

Komatsu IR Day in 2019

Komatsu's Digital Transformation Strategy

Chikashi Shike

Executive Officer and President of Smart Construction Promotion Division

Mid-term Management Plan (FY2019 – FY2021)

Mid-term Management Plan (FY2019 – FY2021)

DANTOTSU Value

FORWARD Together for Sustainable Growth

Linking every workplace through excellence

Our world is changing.

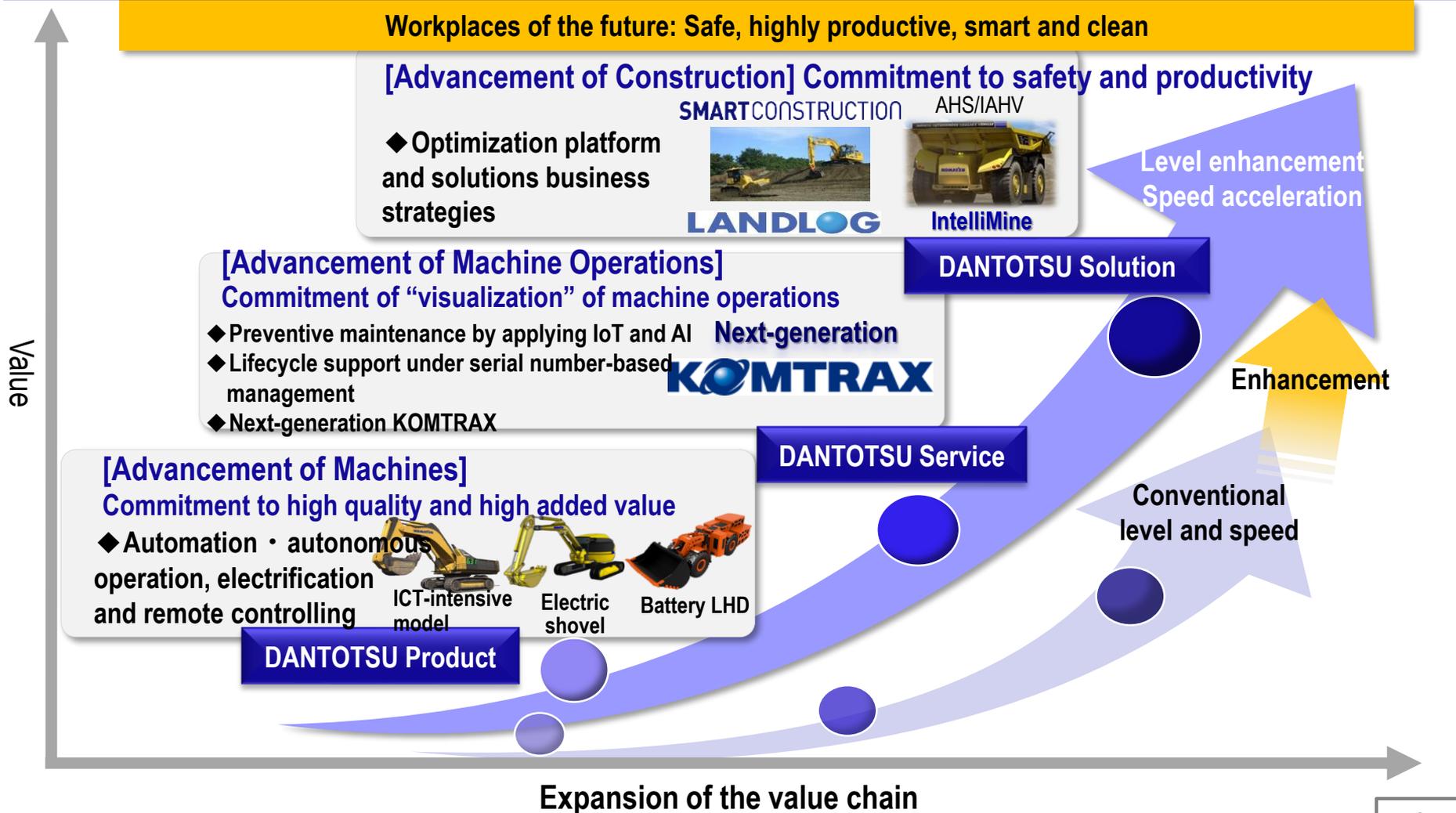
So are the challenges of our customers and society. What can we do to help overcome these challenges while remaining sustainable?

Together, we can reach new, unrivaled heights of excellence in our products, services, and solutions to enable a better world. We can link every workplace and generate value with our global teams, customers, distributors, partners and communities.

We can make a difference. We can do it by delivering DANTOTSU Value.

DANTOTSU Value

(ESG solutions through the creation of customer value and improvement of earnings)



SMARTCONSTRUCTION

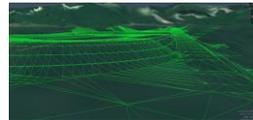
February 2015 --

Announced our “SMARTCONSTRUCTION” concepts and began service.

We will work together with our customers at their jobsites to achieve safe, highly productive and smart workplaces of the future.



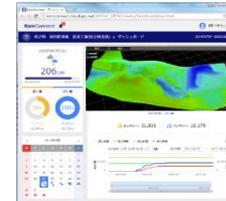
High-precision 3D survey by using drones



Generation of 3D design data



ICT-intensive models (Rental and sales)



As-built data management (SMARTCONSTRUCTION application)



SMARTCONSTRUCTION support (Remote & on-site)

Began successive provision of different services.

April 2016

Japan's Ministry of Land, Infrastructure, Transport and Tourism designated FY2016 as the first year of productivity revolution and declared to promote “i-Construction”.

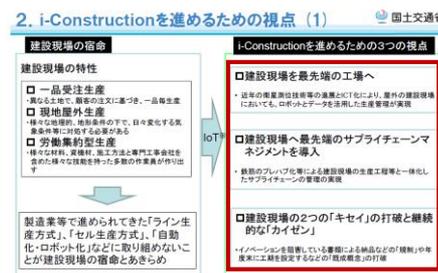
September 2016

PM Abe declared the Promotion of Productivity Revolution of Construction Jobsites at the first meeting of Investing for the Future.



Mr. Ishii, Minister of LIT
At the press conference, he declared FY2016 as the first year of productivity revolution of the construction industry.

January 2016: Komatsu IoT Center



※IoT (Internet of Things)：自動車、家電、ロボット、建設などあらゆるモノがインターネットにつながり、情報のやり取りをすることで、モノのデータ化やそれに基づいた自動的な意思決定、新たな付加価値を生み出す。出典：平成27年度産 情報通信白書

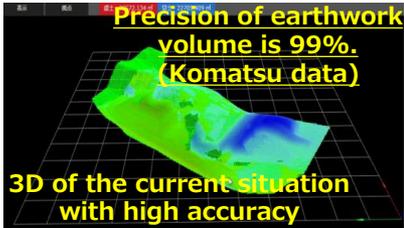
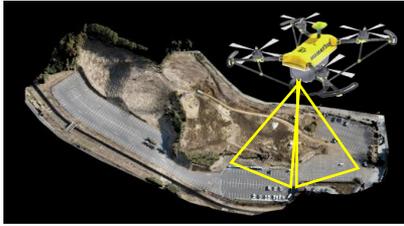
※IoTにより、「製造業のサービス業化」、「サービス提供のボーダレス化」(リアルタイム化)、「産業と供給のマッチング(最適化)」、「大規模生産から小規模生産へのシフト」が実現



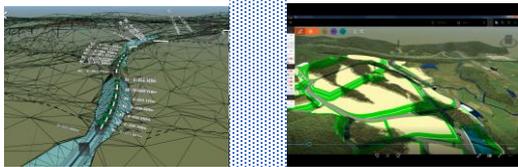
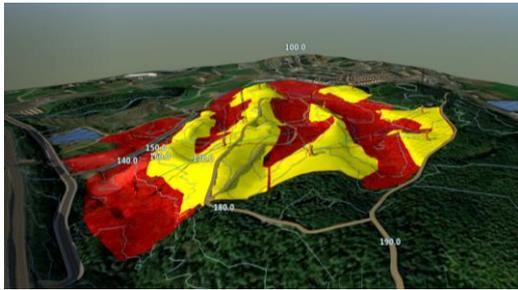
September 2016: The first meeting of Investing for the Future

We aim at 20% improvement of productivity of construction jobsite operations by 2025. (As expressed by PM Abe)

High-precision surveying



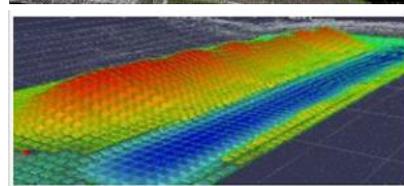
Generation of construction plans



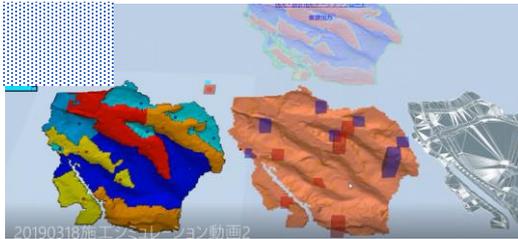
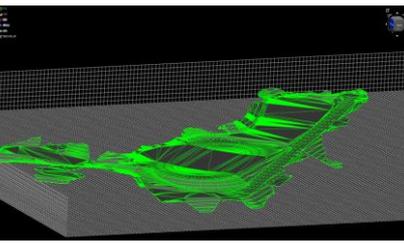
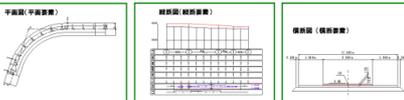
Construction



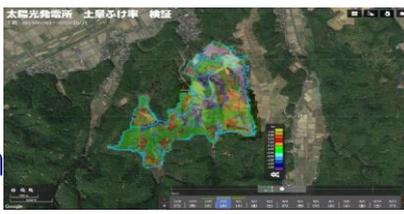
Inspection



3D Design Data



Construction management



項目	設計	施工	検定	備考
測量日	2019/03/18			
測量機	GNSS	GNSS		
測量精度	±2mm	±10mm		
測量範囲	GNSS	GNSS		
測量時間	05:30~09:00	09:00~12:00		
測量員	山本 隆夫	山本 隆夫		
確認員	山本 隆夫	山本 隆夫		
確認日	2019/03/18			
確認機	GNSS	GNSS		
確認精度	±2mm	±10mm		
確認範囲	GNSS	GNSS		
確認時間	05:30~09:00	09:00~12:00		
確認員	山本 隆夫	山本 隆夫		
確認員	山本 隆夫	山本 隆夫		



SMARTCONSTRUCTION Support Center



SMART CONSTRUCTION CLOUD

Since the start of SMARTCONSTRUCTION service in February 2015, we have deployed it at 8,700 jobsites.

(As of August 31, 2019. Limited to Japan)



We have also shared with customers new issues which we must solve together at many jobsites.

Values of “Things”



“Things”: DANTOTSU products that improve customers’ safety and productivity.

“Service of things”: DANTOTSU service that will not stop machines at jobsites.

“Quality assurance of things”:
Our promise to customers reflects
Quality and Reliability of products.



Values of “Matters”

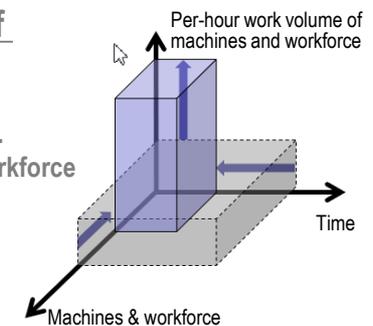


Domain:
Customers’ operations
(civil engineering/construction)

Newly created values:
Improved safety and productivity

Conceptual drawing of value creation

Earthwork volume will not change.
Minimum use of machines and workforce
Shortened construction periods



Working to Achieve “Safe, Highly Productive, Smart and Clean Workplaces”

We will accomplish digital transformation of construction with “things” (automation and sophistication of construction equipment) and “matters” (optimization of construction work), thereby achieving safe, highly productive, smart and clean workplaces of the future.

Safe, highly productive, smart and clean workplaces of the future

Level 5:
Optimized construction

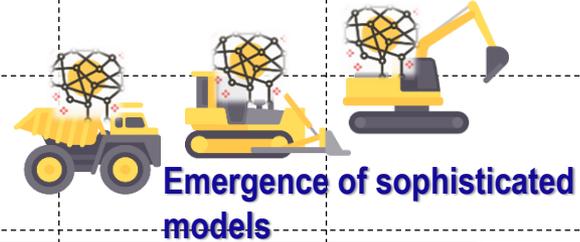
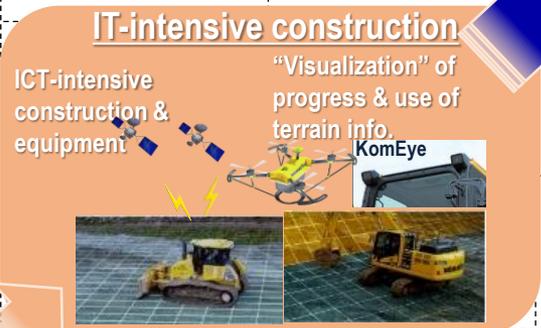
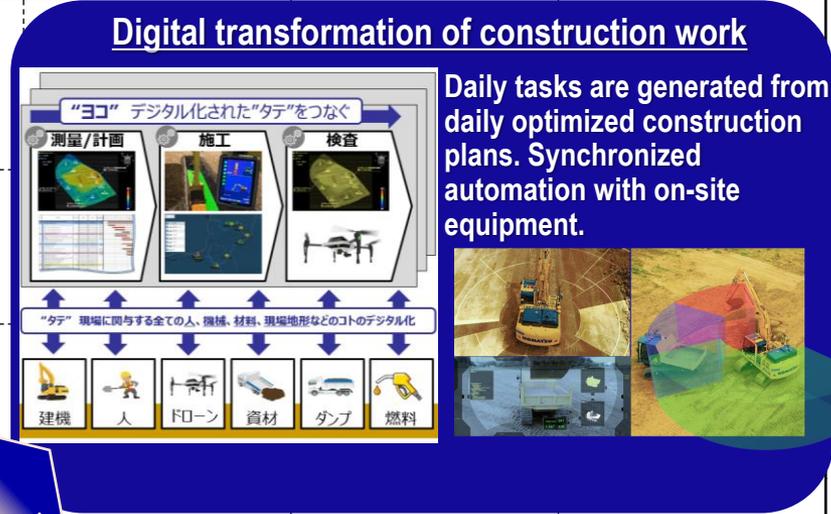
Level 4:
Automated planning of construction

Level 3:
3D construction plans

Level 2:
3D terrain data

Level 1:
3D design data

“Matters” [Optimization level of construction operations]



Conventional construction

“Things” [Automated and autonomous level of machines]

Level 1:
Limited to machine operation support

Level 2:
Expanded scope of operation support

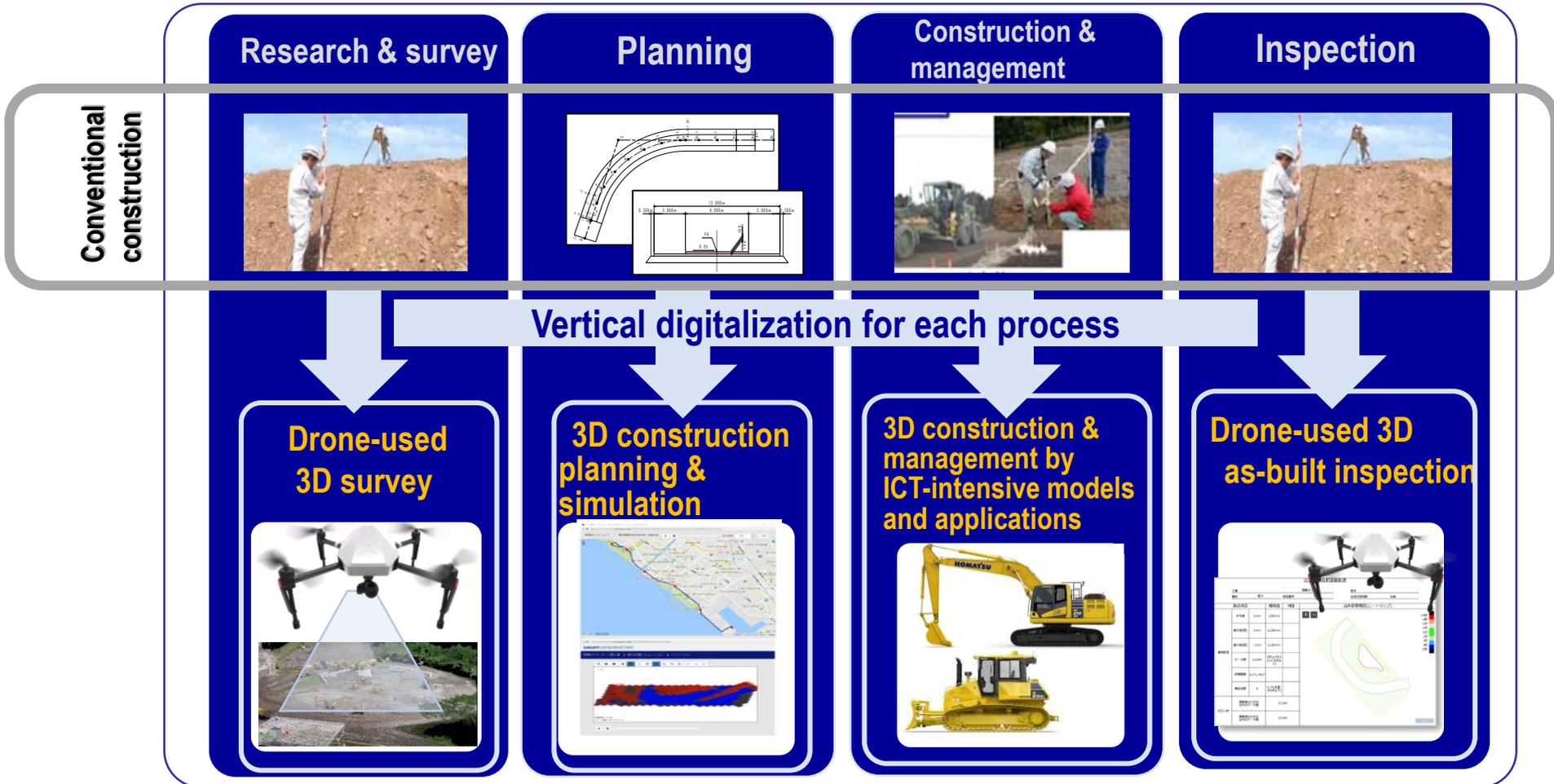
Level 3:
Sophistication:
Automated (solo)

Level 4:
Sophistication:
Synchronized autonomous

Level 5:
Sophistication:
Decision-making autonomous

Achievements Made Possible with SMARTCONSTRUCTION since 2015

In all processes of conventional construction, safety and productivity have been improved by leading-edge digital technologies.



Improved safety and productivity are limited, when each process is partially optimized.

What to Achieve with SMARTCONSTRUCTION from 2019

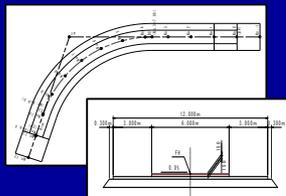
Dynamic improvement in safety and productivity will be achieved by optimization of all processes when each process, which is partially optimized by digital technologies, is linked.

Conventional construction

Research & survey



Planning



Construction & management



Inspection



Digitalization of each process: "Vertical"

Drone-used 3D survey



3D construction planning & simulation



3D construction & management by ICT-intensive models and applications



Drone-used 3D as-built inspection



All processes are digitalized and linked: "Horizontal"

Digital transformation of construction resulting from optimization of the entire process.

Verification of Digital Transformation of Construction at Actual Jobsites

Analyses of Digitalization in Construction Processes in Europe

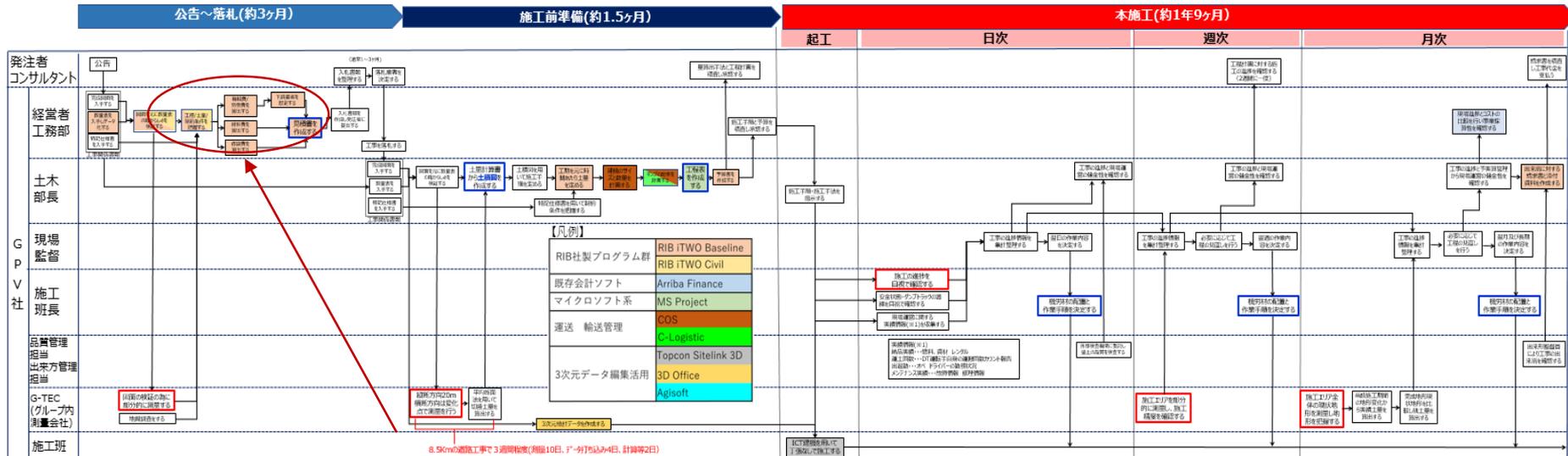
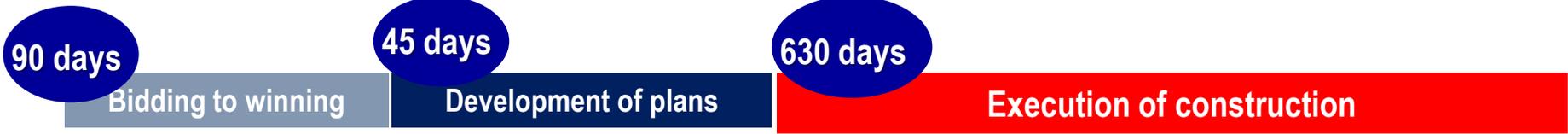


As a result of verifying operational processes with European customers, we have found that the majority of construction processes is in analogue and have confirmed that each step is not connected digitally.

Most processes is not digitalized, so the site foremen check visually and perform other tasks in analogue.

Even when digitalized, digitalization stops at individual processes in analogue. Pre and post processes are continuous, resulting in merely chopped solutions.

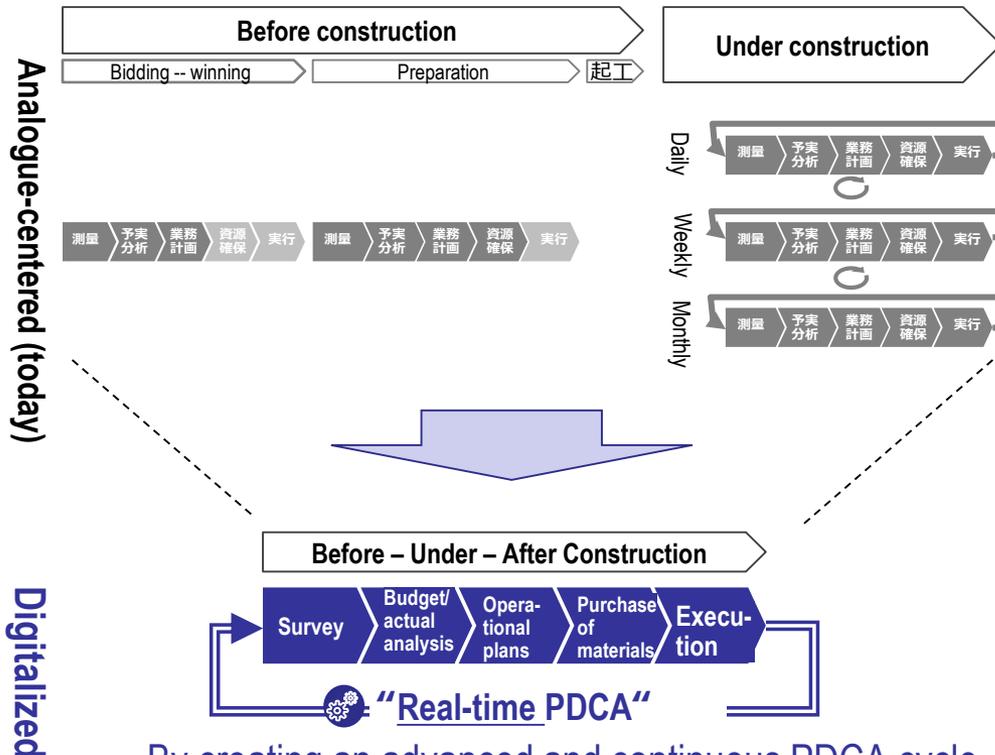
Construction site on the Autobahn expressway used in Komatsu's advertisement



Colored process are individually digitalized.

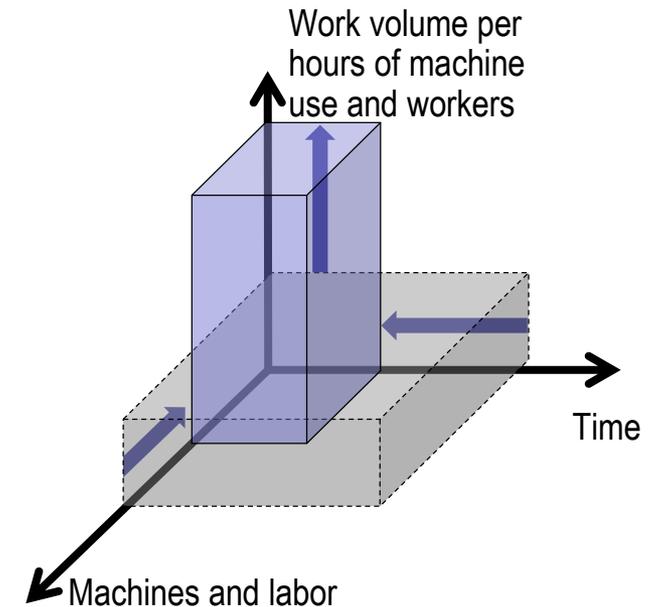
As a result of turning the high-speed, real-time PDCA cycle, customers can change the processes *per se*, which lead to shorten the processes and reduce manpower related to the processes.

Changes in construction processes by digitalization



By creating an advanced and continuous PDCA cycle, customers can **shorten** complicated **processes** and **reduce** necessary manpower.

Resulting improvements (for illustration purposes only)

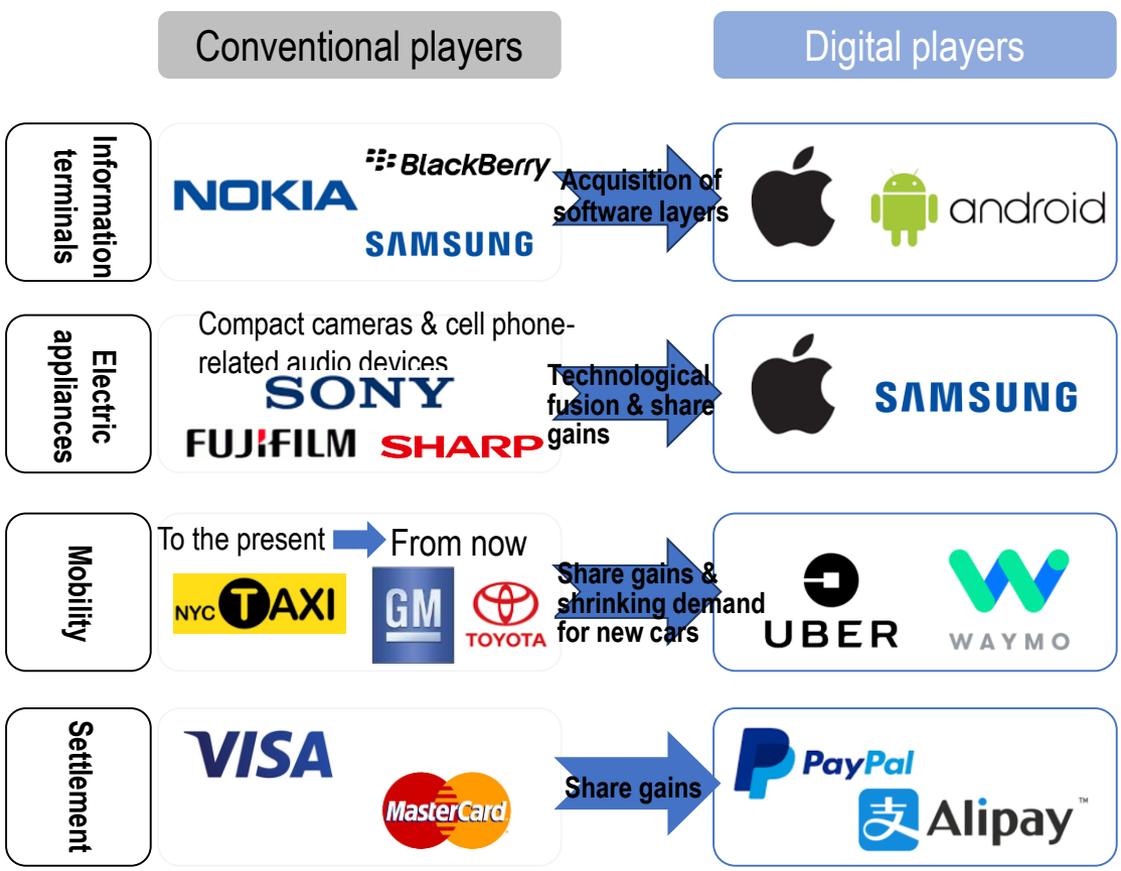


- By achieving targeted terrain with minimum amounts of time, machines and workers, customers can **minimize construction costs**.
- By deploying surplus time, machines and workers, they can **improve earnings of their total business**.

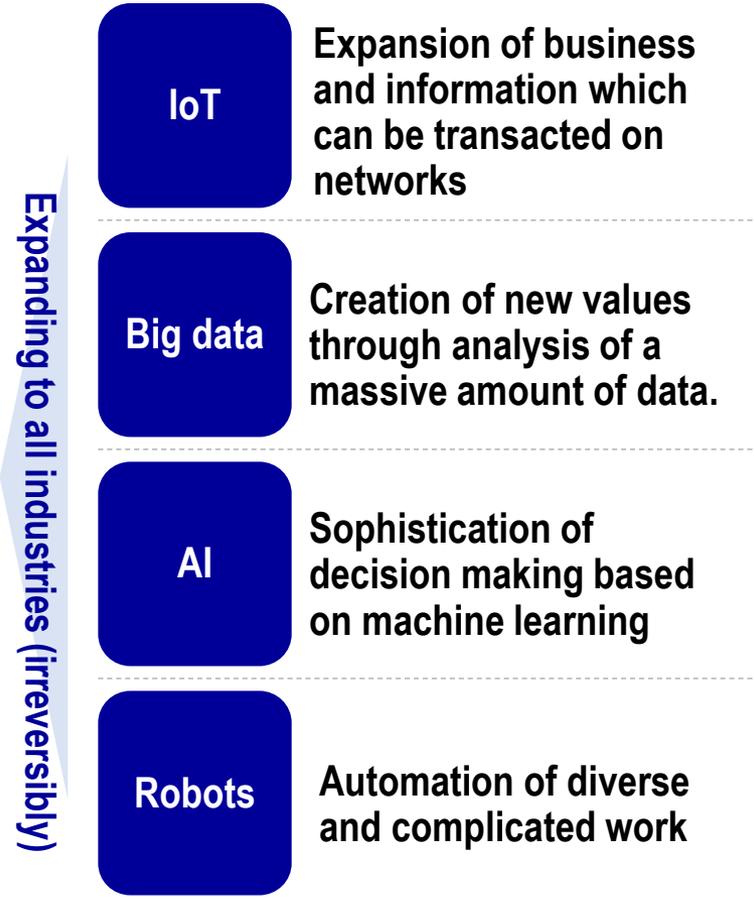
Digital Transformation Emerging in a Diverse Range of Industries

Providers of new digital-based value are capturing the pool of earnings and causing irreversible industrial transformation. As we look into the future of technology innovation, we inevitably need to maintain our lead in the digitalization of construction.

Examples of capturing the pool of earnings by digital players



Further technology innovation into the future



As the maturity of digital technologies is approaching a “critical point”, the scope of applications is beginning to expand greatly through combination of technologies which have advanced and become inexpensive.

Examples of advances of digital technology

Expanding applications into the future

Data rate¹

Past	Today	Future
384kbps (Rising speed) (3G)	1Gbps (4G)	20Gbps (5G)

Autonomous driving

LiDAR price²

Past	Today	Future
About USD8,000/piece (2007)	Abut USD375/piece (2017)	About USD100 /piece (2020)

Remote medicine

No. of IoT connections³

Past	Today	Future
500 million (2003)	18 billion (2019)	35 billion (2021)

Genome analysis

Processing speed⁴

Past	Today	Future
10TFLOPS (2002)	100 EFLOPS (10,000 times from 2002) (2017)	10ZFLOPS (100 times from 2017)...

Space exploitation

Hologram

Replacement of intellectual work by robots (teachers, secretaries, etc.)

1: Ministry of Internal Affairs and Communications (MIC), 2: Technavio, 3: MIC, 4: Super computer's floating point computation capability per one second (Source: Top500)

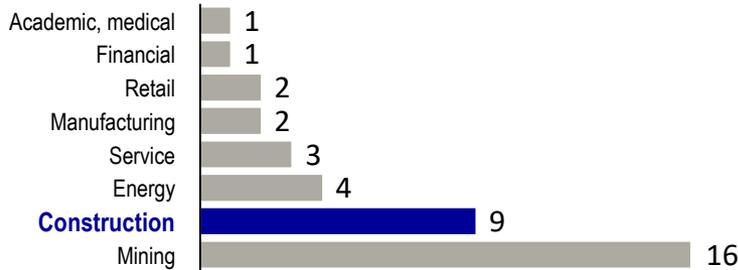
As the construction industry has big tasks related to safety and productivity, it has more opportunities than other industries to create digital technology-deployed solutions for these tasks.

Safety and productivity-related tasks



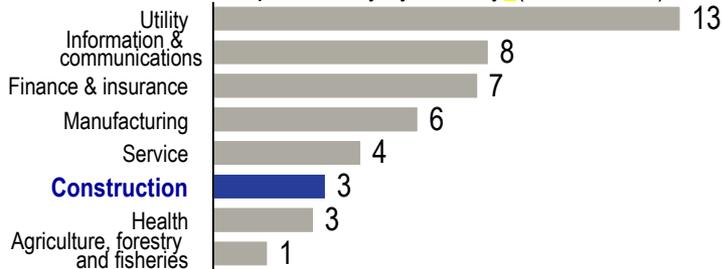
• More dangerous than other industries

No. of deaths per 10,000 employees¹



• Lower than other industries

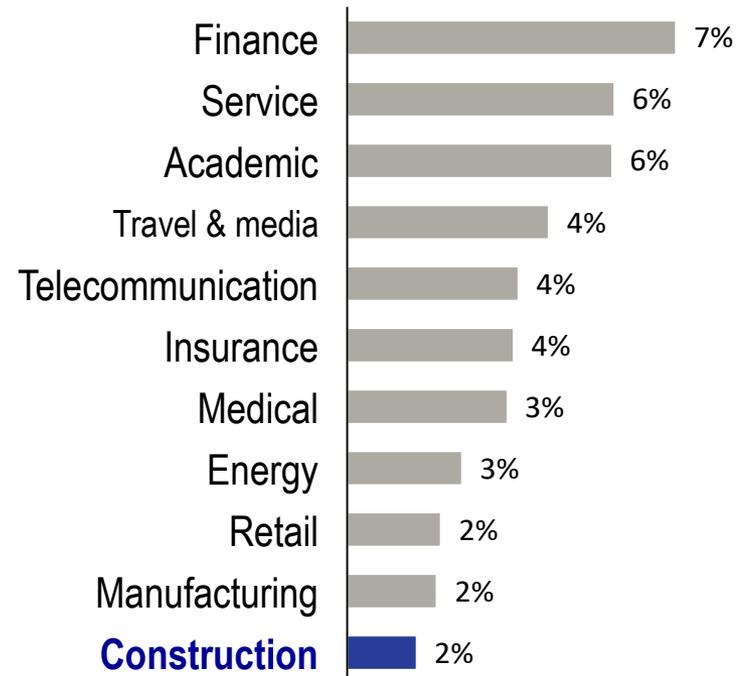
Nominal productivity by industry² (JPY1,000/hr)



Use of digital technologies

• Very small ratio of investment in IT areas compared to other industries

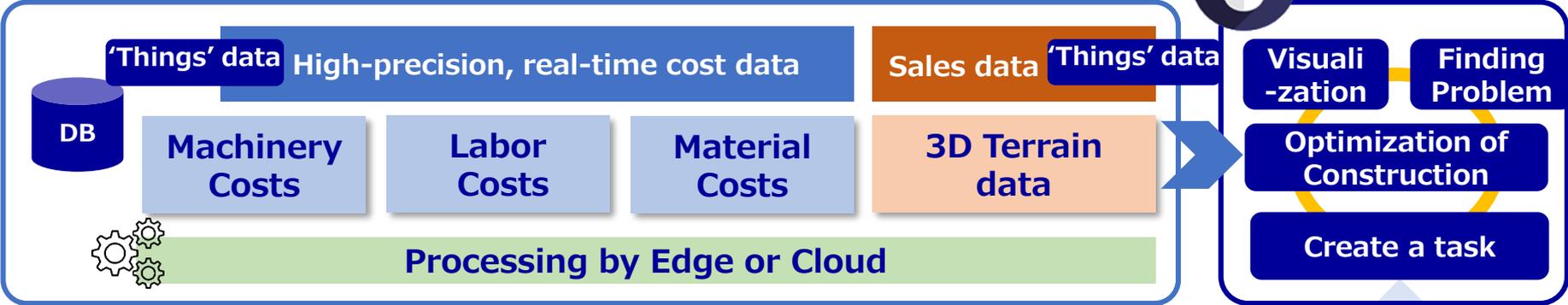
IT expenditures per earnings by industry³



1: USA in 2011 "Direction, Method, and Model for Implementing Design for Construction Worker Safety in the US" 2: Japan in 2017 (Japan Productivity Center) 3: Deloitte 2016-17 Global CIO Survey

Overall View of LANDLOG Platform and SMARTCONSTRUCTION

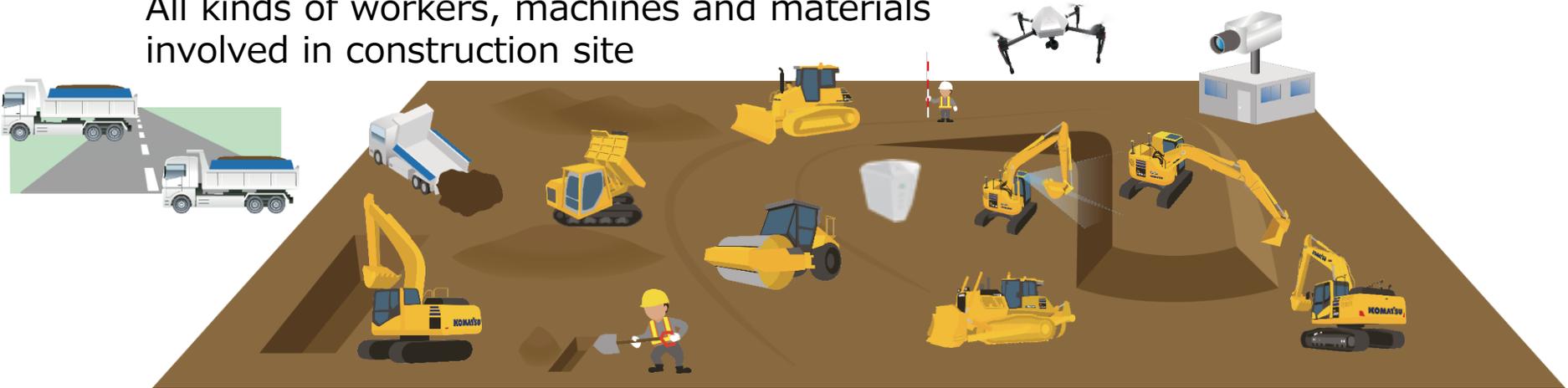
LANDLOG



Making 'Things data' accurately, quickly, easily and cheaply

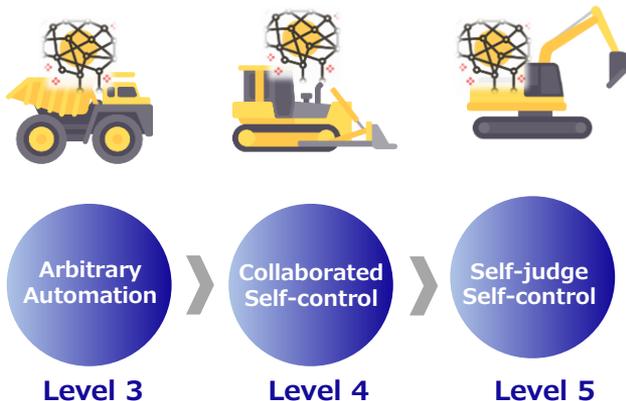
- Machines
- Workers
- Drone
- materials
- Dump Truck
- Fuel

All kinds of workers, machines and materials involved in construction site



Strategies for “Things”

**Advanced Construction
(Automated·Self-controlled)**



**Promote the ICT mechanization*
of existing machine**

ICT machines*  **Approx. 2%**

**To expand and promote
ICT function***

Add ICT functions to existing machines

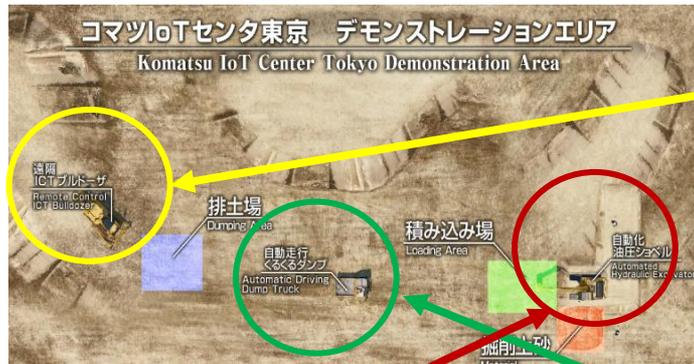
Conventional machines  **Apptox. 98%**

All Excavators working in Japan

*ICT mechanization, ICT machines, ICT functions are, each items of the 3D machine guidance (3D-MG) and 3D machine control (3D-MC) stipulated in "i-Construction" by MLIT, Japan.

Sophistication of construction machinery (Automated, Autonomy)

Demonstration at CEATEC last year Scheduled to operate at the Government ordering construction site in FY2019



Unmanned hydraulic excavators are drilled and loaded



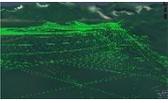
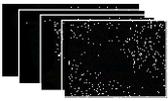
Unmanned crawler dump staked dirt

Promotion of ICT for existing construction machinery

We will Develop and launch the Smart Construction Retrofit Kit.

All hydraulic excavators operating on site will be made functions as if they were the latest ICT CONSTRUCTION equipment.



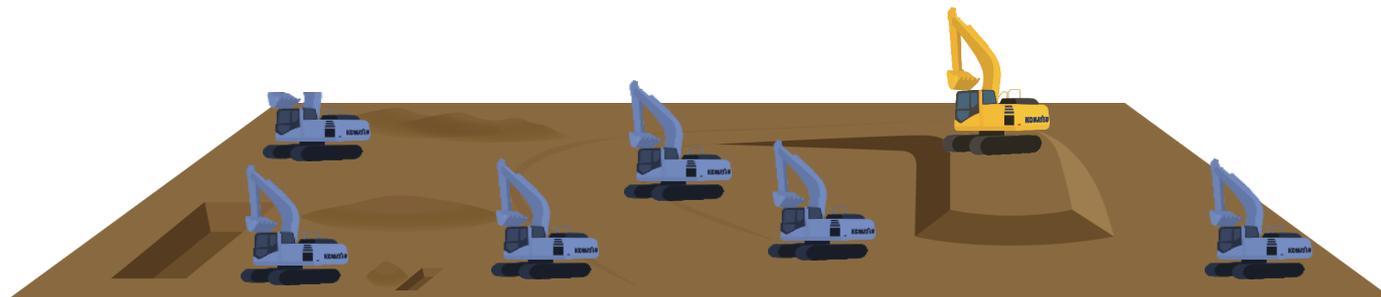
	3D construction with 3D data	Impossible	Possible	Possible
	3D Control	Impossible	Possible Semi-automatic	Impossible Guidance only
	Leveling · auxiliary workers	Necessary	Unnecessary	Unnecessary
	3D Construction results	Can't get	Can get High accuracy	Can get High accuracy

High-precision 3D construction is possible with 3D design data

No leveling, No auxiliary workers improves safety and productivity

Can get 3D construction results, 'things data', digitally in real time

Cheap kits, easy to use





**German highway construction site with smart construction
On building an animal bridge connecting the forests to protect the ecosystem**

Thank you for your interest in Komatsu