Value creation story 1

Bringing innovation to work sites around the world with new ideas Global launch of ConSite® OIL

In recent years, urban development is taking place in Asian countries following economic growth. In the field of civil engineering development where construction machines are particularly in use, downtime due to breakdowns is one of the issues that reduces productivity; therefore, the introduction of new technologies that ensure stable operations has been anticipated.

Relevant SDGs

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Technological advances are considered to be crucial in finding both economically and environmentally sustainable solutions, as they will lead to improved energy efficiency and creation of new employment opportunities.

Construction machinery manufacturer addressing issues in construction and civil engineering sites around the world

Construction machinery is indispensable for infrastructure development, and resource and energy development that accompany social and economic growth. These markets are expanding all over the world. Especially in areas of rapid economic development, large hydraulic excavators are playing an active role in sites of infrastructure and mining site.

If these machines were to breakdown, a majority of on-site processes will be on hold during repair, which would lead to lost productivity. Since most machines operate in rural areas far from cities, performing breakdown maintenance which requires a service agent to travel to the site for repair after a failure occurs results in extended downtime. Up until now, time-based maintenance had been adopted at many sites in order to prevent sudden failure or performance degradation. This approach aims to conduct inspection of machinery and maintenance including oil changes at regular intervals.

Mining equipments frequently used at mining sites

Oil status monitoring derived from the idea of condition-based maintenance

On the other hand, regular inspection according to time-based maintenance does not significantly reduce unexpected failures. In order to provide a higher value service to customers, we must reconsider approaches to maintenance outside of the conventional concept. This resulted in ConSite® OIL.

ConSite® OIL is a service developed as a new solution for ConSite®, which was made available since 2013, following the approach of condition-based maintenance. The condition of oil that had been hard to diagnose up until now is detected using a sensor, which automatically detects sudden changes in oil property and abnormality, which result in preventive maintenance, improved fuel cost and extended service life of machinery. In the past, we have proposed oil changes based on time, but going forward, we aim to provide services with oil change proposals made at appropriate timing by monitoring the condition of oil. Such service delivery will reduce the amount of time spent on inspections and wasted oil use.

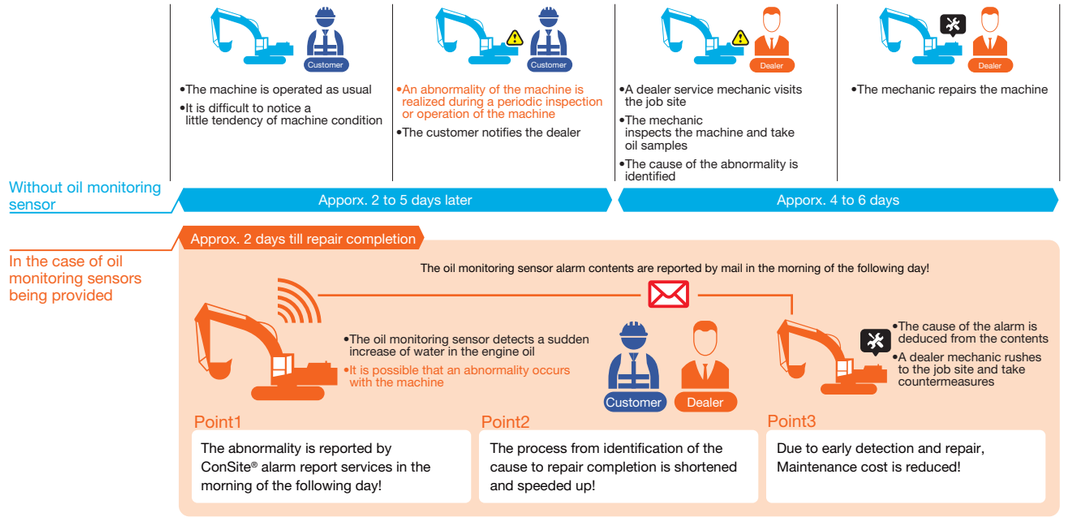
ConSite® OIL was launched in Europe, Japan, and Australia in October 2017, with good reviews from customers in these regions. Furthermore, as the extension of construction machinery's lifespan is linked to effective use of resources, it is also expected to contribute to the planet's environment.

ConSite® logo

ConSite
Consolidated Solution for Construction Sites

ConSite® OIL Case study

In case a lot of water suddenly gets mixed with the engine oil



* Repair process and the number of days vary according to each failure

Expanding service provision of ConSite® OIL to the global market, including southeast Asia and China

As the center stage of economic growth and development has shifted from developed countries to other regions, there is need to help address customer issues in a wider area. To this end, the HCM Group began provision of ConSite® OIL in the Southeast Asia market, including Indonesia, Singapore, Malaysia, Thailand, Vietnam, the Philippines, Cambodia, and Laos, in September 2019, and launched it in the China market since October the same year.

At the convention of Mining Indonesia 2019 held in September, an actual model of ZX470LC-5G equipped with ConSite® OIL was on display to showcase its actual performance and specific merits. In Indonesia, the mining industry and infrastructure development are booming with an abundant labor force, where there is a strong demand for large hydraulic excavators. In addition, the concept of condition-based maintenance is highly regarded not only in Indonesia, but also in Thailand and Singapore, where it is implemented.

Going forward, the HCM Group will actively incorporate AI, analysis and analytical technology in aiming to enhance machinery breakdown prediction with greater analytical precision.

ConSite® OIL equipped ZX470LC-5G large hydraulic excavator

VOICE

Lokanath Abbigeri
Assistant Manager, Planning & Development Sec.,
ConSite Business IoT Dept.,
Customer Support Div., Life Cycle Support Group

Aiming to extend the service life of construction machinery

The spread of constant status monitoring technology such as ConSite® OIL and the concept of condition-based maintenance will ensure customers can access their construction machinery under stable and appropriate status. As a result, if the service life of construction machinery can be extended, then we can also recover core components that are still in good condition before their breakdown and expand our parts remanufacturing business. This is also considered an important initiative aimed at achieving the SDGs while effectively utilizing the planet's limited sources.

Going forward, we will continue to contribute to both reducing customers' life cycle costs, improving on-site productivity, and addressing global environmental issues through the realization of timely and appropriate maintenance.

Value creation story 2

Contributing to problem solving in the construction and civil engineering industry through practical training on ICT construction
Initiatives of PEO Construction Machinery Operators Training Center

The declining birth rate and aging population has largely impacted the construction and civil engineering industry.
While worker shortages have become a norm, the construction workforce as a whole is projected to decrease by about 44% in Japan by 2030 according to the Ministry of Land, Infrastructure, Transport and Tourism.
In addition, as the transfer of skills from experienced to younger operators is insufficient, there are concerns over the decline safety and productivity on the frontline.

Relevant SDGs

4 QUALITY EDUCATION

It is important to cultivate on-site leaders through human resource education and skill transfer, in addressing the critical challenges faced by the construction and civil engineering industry.

ILaunch of a new education institution for learning all work processes of ICT construction

In recent years, there has been little influx of new workers at construction and civil engineering sites. There is concern over experienced workers leaving the job without passing on their skills, which jeopardizes the continuation of safety and productivity at job sites. Given this background, the Ministry of Land, Infrastructure, Transport and Tourism has been promoting i-Construction since 2016 aimed at addressing the issues at sites that have adopted ICT construction. Using ICT in all processes of a construction ensures high productivity and safety despite a shortage of experienced engineers, and is expected to lead to work style reform.

However, there are a number of hurdles at customers newly adopting ICT construction. One of them is the cultivation of ICT human resources. In August 2019, the HCM Group established PEO Construction Machinery Operators Training Center in collaboration with comprehensive human resources service company, Outsourcing Inc. This is a new educational institution that provides training on all processes of ICT construction in addition to the existing construction machinery skills, certification training, and health and safety education.

Logo of ICT Training Brand

i-ConTech univ.

Expresses the concept of a comprehensive learning institution (university) of i-Construction Technology

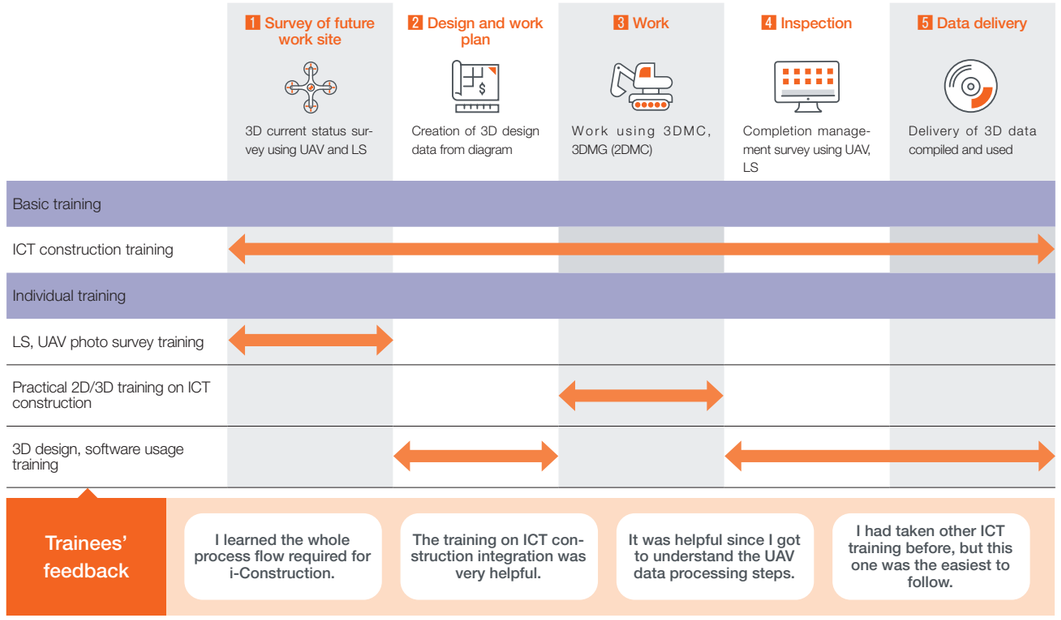
Curriculum to address every issue in ICT construction implementation

In ICT construction, operation of machines and application that did not exist conventionally is necessary through each process from work-site survey to data delivery. Moreover, the site requires a satellite positioning system, such as GNSS, and a telecommunication environment since construction is based on 3D data through surveys using drones (UAV) and laser scanner (LS). Therefore, without fully understanding the essence of ICT construction, it is difficult to fully utilize the system on site. However, up until now, customers actually had nowhere to learn hands-on techniques and processes of ICT construction.

To address this issue, we have formulated a comprehensive curriculum on the latest knowledge and practical skills with a partner business who possess leading technology in drone surveying and 3D design. The content captures a wide range of applications including local governments' public construction projects and small scale projects to tailor to the needs of customers who each have a different project size on site.

Our two domestic ICT demo sites (Ibaraki, Kagawa) showcase ICT construction and machinery that customers can experience first hand and address any questions and concerns.

ICurriculum on jobs using ICT



ICT human resource training as the first step towards addressing social issues

The HCM Group has provided a variety of services to enable ICT utilization as a part of Solution Linkage while it expands the line up of ICT-compatible construction machinery. On the other hand, in order to overcome the crisis in the construction and civil engineering industry, new workers must be hired and cultivated. In the future, we anticipate ICT human resources who possess advanced knowledge and skills to be successful, which will enhance the productivity and safety of work sites and change the work hours and style in addressing multiple challenges faced by the construction and civil engineering industry at the same time. This will lead to a work site that is safe for women and seniors. The training for ICT human resources is undoubtedly the first step in addressing the major social issue of declining labor force.

PEO Construction Machinery Operators Training Center is working to promote ICT construction and planning to expand the ICT training facility in the future. In addition, we aim to expand our role as a base of human resources education for the future with intention to increase our scope of application to include building information modeling (BIM) that is becoming institutionalized overseas.

Lecturers certified by the Japan Construction Machinery and Construction Association (JCMA) provide thorough explanation on the basics

VOICE

Shigenori Yamamoto
President
PEO Construction Machinery Operators Training Center Co., Ltd.

Cultivate next generation human resources and contribute to the future of the industry

The Center was established through collaboration between the HCM Training Center, which has been devoted to the thorough training on construction machinery and safety education over many years, and Outsourcing Inc., a global comprehensive human resources service company that supports manufacturing and IT technology, under the concept of "cultivating the next generation for construction with ICT."

Our mission is to reshape the construction and civil engineering industry through human resource cultivation and provide next generation appealing work to support the constant perpetuation and continued development of world-class Japanese technology.
Going forward, we will fully harness the synergies created through collaboration between HCM and Outsourcing Inc. in helping industry workers to gain status and boost motivation.

PEO Construction Machinery Operators Training Center Website
https://www.pctc.co.jp/ (Japanese Only)

Value creation story 3

Introduction of the work posture automatic determination system utilizing AI
What does a worker-friendly factory look like?

Not only in the field of construction and civil engineering, labor shortages due to a declining birth rate and aging population are also becoming a serious issue at manufacturing sites, with securing human resources being particularly difficult in rural areas.
In order to ensure that high quality and productivity are maintained, it is crucial to develop work sites that are worker friendly, where everyone including seniors and women can also work safely and securely.

Relevant SDGs

The development of a work environment that enables workers to feel safe, secure and a sense of reward is imperative to a sustainable prosperity where everyone can participate.

Promoting the development of work site that is worker friendly by utilizing advanced technology

Since FY2018, the HCM Group has been restructuring its domestic development and production locations and implementing reform of manufacturing sites. Through use of ICT and advanced technology, we have incorporated “People Friendly Manufacturing” that saves labor and physical burden. One is the work posture automatic determination system, which utilizes AI image recognition, introduced at the Tsuchiura Works in January 2020.

At the construction machinery manufacturing site, workers have to bend their knees or squat to carry or unload items. If a worker has an unnatural posture due to an incident, it will damage the body. In order to create an environment that is safe for the workers and creates less load on the body, it is important to understand each person’s work process and promote education that spreads the knowledge of correct work posture and equipment. To this end, HCM has undertaken research on studying the actions and posture of workers through video footage in order to come up with a system for obtaining tips on safety and work efficiency.

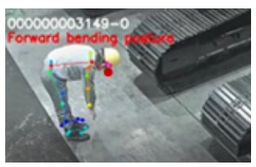
AI identifies a worker’s posture. Based on this, we find incidents* which cause danger

In the beginning, we checked and analyzed the images we had taken with our own eyes. However, in order to accurately check the posture of many workers in the videos that contain many manufacturing equipment requires a tremendous amount of time. Therefore, we searched for a way to shorten the time by applying the AI technology of the Hitachi Group. The newly developed system involves searching people by AI to confirm posture, and marking the time and date of cases where the posture matched the ones previously learned in deep learning. After that, only footage before and after are checked manually by human eyes, thereby reducing the time spent on footage analysis. With its role defined, AI being used as a supplemental tool to humans has reduced the development time and cost, and made the technology ready for use in approximately one year.

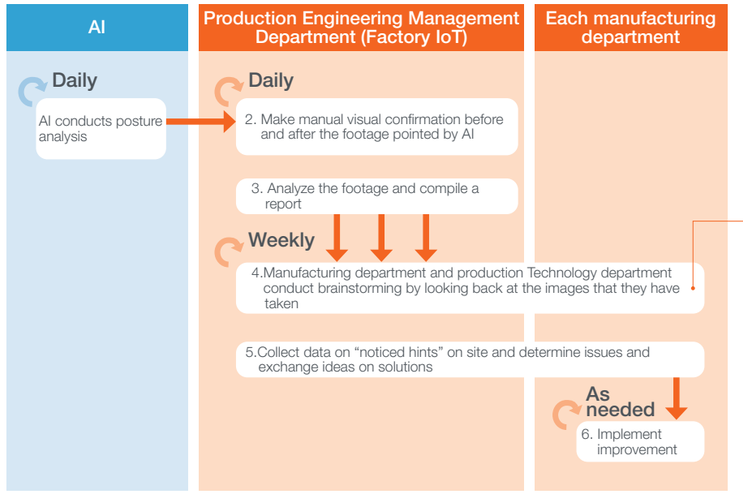
At Tsuchiura Works, the same system is used on the assembly line of medium sized hydraulic excavators for the assembly of boom cylinder, boom, arm, and bucket. AI checks for postures with large physical load, including forward bending and crouching and working at a high place, and extracts footages that require manual examination. This reduces the processing time to 1/8 of that required by manual scanning.

* Incident: Events that can lead to accidents or trouble

Examples of detecting high physical load postures by AI
(Forward bending/crouching posture)



Improvement activities through system

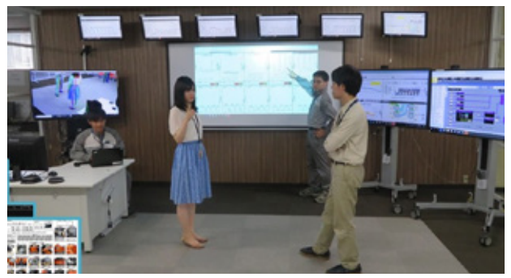


1. Check the content of the report and footages pointed out by AI
2. Repeat discussions to assess the source of trouble or incident
3. Check the video system data
   To obtain awareness of safety, improvement, and efficiency improvement by confirming the video which has been saved regularly

While the system is up and running, video analysis becomes easier and new hints are obtained. Then we use these to improve the production site

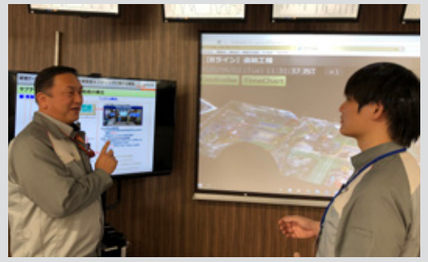
At Tsuchiura Works, the assembly line manager and production engineer in charge meet once a week based on the footages and report collected by this system. We made a hypothesis that any inconveniences happened ahead of the flagged image of a worker taking an unnatural posture. Gaining hints is helpful in improving the work process on site. In the future, the HCM Group plans to expand the number of postures recognized and functions such as a real-time alert feature, as well as improve accuracy, to increase its utilization among more manufacturing sites. In the group production base, we operate a “video reflection system” with two kinds of cameras as a video application system aimed at improving on-site safety and productivity.

This technology allows the visualization of the entire production floor using 360 ° camera and standard camera, while saved videos can be used to look up the time when a problem occurred and to pick up incidents. The development of worker-friendly job site is accelerated by applying the manufacturing site visualization system, which utilizes these videos, in the reform of production structure.



IoT Management Room at Tsuchiura Works
An environment conducive to meeting and discussing among relevant parties

VOICE



Makoto Hakuta (Left)
Associate Senior Manager, Factory IoT Promotion Project,
Production Engineering Div., Production & Procurement Group

Integrating “technology”, “knowledge” and “use case” enables to apply AI and IoT

In order to integrate the latest technology, including AI and IoT, into the system, and yield actual results, it is essential to have compatibility in the match between the “knowledge” based on past successful experience and “use case” (specific scene of application site and scenario). Regardless of how convenient a technology may be, if it does not connect with the human experience accumulated over time, it will not yield its maximum result.

For this reason, when choosing a system to purchase, one should not be fixated on a specific industry type or field, and rather look up case examples of utilization in different industries and make a choice from a wider perspective. We will bring on tools that are convenient and easy to operate that improve the safety and efficiency of work processes of everyone involved in production.