

How the heavy equipment industry can reduce the cost of operations and meet global challenges

**SIEMENS**

## White Paper

Feeding a growing world population, developing infrastructure for major cities and properly utilizing natural resources are macro trends that can be positively impacted by the heavy equipment industry. This paper addresses how product lifecycle management (PLM) can help drive the industry's response to global challenges.

# Contents

- Executive summary ..... 3
- Challenges in the heavy equipment industry ..... 4
- How product lifecycle management can help ..... 5
- Siemens PLM Software’s vision for heavy equipment..... 6
- Answers for the heavy equipment industry ..... 8
- Conclusion ..... 10

## Executive summary

Designing and developing new products is a complex process. Early stage ideation, requirements gathering, systems development, product portfolio management, collaborative design, supply chain management and manufacturing all need to be connected in a seamless process. This will ensure that products meet customer needs, as well as demanding time-to-market and time-to-value goals. The heavy equipment machinery industry is challenging because of this development process complexity, as well as the need to design smarter equipment that combines mechanical, electrical and software systems (mechatronics) and the need to meet safety and emission standards as well as pricing pressure from global competition.

In addition, there are three primary macro-trends in the world today that create both opportunities and tremendous challenges for heavy equipment manufacturers:

- 1. Feeding the world:** The world population is projected to be 9 billion by 2050. To feed all of these people, agricultural output must double. There is, therefore, a critical need to improve yield and productivity on farms around the world. To achieve these great productivity demands, the agricultural equipment used by farmers must be powerful, reliable and state-of-the-art. And there must be a service lifecycle support system in place to keep these machines up and running.
- 2. Massive urbanization:** By 2025, it is projected that there will be 27 megacities (defined as >10 million inhabitants), and by 2050, >70 percent of the world population will live in cities. Much of this urbanization is taking place in BRIC countries (Brazil, Russia, India and China) that are rapidly becoming wealthy. As more wealth is created, people migrate to cities, sparking construction, infrastructure and energy demand. In fact, between 2005 and 2030, \$41 trillion (US) will be spent on global infrastructure: \$15.8T in Asia Pacific and Oceania, \$9.1T in Europe and \$7.4T in South America and Latin America.
- 3. Natural resources consumption:** Base metal demand is expected to double in the next two decades, while tougher production conditions will create new challenges. These conditions, such as more deep mine production, more high risk locations, increased environmental regulations, increasing infrastructure requirements and declining ore grades confront heavy equipment manufacturers and their customers.

Heavy equipment manufacturers are uniquely equipped to respond to these trends. However, they will be challenged to meet the demand for their products that will come as a result of this massive global growth. In order to meet this demand, the global product design and development value chain must be unified on a single view of product, process and people. This will ultimately lead to smarter decisions across the development process, and better products.

Despite all of this growth, risks abound for heavy equipment manufacturers and their customers. There is supply chain risk, product compliance risk, and perhaps most dauntingly, economic risk as evidenced by recent recessions in the U.S., Europe and elsewhere. How do you mitigate this risk? Having a single PLM system to unify the product development process not only helps speed time-to-market so you can meet demand, it also helps minimize the total cost of bringing a new, or updated, product to market. Using PLM software ensures your process is efficient, your designs are easily shared with the global team, and your product costs are minimized. It also ensures your products – the heavy equipment that is helping to feed, build and energize the world – will be as efficient, safe and productive as possible, so your customer's cost of operations is reduced.

## Challenges in the heavy equipment industry

While this incredible growth is occurring globally, it is being made more complex by mandated regulations and social consciousness to conduct agriculture, mining and construction (AMC) work in an environmentally friendly way. For example, Tier 4 regulations for lowering emissions in AMC vehicles have been looming for years, and go into place in 2015. At the same time, the demand for commodities such as coal, oil and copper is rising.

How do you increase agricultural and mining output to meet growing population and urbanization demands, in an environmentally friendly and safe way that does not further strain natural resources?

There are also the headwinds of an uncertain worldwide economy that threaten to limit demand as well as minimize growth and output. Farmers, construction workers and miners are cutting costs and trying to do more with old machinery, opening up the opportunity for lower cost heavy equipment manufacturers from China, Brazil and other emerging economies to rapidly take marketshare.

All of these trends drive heavy equipment manufacturers to rapidly innovate, as well as service the existing equipment of customers efficiently. Innovation can be on many fronts, including hybrid drive trains, manufacturing processes and safer, more comfortable vehicles. Service lifecycle management becomes a strong differentiator for large, established heavy equipment manufacturers. They have the existing supply chains and dealer networks in place to effectively respond to customers' needs. Newer, lower cost manufacturers may not have the ability to respond as quickly to this service demand.

The burning question is how can heavy equipment manufacturers meet the needs of their customers – whether farms, mines or municipalities – quickly, with high quality, high productivity, eco-friendly and safe equipment? A daunting question, but this can be achieved by managing your product information, development process, manufacturing and supply chain on a single technology platform. That platform, Siemens PLM Software believes, is product lifecycle management (PLM) software.



## How product lifecycle management can help

In order to meet global demands, heavy equipment manufacturers must improve the efficiency of how products are globally designed; how products, projects, resources and supplier data are managed; and how to service existing customers with spare parts, upgrades (e.g. emission conversion kits or auxiliary filtration systems to meet Tier 4 regulatory requirements), and repairs. They must also deliver a product that meets market, business, compliance and industry requirements, while enabling requirements traceability for each customer order from design through build. The only way to do this is with an open PLM platform that provides a single data model in a future-proof architecture that can integrate easily with existing enterprise (ERP, SCM, CRM) and manufacturing (MES, DCS, MRO) applications.

The goal is to deliver a heavy equipment product that reduces costs of operation to end users so they can maximize their earning power by increasing product yield, while minimizing the cost of work site operations including fuel efficiency, speed, downtime and changeover time. To accomplish this, the equipment a farmer, construction worker or miner uses needs to be comfortable and safe to their specifications. This will ensure their productivity remains high and they can stay on the job. The equipment also needs to contain standard parts and design, so that it is easily serviceable.

The ultimate value of a good PLM system in supporting heavy equipment design and manufacturing is improving global decision support across requirements management, design, development and launch. You must have access to information on past designs and new product development and launch (NPDL) cycles, change impact analysis and downstream process impact, as well as visibility into all aspects of the project/program across domains. As a result, you can visualize the effect of your decisions

before they are made, improve your trade-off analysis and ultimately make smarter decisions, resulting in better products.



Another important and critical criterion is cost management. When meeting customer demand, heavy equipment manufacturers need to evaluate and optimize the costs of designing, developing and delivering a new product to have a final optimized cost for the customer. The ability to analyze the product cost during the entire product development lifecycle (from product planning – to product design – to manufacturing) can be a significant differentiator. This analysis within a PLM system can be based on product features, material used, machining and manufacturing cost, price of components and estimated prices of an assembly. PLM is also rich with project and portfolio management functionality to monitor schedules, resources, price and reporting to ensure an economical approach during design, development and delivery.

## Siemens PLM Software's vision for heavy equipment

Siemens PLM Software solutions are designed with one goal in mind: provide a decision support platform to automate, simplify and accelerate new product development and launch for manufacturers. You need a single data model that unifies design, data management, portfolio and project management; plus reporting and value chain collaboration that enable smarter decisions during the planning and development phase of a product and better execution in delivering a product that meets compliance, sustainability and customer requirements. Siemens PLM Software provides the most open PLM platform on the market today, enabling you to integrate other data sources and CAD models that your team is working with across your global enterprise.

Siemens PLM Software also believes that PLM in the heavy equipment market will continue to evolve in the coming years to support the following areas that are critical to ensure success.

- **Integrated project and product portfolio management (PPPM) and new product development and launch (NPDL) intelligence:** Product and financial analytics and reporting have always been a part of many PLM systems, but heavy equipment manufacturers want to take this to the next level. This includes connecting ideation, business and financial data and service information to the product portfolio. This will enable these manufacturers to make even smarter decisions as they go through their innovation process. Rich analytics and on-demand reporting through the Siemens PLM Software HD3D visual reporting user interface, combined with this project and product portfolio management capability, helps you attain this goal during the NPDL process.
- **Total vehicle integration:** Equipment makers typically have a wide range of products, each of which have a number of options. These products are also growing in complexity because of increasing electromechanical, software and hydraulic content. Customers demand choices for engines and engine ratings, transmissions, ABS, smart sensors, etc. This environment creates physical and electrical integration challenges for OEMs and suppliers. Unlike passenger cars, where integration costs are amortized over large volumes, heavy equipment must bear the integration burden of being highly configured. The benefits of approaching vehicle design as an integrated system are well recognized, but difficult to achieve. An integrated systems engineering-driven approach can substantially help in achieving this vision.
- **Environmental and safety compliance:** Customers and governments demand that heavy equipment manufacturers produce "greener" and safer products. By 2015, Tier 4 emission regulations will be mandated to ensure no particulate matter and nitrogen oxides (NOx) will be sent into Earth's atmosphere. At the same time, heavy equipment operators want comfortable vehicles that increase their productivity, and meet safety standards for operator training or OSHA standards. So manufacturers have been redesigning drive trains that use alternate fuels, and are as comfortable as a luxury SUV. Equally important is lifecycle analysis (LCA) to ensure that environmental impact can be modeled during the planning, design and manufacturing of a product. There are other safety requirements that many customers demand today as well, including rollover prevention, operator presence detection, visibility package and fender guard rails. Siemens PLM Software provides the platform to support these design and development efforts.



- **Mobility demands:** Heavy equipment manufacturers using PLM today can view calendars, sign off on tasks and collaborate with the global product development team using smart phones. The next step in mobility is integrating tablets such as the iPad. Siemens PLM Software's Teamcenter® Mobility product demonstrates our commitment to be at the forefront of this innovation. Manufacturing shop floor managers as well as service technicians increasingly rely on mobile devices to gather information on production status, projections and service information – all with the goal of meeting customer needs as quickly and efficiently as possible.

To create the best possible platform for collaborative decision support for heavy equipment manufacturers, Siemens PLM Software is investing in three main areas to fulfill that vision:

1. **An intelligently integrated information environment** that links all design information and program management data together for a unified view across the value chain, from internal designers and manufacturer engineers to external partners and suppliers. "Intelligently integrated" means presenting the relationships of information, describing why those relationships exist, and providing the development team the ability to model what intellectual property (IP) and other design information is needed to successfully launch a new product. Siemens PLM Software's system can proactively and intelligently deliver the right information to all stakeholders, across different design domains of electrical, mechanical, hydraulics and software as well as product and program management. Instead of requiring these users to go find it, the software helps make this information rapidly and easily accessible.
2. **A future-proof architecture** on which this decision support environment is built, that ensures your return on IT investment, will continue to evolve in concert with that of Siemens PLM Software, and leverage future advances in information technology.
3. **An exceptional user experience** that proactively delivers the right information to you. This is how mobility and context aware applications fit in our vision.



## Answers for the heavy equipment industry

Siemens PLM Software provides a global decision making environment that accelerates innovation across your organization – from designers, engineers and product managers who make smarter planning decisions; to regulatory and quality controllers who ensure consistency and compliance; to manufacturing engineers who ensure exceptional manufacturing execution and product quality; and to every member of your value chain who executes better against your plan. As the organization leverages collaborative decision support at every level, heavy equipment manufacturers will realize gains in speed, productivity, cost-efficiency and compliance, as well as service delivery and new product success.

Siemens PLM Software enables rapid innovation with intelligently integrated historical and current data and processes, as well as an intuitive user interface. You can execute projects against your portfolio, ensuring the entire development team has access to the most current information. This visibility enables them to work against your desired product design, cost, time-to-market and sustainability objectives. In particular, Siemens PLM Software enables you to manage requirements and regulations as an integrated part of your decision processes to ensure compliance at every step.

Siemens PLM Software's vision of PLM in the heavy equipment market is a platform that enables informed, smarter decisions; better products during the planning, innovation, design, compliance, execution and service lifecycles; advanced virtual prototyping and engineering; and closely managed service and support:

- **Informed process decisions:** With robust geometric and spatial search solutions, visual reports or dashboards on project schedule/timing and model development, manufacturing resource and production planning as well as virtual workspace for the global team both through PC and mobile devices, Siemens PLM Software provides the ultimate decision support platform – Teamcenter – for heavy equipment manufacturers.
- **Advanced virtual prototyping and engineering:** Siemens PLM Software's NX™ CAD and CAE solutions enable simplified design on large model assemblies, multiphysics simulation (where, for example, engineers can simulate the impact of durability requirements and weight requirements), configuration-based modeling no matter what CAD system you are using, and perhaps most importantly, visibility modeling to ensure a driver of your heavy equipment has a clear and holistic view of their worksite.
- **Closely managed service and support:** Siemens PLM Software's design and service integrated solution, content management for service manuals, service planning, service scheduling and execution plus retrofit kits for old machines enable you to reliably service your customer's equipment. This lowers the total cost of ownership, while ensuring any changes made during the service operation are available to product designers to enable future product changes.



Teamcenter helps ensure that requirements for new and existing equipment are effectively captured, easily managed and shared with your teams. The system helps you manage requirements and enables traceability, so you can confirm your designs are consistently accurate and compliant. There is also a complete audit trail of requirements embedded throughout the product development and supply chain process to enable rapid responsiveness to product issues or regulatory agency audits.

Siemens PLM Software also realizes how important it is to establish trust with your supply chain. Our supplier relationship management (SRM) module provides a bridge for supplier on-boarding, web collaboration, costing and supplier performance management. And finally, the combination of our NX CAD tools and Solid Edge® software with Teamcenter truly drives product excellence from conception, to design, to field and job site. Our CAD solutions for virtual prototyping and engineering reduce upfront development costs, improve overall time-to-market, eliminate costly physical prototypes,

improve product performance (through virtual machine performance analysis) and improve trade-off analysis.

As the most open PLM system on the market today, Teamcenter seamlessly integrates with our CAD and CAE solutions, as well as those of other vendors.



## Conclusion

“Smarter decisions, better products” is our tagline; perhaps in the heavy equipment industry this should be expanded to “smarter decisions, better products so your customers can increase their productivity and reduce their cost of operations.” The world’s population explosion drives the need to improve agricultural yield and productivity, manage megacity growth and infrastructure development, and meet the growing demand for strained natural resources.

To meet the resulting demand for heavy equipment by farmers, miners and construction workers, manufacturers need a system in place to continuously innovate and efficiently manage the lifecycle of their products; meet environment, safety and service demands; and bring innovative machines to market, whether in agriculture, construction or mining.

To achieve this product and service excellence, your PLM system needs to be open and have the ability, through a services oriented architecture, to connect to any external data source whether that information is about customers, requirements, project (scope, schedule, resources and cost), supply chain or service. In short, the PLM system must be connected tightly to demand signals and the supply network to enable a complete view of the product design and development process. Siemens PLM Software enables this to happen, resulting in informed decision making throughout every stage of the product development process, and world-class products that meet customers’ needs.

Leading companies in the heavy equipment market such as Caterpillar, JCB, Hitachi and Sandvik rely on Siemens PLM Software to support their new product development and launch initiatives, from design to product data management to product portfolio management, to manufacturing and service.

When products from these and other heavy equipment companies meet their customers’ needs of minimizing the costs of work site operations (through fuel efficiency, reduced downtime and improved changeover time) and increasing productivity (through better operator comfort and safety, increased speed and flexibility and standardization of equipment), these customers – farmers, miners and construction workers – are better able to meet the critical agriculture, energy and infrastructure needs for today and tomorrow.

For more information, please see:

- Customer case study: Changsha Zoomlion
- Mechatronic Simulation white paper

## About Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Industry Automation Division, is a leading global provider of product lifecycle management (PLM) software and services with seven million licensed seats and more than 71,000 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with companies to deliver open solutions that help them turn more ideas into successful products. For more information on Siemens PLM Software products and services, visit [www.siemens.com/plm](http://www.siemens.com/plm).

### [www.siemens.com/plm](http://www.siemens.com/plm)

All rights reserved. Siemens and the Siemens logo are registered trademarks of Siemens AG. D-Cubed, Femap, Geolus, GO PLM, I-deas, Insight, JT, NX, Parasolid, Solid Edge, Teamcenter, Tecnomatix and Velocity Series are trademarks or registered trademarks of Siemens Product Lifecycle Management Software Inc. or its subsidiaries in the United States and in other countries. All other logos, trademarks, registered trademarks or service marks used herein are the property of their respective holders.

© 2012 Siemens Product Lifecycle Management Software Inc.

X12 31009 7/12 B

## Siemens Industry Software

### Headquarters

Granite Park One  
5800 Granite Parkway  
Suite 600  
Plano, TX 75024  
USA  
+1 972 987 3000  
Fax +1 972 987 3398

### Americas

Granite Park One  
5800 Granite Parkway  
Suite 600  
Plano, TX 75024  
USA  
+1 800 498 5351  
Fax +1 972 987 3398

### Europe

3 Knoll Road  
Camberley  
Surrey GU15 3SY  
United Kingdom  
+44 (0) 1276 702000  
Fax +44 (0) 1276 702130

### Asia-Pacific

100 How Ming Street  
Suite 4301-4302, 43F  
Two Landmark East Kwun Tong  
Kowloon  
Hong Kong  
+852 2230 3333  
Fax +852 2230 3210