Collaboration as a driver for success in the digital era

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Industrial Revolution towards Industry 4.0

Late 18th century | Beginning of 20th century | 1970s–2000s | 2010 onward
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First industrial revolution: Power generation
- Introduction of the power loom in 1784
- Mechanization of production facilities with water and steam power

Second industrial revolution: Industrialization
- Introduction of the assembly line in slaughterhouses in 1870
- Electrification drives mass production in a variety of industries

Third industrial revolution: Electronic automation
- Development of the first programmable logic controller (PLC) in 1969
- Growing application of electronics and IT to automate production processes

Fourth industrial revolution: Smart automation
- Increasing use of cyber-physical systems (CPS)
- In January 2011, Industry 4.0 was initiated as a “Future Project” by the German federal government
- With the introduction of IPv6 in 2012, virtually unlimited addressing space becomes available
- Governments, private companies, and industry associations have been focusing on Industry 4.0 and making investments since the 2010s

Sources: Germany Trade & Invest, “INDUSTRIE 4.0—Smart manufacturing for the future,” July 1, 2014; National Academy of Science and Engineering, “Securing the future of German manufacturing industry: Recommendations for implementing the strategic initiative Industry 4.0,” April 2013; Deloitte analysis.

2. In 2016, 90% of Manufacturers Will Impose Their Global Standards on All Operations, Including Outsourced Operations, and Suppliers, to Decrease Risk and Increase Market Opportunities.

3. By the End of 2016, 65% of Manufacturers Will Have Metrics in Place to Evaluate and Drive Pervasive Changes in the Workplace with Their New Technology Investments.

4. By 2019, 75% of Manufacturing Value Chains Will Undergo an Operating Model Transformation with Digitally Connected Processes That Improve Responsiveness and Productivity by 15%.


6. By the End of 2019, Enterprise-wide Improvements in Resiliency and Visibility Will Render Short-Term Forecasting Moot for 50% of All Consumer Products Manufacturers and 25% of All Others.

7. By 2018, 60% of top 100 Global Manufacturers Will Be Using a Product Innovation Platform Approach to Drive Enterprise Quality Throughout the Product and Service Life Cycles.

8. By 2017, 40% of Large Manufacturers Will Use Virtual Simulation to Model Their Products, Manufacturing Processes, and Service Delivery to Optimize Product and Service Innovation.

9. By the End of 2017, 50% of Manufacturers Will Exploit the Synergy of Cloud, Mobility, and Advanced Analytics to Facilitate Innovative, Integrated Ways of Working on the Shop Floor.

5GEM

5G-Enabled Manufacturing
Collaboration drivers

- Access to new technology
- Ability to strengthen innovation capabilities
- Access to new markets and customers
- Access to larger contracts
- Risks Reduction

Lower the costs generated from the non-value adding processes

Operational flexibility, rapid reaction and adaptation to changes

Support the human worker in different ways

Enabling the efficiency of networks

Increase the productivity and efficiency in all levels

Competiveness


Ref: https://www.linkedin.com/pulse/collaboration-key-driver-organisational-success-peter-westbrook/
Characteristics affecting to the quality of inter-firm collaboration

- **Distance between 'man and the system'**
  - Other companies were distant.

- **Lack of visibility**
  - Factory
  - Network
  - Company, that was considered as a potential partner, focused on different technology.

- **Low information quality (timing, format, content)**
  - Other companies were already in their own networks, and P3 was not able to fit into them.

- **Lack of trust**
  - Partner
  - IT
  - One potential company to do collaboration with left out just before project started

- **Multiple tools – lack of information flow. Complexity**
  - Other companies were interested in C4 part, but did not want to allocate resources to collaboration. From business perspective the times were difficult and this affected the resourcing.

**C1**
Company with synergetic business interests left the project in early stage. This was possibly due to financial challenges.

**C2**
Other companies had different focuses in their R&D.

**C3**
Big customer, that encouraged C3 to participate, did not participate the “group project”. The customer was not able to reach an agreement with other participating companies.

**C4**
Other companies were interested in C4 part, but did not want to allocate resources to collaboration. From business perspective the times were difficult and this affected the resourcing.

**C5**
Project topic in C5 was different. Other companies focused on product development when C5’s aim was to develop other risk management processes.

**C6**
R&D subjects were close, but not close enough to do collaborative development

**C7**
Lack of resourcing in C7. Collaboration would have required human resources from wide range of functions in C7.

**C8**
Desired results were delivered with very little collaboration. Knowledge exchange between companies happened through research organization.

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Majuri, M., Nylund, H. & Lanz, M., Analysis of Inter-firm Co-operation in Joint Research and Development Projects, Advances in Production Management Systems: Initiatives for a Sustainable World - IFIP WG 5.7 International Conference, APMS 2016, p. 536-543 8 p. (IFIP Advances in Information and Communication Technology)
Characteristics affecting to the quality of inter-firm collaboration

• Positive impact
  – Common vision
  – Partner was showing trust
  – Encouragement by the partner
  – Desire to help
  – Honest and straight dialogue
  – Good relations
  – Openness
  – Experienced appreciation
  – Similar commercial goals

Ref: Majuri, M., Nylund, H. & Lanz, M., Analysis of Inter-firm Co-operation in Joint Research and Development Projects, Advances in Production Management Systems: Initiatives for a Sustainable World - IFIP WG 5.7 International Conference, APMS 2016, p. 536-543 8 p. (IFIP Advances in Information and Communication Technology)

MANU/LEANMES
‘The ultimate goal of the project is to provide lean, scalable and extendable concept for new type of MES that supports the human operator in a dynamically changing environment’
LeanMES - Common understanding of each position
Digitalisation of the Production

DIMECC MANU/LeanMES: http://hightech.dimecc.com/results/leanmes-always-up-to-data

Dashboard Prototypes

Mobile user interfaces

Specifications:
- Diameter: 12.56
- Tolerance: .04

Instructions: ...

Machine parameters

Intelligent Workorder concept

Guiding to the correct shelf
LeanMES results in Companies

DIMECC MANU/LeanMES:
http://hightech.dimecc.com/results/leanmes-always-up-to-data
RAPID RECONFIGURATION OF FLEXIBLE PRODUCTION SYSTEMS THROUGH CAPABILITY-BASED ADAPTATION, AUTOCONFIGURATION AND INTEGRATED TOOLS FOR PRODUCTION PLANNING

To develop and demonstrate the next generation of versatile production systems based on reconfigurable modular production resources.

Project Goals

- Economic production of smaller lot sizes and higher number of variants
- Reduction of the set-up, changeover times and costs
- Reduction of average energy consumption

The approach is grounded on the development of techniques for the design, reconfiguration and management phases of production systems.

The ReCaM Approach

- Rapid capability-based system reconfiguration according to product requirements
- Automatic adaptation of resource capabilities
- Auto-programming of mechatronic objects (MOs)
- Engineering methods for the integrated reconfiguration and production planning

The ReCaM solutions will be implemented and demonstrated on two industrial environments and one lab demonstrator.

Demonstration Environments

1. Bosch Plant Demonstrator
2. CESA Plant Demonstrator
3. Bosch Lab

www.recam-project.eu
ReCaM Systems Architecture
Capability matchmaking – Interactions between the associated SW

1. Request for matchmaking for certain search space
2. Get resource information, including capabilities
3. Get PRD (step) description
4. Return PRD (step) description
5. Return matching resources (combinations) for each PRD step
6. Check found and missing matches
7. Define strategy for reconfiguration
8. Request for matchmaking with new search space
9. Get resource information, including capabilities
10. Get PRD (step) description
11. Return PRD (step) description
12. Return matching resources (combinations) for each PRD step
13. Check found and missing matches
14. Optimize system layout
15. Request for new matchmaking until enough resources are found
16. Create new resource combinations matching with the PRD
17. Get resource information, including capabilities
18. Get PRD (step) description
19. Return PRD (step) description
20. Return matching resources (combinations) for each PRD step
21. Check found and missing matches
22. Optimize system layout
23. Request for new matchmaking until enough resources are found
24. Create new resource combinations matching with the PRD
Flexible System Engineering Platform (FSEP)

- Assembly system model generation
- Transportation modelling
- Processing station modelling
- System visualisation tool

- Reliability parameters
- Cycle times
- System topology

Performance evaluation tools

System configuration

Performance

Optimised layout and parameters

Robustness and simulation analysis

Multi-period:
- Product mix
- Demand

User–Platform Interaction

Optimal System Configuration
- MOs
- Optimal Configurations
- KPIs

- Installation and testing of design solutions (WP4)
- Engineering Integration (WP5)
- Demonstrators (WP6)
ReCaM joint demos

Use Case 1: Bosch Lab Demonstrator for testing the concepts

Use Case 2: Bosch Hydraulic Valve Assembly

Use Case 3: CESA Retraction Actuator Assembly
Conclusions

Common vision of "ToBe" in long term

Assessment of capabilities & Building of strengths together

Visibility to the strategies and drivers is essential

Trust takes time, and it is not a technical problem

Development is not a project
THANK YOU!