or perish", to "prototype or perish", to "deploy or die")

One more thing...

We often make one BIG mistake when managing innovation:

Time to think!
Activity 4 "Smart Service" Seminar

Agenda

1. Introduction to smart services
2. Tea break
3. New business model innovations
4. Innovation principles in smart services
5. Lessons learned

New Business Models to gain new innovation possibilities...

Example: Business Model Innovation

KEX Knowledge Exchange

Fraunhofer
Activity 4 "Smart Service" Seminar

**Innovative Business Models are often a factor of success in the past**

- **Amazon**: became the biggest book seller without having one single book store
- **Apple**: became the biggest music retail seller without selling one single CD
- **Netflix**: won in the last ten years eleven oscars without showing one single actor in the movies
- **Skype**: reinvented the video business without operating one single video store

**BMI not only relevant for consumer goods – Example: Sensors as Service**

- System optimization
- Remote diagnostic
- Remote parametrization
- Behaviour-based services
Activity 4 "Smart Service" Seminar
Activity 4 "Smart Service" Seminar

Working task
Aggregation of BMI ideas to a business model

Basis elements of a business model

What do you offer to the customer?

Value Proposition

How is the value proposition created?

Profit Mechanism

Who is your target customer?

Value Chain

How is revenue created?

Who?

Why?

What?

How?

What might be the business model of a traditional quad producer and supplier?

Guiding questions
Mapping an existing business model

- Who is the target customer? (Who)
- What is the value proposition towards the customer? (What)
- How is value created? (How)
- Why is the business model successful? Why is revenue and profit be generated? (Why)
Activity 4 "Smart Service" Seminar

Player analysis to identify relevant player in the value chain

Player analysis
Mapping the players in the value chain?

Agenda

1. Introduction to smart services 14:00 – 15:15
2. Tea break 15:15 – 15:30
3. New business model innovations 15:30 – 16:15
4. Innovation principles in smart services 16:15 – 16:45
5. Lessons learned 16:45 – 17:00

Innovation patterns - smart services

Usage optimization
- Predict user need
- Optimize service through collected usage data

Ecosystems
- Provide ecosystem platform
- Personalize user experience
- Self-collected usage data

Resources
- Schedule resource infrastructure use
- Provide user access to resources independent of device

Communities
- Integrate service with communities
- Provide user support on demand

(source: O. Gassmann, ITEM St. Gallen)
**Smart services innovation principles**

**Usage optimization (I/II)**

**Predict user need**
- Office coffee machine is kept restocked with right amount of milk without spoilage
- Car offers reserving hotel room in city approached at 8:00 PM

**Sell location-relevant services**
- Jet engine performance is optimized by analysis of global usage data via service platform

**Smart services innovation principles**

**Resources**

**Schedule resource/infrastructure use**
- Energy provider platform assigns least-cost timeframe for starting laundry machine

**Smart services innovation principles**

**Ecosystems (I/III)**

**Provide ecosystem platform**
- Smart grid app store allows customers to select third party developed apps for optimizing energy usage
- Shopping assistant recognizes individual style and recommends specific accessories

**Personalize user experience**
Smart services innovation principles
Ecosystems (II/II)

Sell collected usage data
Sell detected trends from customer search data to local warehouses to stock new products in current demand

Smart services innovation principles
Communities (II/II)

Provide user support on demand
On a car breaking down in rural areas, customer can connect to car service support staff helping to fix the problem on the spot

Smart services innovation principles
Communities (II/III)

Integrate service with communities
Wine tasting service platform users can discuss pairings online and read recommendations of their peers for finding appropriate recipes for a wine

Agenda

1. Introduction to smart services  14:00 – 15:15
2. Tea break  15:15 – 15:30
3. New business model innovations  15:30 – 16:15
4. Innovation principles in smart services  16:15 – 16:45
5. Lessons learned  16:45 – 17:00
Activity 4 "Smart Service" Seminar
Activity 5 "Smart Product" Seminar

Mr. Myron Graw

Partner and Technology Manager

KEX Knowledge Exchange AG, Germany

- Expertise in latest technology and market research and consultancy on Industrie 4.0
- Proactive on Smart Products, Smart Manufacturing and Smart Service implementation in Germany and Europe
Activity 5 "Smart Product" Seminar
Agenda

1. Introduction to smart services  14:00 – 15:15
2. Tea break                  15:15 – 15:30
3. New business model innovations  15:30 – 16:15
4. Innovation principles in smart services  16:15 – 16:45
5. Lessons learned              16:45 – 17:00

Smart Solution: Smart Service

- Sense Condition
- Connect Network
- Visualize & Adopt
- Analyze & Predict

Further services based on customer behavior.

Lightening OEM opens up new revenue stream by offering extended services to local authority by adapting light intensity to regulate traffic flow based on traffic and weather conditions.

Smart i4.0 Navigator

- Network
- Data
- Sensors
- Smart Innovation
- Smart Network
- New Digital Business Models
- Smart Production
- HMI
- Smart Solution
- Strategy and Organization
- Mindset and Culture
- Growth & Revenue
- Value
- Productivity & Efficiency

Jet engine manufacturer globally equip their turbo machines with sensors and analyze the usage data in order to realizes repair and maintenance services in advance.
Activity 5 "Smart Product" Seminar

What is the job of an IoT/4.0 application (or any other innovation)?

Does IoT 4.0 really consider jobs?

Do we really need this?
“People don’t want to buy a quarter-inch drill… they want a quarter-inch hole!”
- Theodore Levitt

"Blending instead of drilling"
"Mobile payment"
"Genetically engineered grass seed that never needs to be cut"

Job to be done method

J
Job-to-be-Done
Context-specific problem facing a customer

O
Objectives or Outcomes
Functional, emotional, social metrics

B
Barriers
Factors inhibiting getting job done (pains / gains)

S
Solutions
Products, services, compensating behaviors

The pacifier becomes an open platform ... expect 100s of baby apps

A larger shift in innovation landscape
Activity 5 "Smart Product" Seminar

Platforms beat products

From products to platforms... these want to become a platform

Gilette business
By the way: For users, Amazon just provided a platform for play.

“A platform is a system that can be adapted to countless needs and niches that the platforms original developers could not possibly contemplated.”

Mark Andreessen

Why will one win and the other loose

An integrated isolated product
So what is the problem?

Business model of the future

Current realities drive our thinking about the business model of the future

- Our picture of the future?
- How will our market look in five years?

What are we selling to whom?

- Corporate history
- For example:
  - > 100 years
  - Largest employer in the region
  - ...

YOUR COMPANY HERE

How do I organize the value creation of this offering so that I have a beyond-average profit in the end?

Our assumptions about change

- Competition dynamics
- For example:
  - Market competition
  - Potentially new competitors from different region
  - Potentially new competitors by different activities
  - ...

If the market will be like this in the future... what do we have to start doing today?

Evolution vs. disruption

We can see the effects of Industrie 4.0 either as evolution or disruption

<table>
<thead>
<tr>
<th>Evolution (current business model logic unchanged)</th>
<th>Disruption (strong change of current business model)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on technology-enabled efficiency gains</td>
<td>Radical reinterpretation of value proposition</td>
</tr>
<tr>
<td>Digital enhancement of products and services</td>
<td>Digital products and services as part of an open ecosystem</td>
</tr>
<tr>
<td>Digitalization of data flows in manufacturing</td>
<td>Open manufacturing concepts (cloud based manufacturing)</td>
</tr>
<tr>
<td>Empowerment of human decision makers and operators</td>
<td>Cyber-physical production system with autonomous, market-driven agents</td>
</tr>
</tbody>
</table>
So what is the problem?

Managing short term profitability
With long term sustainability

The challenge: The more we move to the “white space” (= engage in exploration), the more we have to build and manage assumptions.
How to deal with the disruption?

(a) Wait and Double up: The decision Microsoft executed several times successfully. Once it was confirmed that a new technology (WebBrowser, esp. Netscape, Cloud, Gaming) became a core technology, it rapidly placed huge resources into developing its own technology in the center of the company.

(b) Wait and Buy up: The typical pattern executed by many companies who acquire owners (startups) of disruptive technologies. Consider Pharmaceuticals, Energy companies, Automotives (Nokia Navigation)
(c) Wait and Give up: Going down gracefully (perhaps Kodak did the right thing; same with Cisco and the Flip).

(d) Self-disruption: Cannibalizing one’s own existing products while those are still doing well (e.g. Apple cannibalizing its computers with tablets, New York Times cannibalizing its Print paper with digital editions), executed by creating an autonomous entity (skunkwork).

(e) Create a separate and independent innovation unit to sense / invent / own disruptive technologies at the first place. The many “innovation labs” being created today. Example: Daimler with its broad moves towards mobility services with Moovel/Car-to-Go.
We also need to better connect (broker) knowledge we have internally – across divisions, BUs, sectors, functions …
Activity 5 "Smart Product" Seminar

"Business as usual"

An ambitious and brave business experiment (from prototype to deploy or die)

Innovation is not just ideas.

(MIT Media Lab: "publish or perish" to "prototype or perish" to "deploy or die")

One more thing...

We often make one BIG mistake when managing innovation:
### Agenda

1. Introduction to smart services  14:00 – 15:15
2. Tea break  15:15 – 15:30
3. New business model innovations  15:30 – 16:15
4. Innovation principles in smart services  16:15 – 16:45
5. Lessons learned  16:45 – 17:00

---

**Example: Business Model Innovation**

- **Nespresso**
  - 1984 launch of machine
  - 1997 launch of coffee capsules (fun and easy)
  - 2001 launch of coffee machine
  - 2011 launch of coffee capsules

- **Innovation potential**
  - Business model innovation
  - Process innovation
  - Product innovation
  - Technology innovation

---

**New Business Models to gain new innovation possibilities**

- Nespresso business model initially almost failed, business model became successful when Jean-Paul Gaultier adapted the business model.

---

**Quelle:** TIME, Lehnshof RWTH Aachen
Innovative Business Models are often a factor of success in the past

- Amazon became the biggest book seller without having one single book store
- Apple became the biggest music retail seller without selling one single CD
- Netflix won in the last ten years eleven oscar without showing one single actor in the movies
- Skype reinvented the video business without operating one single video store
- Skype is the biggest international communication provider without having an own network infrastructure

Business Model Innovation Myths

- Innovations are always evaluated by the R&D report. (R&D Deviation)
- Massive amounts of resources are needed to initiate breakthroughs. (Google, Facebook, YouTube)
- Only consider companies are capable of developing truly innovative ideas. (Apple)
- Commercial breakthroughs are based on totally new ideas. (Nvidia, Youtube)
- BMI are always radical and near to the world. (Netlix)
- BMI are always based on a new and fascinating technology. (Internet; E-Commerce)
- BMI happens by chance and are therefore not systematically manageable. (St. Gallen Business Model Navigator™)

BMI not only relevant for consumer goods – Example: Sensors as Service

- System optimization
- Remote diagnostic
- Remote parametrization
- Behaviour-based services
Activity 5 "Smart Product" Seminar
Activity 5 "Smart Product" Seminar

Basis elements of a business model

Who is the target customer? (Who)

Value Propostition

What is the value proposition towards the customer? (What)

How is value created? (How)

Why? (Why)

What do you offer to the customer? (What)

How is revenue created? (How)

Working task

What might be the business model of a traditional quad producer and supplier?

Working task

Mapping an existing business model

Guiding questions
Activity 5 "Smart Product" Seminar

Player analysis to identify relevant player in the value chain

Agenda
1. Introduction to smart services 14:00 – 15:15
2. Tea break 15:15 – 15:30
3. New business model innovations 15:30 – 16:15
4. Innovation principles in smart services 16:15 – 16:45
5. Lessons learned 16:45 – 17:00

Innovation patterns - smart services

Usage optimization
- Predict user need
- Self location relevant services
- Optimize service through collected usage data

Ecosystems
- Provide ecosystem platform
- Personalize user experience
- Self collected usage data

Resources
- Schedule resource infrastructure use
- Provide user access to resources independent of device
- Provide user support on demand

Communities
- Integrate service with communities
Activity 5 "Smart Product" Seminar
Activity 5 "Smart Product" Seminar

1. Introduction to smart services
2. Innovation principles in smart services
3. Innovation principles in smart services
4. Lessons learned

*Fraunhofer KEX*
Activity 5 "Smart Product" Seminar
Activity 6 Workshop on Enabling Manufacturing Systems for Implementing "Industry 4.0"

• Insight on Digitalization 企業數碼化經驗分享
• Digitized Production Planning 數碼化生產計畫及排程
• Transparent Production Management 生產管理透明化
• Big data and data analytic 大資料之分析
• Network Infrastructure for i4.0 工業 4.0 網路架構及技術
• Case studies 個案研究及分析
Activity 6 Workshop on Enabling Manufacturing Systems for Implementing "Industry 4.0"

6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics 面對智能新世代—進行智能數據分析新科技

Mr. Myron Graw

Partner and Technology Manager

KEX Knowledge Exchange AG, Germany

- Expertise in latest technology and market research and consultancy on Industrie 4.0
- Proactive on Smart Products, Smart Manufacturing and Smart Service implementation in Germany and Europe
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Revolution have never been predicted in advance!
Activity 6.1 Facing the Smart Future –Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6.1 Facing the Smart Future – Enabling Technologies for Smart Data Analytics
Activity 6 Workshop on Enabling Manufacturing Systems for Implementing "Industry 4.0"

6.2 Increase Business Responsiveness with Integrated ERP and MES system

一站式整合的 ERP 及製造執行系統有助提升業務反應速度

Ms. Gina Au 區凱珊小姐
Senior Solutions Manager, EpicorSoftware (North Asia) Limited, USA Epicor

資深方案經理
Activity 6 Workshop on Enabling Manufacturing Systems for Implementing "Industry 4.0"

6.3 I4.0 Smart Operation, Manufacturing and Factory Upgrading

工業 4.0 智能運作，製造和工廠升級

Mr. Horace Leung 梁振豪先生

Consultant, Smart Manufacturing and Materials Division - Hong Kong Productivity Council;

香港生產力促進局材料及製造科技部顧問

Member of HKPC Industry 4.0 Project team that is committed to promoting and providing advisory services to come up a holistic strategic roadmap and landscape towards Industry 4.0 in Hong Kong Industry.

Responsible for Industry 4.0 enabling technologies and cyber manufacturing solutions to provide project management, implementation, consultancy of Product Life-cycle Management (PLM), Enterprise Resource Planning (ERP), Intelligent Production Scheduling (i-PS) and Manufacturing Execution Solutions (MES).
Activity 6 Workshop on Enabling Manufacturing Systems for Implementing "Industry 4.0"
Activity 6.3 I4.0 Smart Operation, Manufacturing and Factory Upgrading
Activity 6.3 4.0 Smart Operation, Manufacturing and Factory Upgrading

i4.0 Pilot Project – Plastic Injection Machine Status Monitoring
- Real time machine status acquisition by integrating off-the-shelf heterogeneous devices - Level 1 MES

Advanced i4.0 Project – IoT, CPPS & Vertical Integration
- Real time process performance data acquisition, job placement & management, process control and realization of “Cyber Physical Production System (CPPS)” by ITF support developed Machine Specific Driver (MSD)
- i4.0 enabling solutions & technologies integrated:
  - Smart Sensor
  - Smart Data
  - MSD/MES/Embedded System/AP/ERP
  - Internet/WiFi
  - Robot & HMI

i4.0 Maturity Level Evaluation Result
- Observation for “Enterprise Layer”
  - Lack of 4.0 Digital Strategy & Holistic Plan: Digitalization is unbalanced, in-depth knowledge on i4.0 Culture/ Mindset & Resources
  - KPIs are vague, definition required, & process performance not yet fully digitized & linked to business value
  - Need further technology, process, and digitized especially R&D, Production planning & scheduling
  - Lack of IT strategy (as hoc basis) and cyber security measure
  - Value chain not integrated with direct IT interface

- Observation for “Layer 1”
  - Smart Business
    - Single Source of Truth
    - Converting Legacy system to integrate and digitalize
    - Lack of IT strategy (as hoc basis)
  - Smart Production
    - Production process data acquisition is not in real-time
    - Machines are not connected and monitored in real-time
    - Lack of knowledge on data analytics & business intelligence

- Observation for “Layer 2”
  - Smart Business
    - Division of Labour
    - Reasonable automation is still insufficient

i4.0 Smart Operation, Manufacturing & Factory Upgrading
- Evaluate the existing 4.0 maturity level of companies of various sectors, scales and business models
Activity 6.3 I4.0 Smart Operation, Manufacturing and Factory Upgrading
Activity 6 Workshop on Enabling Manufacturing Systems for Implementing "Industry 4.0"

6.4 Advanced Planning & Scheduling (APS)

先進規劃與排程

Mr. Jia-Liang Xu 徐嘉良先生

General Manager, Asprova Software Technology Co. Ltd. Japan, Asprova

Asprova Corporation was founded in 1994 as the first company in Japan to specialize in production scheduling software. Asprova focuses on the development and sales of the Advanced Planning & Scheduling (APS) Software. The market share of production scheduling software in Japan is 52.4% which is the No.1 in Japan.
Activity 6 Workshop on Enabling Manufacturing Systems for Implementing "Industry 4.0"

6.5 Manufacturing Execution System and Overall Equipment Efficiency

製造執行系統和整體設備效率

Mr. Bernd Michel

Managing Director of FORCAM in CHINA, FORCAM Shanghai Software Technology Co., Ltd., Germany, FORCAM 常務董事
Activity 6 Workshop on Enabling Manufacturing Systems for Implementing "Industry 4.0"

6.6 Connected Industrial 4.0

Mr. Raymond Poon 潘啟樑先生

Solutions Architect, CISCO System (HK) Ltd., USA, CISCO 解決方案架構師
Activity 7  Workshop on Enabling Manufacturing Technologies for Implementing "Industry 4.0"

• What is CPS in Production? 甚麼是資訊物理融合生產系統

• Manufacturing Virtualization 製造虛擬化

• Sensor application in Smart Factory 智慧工廠感測器應用

• What is cooperative robotics 甚麼是協作機械人

• Case studies 個案研究及分析
Activity 7 Workshop on Enabling Manufacturing Technologies for Implementing "Industry 4.0"

7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems

面對智能新世代—實現智能生產系統新科技

Mr. Toni Drescher

Head of Department, Industrie 4.0 & Technology Management, Fraunhofer Institute of Production Technology (IPT) Germany

• 10 years experience in technology and innovations management

• Expertise in Industry 4.0 consultancy and its’ enabling technologies

• Advisor of Industrie 4.0 Taskforce
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7.1 Facing the Smart Future – Enabling Technologies for Smart Production Systems
Activity 7 Workshop on Enabling Manufacturing Technologies for Implementing "Industry 4.0"

7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories

智能工廠工業 4.0 解決方案和傳感器應用

Dr. Siu 蕭瑞華先生

Project Manager, Bosch Rexroth China, Germany; Bosch Rexroth China 项目经理
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories

[Image of diagrams related to i4.0 solutions and sensor applications in smart factories.]
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7.2 Enabling i4.0 Solutions and Sensor Applications in Smart Factories
Activity 7 Workshop on Enabling Manufacturing Technologies for Implementing "Industry 4.0"

7.3 I4.0 Smart Operation, Manufacturing and Factory Upgrading

工業 4.0 智能運作，製造和工廠升級

Mr. Horace Leung 梁振豪先生

Consultant, Smart Manufacturing and Materials Division - Hong Kong Productivity Council;

香港生產力促進局材料及製造科技部顧問

Member of HKPC Industry 4.0 Project team that is committed to promoting and providing advisory services to come up a holistic strategic roadmap and landscape towards Industry 4.0 in Hong Kong Industry.

Responsible for Industry 4.0 enabling technologies and cyber manufacturing solutions to provide project management, implementation, consultancy of Product Life-cycle Management (PLM), Enterprise Resource Planning (ERP), Intelligent Production Scheduling (i-PS) and Manufacturing Execution Solutions (MES).
Activity 7 Workshop on Enabling Manufacturing Technologies for Implementing "Industry 4.0"

7.4 Collaborative Robotics with Artificial Intelligence Embedded

人工智能嵌入式協作機器人

Dr. Hansruedi Früh

Founder, F&P Robotics, Switzerland; F&P Robotics 創辦人

F&P aims to establish as a leading provider of light weight robots. F&P focuses on the reduction of the complexity in automatization. It should be as easy as possible to program and to steer a P-Rob, so that the P-Rob can be used for many new applications in collaborative robotics and service robotics. The “P” in P-Rob stands for “personal”, this refers to the easy and intuitive handling with the P-Rob, the intrinsic security concept and to the design of the P-Rob.
Activity 7 Workshop on Enabling Manufacturing Technologies for Implementing "Industry 4.0"

7.5 人機協作智造未來

Mr. Allen Liang  梁祺先生

Vice President, Human CothinkRobotics Tech. Co. Ltd.; 瑞森可副總裁

Established in 2015, Hunan Cothink is headquartered in Changsha with a registered capital of RMB100 million. Hunan Cothink’s newest division leverages the company’s expertise to help Chinese manufacturers successfully and effectively deploy Sawyer and Baxter.
Activity 8 Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0” Seminar

There is a growing demand for personalized products on the market, and the need of SMART design and service with customized products become larger. However, the traditional manufacturing model cannot utilize marketing data in all aspects of design and production, and the traditional automation is not flexible enough to diminish the market demand gap. "Industrial 4.0" intelligent program and SMART manufacturing are the solution to achieve creative and personalized design, to capture market opportunities and to be more effective.
Activity 8 Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0” Seminar

8.1 Industrie 4.0 – The 4th Industrial Revolution, Facing the Smart Future!

Mr. Raymond SHAN 單銘賢先生

Principal Consultant, Smart Manufacturing and Materials Division - Hong Kong Productivity Council; Certified Industrie 4.0 Expert & Trainer, Fraunhofer IPT Germany

香港生產力促進局智能材料及製造科技部首席顧問及德國 Fraunhofer IPT 工業 4.0 專家

Industry 4.0 Chair

Society of Automotive Engineers – Hong Kong

Chair (Technology & Management)

Hong Kong Auto Parts Industry Association

Honorary Committee

Hong Kong Mould & Product Technology Association
Activity 8.1 Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0” Seminar
Activity 8.1 Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0” Seminar
**Activity 8.1 Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0” Seminar**

**Smart Factory?**

**Change of Business Model – Digital BM**

- **Market Trend: Pay-per-use Automotive Manufacturer vs Mobility Service Provider**
  - BMW i Mobility Services – DriveNow (Car Sharing)
  - Uber - Taxi App
  - Google Self Driving Car

*“It’s a paradigm shift similar to what we’ve seen in the Music Industry, away from records to CDs and now iTunes.”*

Source: IFPI and KPMG Shanghai 2015

---

**Evolution of Industrial Revolution**

<table>
<thead>
<tr>
<th>Highlight</th>
<th>Industry 1.0</th>
<th>Industry 2.0</th>
<th>Industry 3.0</th>
<th>Industry 4.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of Initiation</td>
<td>~1760</td>
<td>~1870</td>
<td>~1969</td>
<td>~2011</td>
</tr>
<tr>
<td>Originated By</td>
<td>Great Britain</td>
<td>Europe &amp; the United</td>
<td>Germany</td>
<td>Germany</td>
</tr>
<tr>
<td>Nutshell Technology</td>
<td>Mechanicalisation</td>
<td>Electrification &amp; Division of Labour</td>
<td>Use of IT to further automate production</td>
<td>Cyber Physical System, Integration &amp; Digitalisation of Value Chain</td>
</tr>
<tr>
<td>Enabler</td>
<td>Steam Power &amp; Water Power</td>
<td>Electrical, Skillful Labour &amp; Production Line</td>
<td>Programmable Logic Controller (PLC)</td>
<td>Sensors, Internet, Data Analytics &amp; Human Machine Interface</td>
</tr>
<tr>
<td>Application</td>
<td>Discrete Production</td>
<td></td>
<td></td>
<td>Product Life Cycle (Smart Products, Smart Service, Service Innovation, Smart Supply Chain &amp; Smart Production)</td>
</tr>
<tr>
<td>Business Value</td>
<td>Productivity &amp; Efficiency</td>
<td></td>
<td></td>
<td>Business Growth &amp; Resilience and Productivity &amp; Efficiency by Digital Business Models</td>
</tr>
</tbody>
</table>

**156+ Interpretations in Germany (Year 2015)**

Definition of Industrie 4.0:
- Lack of common understanding

Industrie 4.0
- Industrial Internet
- Cyber-Physical Systems
- Smart Services
- Internet of Services
- Smart Production
- Smart Cities
- Smart Products
- Digitalization
- Factories of the Future
- Smart Manufacturing
- Smart Factory
- Smart Home
Activity 8.1 Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0” Seminar
Activity 8.1  Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0” Seminar
Activity 8.1 Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0” Seminar
Activity 8.1 Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0” Seminar
Activity 8 Enabling Hong Kong Manufacturing Industry for Implementing “Industry 4.0” Seminar

8.2 Case Study and sharing—Shing Hing Plastic Manufacturing Limited

業界分享 — 成興塑膠製品有限公司

Mr. Calvin Wu 胡力恒先生

General Manager, Shing Hing Plastic Manufacturing Limited

成興塑膠製品有限公司總經理
Activity 8 Case Study and sharing – ShingHing Plastic Manufacturing Limited
業界分享 — 成興塑膠製品有限公司
Activity 8 Case Study and sharing – ShingHing Plastic Manufacturing Limited

業界分享 — 成興塑膠製品有限公司