JGC CORPORATION

IT GRAND PLAN 2030

MANUFACTURING PERFORMANCE DAYS

Harnessing the Ecosystem Economy

Tampere, Finland | June 4th – 6th, 2019

Who is JGC Corporation?

- Name — JGC Corporation (Japanese name: NIKKI)
- Office — [HQ] 2-3-1 Minato-Mirai, Nishi-ku, Yokohama, Japan
  [Affiliate] (USA, China, Philippines, Singapore, Indonesia, etc.)
- Main business ENGINEERING
  (Engineering, Procurement & Construction of Plants)
- Established in Oct. 25, 1928 (89 years)
- Revenue — 6,550 MM$ (FY2018)
- Overseas — 73 % (FY2018)
- Workforce — 10,000 (as of Feb. 2019)
  Japan : 4,700
  Abroad : 5,300

Yokohama HQ

Petrochemical complex in Saudi Arabia

LNG Plant in Malaysia

IT Grand Plan: Why, and for whom?

POURPOSE	● **To establish a long-term IT vision until 2030 for JGC Group**
BACKGROUND	● **Advices from ExxonMobil in Dec-2017** ● **Current challenges for JGC's IT** • Looks lagging behind competitors in IT systems • Absence of long-term IT vision or a grand plan ● **Impact of digital technologies to the plant architecture and industry ecosystem**
SUCHEDULE	**May 2018 - Oct. 2018**
TEAM	Planning by the people who will be actively working for JGC in 2030 **35 working level members (under 50 years old)**
PROCESS	STEP 1 ● **Envisioning JGC's capabilities utilizing digital technologies in 2030** STEP 2 ● **In-depth research on key technologies and the industry trends** ● **Back-casting from future visions to create a roadmap**
PROPOSAL SUMMARY	● **5 innovation programs to take by 2030** ● **7 IT development programs for the next 3 years** ● **3 supporting actions at the organization level**

The Roadmap & 5 Innovation Programs

1. AI Design

- Drastic improvement in design capabilities

2. Digital Twin

- Project digital twin for simulating/ forecasting the plant and the project

3. 3D Printing/Construction Automation

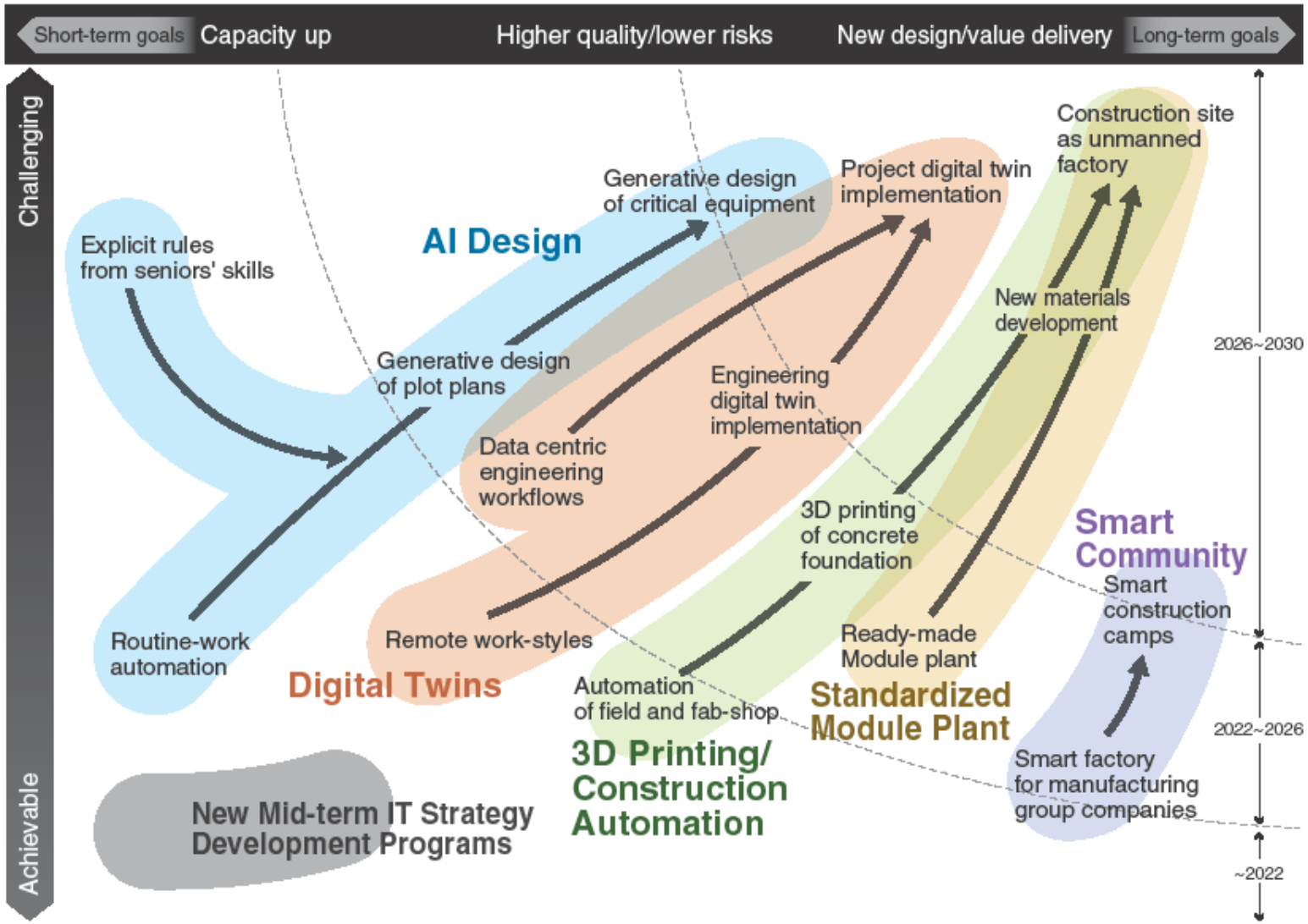
- Drastic changes in the EPC sequence
- Improving schedule, quality and safety
- Development of new materials

4. Standardized Module Plant

- Improvement of productivity and drastic reduction of project schedule
- Improving cost competitiveness

5. Smart Community

- Synergies with Manufacturing Companies in JGC Group
- Expanding Infrastructure business fields



5 Innovation Programs

1. AI Design

PURPOSE/AIM

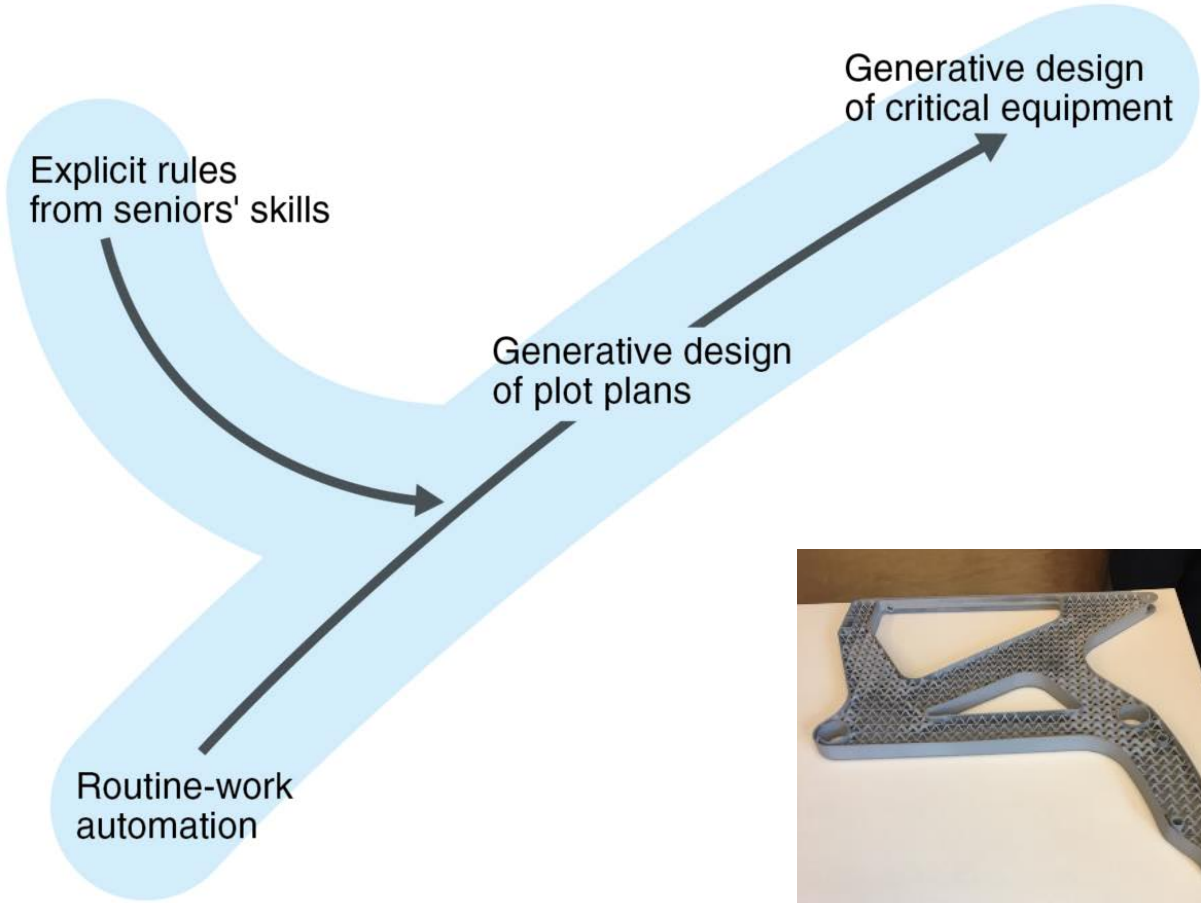
AI technology

Acquisition of explicit knowledge

Drastic improvement in design capabilities

STEPS

① Robotic automation of simple tasks
② Acquisition of explicit knowledge from senior engineers / Automated identification of specific customer requirement
③ Generative design of the plot plan / Pipe auto-routing
④ Automatic design of innovative process equipment



Example of Generative design (Autodesk Development Center)
automobile parts (3D printers for mass production) developed by GM

5 Innovation Programs

2. Digital Twin

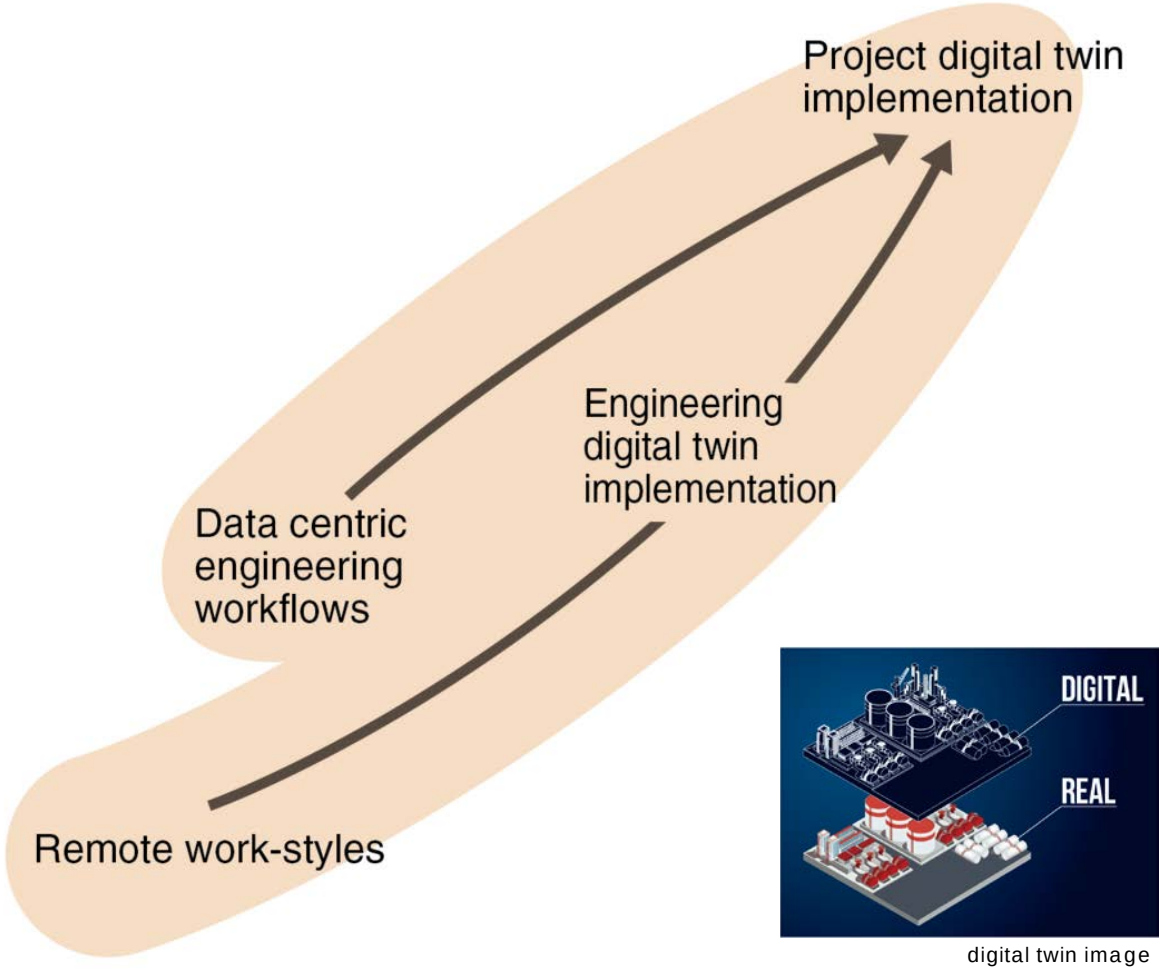
PURPOSE/AIM

Shift of Customer needs
Data Centric, Digital Twin

Development of Project Digital Twin
Project Future Forecast
Project Simulation

STEPS

① Remote working styles using cloud/5G
② Data-centric engineering workflow
③ Engineering Digital Twin
④ Project Digital Twin / Project Future Forecast



digital twin image

5 Innovation Programs

3. 3D Printing/Construction Automation

PURPOSE/AIM

Transformation from a labor-intensive construction industry to an intellectual industry

Drastic changes in the EPC sequence

Improving Cost, Schedule and Quality

Reducing Safety Risks

STEPS

① Automation of pre-fab shop and field work using IoT, robotics and drones
② Field 3D printing of concrete foundations
③ Field 3D printing of pipe rack and simultaneous piping installation using new materials
④ Automated and Unmanned Construction Sites

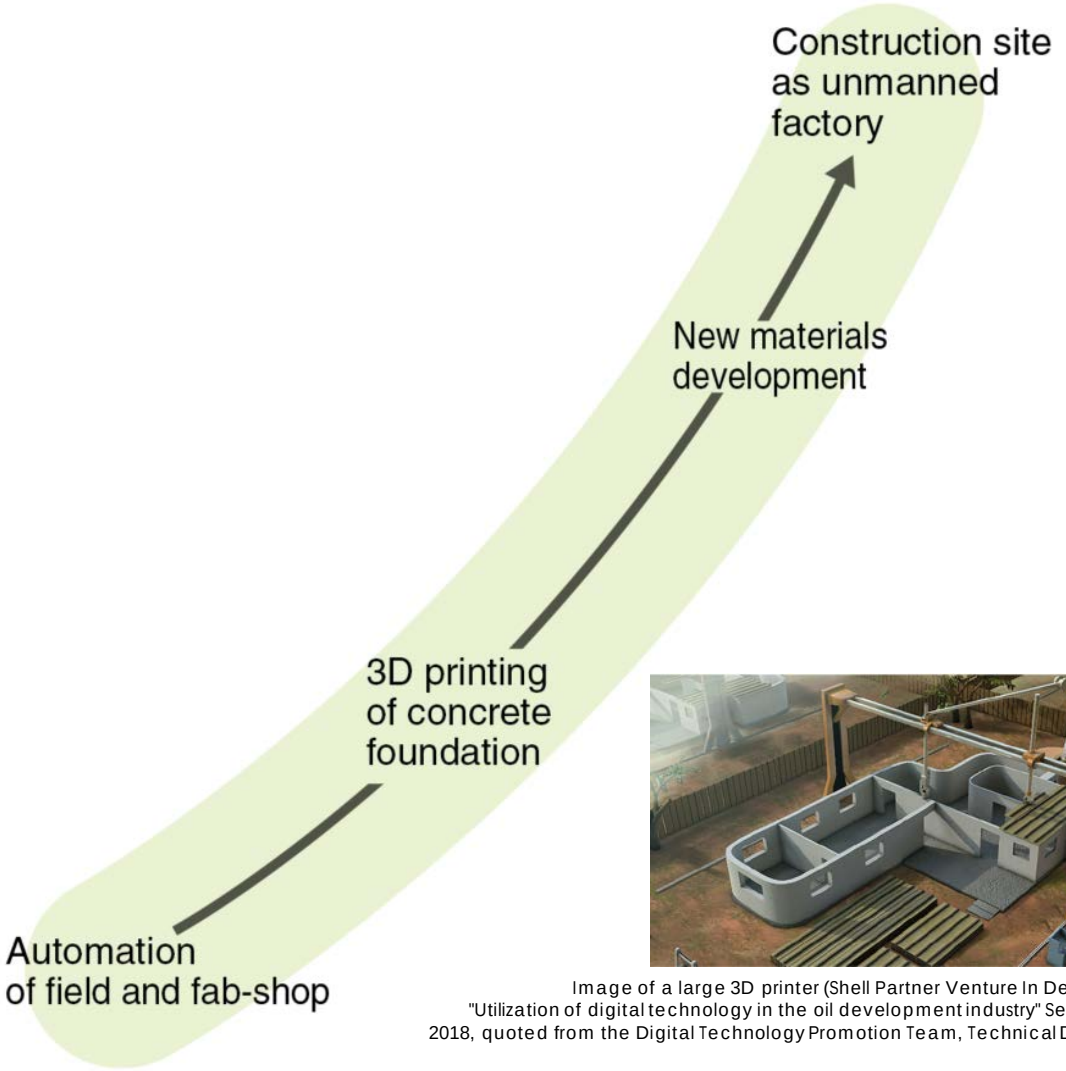


Image of a large 3D printer (Shell Partner Venture In Development)
"Utilization of digital technology in the oil development industry" September 20, 2018, quoted from the Digital Technology Promotion Team, Technical Department, JOGMEC

5 Innovation Programs

4. Standardized Module Plant

PURPOSE/AIM

Breaking away from individual design

Improvement of Productivity and reduction of PJ Schedule

Improving Competitiveness

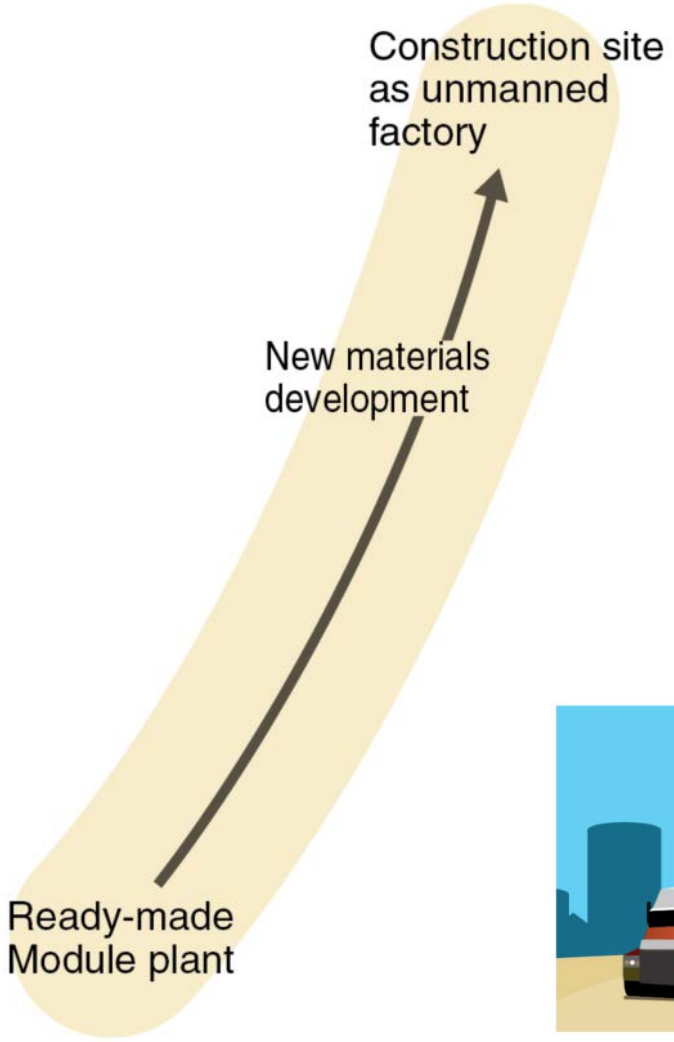
STEPS

① Ready-made Module
- Design based on standard engineering packages

② Truck-able Module
- Fabrication in factories and transportion by container ship or truck

③ Advanced Module
- New materials developed
- Generative Design
- 3D Printer

④ Automated and Unmanned Construction Sites



Truck-able Module Image

5 Innovation Programs

5. Smart Community

PURPOSE/AIM

Shift of Customer needs
Environmental Consideration

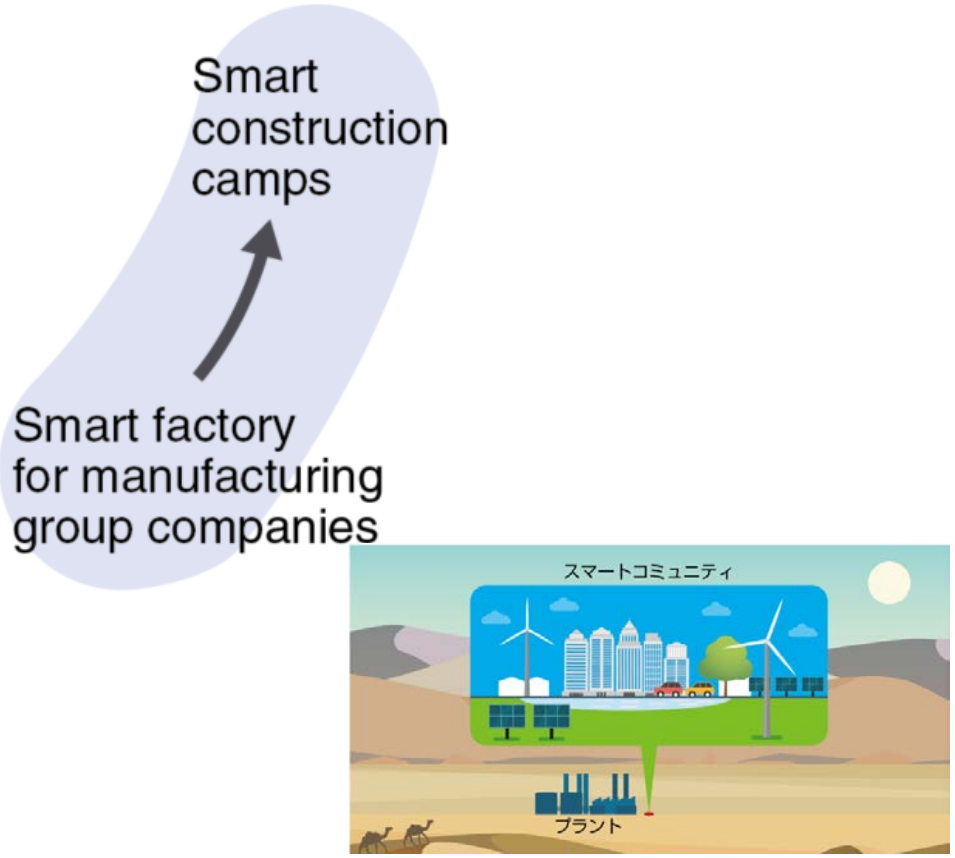
Increase demand of renewable Energy

Synergies with Manufacturing Companies in JGC Group

Expanding Infrastructure business fields

STEPS

① Smart-factories of manufacturing group companies
② Smart-camp at construction site with IoT monitoring, functioning as regional support center in disasters



Smart Community Image

7 IT Development Programs (Prescribed in the new medium-term information strategy)

- **A. Man-Power Control**
- **B. J-DMS / Correspondence System**
- **C. JGC Group Common ICT Infrastructure** (JGIP)
- **D. Data Centric EPC**
- **E. JAS** (new JGC Accounting System)
- **F. New PMS / CMS**
- **G. KM** (Knowledge Management)

(Program A - E are ongoing, F and G are not yet commenced)

3 Organizational Actions

1. Mechanisms to promote innovative ideas

- Supporting the initial idea building process ▶ "Lean Lab", etc.
- Supporting selection process of technology partners to promote joint development

2. Revision of "Mid-term IT Development Strategy" (Apr. 2018) for the next three yeas

- Revising plans of the 7 IT Development Programs
- Organizational schemes
- Identification of required budget
- Establishment of IT governance ▶ Implementation of the Digital Officer organization

3. Establishment of "IT Summit" (steering committee) by the Senior Management

- Monitoring the implementation of the IT Grand Plan 2030
- Managing the budget for IT Grand Plan 2030, coordination with other technical committees