How can services help SMEs enhance productive capacity?  
With the focus on “Ppuri Industry”

by

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How Can Services Help SMEs Enhance Productive Capacity?

-with the focus on “Ppuri Industry”-

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Sung Duk Kim, Ph.D.
Ppuri industry is the manufacturing industry that produces components and finished products using manufacturing process technologies such as casting, molding, metal forming, welding, surface treatment, and heat treatment.
Proportion of manufacturing sector by nations

Sources: https://unstats.un.org/unsd/snaama
The Reality?

3D Industry

- DANGEROUS
- DIRTY
- DIFFICULT

Costs

Hiring

Job Wanted!

Productivity
What Should We Do?

3D Industry
- Dangerous
- Dirty
- Difficult

ACE Industry
- Automatic
- Clean
- Easy

System Automation
Emission-free Process
Simplified Process
Smart Factory
Energy saving Process
System Integration
1. Ppuri Industry-Specialized Complex Project

- Designating complexes as a cluster of Ppuri companies to enhance productivity and reduce environmental costs

- Supporting sharable facilities and innovative activities
  - Sharable facilities: common wastewater treatment plant system, waste heat retrieval system, recyclable energy generation facility, etc.
  - Innovative activities: planning new ideas to enhance productivity
Wastewater treatment costs of surface treatment plants

Cluster & Integration

<Industrial Complex-Type>
Cost: 15 ~ 20 USD/ton

<Independent Operation>
Cost: 150 ~ 200 USD/ton

<Apartment-Type>
Cost: 10 ~ 15 USD/ton
2. Process Automation & Optimization Project

- Facilitating automation and optimization for improvements in productivity and work environment of Ppuri industry

**Surface Treatment (SAMIL BUFFING)**

Automation of the plating process
⇒ Increasing productivity and improving working environment

**Casting (CASTEC KOREA)**

Replacement of manual pouring with a stopper-type automatic pouring system
⇒ Increasing productivity and preventing workplace accidents

**Welding (YUSEUNG)**

Integration of manual assembly and inspection process into a continuous automatic system
⇒ Decreasing defect rate and shortening the working hours

**Before**

- Automation of the plating process:
  - (2.4 ton/day)
  - (51.8 ton/day)
  - (500 unit/hr)

**After**

- Automation of the plating process:
  - (4.5 ton/day)
  - (55.3 ton/day)
  - (600 unit/hr)

**Surface Treatment**

- 87.5%

**Casting**

- 6.8%

**Welding**

- 20.0%
## Smart Factory Project

An intelligent factory that produces customized products using ICT in all manufacturing processes

<table>
<thead>
<tr>
<th>Planning and Design</th>
<th>Manufacturing Process</th>
<th>Supply Chain</th>
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</thead>
<tbody>
<tr>
<td>Product performance</td>
<td>Real-time communication between components</td>
<td>Predicting the needs of customers in real time</td>
</tr>
<tr>
<td>simulation</td>
<td>Improving facility efficiency and mass customization</td>
<td>Optimizing net profits and improving customer service</td>
</tr>
<tr>
<td>→ Developing customized products</td>
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- **Resource efficiency**
- **Productivity**
- **Flexibility**
Levels of Smart Factory of Ppuri Industry

Level 0 (ICT not applied)
- Manually managed production

Level 1 (Basic)
- Limited process automation
- Online connectivity with key business partners

Level 2 (Intermediate 1)
- IT-based production management
- Online connectivity with multi-tier business partners

Level 3 (Intermediate 2)
- Real-time control integration based on IT and SW
- Online connectivity with multi-tier business partners

Level 4 (Advanced)
- Customized flexible production based on IoT and CPS
- Real-time connectivity between multi-tier business partners and all supply chains
Model case 1

Mold design and manufacturing company for large high-pressure die casting

- ICT connection to the large die casting manufacturing process
- Installation of NC processing optimization program
- Real-time monitoring
  → Rapid improvement by identifying the causes of the defect

(90 hr/set)  (70 hr/set)

<table>
<thead>
<tr>
<th>Processing time</th>
<th>17% ↓</th>
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<tbody>
<tr>
<td>Defect rate</td>
<td>50% ↓</td>
</tr>
</tbody>
</table>
Model case 2

The annual production capacity of approx. 40 million pistons

1. CASTING PROCESS

2. MACHINING PROCESS

3. SURFACE TREATMENT PROCESS

PISTONS FOR AUTOMOBILE
Gasoline and diesel engine pistons for passenger cars

PISTONS FOR COMMERCIAL
Diesel engine pistons for commercial vehicles

PISTONS FOR INDUSTRIAL
Gasoline and diesel engine pistons for air compressors and construction equipment

Source: http://www.dypiston.co.kr
Key Activities in the Overall Process

- Simultaneous implementation of process design and analysis
- Engineering data collection utilizing IoT

Planning & Design

- Automatic and flexible casting process including salt core inserting process
- Development of flexible machining lines and automatic surface treatment system
- Automatic assembly system (precise measurement and vision inspection data management)

Manufacturing Process

- Integrated management system of purchase, production, and sales through SCM
Measuring the project performance

**Productivity**
- Pieces per man-hour
  - Before (15): 17.7
  - After (18): 20.9
  - Increase: 18%

**Defect Ratio**
- Defects per million
  - Before (15): 1.92
  - After (18): 0.70
  - Decrease: 64%

**Automation**
- Automation rate (%)
  - Before (15): 80
  - After (18): 88
  - Increase: 10%
Summary

All three projects help SMEs improve productive capacity

- “Specialized Complex Project” is effective for surface treatment and molding industry in need of cooperative activities such as wastewater treatment, procurement of raw materials, and logistics.

- “Automation Optimization Project” is suitable for small company units that need improvements in their work environment.

- “Smart Factory Project” is the most impactful and future-oriented project, although it is at an early stage.
Suggestions

Seven keys to a successful switch to a Smart Factory

1. Customizing smart factory construction to an acceptable level
2. Developing related technology (5G, big data analysis, knowledge information security, AR / VR, etc.)
3. Building testbeds & developing leading models
4. Supporting shared infrastructure (database server, cloud system, operational management platform, etc.)
5. Developing human resource training programs for the management of smart factory
6. Sharing case studies on success and failures
7. Arousing social interest through public relations (PR)
Thank you!

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