

## Featured Articles

# Hitachi Construction Machinery's Global Production System

## —Startup of Plant in Russia and Overview of Plant in Brazil—

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*OVERVIEW: Hitachi Construction Machinery Co., Ltd. is expanding its business internationally in response to the changing nature of the market for construction machinery. This includes its production division's expansion of local production with the aim of reducing exchange rate risks while also achieving industry-leading QCD on the basis of "local production for local consumption." As a result, the company now has 19 production sites outside Japan, with approximately half of all production taking place at these overseas plants. This growing use of local production started in Europe, followed by North America, China, and Asia. Recently, the company has also opened a plant in Russia to maintain price-competitiveness and improve quality, and it has established a joint-venture company in Brazil with a local partner that includes the construction of a new plant.*

### INTRODUCTION

HITACHI Construction Machinery Co., Ltd. is expanding its business internationally in response to the changing nature of the market for construction machinery. The proportion of overseas sales has grown from 6%, when the company was established in 1970, to an anticipated near 80% in FY2014.

In terms of production, the company has also transformed its business by shifting from its focus on

exporting from Japan toward greater local production. Local production got underway in earnest in the 1980s in response to the high Yen and anti-dumping tariffs. In the late 1990s, Hitachi Construction Machinery commenced production in nations such as Indonesia, China, and India in response to growth in emerging markets. Now, in the 2010s, Hitachi Construction Machinery is commencing production in Russia and Brazil with the aim of achieving industry-leading quality, cost, and delivery (QCD).

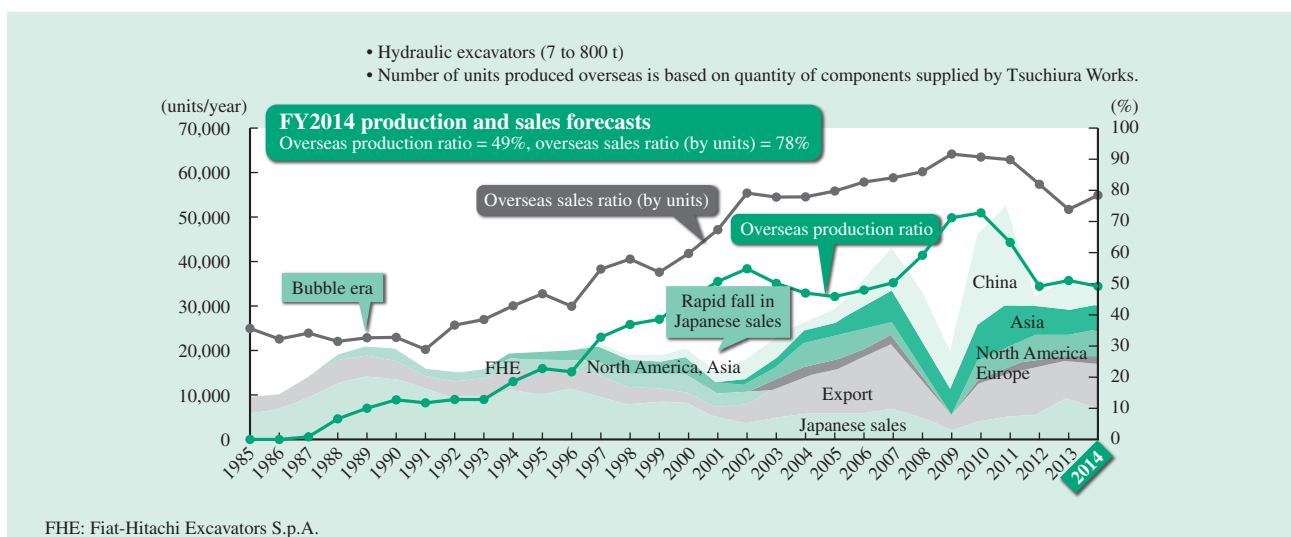


Fig. 1—Ratios of Overseas Production and Sales by Hitachi Construction Machinery.  
Hitachi Construction Machinery has transformed itself from a Japanese company to a global company.

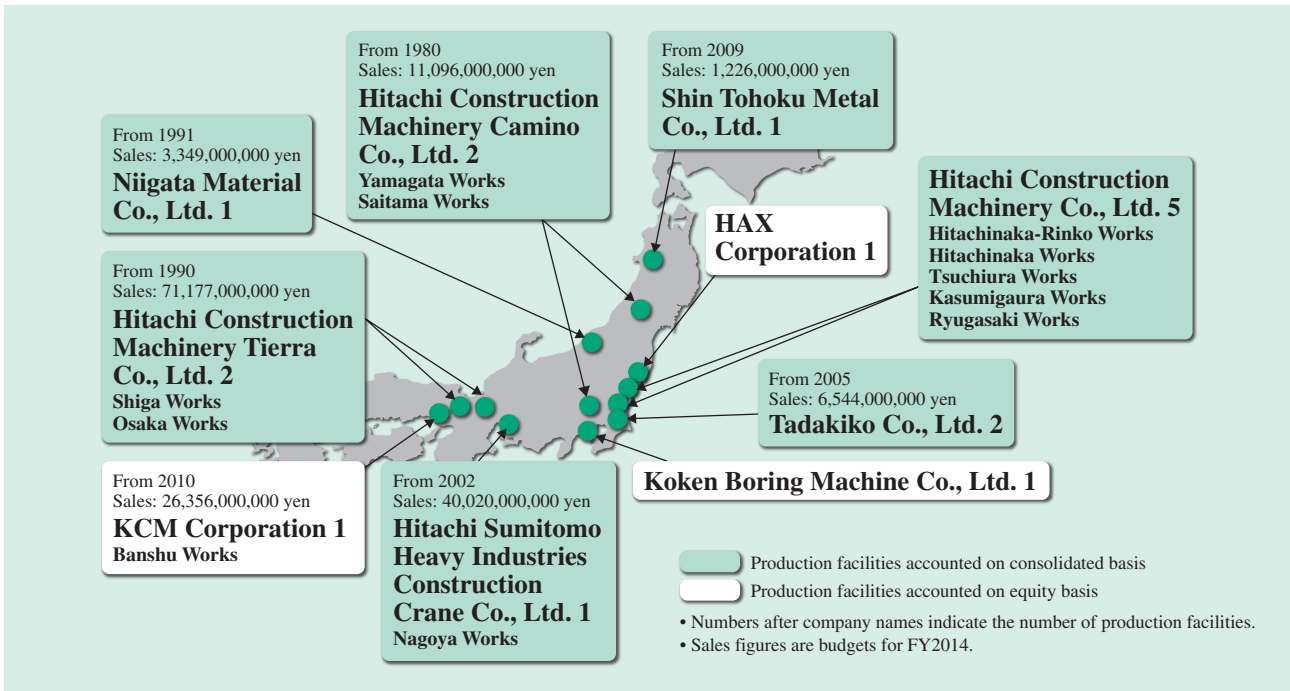


Fig. 2—Hitachi Construction Machinery’s Japanese Production Sites. Hitachi Construction Machinery has 17 production facilities in Japan, including five plants belonging to Hitachi Construction Machinery.

This article looks back at the history of increasing local production by Hitachi Construction Machinery and describes the features of the recently opened plants in Russia and Brazil.

**EXPANSION OF OVERSEAS BUSINESS**

Fig. 1 shows a graph of the proportions of overseas production and sales (by number of units) of construction machinery by Hitachi Construction Machinery since 1985.

Whereas sales in Japan have continued to decline since peaking in the bubble era, overseas sales have remained on a rising trend. As a result of shifting increasingly to local production as overseas sales have grown, the ratio of overseas production surpassed 50% in 2001, and has remained close to, or above, this level ever since.

As of 2015, Hitachi Construction Machinery has 17 production facilities in Japan and 19 overseas (see Figs. 2 and 3). Broken down by region, these comprise two sites in North America, one in South America, four in Europe (including Russia), five in China, six in Asia (excluding China), and one in Africa.

The following section describes how Hitachi Construction Machinery’s operations have changed over time in each region.

**Europe**

In 1984, the European Community (EC) imposed anti-dumping tariffs on imported machines. This led Hitachi Construction Machinery to adopt an “insider” strategy of moving to local production. Local production and sales in Europe commenced in 1986 with the establishment of Fiat-Hitachi Excavators S.p.A. (FHE) as a joint venture with Fiat S.p.A. Hitachi Construction Machinery initially owned 44% of the company, a stake that it subsequently reduced to 36%.

A problem arose in 1999 with the purchase by Fiat of a competing company, Case IH, leading to the joint venture contract being dissolved in 2002 and Hitachi Construction Machinery continuing its European business on its own.

Building on the existing operations of Hitachi Construction Machinery (Europe) N.V. (HCME), which had been the lead distributor in Europe from its base in the Netherlands since 1972, a new plant was opened in Amsterdam in 2003 for the production and sales of Hitachi-branded machinery under Hitachi Construction Machinery’s own management.

While the greatest fear that accompanied the shift to operating independently was the potential loss of support from FHE dealers, in fact not only did most dealers choose to stay with Hitachi Construction

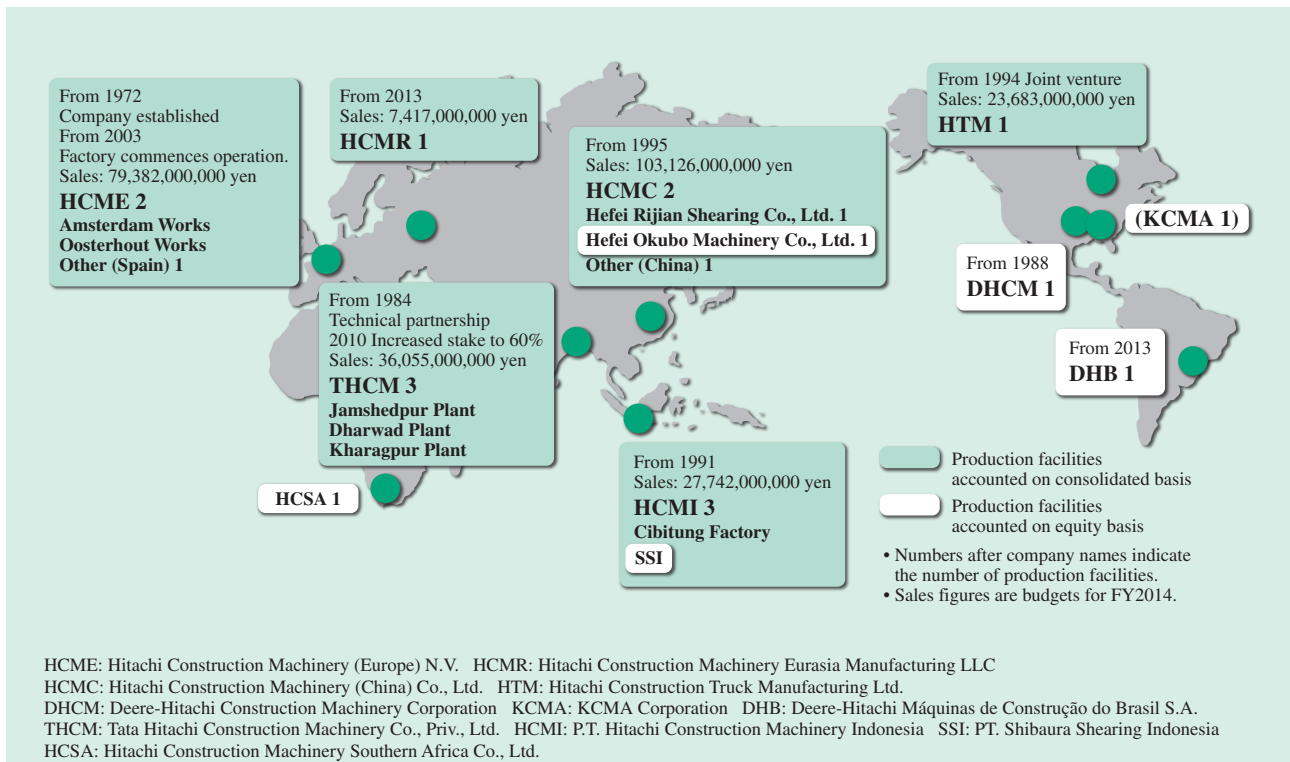


Fig. 3—Hitachi Construction Machinery's Overseas Production Sites.  
 Hitachi Construction Machinery has 19 overseas production sites.

Machinery, but a major dealer that handled competing brands also chose to represent Hitachi Construction Machinery. This indicated how well-perceived Hitachi Construction Machinery was in the market for the excellence of its machinery, its attitude to its customers, and the name-recognition of its brand.

### North America

Hitachi Construction Machinery decided to commence local production in the USA after the profitability of exporting was hit badly by the sharp appreciation in the Yen against the US dollar in the late 1980s. In 1988, Deere-Hitachi Construction Machinery Corporation was established in North Carolina as a 50-50 joint venture with Deere & Company, with which Hitachi Construction Machinery already had close relations including the supply of products on an original equipment manufacturer (OEM) basis. The new company produced medium-sized hydraulic excavators under both the Hitachi Construction Machinery and John Deere brands.

Euclid-Hitachi Heavy Equipment, Inc. (EHHE) was established in 1994 as a joint venture with Volvo Michigan Euclid (VME) (subsequently Volvo) and commenced production of extra-large rigid dump trucks in Canada. Hitachi Construction Machinery

subsequently acquired full ownership of EHHE in 1998 and went on to re-launch it as Hitachi Construction Truck Manufacturing Ltd. (HTM) in 2004.

### China

Hitachi Construction Machinery commenced local production in 1995 by teaming up with Hefei Mine Machinery, China's second largest manufacturer, to establish Hefei Hitachi Excavators Co., Ltd. as a joint venture company in which Hitachi Construction Machinery had a majority shareholding (55%). Hitachi Construction Machinery bought out Hefei's stake in 1998 to make the company fully Japanese-owned and enable it to be managed independently.

The company was renamed Hitachi Construction Machinery (China) Co., Ltd. (HCMC) in 2005. Its production capacity at this point was second only to Japan. In addition to its main product of medium-sized hydraulic excavators, it also produced mini-excavators and mobile cranes. As a result of ongoing work on quality improvement, the company has also become a supplier of high-quality and low-cost components to other plants, particularly welded structures.

In 2013, Hefei Okubo Machinery Co., Ltd. (HOM) was established as a joint venture with Okubo Gear Co., Ltd., a supplier of hydraulic equipment, and

commenced production of hydraulic components in China.

### Asia (Excluding China)

Hitachi Construction Machinery commenced production in Indonesia and Malaysia in 1991 in partnership with local investors. P.T. Hitachi Construction Machinery Indonesia (HCMI) subsequently made good progress, producing not only medium-sized excavators but also welded structures, modules for very large excavators, and other components for supply to other facilities.

Telco Construction Equipment Co., Ltd., a joint venture in India with Tata Motors Limited, was launched in 1999. While Hitachi Construction Machinery only had a 20% stake to begin with, it increased this to 40% in 2005 and 60% (majority ownership) in 2010. A new plant on a site of approximately 1,000,000 m<sup>2</sup> was established in Kharagpur in eastern India in 2009, becoming a major plant supplying medium-sized hydraulic excavators not only to the Indian domestic market but also (from 2014) to the Middle East, Africa, and elsewhere.

### Other Regions

Brazil, Russia, India, and China are collectively known as the BRIC nations. Prompted by the potential for tax-related risks, Hitachi Construction Machinery started production in 2013 in the two BRIC nations where it did not already have local production operations, namely Russia and Brazil. Hitachi Construction Machinery currently does not manufacture in Africa or Oceania.

The following sections describe the plants in Russia and Brazil, each of which was established based on a different approach.

## COMMISSIONING OF PLANT IN RUSSIA

With their large land area and extensive natural resources including oil and gas, Russia and the other nations of the Commonwealth of Independent States (CIS) have been experiencing robust demand for construction machinery for use in areas such as urban earth works, pipeline construction, and mine development. Hitachi Construction Machinery has been supplying machinery to these countries for more than 30 years, primarily by importing fully assembled machines from Japan. Total sales to date amount to more than 16,000 machines.

However, Hitachi Construction Machinery embarked on a serious investigation into becoming

an “insider” in response to import restrictions and encouragements for domestic production introduced by the Ministry of Economic Development of the Russian Federation that came into force in 2009.

A decision was subsequently made to build a factory for medium-sized excavators in Russia. The plant commenced shipments in June 2014.

The following sections describe Hitachi Construction Machinery’s plans to become an “insider,” the factory commissioning process leading up to the commencement of full-scale production, and features of these.

### Aim of Becoming an “Insider”

Price competitiveness is essential if customers are to be able to purchase and use high-quality products on a regular basis. Tariffs and freight costs are among the factors that influence price competitiveness.

While Russia currently imposes a tariff of 5% on imports of fully assembled hydraulic excavators, past threats to introduce regulations that would increase this by double or more have provoked concern from Hitachi Construction Machinery about losing price competitiveness.

To counter this, Hitachi Construction Machinery has sought to reduce tariff payments by becoming an “insider” with a high proportion of locally produced parts. In other words, by importing parts only and in as small a number as possible.

Meanwhile, although average freight costs vary depending on the destination and the mode of transportation used, making major reductions in these under the conditions that have prevailed to date has proved difficult.

Another problem with the import of fully assembled models is that they are liable to be held up at the port or suffer damage or exterior deterioration of parts during transportation by sea, truck, or rail, with a notable loss of finish quality when the machine is handed over to the customer. In the case of transportation by rail in particular, the machines need to be partially disassembled for reasons of size and secured to the wagon, and they invariably suffer from exposure to things like dirt and weather when transported over long distances.

Accordingly, as part of the shift to an “insider” approach, Hitachi Construction Machinery set out to reduce the total cost from the start of production through to delivery to the customer and to improve the quality at the time of delivery by significantly improving transportation conditions.

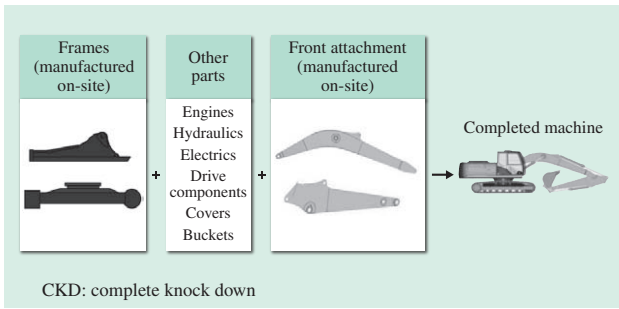


Fig. 4—Parts Supplied in CKD Form or Manufactured Locally. A CKD production model with large and heavy frames being manufactured on-site was adopted to reduce freight costs and increase the percentage of locally produced parts.

### Production Model and Locally Produced Components

First, a complete knock down (CKD) production model<sup>\*1</sup> was adopted to achieve a high proportion of locally produced parts, with as much as possible of the frame and front attachment being built at the plant (see Fig. 4).

Second, ongoing imports were still required for precision components such as those used in the engine and hydraulics, with these primarily being produced in bulk in Japan.

Based on the results of the current study, it was found that the best economics were achieved by adopting the semi knock down (SKD) model<sup>\*2</sup> for products shipped via the east and the CKD model for those shipped via the west (see Fig. 5).

Third, to increase the number of parts manufactured locally, parts procurement includes working with local suppliers and other Japanese companies with operations in Russia to increase production (see Fig. 6).

### Site Selection

While Hitachi Construction Machinery surveyed approximately 40 potential sites across Russia, the final comparison was between a shortlist of five cities in the vicinity of Moscow, chosen in part because of the proximity of other manufacturing operations and convenient port access, and also because approximately 80% of hydraulic excavator sales are made west of the Urals (see Fig. 7).

\*1 A production model that involves handling non-assembly processes such as the welding and painting of the frame, front attachment, and other components, and also performing the bulk of assembly work while procuring parts on a function-by-function basis.

\*2 A practice that involves only handling the final assembly, with components provided on a function-by-function basis in pre-assembled semi-finished form, without including processes such as welding and painting.

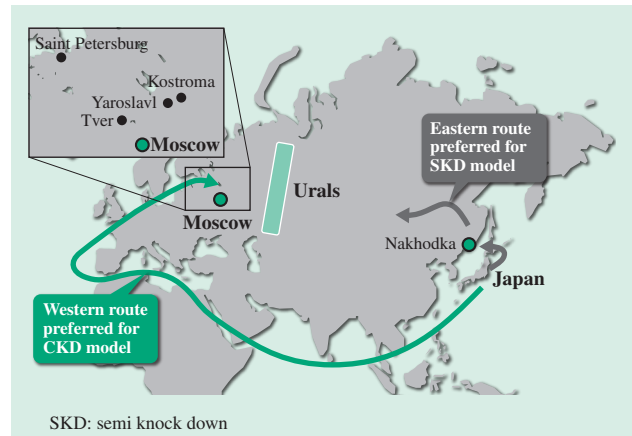


Fig. 5—Transportation Routes Selected Based on Economic Assessment.

For reasons of economics, Hitachi Construction Machinery chose to ship parts via the western route and construct its production site in the vicinity of Moscow.

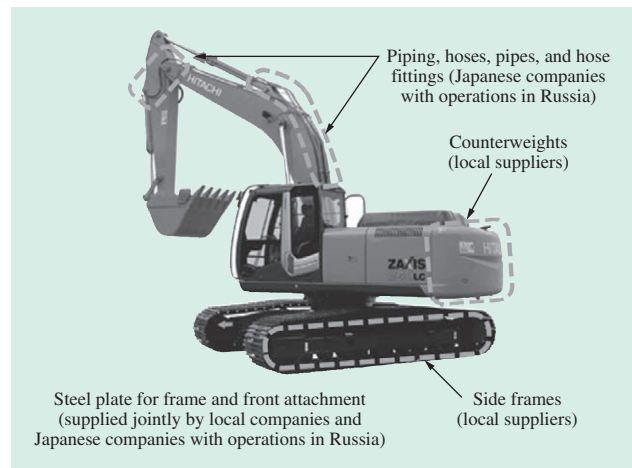


Fig. 6—Local Parts Procurement Plan.

Hitachi Construction Machinery is working to increase local production of parts in collaboration with suppliers.

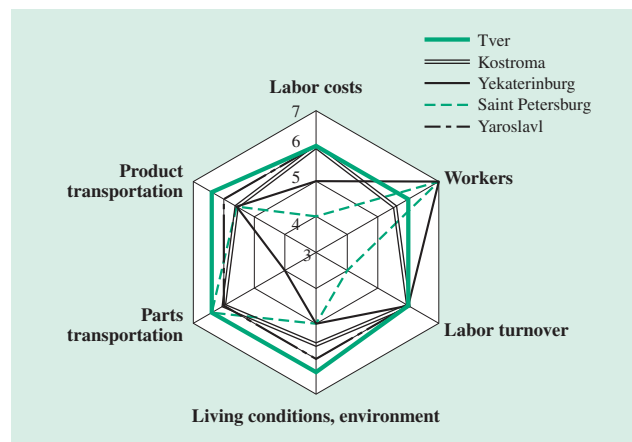


Fig. 7—Comparative Assessment of Potential Sites (Cities). Hitachi Construction Machinery selected Tver because of its transportation advantages and its favorable conditions for operating a production facility.

In addition to the site comparisons, Hitachi Construction Machinery also undertook a detailed survey before finally deciding on Tver. Of the major factors in the decision, the most important was the significant benefits for the transportation of products and parts. Other factors include that Tver is one of Russia's industrial cities, with a technical university and local companies producing goods such as rolling stock (freight cars) and excavation machinery, few foreign companies, and a regional government that was proactive about attracting foreign direct investment.

### Company Formation and Commencement of Operations

Past construction of large-scale production facilities by Hitachi Construction Machinery had been undertaken first in partnership with local companies, and then had been progressively expanded. This, in contrast, was the first time Hitachi Construction Machinery had constructed a greenfield factory on its own, although its operations in Russia included having already established a sales company in Moscow.

While work proceeded on company formation, establishing management structures, and preparing for production, differences of understanding arose regarding the preparation of contracts with the relevant agencies and companies, the complex legal system, and the large amount of paperwork associated with obtaining certain approvals and getting hooked up to infrastructure, and contractual responsibilities to fulfill obligations on time.

While more effort than expected was required to get things done while learning to understand and accept this situation, Hitachi Construction Machinery worked to resolve the issues one by one.

### Factory Size

The factory is intended to produce hydraulic excavators in the 20- to 33-t range, the company's main product in Russia and the CIS market.

Based on demand forecasts, the factory has an annual capacity of 2,000 units, with a floor space of 32,000 m<sup>2</sup> on a 400,000-m<sup>2</sup> site (see Fig. 8).

### Recruitment and Work Qualifications

Hitachi Construction Machinery successfully recruited staff for the factory by advertising widely in Tver Oblast.

Next, workers recruited for tasks such as welding, painting, and assembly were required to obtain

qualifications. During recruitment, qualifications were handled using the ETKC vocational qualifications\*<sup>3</sup> of Russia, which stipulate the skills, knowledge, and level of achievement required for a large number of finely demarcated professions.

However, because companies in Russia tend to have a high degree of demarcation between jobs, many staff did not have all of the expected qualifications at the time of their recruitment.

Accordingly, staff received instruction and sat for examinations at educational institutions prior to commencing operation. Specifically, most of this was done at Konyaeva College\*<sup>4</sup>, a nearby industrial training institution, and Hitachi Construction Machinery donated equipment for use in welding training to establish a collaborative relationship for recruitment, obtaining qualifications, and identifying potential candidates.

To improve the level of knowledge and skills specific to hydraulic excavators, staff underwent training in Japan along with hands-on instruction and competitive assessments at a basic training area set up at the factory.

### Features of Production Line and Progress Management

Work performed at the factory includes welding, managing parts, painting, assembly, and inspection. Operations have been set up to use just in time (JIT) production based on the principles of lean manufacturing.

While there is a general awareness of the idea of lean manufacturing in Russia, because there are few examples where it has actually been used, frequent re-education of local staff was needed.

\*<sup>3</sup> ETKC (Единый тарифно-квалификационный справочник работ и профессий рабочих)

\*<sup>4</sup> Konyaeva College (Тверской колледж имени А.Н. Коняева)



Fig. 8—Factory Building.

The site includes an office, production facility, and production equipment. It has the capacity to build 2,000 hydraulic excavators a year.

For example, measures were taken to ensure everyone could see the correct situation, such as establishing practices whereby the required parts are produced at the required time to keep a constant level of parts inventory on hand at each step based on process cycle times.

It was also anticipated that problems would arise when production first commenced, such as production delays or a lack of parts at various steps. Accordingly, production schedules were prepared based on theoretical cycle times as worker proficiency steadily improved, and the extent to which these schedules were achieved was assessed on a daily basis using key performance indicators (KPIs) that quantified progress.

Issues that caused poor KPIs were dealt with using the plan, do, check, and act (PDCA) cycle, and quick resolutions were sought at daily progress meetings.

### Expanding the Benefits of an “Insider” Status

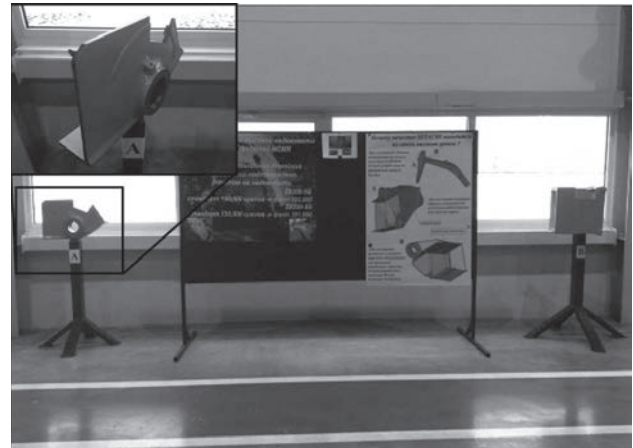
While medium-sized hydraulic excavators are built to a variety of specifications, the proportion of machines delivered to dealers in the standard configuration was very high in Russia. A factor in this was the difficulty of predicting demand at the time the machines would go on sale, with the long lead time when products were imported from Japan meaning that fitting options at the factory required production to look a long way ahead.

Nevertheless, demand for optional features has been growing in many markets, particularly Japan and Europe, and it was anticipated that this trend would also develop in Russia. Hitachi Construction Machinery’s decision to become an “insider” means it can take advantage of its shorter lead times to take steps to satisfy this demand.

Now that the core production equipment and operational framework have been established, a number of specification changes have been made such as changing the width of traction components.

### Involvement with Customers and Community

There is a very high level of trust in “made in Japan” in Russia and the CIS. Accordingly, along with becoming an “insider,” one of Hitachi Construction Machinery’s top priorities was to reassure customers, dealers, and other stakeholders about the high level of quality to assuage their concerns about the increasing proportion of local production and enable them to be confident about purchases. To achieve this, Hitachi Construction



*Fig. 9—Presentation of Cutaway Model of Weld at Factory. Part of the front attachment (a part that requires a high degree of durability) was cut away to provide a visual representation of how well the weld had been performed.*

Machinery held a ceremony and factory tours in 2014 with a total of approximately 1,000 guests, including customers, dealers, people from regional government and local companies, and educational institutions and their students.

At the same time, Hitachi Construction Machinery also sought to raise understanding through the use of actual products, exhibiting test parts to demonstrate their manufacturing precision and holding product demonstrations. This included a cutaway model of a front attachment weld to provide a visual representation of how the weld reaches the required depth into the metal, something that cannot be seen by external inspection (see Fig. 9).

Meanwhile, Hitachi Construction Machinery also commenced a number of activities that it needed to undertake to become an “insider” and that were aimed at contributing to and becoming part of the local community. One of these was a factory event held in September 2014 that was well received and provided the opportunity to mingle with staff and their families. Hitachi Construction Machinery plans to hold further such exchanges in the future (see Fig. 10).

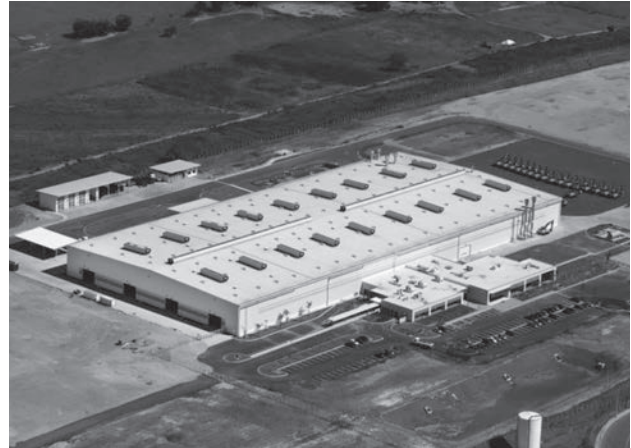
### OVERVIEW OF THE BRAZIL PLANT

Hitachi Construction Machinery decided in 2011 to establish a local manufacturing and sales company in order to become fully involved in the Brazilian market.

Hitachi Construction Machinery and Deere & Company have built an important partnership in North, Central, and South America since the establishment of Deere-Hitachi Construction Machinery in 1988.



*Fig. 10—Product Demonstration at Factory Event. In addition to exhibiting products and giving tours of the facilities, the event included a cultural exchange aimed at meeting staff.*



*Fig. 11—New Factory in Brazil. The site includes an office and a plant for the production of medium-sized hydraulic excavators. Most welded structures are produced on site to increase the percentage of locally produced parts.*

This included setting up a joint venture company for the manufacture and sale of hydraulic excavators in Brazil to enable the two companies to continue pursuing long-term growth opportunities. Hitachi Construction Machinery contributed the world-class technology from its hydraulic excavators to undertake full-fledged local production, while their presence in Brazil was boosted by having marketing handled by Deere & Company, which has a solid infrastructure in place for agricultural equipment.

Table 1 lists details of the joint venture company and Fig. 11 shows the factory site.

TABLE 1. Profile of Brazilian Joint Venture (Deere-Hitachi Máquinas de Construção do Brasil S.A.)

*This joint venture between Deere & Company and Deere-Hitachi Construction Machinery Corporation is located in the São Paulo state of Brazil.*

Company name	Deere-Hitachi Máquinas de Construção do Brasil S.A.
Factory	Indaiatuba, São Paulo
Capital	\$US130,000,000
Ownership	Hitachi Construction Machinery Co., Ltd.: 40% John Deere Brasil Limitada: 40% Deere-Hitachi Construction Machinery: 20%
Business activities	Manufacture and sales of medium-sized hydraulic excavators (15 to 40 t) Import and sales of mini-excavators and hydraulic excavators (up to 100 t)
Joint venture established	October 2011
Production commenced	September 2013
Production capacity	Approximately 2,000 machines per year (with 60% or more locally produced parts)
Site area	200,000 m <sup>2</sup>

Brazil has a Special Agency for Industrial Financing (FINAME) that provides financing assistance to end users when they purchase machinery or other capital equipment. This provides finance on much better terms than otherwise available (lower interest rate and longer term) if the equipment being purchased has 60% or more locally produced parts, making it vital that manufacturers exceed this 60% threshold. The criterion is evaluated by both value and weight, both of which must exceed 60% to be eligible.

Accordingly, Deere-Hitachi Máquinas de Construção do Brasil S.A. produces most of the heavy welded structures itself. The following measures were adopted to commission the production of a wide variety of welded structures in a short period of time. (1) Production equipment and processes were based on those at Deere-Hitachi Construction Machinery in the USA. Staff from Deere-Hitachi Construction Machinery were sent to Brazil to assist with commissioning the equipment, while production engineers and other staff from Brazil were sent to Deere-Hitachi Construction Machinery for training lasting from several weeks to several months.

(2) A major help with welding skills came from Deere-Hitachi Máquinas de Construção do Brasil's recruitment of nine Brazilian technicians who had been working for Hitachi Construction Machinery. In addition to welding skills themselves, the technicians were able to pass on Hitachi Construction Machinery's approach to things such as manufacturing and quality to the worksite, so the plant was able to achieve a very high level of technical skill for a new operation.



## CONCLUSIONS

This article has described the history of the expansion of overseas production undertaken by Hitachi Construction Machinery Co., Ltd. in accordance with its production strategy, together with the features of the plants it recently opened in Russia and Brazil.

Local production for local consumption is at the core of Hitachi Construction Machinery's production strategy. In addition to contributing to regional economies by delivering products to customers around the world in a timely manner, this provides commercial benefits in the form of driving further cost savings and reducing exchange rate risk. What will also be needed in the future is to acquire the operational flexibility to enable product supply accommodations to be arranged

between regions. This is to adapt to fluctuating regional demand and to avoid missed opportunities with the aim of maximizing consolidated marginal income by making strategic use of production sites.

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