Introduction of "Solution Linkage" making use of ICT and IoT technologies

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Hitachi Construction Machinery Co., Ltd.
1. “Solution Linkage” in Mid-term Management Plan “CONNECT TOGETHER 2019”

Kotaro Hirano
Representative Executive Officer, President, Executive Officer and Director

2. “Solution Linkage” : New value created by HCM

Hideshi Fukumoto
Vice President and Executive Officer
President, Research & Development Div
President, Client Solution Div.
Transform to the corporate structure with high adaptability to changes by improving the profitability and efficiency through value chain enhancement and business structure reform

<table>
<thead>
<tr>
<th></th>
<th>GT2016 &lt;FY2016&gt;</th>
<th>CT2019 &lt;FY2019&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted operating income ratio</td>
<td>3.7%</td>
<td>Over 9%</td>
</tr>
<tr>
<td>ROE</td>
<td>2.0%</td>
<td>Over 9%</td>
</tr>
<tr>
<td>Net D/E ratio</td>
<td>0.46</td>
<td>0.4 or less</td>
</tr>
<tr>
<td>Dividend payout policy</td>
<td>31.8%</td>
<td>Approximately 30% or more</td>
</tr>
</tbody>
</table>

< FY2019 preconditions >

| Sales revenue | ¥850 billion | Foreign exchange rate | $1=¥100 / €1=¥110 / RMB1=¥15 |

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Deepening Value Chain

Main products:
- Skid-steer loader
- Crawler crane
- Backhoe loader
- Bulldozer

Other product group:
- Skid-steer loader
- Crawler crane
- Bulldozer

Customer interests: Safety and productivity improvement, reduction of life cycle cost

Value chain business ratio:

Current
- Value chain
- New machinery

FY2019 target
- Value chain
- New machinery

Value chain:
- Marketing
- R&D
- Production
- Procurement
- Logistics
- New machinery
- Finance
- Rental
- Used machinery
- Service
- Parts
- Parts recycling

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Value Chain Connect (Construction)

**Product Development**
- Environment Responsiveness: Machinery which adopt latest exhaust gas regulation
- Energy saving and efficiency: Hybrid machinery, Electric machinery
- Automation, Computerization: ICT machinery (Application for i-Construction)

**Solution**
- Remote monitoring
- Big data analysis
- Artificial Intelligence Sensor

**Value Chain**
- New machinery sales
- Rental
- Design and construction plan
- Construction
- Inspection

**Life Cycle**
- New machinery sales
- i-Construction
- Used machinery with warranty
- Resale (used machinery)
Value Chain Connect (Mining)

Product Development
- Durability, Reliability
- Electrification, Energy saving, Safety
- Labor-saving, Automation
  - AHS (Autonomous Haulage System)

Solution
- Remote monitoring
- Maintenance management of main components
- Fleet management
  - Big data analysis

Service (M&A)
- Provision of service solutions
- Development, manufacturing and sales aftermarket parts
- Casting, manufacturing and distribution service of casting products

Life Cycle
- New machinery sales
- Value Chain
- ConSite CPR
- Wenco

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Significant changes brought to the construction and civil engineering industry

Social challenges
Declining birthrate and aging of the population
Lack of workforce, lack of skilled workforce

Deceleration of growth
From expansion of the production volume to improvement of productivity

Sustainable growth
Climate change: emission regulations, CO₂ reduction

The rapid progress of digitalization
IoT+Big Data
All things are connected by data

Fusion of real and cyber worlds
A new paradigm for automatization and labor saving

Rise of venture companies
Collapse of entry barriers and competition rules

Challenges → Methods

【Products】 → 【Products】 + 【Services】
Creating value for customer using ICT /IoT is the most important issue
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Customers’ needs

- Enhancement of safety
- Improvement of productivity
- Reduction of life-cycle cost

Solution Linkage

ICT/IoT solutions solving problems together with customers

One Hitachi
Hitachi Construction Machinery
Open Innovation

AHS: Autonomous Haulage System
ICT: Information & Communication Technology

* Wenco, ConSite is a registered trademark of Hitachi Construction Machinery Co., Ltd.
* Solution Linkage is currently applying for registered trademarks.
New value created by Hitachi Construction Machinery

Customers’ needs

Enhanced safety
Productivity improvement
Reduction of life-cycle cost

Solution Linkage
ICT /IoT solutions solving problems together with customers

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Most important issue: maximizing the management efficiency through innovations

Optimization including electricity, fuel, logistics fields

Improvement of operation efficiency utilizing data from sites around the world

Unmanned and automated excavation, loading, transportation etc.
Offering operation management system currently used in 150 mine sites around the world, mainly in open pit mines

- Open platform enabling customers to freely utilize data
- Expansion of functions and business categories due to full utilization of Hitachi's funds, credit and technologies
Basic functions

- Fleet Management
- Fleet Dispatching
- Machine Guidance

Extension functions

- Safety and Navigation
- Mine Intelligence
- Maintenance
- Others
AHS - Autonomous Haulage System (AHS) for dump trucks

MAP management of mining
Stop/Restart instructions
Operation management

Control tower

Soil dropping location recognition
Approaching, soil dropping

Travel route recognition

Obstacle detection

Shovel position recognition
Approaching, loading
AHS Development Concept

Scalability
Hitachi’s railway blockage management system keeps data traffic per unit under control and can handle hundreds of fleets.

Flexibility
Dump trucks equipped with Hitachi’s automobile electric control technology and AC motor control technology can be converted into AHS model after delivery.

Agility
Realized fast system improvement meeting customers’ needs due to state-of-the-art model-based development and simulation technology.
Further developments
FY2017: Commercialization test in progress
FY2018: User test (planned)
FY2019: Commercialization (planned)
New value created by Hitachi Construction Machinery

Customers’ needs

Enhanced safety
Productivity improvement
Reduction of life-cycle cost

Solution Linkage
ICT /IoT solutions solving problems together with customers

AHS Solutions [Autonomous Haulage System]
Fleet Management Solutions
ICT Solutions fori-Construction
Service Solutions

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Machine control that can be selected regardless of operator's skills

Solution Linkage Assist

Each process is seamlessly connected

Solution Linkage Cloud

Optimization of the relationship between people and work due to mobile solutions

Solution Linkage Mobile
ZX200X-6  Equipped with Solution Linkage Assist

Offering ICT construction machinery capable of handling both 2D-MC and 3D-MC

- The operator recognizes and sets the standards
  - 3D design data unnecessary
  - Use of fixed ruler

- Recognition of excavated surface by position information
  - 3D design data required
  - Drastic reduction of fixed rulers
Establishment of a cloud platform enabling open innovations by seamlessly connecting 3D data of each process
Survey using drone
Survey using laser
3D point cloud data

Solutions necessary for ICT construction

Survey using drone
3D design data
Calculate cut/fill volume
ICT backhoe
ICT bulldozer
ICT roller
Support of data delivery

List of our company’s open innovations

Survey using UAV/Survey using laser
3D design data

Terra Drone, Kokusai Kogyo, LIKANOS, HIRAI SOKKEN, UNITEC, Kitamura Survey, Geo Research, NT GEOTEC CYUBU, NISOHKEN, COSMO, Jitsuta, Koishi, Geotex chugoku etc.

Sale of construction software
Kensetsu System, FUKUI COMPUTER

Provision of installation service and products
NIKON-TRIMBLE, TOPCON, LEICA

Inspection and form creation
Kensetsu System, FUKUI COMPUTER, SITECH

Cloud service
Trimble, Hitachi Solutions

Location information distribution
JENOBA, Nippon GPS Data Service

Support center
Hitachi Systems
**Customer collaboration case example: Kimura Corporation**

**Effect**

1. Customers are accumulating know-how in the company
2. Improvement of safety (fixed ruler near machine is unnecessary, etc.)
3. Reduced construction period by ~ 2 weeks
4. Optimization of on-site management
5. Changes in working style due to shortened construction period

**Solutions necessary for ICT construction**

- Survey using drone
- Survey using laser
- 3D point cloud data
- 3D design data
- Calculate cut/fill volume
- ICT backhoe
- ICT bulldozer
- ICT roller
- Support of data delivery
- Survey using drone
- Survey using laser
- 3D point cloud data
- ICT construction solution

*Partly supported by Hitachi Construction Machinery Group*
Further developments
Digitization of construction machines + Pursuance of solutions for optimization of relationships between people and work

- Corresponding to i-Construction
- Solution Linkage Assist
- Solution Linkage Cloud
- Solution Linkage Mobile

Other industries, overseas expansion
Multifunctionalization including load measurement, work condition analysis and safety functions.
Expansion of Solution menu
Expanding the number of sites introducing technology
New value created by Hitachi Construction Machinery

Customers’ needs

- Enhanced safety
- Productivity improvement
- Reduction of life-cycle cost

Solution Linkage

ICT /IoT solutions solving problems together with customers

- AHS Solutions (Autonomous Haulage System)
- ConSite (registered trademark of Hitachi Construction Machinery Co., Ltd.)
- Wenco
- ICT Solutions for-i-Construction

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AHS: Autonomous Haulage System
ICT: Information & Communication Technology
We constantly monitor machines with remotely and support stable operation with our data report service

- **Distribute data report** to 68,000 units worldwide via our **fully automated system**

- Assess malfunction risk from sensing data. **Distribute of alarm report and correspondence manual automatically** in accordance with the seriousness of problem

- **Strengthen efforts for sign diagnostics** and further expand service menus in the future

---

**Offered worldwide**

Registered number exceeded 68,000

* Started service in 2013
  As of October 31, 2017
Aiming to achieve a predictability detection rate of 90% or more by utilizing operation data accumulated from approx. 250,000 communication terminal loading machines and introducing IoT technology.

Remote prognostic detection rate using sensing technology:

- **2020**
  - Target: 90% or more

- October 2017
  - ConSite OIL

Improvement of various service menus to optimize on-site work.

- 2000
  - Communication start
- 2013
  - Launched ConSite
  - 37%
- 2020
  - Target: 90% or more
Launched ConSite OIL to improve prognostic detection rate

October 2017
To initiate worldwide promotion of ConSite OIL enabling 24-hour oil monitoring for the first time in the construction machinery industry, we have launched a campaign in Europe and Australia.

【Supplement】 Necessity of preventive maintenance based on oil diagnosis

If you do not perform proper oil management and maintenance…

Because of sudden trouble
- Machine breakage

Due to repair after trouble occurrence
- Increase of running cost

Due to response after trouble occurrence
- Increase of repair time

Risk avoidance based on oil diagnosis is important
Aiming to differentiate ourselves from other competitors by introducing oil sensors to the industry

- **Oil sensor:** Detects the state of the oil in each machine by sensor, which could only be judged by color change with the conventional model.

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<th>Monitoring period</th>
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<td>Engine oil</td>
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<td>Keep thoroughly watching every day, not regularly, until scrap during operation</td>
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<td>Hydraulic oil</td>
<td>Oil contamination: moisture, soot, fuel mixture</td>
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  - Engine oil
  - Hydraulic oil

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**<ConSite OIL installation image>**

**Past**
- Regular oil analysis conducted semi-annually requires labor, time and cost as we need to contract the analytical company.

**After introduction**
- Guarantees safety with 24-hour/365-day watch system!
- Reduces repair costs due to timely response!
- Increases speed of response by use of single sensor!

**ConSite OIL sensor performs 24-hour monitoring**

Detects abnormality

Corresponding manual

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Future prospects of Solution Linkage

Improve customer safety and productivity and reduce life-cycle cost

Promote customer collaboration for ICT solutions for all industries involving construction machinery

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Hitachi Construction Machinery Co., Ltd.
Public Relations Strategy office