27th annual INCOSE international symposium

Adelaide, Australia

July 15 - 20, 2017

Designing a conceptual Inter-factory architecture for Higher adaptability of Manufacturing supply chain based on systems engineering

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Contents♪

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- Research method
- Conceptual design of inter-factory architecture for higher adaptability of SCM
- Development of inter-factory prototype system
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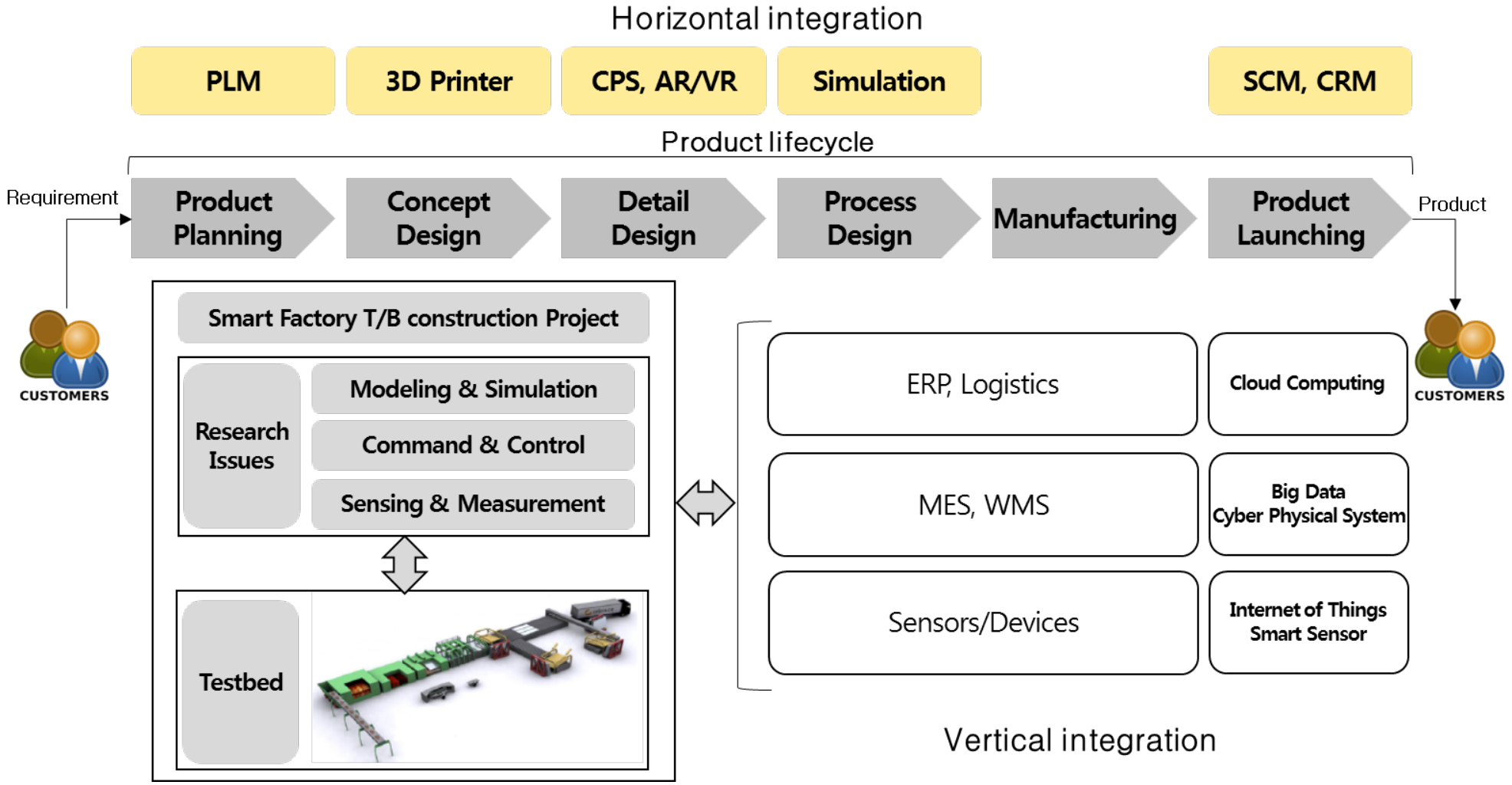
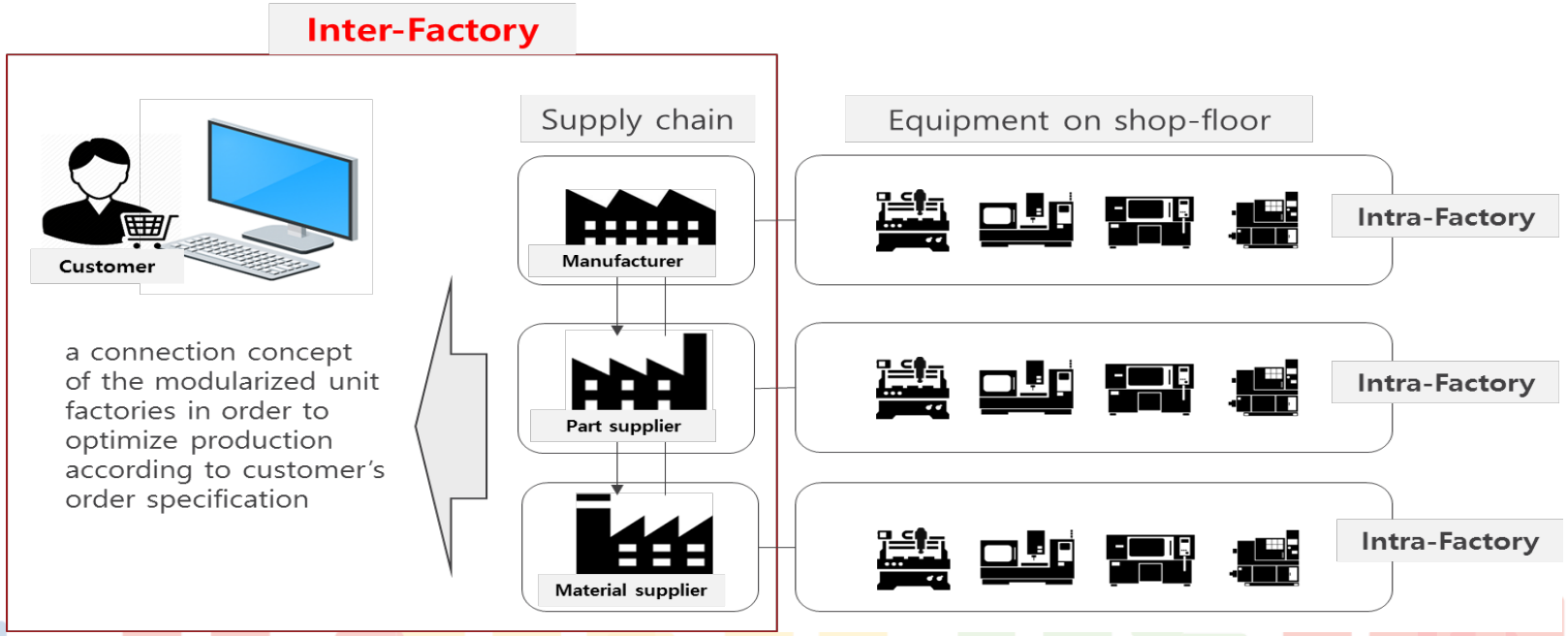
Research Background – Smart Factory♪



Introduction♪

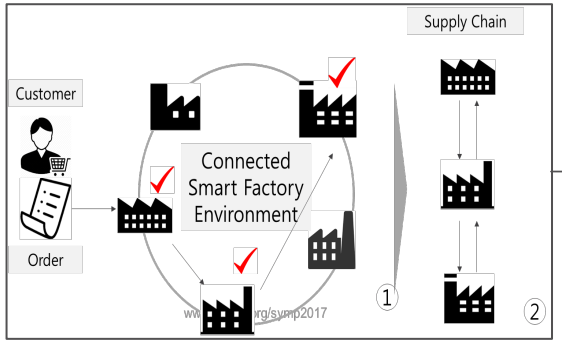
Inter-factory system

- The extension of on-going project called Modular factory or intra-factory
- To increase the speed of responsiveness of manufacturing systems to unpredicted events, suc h as sudden market demand changes or unexpected machine failure of suppliers
- To provide exactly the functionality and production capacity needed, and can be economically a djusted when needed



Research Method♪

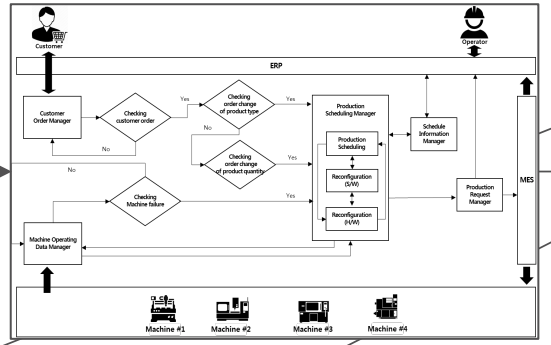
- To conduct a research on the inter-factory system for flexible manufacturing environment



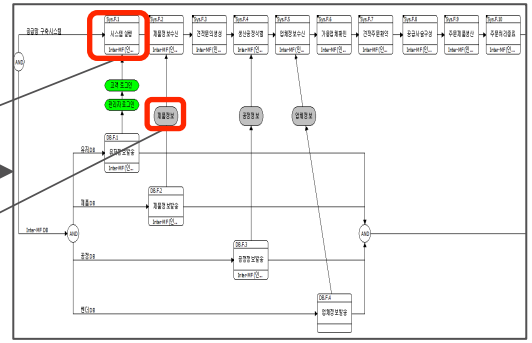
Concept modeling

Stakeholder Requirements			
No.	Name	Description	Func.
StR.1	Estimating customer's order	Inter-MF application should receive customer's order information.	0
StR.2	Recognizing manufacturing process	Inter-MF application should recognize overall manufacturing process for the product which the customer ordered.	0
StR.3	Checking available suppliers	Inter-MF application should identify available suppliers to build supply chain.	0
StR.4	Confirming customer's order	Inter-MF application should have a commitment based on customer's estimate	0
StR.5	Building supply chain	Inter-MF application should build manufacturing supply chain using confirmed customer's order.	0
StR.6	Manufacturing products	Inter-MF application should manufacture the product which the customer ordered with the manufacturing supply chain.	0
StR.7	Closing order	Inter-MF application should close the customer's order after delivering the product to the customer.	0
StR.8	Receiving product specification	Inter-MF application should have product specifications which the customer ordered.	0
...	...	...	...

Requirement Analysis



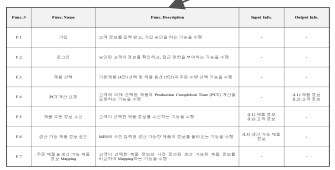
Operation Scenarios



Dynamic Modeling

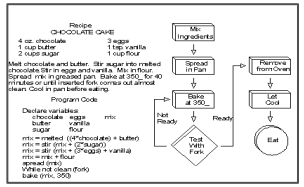
Inter-factory Architecture

Logical

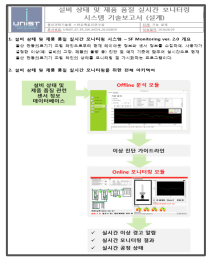


Functional List

Data Structure



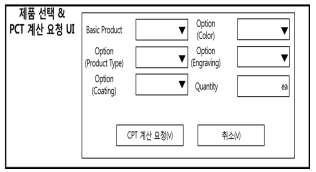
Algorithm



Design Document

Physical

Web Server

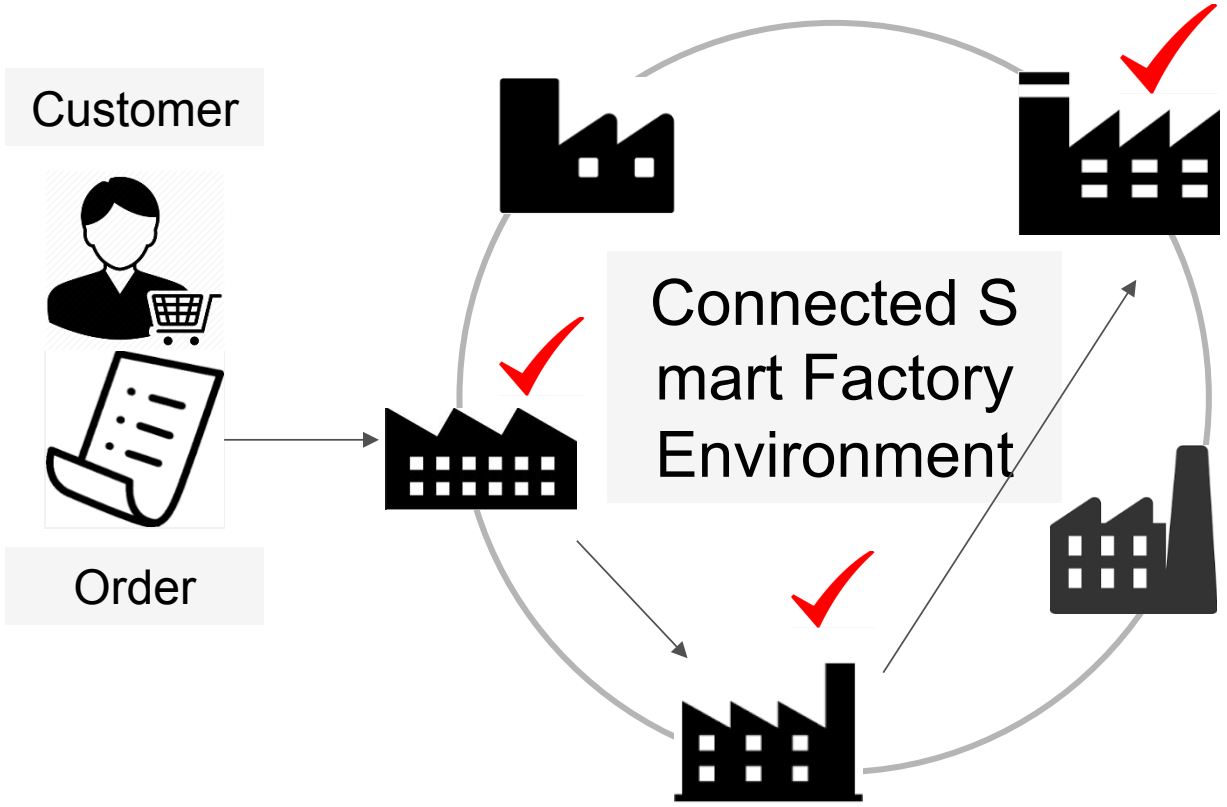


User Interface

Application

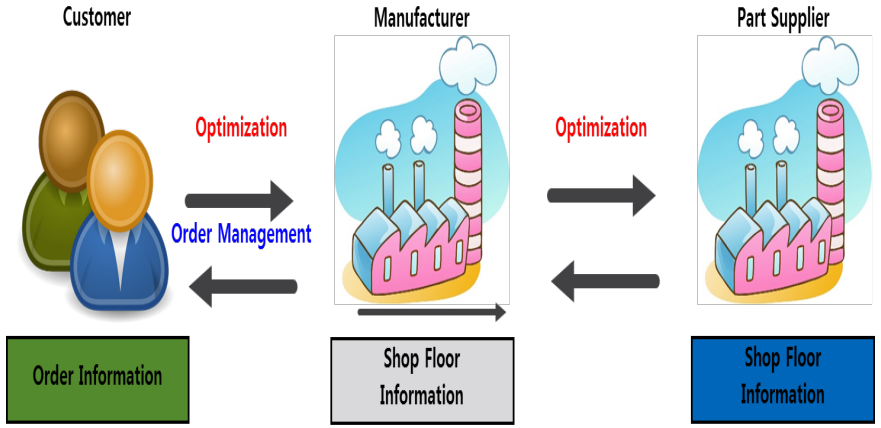
Conceptual modeling of inter-factory architecture♪

- **To meet customers' needs in a connected Smart Factory environment**
  - Function to make dynamic supply chain meeting delivery date and product specification(1)
  - Function to share information among partners in a supply chain (2)



Requirement analysis of inter-factory architecture♪

- **Identifying stakeholders and extracting stakeholder requirements**
  - To catch stakeholder requirements which are affected direct and indirect regarding developing inter- factory m anagement system
  - Totally 36 stakeholders requirements



Identifying major stakeholders

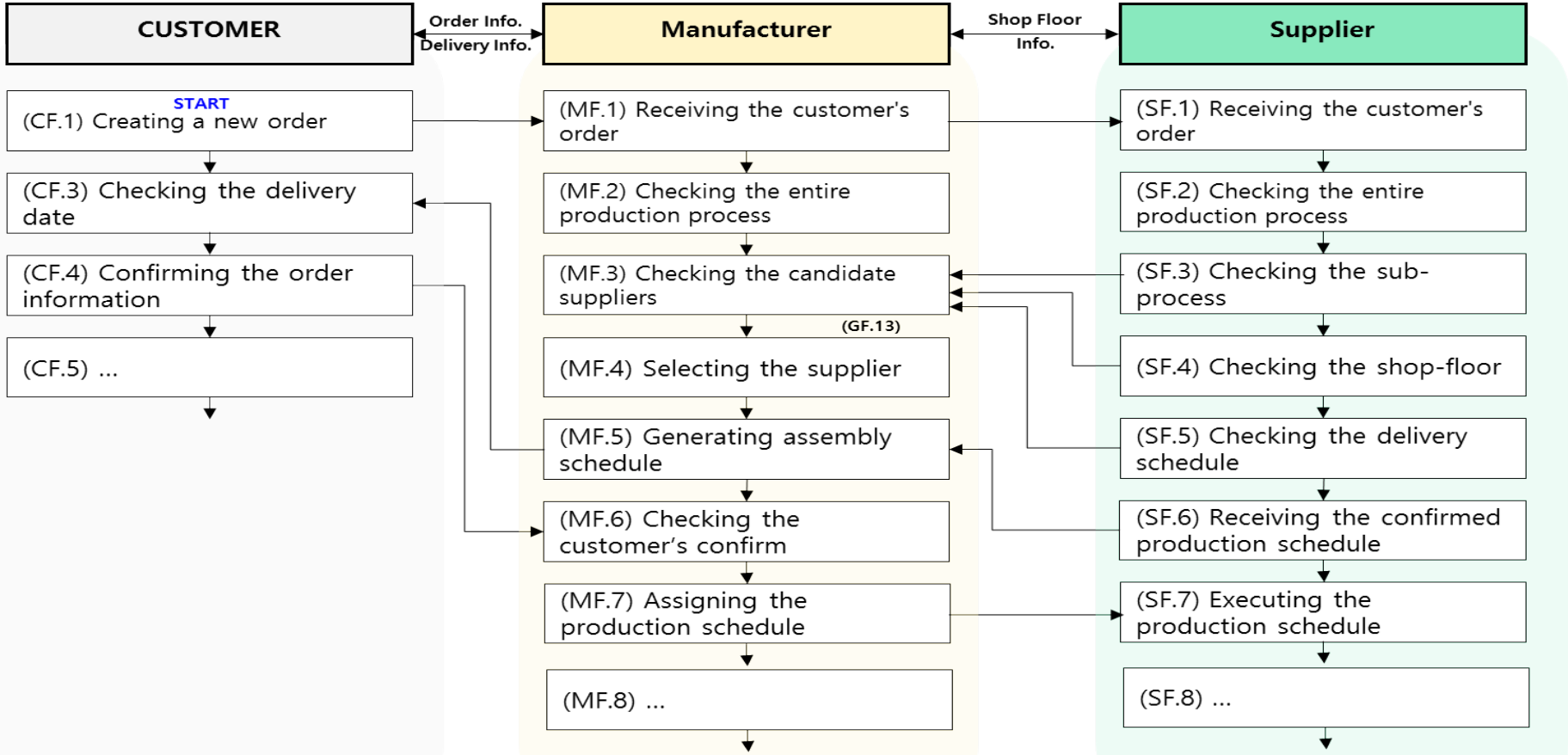
Stakeholder Requirements			
No.	Name	Description	Func.
StR.1	Estimating customer's order	Inter-MF application should receive customer's order information.	O
StR.2	Recognizing manufacturing process	Inter-MF application should recognize overall manufacturing process for the product which the customer ordered.	O
StR.3	Checking available suppliers	Inter-MF application should identify available suppliers to build supply chain.	O
StR.4	Confirming customer's order	Inter-MF application should have a commitment based on customer's estimate	O
StR.5	Building supply chain	Inter-MF application should build manufacturing supply chain using confirmed customer's order.	O
StR.6	Manufacturing products	Inter-MF application should manufacture the product which the customer ordered with the manufacturing supply chain.	O
StR.7	Closing order	Inter-MF application should close the customer's order after delivering the product to the customer.	O
StR.8	Receiving product specification	Inter-MF application should have product specifications which the customer ordered.	O
…	…	…	…

Stakeholder requirements

Operation Scenario of inter-factory architecture♪

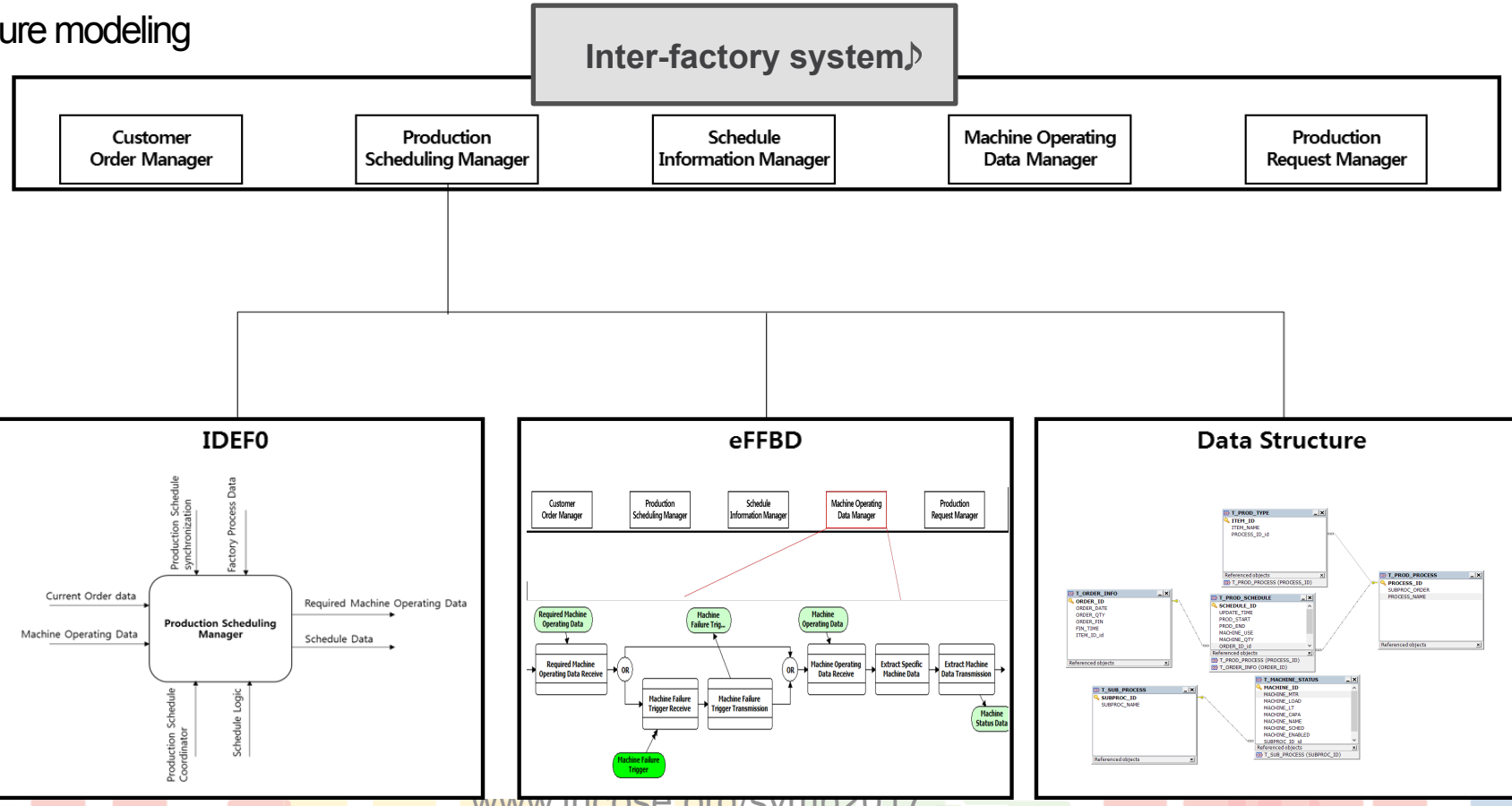
❑ Basic Operational Scenario

- Developing operational scenario modeling based on identified stakeholder requirements



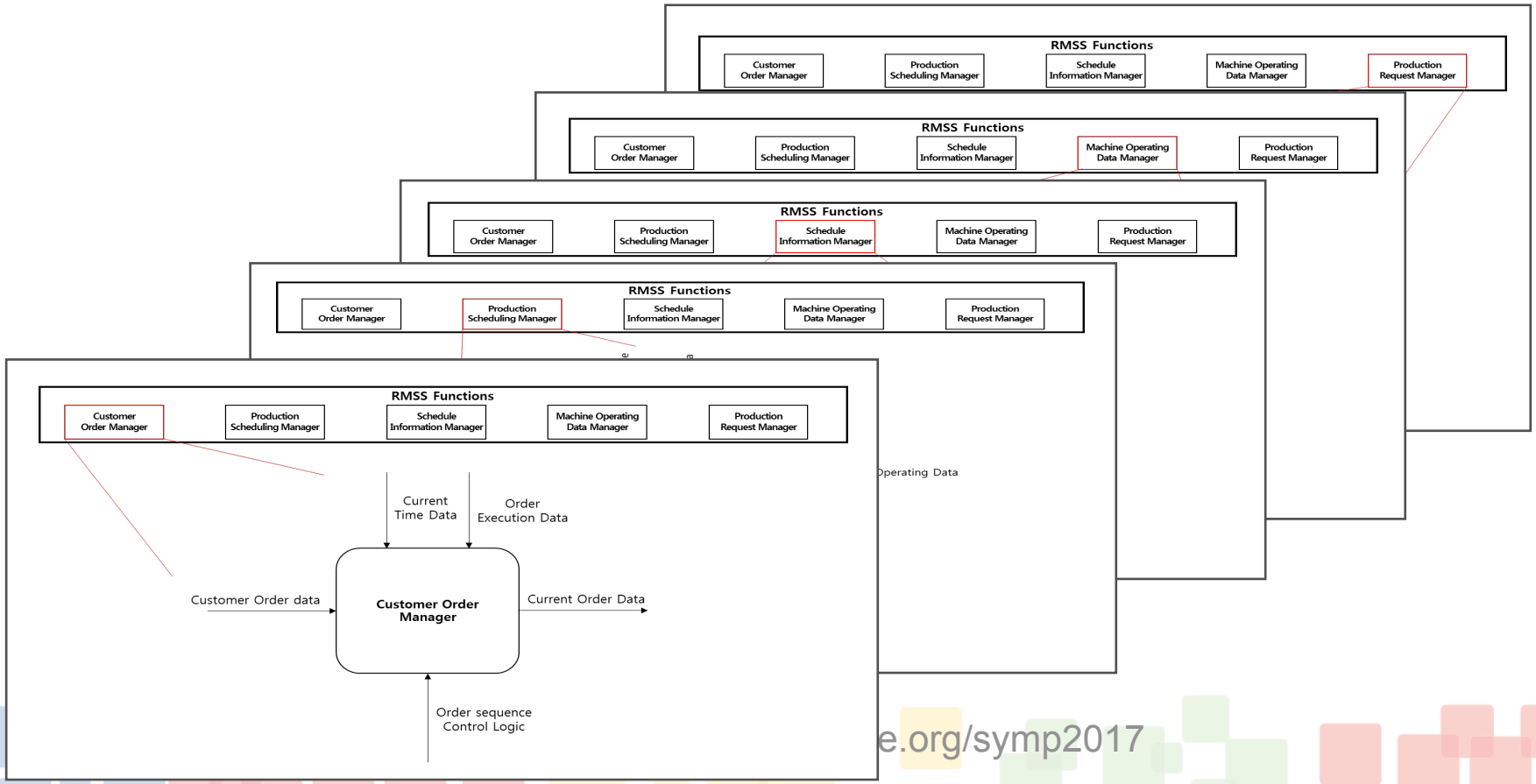
Designing logical architecture of inter-factory system♪

- **Performing detail design based on five components**
  - Function modeling using IDEF0
  - Dynamic modeling using eFFBD
  - Data structure modeling



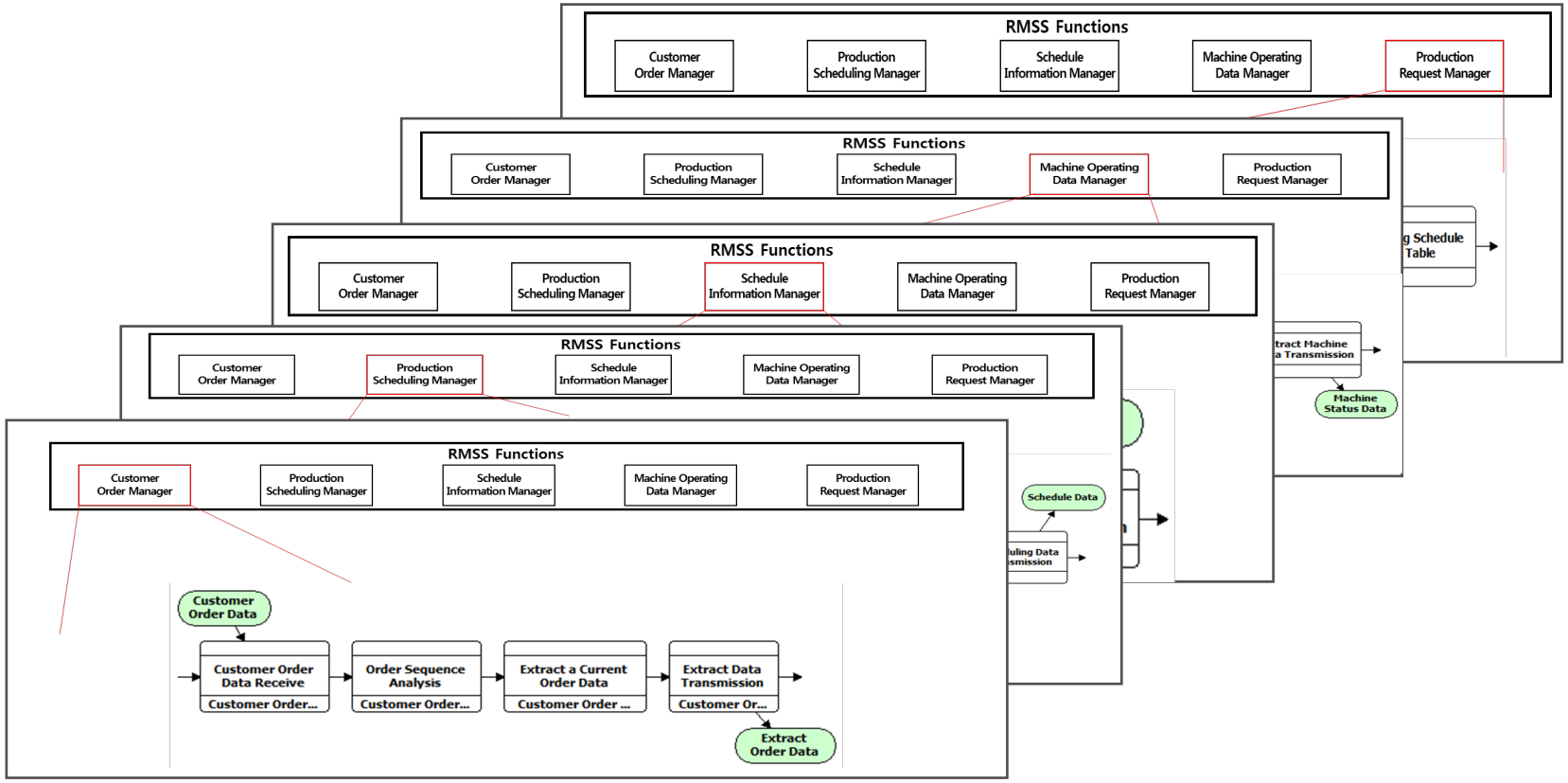
Function modeling of inter-factory architecture♪

- **Major five functions modeling using IDEF0**
- **‘Customer Order Manager’, ‘Production Scheduling Manager’, ‘Schedule Information Manager’, ‘Machine Operating Data Manager’, ‘Production Request Manager’**



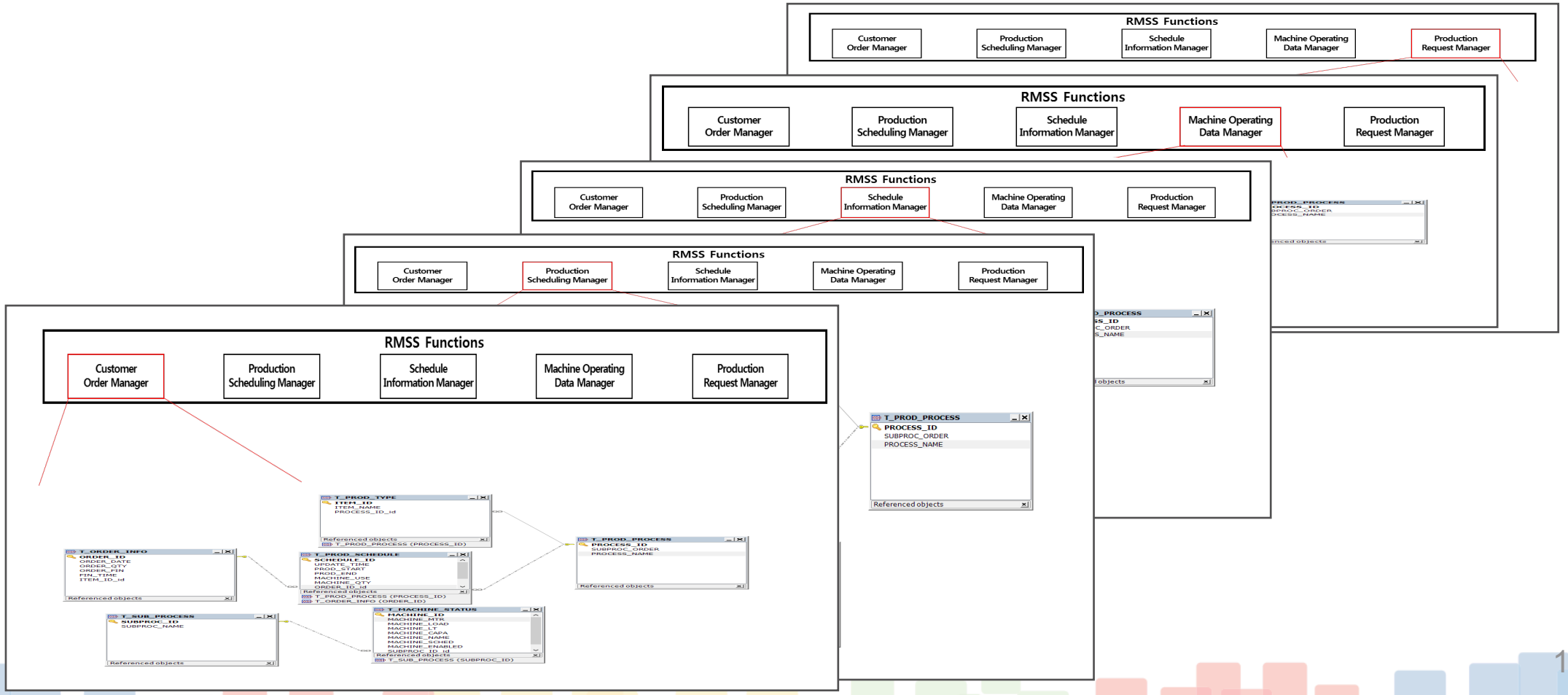
Dynamic modeling of inter-factory architecture♪

- **Major five functions modeling using eFFBD(Extended Functional Flow Block Diagram)**



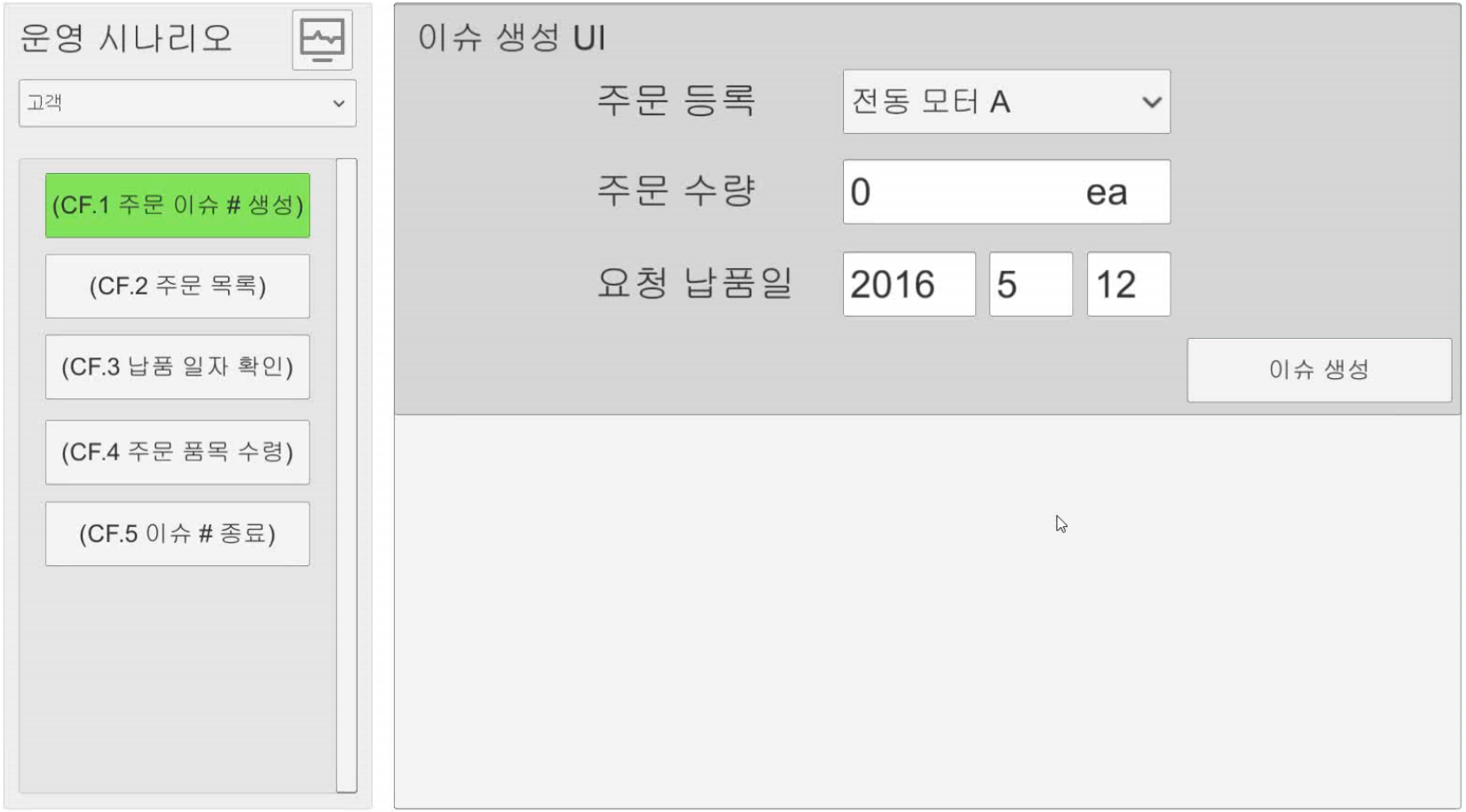
Data structure modeling of inter-factory architecture)

- **Designing the detail structure of data**
- **Consisting of Table, column name, column ID, and Data type**



Development of inter-factory prototype system

- **A web based inter-factory prototype system for supporting dynamic supply chain**



Conclusion♪

- **Research summary**
  - Inter-factory system, a connection concept of the modularized unit factories in order to optimize production acc ording to customer's order specification
  - Suggesting a conceptual model of the inter-factory system to optimize manufacturing supply chain according t o the customer's needs in real time
  - Making the operation concept of inter-factory, defining key components, and designing system architecture ba sed on systems engineering approach
  - Developing a prototype system with key features of inter-factory application in order to validate effectiveness o f this study

- **Further research**
  - Focusing on dynamic supply chain based on discrete manufacturing process, not continuous manufacturing pr ocess
  - The scope of following research♪

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