Partnership driven Business Growth in Komatsu

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Partnership driven Business Growth in Komatsu

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6. Challenge
1. Komatsu DNA of “MONOZUKURI”

- Outline of Komatsu and Business History
- Komatsu Product Line
- Komatsu Way
1-1. Outline of Komatsu (FY2014 Business Results)

- Established: May 13, 1921
- Net Sales: ¥1,978.6bn
- Ope Income: ¥242.0bn
- Affiliated Companies: 177
- Employees: 47,417

Sales* by Segment

Construction/Mining/Utility Equipment
(¥1,761bn)
- 11%
- 89%

Industrial Machinery, etc.
(¥217bn)
- 11%

As of March 31, 2015

Construction/Mining/Utility Eq. Sales* by Region

- Japan 19%
- North America 19%
- Europe 8%
- Latin America 15%
- Rest of Asia 12%
- China 6%
- Africa 6%
- Oceania 8%
- Middle East 3%
- CIS 3%

*by Final Delivery

As of March 31, 2015
1-2. Business History

Exch. Rate (JP¥/US$) - Plaza Accord - Yen on a rise - Stable exchange - Yen alone high

Pegged rate (US$=JP¥360) - Floating rate

【Sales】

Consolidated Sales (Left Scale) - Overseas Sales Ratio (Right Scale)

CAT entry into Japan

Operating income ratio

Construction
Mining

Construction
Mining

Construction
Mining

Construction
Mining
1. Komatsu DNA of “MONOZUKURI”

- Outline of Komatsu and Business History
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1–3. Komatsu Product Outline (1/4)

**PC01**
- Bucket capacity: 0.008 m³
- Machine weight: 300 kg

**PC8000**
- Bucket capacity: 42 m³
- Machine weight: 752,000 kg

**D21**
- Blade capacity: 0.57 m³
- Machine weight: 3,940 kg

**D575**
- Blade capacity: 69 m³
- Machine weight: 152,600 kg
HD255
Loading capacity 25,000 kg

960E
Loading capacity 327,000 kg

WA10
Bucket capacity 0.16 m³
Machine weight 1,065 kg

WA1200
Bucket capacity 20 m³
Machine weight 216,400 kg
1-5. Komatsu Product Outline (3/4)

Road work in New York

Pipe-layer working in extreme coldness in Siberia.

Forestry machine valued in Nordic Countries

<Workplace>
- Extremely cold
- $-50^\circ C$

<Harsh Operating Conditions>
- Operating Hours
  23hrs/day $\rightarrow$ 6,000hrs/year
  $\rightarrow$ 60,000hrs in 10 years
- Temperature range
  Extreme cold $-50^\circ C \sim +55^\circ C$ hot
- Altitude Max
  at 4,600m elevation

Driver-less dump truck operating in Australia

Utility equipment used in urban area in Europe
1–6. Komatsu Product Outline (4/4)

Construction/Mining Equipment

Hydraulic Excavators

- **No. 1**
  - 0.3～42m³
  - (7～770t)

Bulldozers

- **No. 2**
  - (4～108t)

Dump Trucks

- **No. 2**
  - (37～580t)

Motor Graders

- **No. 2**
  - (17～30t)

Wheel Loaders

- **No. 3**
  - (7～216t)

Sales Ratio to the Overall Sales

<table>
<thead>
<tr>
<th></th>
<th>C/M equipment</th>
<th>Ind. Mach. etc.</th>
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<tbody>
<tr>
<td>Share No. 1</td>
<td>51%</td>
<td>49%</td>
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<td>Share No. 1+2</td>
<td>88%</td>
<td>84%</td>
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</table>

Industrial Machinery, etc.

Machine Tools for automobile manufacturing: Komatsu NTC

- **No. 1**
  - Wire saws
  - Crankshaft millers

Forklift Trucks

- **No. 1**
  - Forklift trucks

Large Presses for automobile manufacturing

- **No. 2**
  - Transfer machines

Sheet-Metal / Metal Forging Machines: Komatsu Industries Corp.

- **No. 2**
  - Servo presses
  - Plasma cutting machines

Semiconductor manufacturing equipment: Gigaphoton / KELK

- **No. 1**
  - Thermoelectric modules
  - Excimer lasers

Figure in ( ) is machine weight.

Sales Ratio to the Overall Sales

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1. Komatsu DNA of “MONOZUKURI”

- Outline of Komatsu and Business History
- Komatsu Product Line
- Komatsu Way
1921

<Founder’s Philosophy>
- Overseas markets in perspective
- Quality first
- Technical innovation
- Human resource development

Founder: Meitarou Takeuchi

1. Corporate governance
2. Enhancement of “MONOZUKURI”
   - (1) Pursuit of quality and reliability
   - (2) Customer-oriented
   - (3) Headwater-oriented
   - (4) GENBA-oriented
   - (5) Policy deployment
   - (6) Develop partnerships
   - (7) Develop human resources

3. Customer-oriented mind (Brand Management)

   Selling: Sell what is made
   Marketing: Sell what is in need on market
   Branding: Keep sustainable business

Emphasis in marketing shifting from “Deal” to “Relationship”
(Sell products) (Keep sustainable business)
2. Komatsu Business Strategy
2-1. Komatsu Strategy and Products

Customer Value

Think from customer’s perspective

Phase 1
[Improve machine values]

- DANTOTSU performance
  - "Emissions / Fuel economy" "Safety" "ICT"

Hybrid Excavators

DANTOTSU Products
High price enabled by added values

Phase 2
[Visualize machine operations]

- Comms with machines
  - Fleet management • Big data
  - Services, Retail finance

DANTOTSU Services

Phase 3
[Visualize work processes]

- Create new business models

Efficient Work + GEMBA Management
- Integrated equipment & project management
- Lowering customer’s whole cost
- Autonomous / Intelligent machine control

DANTOTSU Solutions
Creation of new values for customers

Mining
Construction

Revenue increase over the values chain

Growth Strategy
2-2. Definition of DANTOTSU Product & Examples

● Definition of DANTOTSU Product

Must satisfy the following 2 criteria.

Must excel in more than one aspect of safety, environment & economy, by ICT with a several-year lead.

+ Must enable raising retail prices (Substantial margin increased)

= DANTOTSU Product

● Examples

DANTOTSU operator sight: 40% improved
Bulldozer D51PX-22

DANTOTSU fuel economy: 30 to 40% improved
Hybrid Excavator HB205-1

DANTOTSU fuel economy: 30% improved
Forklift Truck FH40/45-1
2–3. Product Strategy in view of Customer Field Jobs

Customer Value

Think from customer’s perspective

Phase 1

[Visualize machine operations]

- DANTOTSU performance
  - Fuel economy, emissions, vibration/noise
  - Usability, functions, durability
  - Ergonomics, easy operation, safety

Phase 2

[Visualize work processes]

- Efficient Work + GEMBA Management
  - Integrated equipment & project management
  - Lowering customer’s whole cost
  - Autonomous / Intelligent machine control

DANTOTSU Products

- Communications with machines
  - Fleet management, Big data
  - Services, Retail finance
  - Lowering machine’s life cycle cost

DANTOTSU Services

DANTOTSU Solutions

Customer’s GEMBA

Use of M2M comms transforms manufacturer to service provider.

R&D  Production  Sales  Product Support

Product Quality, Product Support + Improving of customer’s business process

Go in customer’s GEMBA

Customer Business

Customer Values

Think from customer’s perspective
2–4. KOMATSU Strategy

Together We Innovate GEMBA Worldwide

KOMATSU medium-term management plan

**Improve Quality of Product**

We provide **the best products** to customers **continuously**.
- High Quality
- High Performance
- High Reliability
- Safety

These are competitive.

**Dantotsu Solution**

**Provide new Value to Customers**

We should provide **the best service** to customers. The best service should match **customer earnings structure**.

Once we understand **customer environment and their concern**, we can create **New Values** customer has not noticed yet.

**Dantotsu Service**

**Dantotsu Product**

- Improve Quality of Product
- Together We Innovate GEMBA Worldwide
- Dantotsu Solution
- Provide new Value to Customers
- Dantotsu Service
- Dantotsu Product
2–5. Create a new Value by DANTOTSU Service

Meet customer’s expectation?

Customer’s concern
Market Environment

What is Dantotsu service?

- Timely parts delivery
- Quick repair and maintenance
- Reasonable service contract
- …

Common Sense Service

Shift the view point to Customer oriented

To create new values for customer, it has become essential that we review customer earnings structure. After understanding it, we should approach with the most effective way. Even a customer has not noticed it’s value.
2-6. Customer View point in the Production Cost

Get strong competitiveness through customers’ $/Ton cost down by not only TCO reduction but also production improvement.

Machine Cost form a small part!

Customer’s concern

Production Cost ($/ton) = TCO/h ($/h) = Production/h (ton/h)

Multiplications have big effect!

How do we improve TCO and Production?

Operator
Fuel
Parts & Repair
Tire

Machine Cost

TCO reduction
LCC reduction

Maintenance, Repair, OV
Tire + Fuel + Operators wage

Machine Cost

Down

Job efficiency (%)
Payload
Cycle time
Availability
Utilization

Down

Production improvement

Up
Proposals for production improvement: Continuous Improvement activities

- Payload analysis
- Operation analysis
- Course analysis
- Time efficiency analysis
- Operation analysis by operator

Propose operation improvement, reduction wasted time and training

Reduce Operation Cost: Repair & Maintenance activities

Production Cost ($/ton) = TCO ($/h) / Productivity (ton/h)

Predict and enhance component life
<Monitoring severity, trend of characteristic value>

Condition based maintenance
<Planning maintenance schedule>

Monitoring availability & MTBF

Enhance capability to reduce machine down and break through daily monitoring
Enhance component life by condition based maintenance to make more money

Support tool for R&M and CI activities of a distributor

KOMTRAX KOMTRAX Plus

Big Data

Telematics

Monitor

AE
Dantotsu Solution

Strategy

Dantotsu Service

Dantotsu Product

The Best Products

Automation and Management system

Implement the best knowledge into automation and management system!

“The Best Usage” of machines

Big Data Analysis

Telematics

ICT Construction Machine

AHS
“For production – what we get from our best day in a manned operation we get everyday from an autonomous operation”

- Anonymous customer quote
2-10. Enhancing Customer Value Added by ICT Service

Customer’s Goal

- No Harm: Safety First
- Increase Production
- Save Cost
- Protect Environment
- Semi & Full Automated Operation

KOMATSU’s Possible Value

- Safe Product linked with Safety Management
- High Machine Performance with Better Operation
- Robust Product with Health Monitoring & Management
- Competitive Initial Cost and Low Maintenance Cost
- Efficient Machine Performance with Economic Operation
- Innovative Technology for Job-site Automation

High Quality Machines can be more valuable with better usage.

Practical use of ICT
By utilizing this system...

- Where the machine is located,
- When and how often the machine is working,
- How the machine is used,
- Which machines need maintenance, etc. can be known at the office.
3-2. Telematics in KOMATSU

**Telematics System for construction machine**

Statistic operation analysis by DBs, Countries, models, etc.

- D275
- PC850
- HD405
- WA500

**Machine Health Monitoring System for Mining machine**

In-depth analysis focused on a machine.

- D375
- PC1250
- HD465
- WA600
1997-1999
Test of HD785-5 in Australia

2000
1st Production HD785-5 with VHMS Delivered for construction of Kansai Int'l. Airport

2005
Start as Standard In Japan
Start as Standard In China
Start as Standard In C.S.A.
Start as Standard In North America and Europe
Start as Standard In Oceania

2010
Start as Standard In S.E.A. (Malaysia)
Start as Standard In M.E. (Turkey)

VHMS changed to Komtrax Plus

2015
YR 2007 Development of TIER II Models
Launch of Webcare

Brand name Changed

HD785-5 in Australia
3-4. KOMTRAX System Overview
More than 388,000 machines are working with KOMTRAX.
3-6. KOMTRAX Screen Example (1/2)
3-7. KOMTRAX Screen Example (2/2)

Daily working hour/idling time

Caution Record

Daily Fuel Consumption

Load History

Oil/Filter/exchange timing management
3-8. Benefits from KOMTRAX

**Customer**
- Minimize machine stoppage
- Lowering machine life cycle cost
- Efficient administrative work

**Distributor**
- Services: Minimize downtime
- Parts: Just in time delivery
- Lowering financial risks

**Komatsu**
- Analysis of machine abnormality trends
- Product Development
- Demand forecasting / Production planning
By incorporating *Partners Knowledge* with Komtrax, Komatsu can provide better information more timely and efficiently.
4. Driver-less Truck Haulage

**Autonomous Haulage System**: AHS
World-Largest Copper Mine (Length × Breadth × Depth: 2km × 4km × about 1km)

930E (payload: 290 t)
4–2. Introduction of use cases of mining equipment

**Major resource-producing countries**

- **United States**: Coal
- **Chile**: Copper
- **South Africa**: Diamond / Gold
- **Brazil**: Iron ore
- **Russia**: Coal / Gold
- **China**: Coal / Iron ore
- **Indonesia**: Coal
- **Australia**: Iron ore / Coal

**Open pit copper mine** (Chile)

**Open pit coal mine** (China)

**Altitude**: 4,000m

**Copper ore**

**Coal**
4–3. Examples of open pit mines
4–4. Customer Benefit by AHS Operation

※ Autonomous Haulage System
(Haulage by driver-less trucks)
4-5. System configuration

- Controller of autonomous haulage system (Upper: exterior, Lower: interior)
- Operation mode light (forward)
- Steering sensor
- Operation mode light (backward)
- Obstacle detection sensor
- GPS antenna
- Radio antenna
- Side strip guidance laser
- Obstacle detection sensor
AHS basic operations

① Autonomous haulage
② Loading
③ Dumping
④ Traffic control

Mine site map displayed on monitor in operation control room (Image view)

Full view of mine site

Loading area

Dumping area
The time of Intelligent Construction has come
5–1. System Configuration

- Control Box
- GPS Box
- Radio Antenna
- GPS Antenna
- Radio Unit
- Tilt Sensor
- Electronic Control Valve
- Automatic/Manual SW
5-2. Control Diagram

Vehicle Terminal

3D Construction Data

Correction Signal from Ground Station

X, Y Data

Z Data

RTK-GPS Measurement

GPS Signal

GPS Antenna

Current Blade Location

Finished Shape

**Finished Surface** that indicates the construction surface which made and memorized beforehand
5-3. Customer Benefit by Intelligent MC Machine Operation
5-4. Komatsu Intelligent Machine Control (Dozer)

- **Typical Aftermarket Machine Control System**

- **Standard factory installed Intelligent Machine Control System**

**Cab Top GNSS Antenna**

**Stroke Sensing Hydraulic Cylinders**

- **Factory Integrated Sensor Package**
  Komatsu durability & quality with factory installation, integration.

- **Operator Selectable Load Settings**
  Machine control load settings can be adjusted between presets to tailor response to material conditions.

- **Automated operation only for finish grade**
  Issues with the Conventional IB (Blade control only by blade edge position)

- **Automated operation from rough dozing to finish grade**
  Improvement on the Dantostu Control (Blade edge position + load control + track slip control)

- **Progress can be measured in real time**
  As-Built Surface Track Mapping
  Cab top GNSS antenna provides for accurate as-built surface data collection by measuring actual elevations as machine continuously tracks in operation.

- **As-Built Surface Track Mapping**
  Cab top GNSS antenna provides for accurate as-built surface data collection by measuring actual elevations as machine continuously tracks in operation.
Automatic control keeps bucket following design surface not to dig beyond design surface. This makes operators free from mention about too much digging.
Full Integration of Komatsu Components (Stroke Sensing Cylinder etc.) and Topcon Components to ensure Komatsu Quality and Accuracy.
ICT solution for construction site named “Smart Construction” has been started.

Brand new approach of Komatsu

Traditional approach of Komatsu

Plan

Design

Construction (Before launch)

Construction (completion)

Sustention/Management

① High precision site measurement

3D map generation (utilization of drone)

② Making 3D model by plan drawings

3D data generation from 2D drawings

③ Analysis on soil, underground water / facilities

Survey & Analysis for Risks

<Under researching>

④ Simulation for construction plan

Optimized proposal for cost / period priority

⑤ Intelligent construction / management

Transfer 3D data to ICT machine -> safe / efficient construction

Design change
Support center of smart construction will accommodate

⑥ Completion

Utilize data for review / inspection

Fast recovery from damage of natural hazard in case

Put all the processes on ICT and link them organically

High precision site measurement
3D map generation (utilization of drone)
Making 3D model by plan drawings
Analysis on soil, underground water / facilities
Survey & Analysis for Risks
<Under researching>
Simulation for construction plan
Optimized proposal for cost / period priority
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Completion
Utilize data for review / inspection
Fast recovery from damage of natural hazard in case

KomConnect

Visualization of site, Continuous improvement (Plan/Do/Check/Act)
6. Challenge
6-1. Open Innovation and Fostering of Global Human Resource for development

(1) Open Innovation (the case of AHS)
- MMS (Modular Mining Systems Inc.) M&A
  The University of Arizona
  1996 Acquisition MMS
  2008 AHS go live
- High Tech Search
  Cooperation with Ventures
  MMS Komatsu
  • External Sensor
  • GNSS
  • UI controller
  • Laser Ranging
  Tenacious R&D

(2) Creating CTO division
  (Apr. 2014 –)
  Grab High Tech.
  Open Innovation
  Venture Collaboration
  M&A Strategy
  industry–university cooperation

(3) Globally competitive human resource for development
  Accumulation of experiences and failures
  Full Knowledge of “GEMBA”
  Diversity in Culture (Equal Partner)
  Logical Thinking

(4) Global Integration of Technology
  AHS (2008–)
  Global Integration of High Tech
  Overall Control
  Internal development
  Truck design
  Engine design
  Truck Control
  Dispatch Control
  External collaboration
  GNSS
  Electric Drive
  High Tech Sensor (Venture)
  Intelligent MC (Jun. 2013–)
6-2. KOMATSU in the Future
Together We Innovate GEMBA Worldwide

Komatsu Group employees worldwide will team up with distributors, suppliers and other partners, innovate customers’ Gemba together with them, and provide innovation designed to create new values, thereby working for sustainable growth of our core businesses of construction and mining equipment as well as industrial machinery.

Thank you for your attention