

WITH MAJOR FUTURE GROWTH IN THE INDUSTRIAL VEHICLE MARKET SET TO BE CONCENTRATED AROUND THE EQUATOR, SUPPLIERS OF HYDRAULIC AND ELECTRONIC COMPONENTS WHO BOAST A GLOBAL PRESENCE ARE LIKELY TO BE PREFERRED BY OEMs DEALING WITH HIGH CUSTOMER DEMAND

EQUATORIAL GIMME

Off-highway vehicles will certainly continue to be an important market for suppliers of hydraulics and electronics in the coming years – but this market is changing. Manufacturers of these components and systems face many challenges, today and in the future, and will require equally challenging strategies to cope with them.

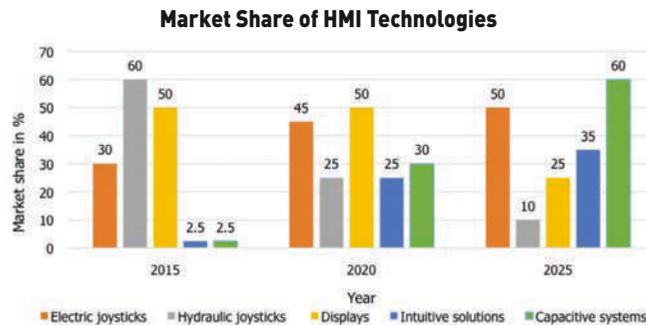
Your global presence required

There has been a global shift of power during recent years. Whereas OEMs in Europe and North America provided the most attractive sales opportunities for many component suppliers for decades, the industrial vehicle manufacturers in Asia (most notably China) and South America (largely Brazil) have significantly gained in importance during the last seven years.

In general, the market's major future growth is expected to take place along the equator, whereas demand in southern and western Europe will continue to be weak.

As will be discussed later, OEMs in the industrial vehicle market are currently building up structures comparable to those used in the automotive industry. Accordingly, they will prefer partners who boast a global presence.

Component suppliers for these machines therefore need to embrace globalization and be present around the globe – in particular in countries



ABOVE: The changing face of HMI over the next 10 years

such as China, Brazil, Turkey and, increasingly, those in Southeast Asia.

Some examples of recent supplier global expansion projects include:

- Argo-Hytos acquired a majority stake in AT Automacao Industrial in Jarinu (São Paulo, Brazil) recently. Since January 2014, the company has also opened offices in Istanbul, Turkey. The next step might be a stronger presence in Russia.

- Bosch-Rexroth has announced two takeovers: the acquisition of Hytec Holdings (Pty), a leading supplier and manufacturer of hydraulic and automation components and fluid power solutions in Africa. With the acquisition, the company will expand its network south of the Sahara, particularly in South Africa, Ghana, Mozambique, Namibia and Zambia. Furthermore, the company plans to take over the hydraulics business unit of Maestranza Diesel S.A. in Chile, so as to strengthen its presence in one of South America's most promising markets.

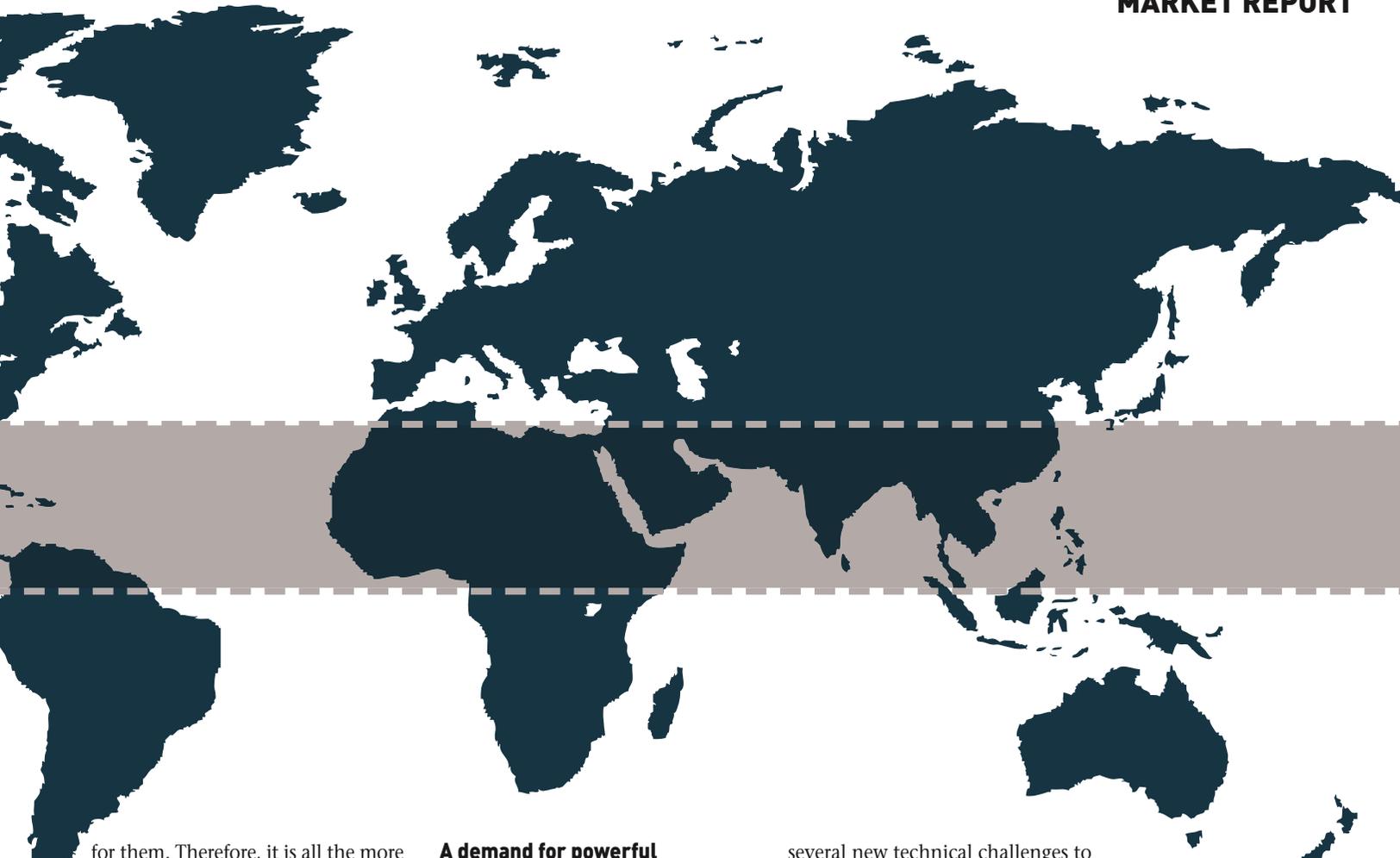
- Linde Hydraulics announced a strategic alliance with the Italian power transmission and fluid power company PMP Industries in May 2014. It also declared the extension and deepening of its worldwide strategic alliance in the field of hydraulics that it started with Eaton Corporation in 2010. The core of the cooperation is to provide customers with access to the entire range of products and services from both companies and to expand their global sales channels. In particular, the two partners plan to combine their strengths in the emerging markets of South America, Southeast Asia (including Vietnam, Thailand and Indonesia) and India.

Furthermore, Linde announced that it would use the funds of its new Chinese owner Weichai not only to build a brand-new factory in Germany, but also to increase its sales activities in China.

- Parker Hannifin opened a new plant in Chennai, India, for the production of filtration, pneumatics and drives, sealing and shielding products in 2013.

Risk and reward

The increasing trend toward globalization poses a particular challenge to the large number of medium-sized companies in the hydraulics industry. While overseas expansion is a necessity on the one hand, it also poses a substantial risk



for them. Therefore, it is all the more important to prepare these ventures carefully and to be aware of how to fully exploit the potential of these new markets.

Due to the high price sensitivity typical of emerging markets, western component manufacturers must also come up with matching products for this environment. Therefore, we can expect much more development and production of hydraulic and electronic products in these areas. According to the market conditions, customized products will gradually emerge, enabling supply shortages in western countries to be avoided. However, the level of training and creativity assets need to be carefully considered, as well as the fluctuation and rising personnel costs.

A demand for powerful system technologies

There is one technological change that has been taking place in the industrial vehicle industry during recent years, and is set to continue: stricter requirements in terms of energy efficiency and exhaust emissions require new solutions. Hydraulics and electronics will be the crucial components in high-performance system technologies.

To successfully address this development, hydraulic suppliers must also offer electrohydraulic system solutions. Whereas today's hydraulics are still driven directly by the diesel engine – or indirectly via a gearbox – electric pump drives (powered by a generator) will be used in the future. This will pose

several new technical challenges to the industry.

The developments in industrial vehicles (see Table 1, below) aim at increasing the efficiency of these machines and their automated work functions. Also, we will see more ergonomically optimized human-machine interfaces.

Energy-efficient hydraulic systems are in the foreground in the western world, and the emerging countries will have to follow this trend. This is especially true for the export versions of their machines – though medium- and long-term, this also applies to machines for their own region.

To ensure they will be able to provide the corresponding system solutions, hydraulic companies have extended their product portfolios to

Trends

Efficient driving and working drives

Automated work functions

Ergonomically optimized HMI

Electrohydraulic solutions

Diesel-electric drives require matching electronically controlled hydraulic solutions

Hydraulic components (pumps, motors, valves, cylinders) equipped with sensors and electronics; substitution of hydraulic controls with electrical controls

Whereas operating systems based on joystick solutions are dominating today, there will be tablet solutions coming into play in the future

TABLE 1: Trends in electrohydraulic solutions for mobile working machines



LEFT: Caterpillar's Cat Connect telematics platform is soon likely to enjoy success in emerging markets – but for different reasons to those in the West

OPPOSITE PAGE (CLOCKWISE FROM TOP LEFT): Vemcon's uniGrip could challenge the status quo in terms of joysticks; Innas uses automotive-style production technology for its advanced Floating Cup pump technology; the PC210LCi-10 Komatsu excavator greatly improves operator efficiency through Intelligent Machine Control

include additional hydraulic products, comprising valves, pumps and accessories including filters and accumulators or electronics, such as controllers and sensors. This is being carried out by in-house development, partnerships or acquisitions.

Examples include:

- Large hydraulic suppliers such as Bosch-Rexroth, Danfoss, Eaton and Parker offer not only the hydraulics, but also the electronic control technology;
- Hydac and TTTech have established a joint venture – called TTControl – in the field of electronic control technology;
- Weber-Hydraulik acquired Fluid Team, LOG Hydraulik and Hyc International in recent years. In late 2013, a joint venture with the Dutch company VSE, a manufacturer of spring and steering systems used in the automotive and agricultural industries, has been completed;
- Hawe Hydraulics, best known for hydraulic power packs and valves, has acquired InLine Hydraulik, a manufacturer of axial piston pumps. Programmable logic controllers complete the program range.

HMI – an intermediate step to automated machines

Human-machine interfaces (HMIs) play an important role in modern machines. These must meet many demands, such as user acceptance,

systems support, driver assistance, and aiding health and safety.

Joystick solutions have prevailed for years, and electronic joysticks will – if they haven't already done so – replace hydraulic models. In addition, intelligent display devices, including head-up displays, typically provide the operator with the correct information.

However, existing joysticks and displays may come under pressure from new solutions. The Vemcon uniGrip solution, for example, is an intuitive, efficient and safe operating system for mobile machinery. The system allows operation of the tool or attachment with the right hand, leaving the left hand free to control directional travel, meaning a faster, harmonic motion will be possible. When using uniGrip, even untrained excavator operators can quickly learn how to control the machine in an efficient way. Experienced excavator drivers can control all the machine functions simultaneously.

In cooperation with Continental, Rafi has produced a new capacitive input system for agricultural and construction machinery. This uses capacitive sensors for the operation of machinery and comprises a 3D operating element, a haptic Glasscape touchscreen and a wear-free joystick. The ergonomically shaped 3D-Scape control module is integrated into the driver's armrest and functions

intuitively using touch and swipe movements, with guides to support the fingers during blind operation. The hydraulics system is controlled via a heavy-duty joystick from the Rafi Joyscape series, which features a waterproof and wear-free design.

Mounted on the armrest, the Glasscape touchscreen can be used for data display and information input/programming and provides reliably tactile feedback when actuated.

More futuristically, Volvo CE's GaiaX concept (see p44) relies on a tablet-style device to control many of the excavator's functions.

Far beyond operating devices

HMI technology, however, must also be seen in conjunction with other technologies, such as intelligent machine control systems and satellite-based machine information systems.

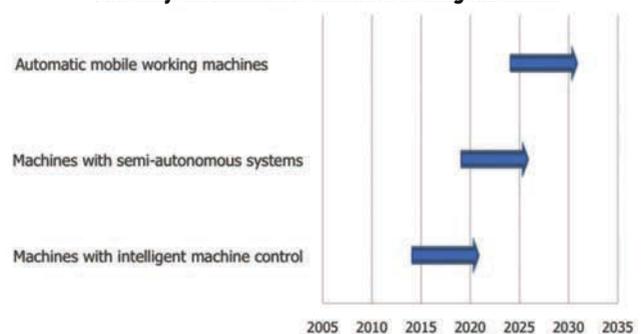
At last year's Bauma, Komatsu presented a dozer with Intelligent Machine Control, before introducing the PC210LCi-10 hydraulic excavator with a new machine control and guidance system in August of this year. According to the OEM, the

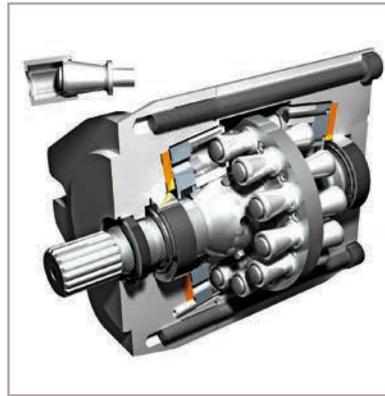
BELOW: Rafi's Glasscape touchscreen provides intuitive operation with reliable, tactile feedback

BOTTOM: The highway 'exits' on the road to autonomous vehicles



The Way to Automatic Mobile Working Machines





ADOPTING TECHNOLOGIES FROM THE AUTOMOTIVE SECTOR

Manufacturers of off-highway machinery are observing the trends in the automotive industry very carefully, as many of the developments from this industry can be transferred to their own products. Industrial vehicle OEMs are using technologies from the automotive sector to reduce energy consumption and exhaust emissions, using, for example:

- Fuel-efficient engines with speed reduction;
- Start/stop systems;
- Electric/hydraulic hybrid technologies.

Another important lesson comes from telematics solutions, classed under the term 'connectivity' in the automotive industry. Such long-distance data-transmission systems can be used for both fleet management and customer service. It is also expected that the share of automated solutions in the production of machines will increase.

Hydraulics and electronics suppliers also use manufacturing principles from the automotive industry – Innas BV, for example, applies low-cost manufacturing technology to the production of its Floating Cup hydraulic pump technology, resulting in an 'automotive' cost level.

There are numerous parallels between the two industries, and Table 2 (available from www.ivtinternational.com) highlights examples of some different technologies deployed both in cars and in off-highway machinery. The corresponding annual growth rates between 2015 and 2020 for these technologies are shown in the diagram below.

Due to the trends mentioned above, industrial vehicle OEMs are seeking suppliers with a comprehensive product portfolio, a global presence and the capabilities to solve interface problems. Globally oriented component suppliers, who have a wide range of products, and an organization that can correspond to the structures of the automotive industry, will benefit most from this new set of rules.

operator no longer has to worry about digging too deep or damaging a target surface, as the system greatly improves the excavator's efficiency, provides higher precision and higher productivity, and increases site safety.

Many off-highway OEMs now commonly offer satellite-based machine information systems to their clients – Komatsu, for example, offers Komtrax as standard. Caterpillar has a partnership with Trimble and uses Cat Connect to offer its telematics and fleet management platform.

Cat expects its system to benefit users not only in developed countries, but in emerging markets as well – although there, they want data on fuel usage as a way to combat fuel theft, rather than for efficiency.

The technology presented here constitutes precursors on the way to fully autonomous machines. For example, Volvo CE's project THOR (Terraforming Heavy Outdoor Robot) has aimed to develop concepts for the automation of machines for the construction and mining sectors – namely the semi-autonomous control of a Volvo wheeled excavator (and an autonomous wheeled loader

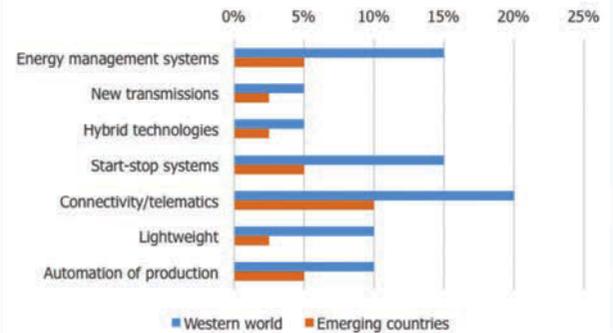
– look out for *iVT* November 2014). The long-term goal is to have an 18-ton excavator performing fully autonomous landscape-shaping tasks.

The medium-term goal is to assist the driver in monotonous, repetitive tasks. According to Volvo, this is a research project, rather than a plan to replace the driver with a fully autonomous machine in the future. The development process should be seen as a kind of highway, from which there will be 'exits' taking the form of repeatedly useful assistance systems, optimally via continuous research, facilitating the everyday life of operators.

Comparable trends are evident in agricultural equipment, where autonomous machines will also be used. For this purpose, sensors and software have to be developed, such as stereo camera, radar, ladar and thermography, that can recognize obstacles, differences in soil texture and objects such as people, animals trees and fences. We can expect these technologies to initially take form in semi-autonomous systems.

The technologies described here will be initially, and primarily, used

New Technologies for Mobile Working Machines
Growth rates p.a. 2015-2020



in western markets – but with the widespread use of electronics, the developments in emerging markets are expected to be offset in time. This development is facilitated by the use of standard electronics, which are adjusted by means of software to meet customer needs. **iVT**

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