Tech-Clarity

Tech-Clarity Insight:

Preparing Industrial Equipment Manufacturers for Growth

Innovating Future Product Lines with Higher Margins and Less Risk

Table of Contents

Executive Overview

The industrial equipment industry has evolved significantly over the last few decades. Today, increasing global competition makes it very difficult for industrial equipment manufacturers to differentiate themselves. In addition, with growth in emerging markets slowing down, and the ability for fast followers to quickly copy incremental improvements, industrial equipment manufacturers looking to grow need to develop new strategies. With this in mind, it is not too surprising that past research from Tech-Clarity, Best Practices for Developing Industrial Equipment, finds that differentiating products through innovation is the top reported business strategy, reported by 45% of industrial equipment manufacturers.

Joy Global, a leader in high-productivity mining solutions, stresses the value of innovation to their business. Says Chris Flynn, Director of Engineering of Underground Mining at Joy Global, "*Innovation is a key part of our business. It enables us to grow in new areas and prevents erosion of our current market position*." Flynn also comments on how it helps them remain competitive. "*Other companies copy us. As time goes by, copied products and parts become commodities. Innovation is critical to competitiveness*."

Innovation is a key part of our business. It enables us to grow in new areas and prevents erosion of our current market position.
Chris Flynn, Director of Engineering of Underground Mining, Joy Global

While innovation is critical to future success, the challenge is that industrial equipment manufacturers need to focus their limited resources on on-time delivery requirements and getting products out the door. This consumes so much time and effort, it can be very difficult to spare resources for innovation. This is particularly true for transformative innovation, which consists of breakthrough innovations that can lead to the biggest growth opportunities, but may also represent more risk.

Transformative innovation, which consists of breakthrough innovations, can lead to the biggest growth opportunities.

This paper examines how companies can transform themselves to enable greater focus on transformative innovation to help them meet their goals for profitable growth. The report discusses how innovation starts with a culture of innovation. In addition to culture, with the right processes in place, companies can ensure they stay focused on the innovations that have the greatest chance of commercial success. Technology also plays a key role in enabling innovation. With tools such as CAD and simulation tools, companies can explore more ideas in less time. This combination of people, process and technology will

enable industrial equipment manufacturers (IEMs) to make time for innovation, while remaining focused on the day-to-day activities of getting product out.

Why Should IEMs Care about Innovation?

This is a very exciting time for industrial equipment manufacturers with so many opportunities for innovation. Trends such as needs to reduce power consumption, lower material costs, and increase safety create many areas to explore from a product development perspective. In addition, with the increasing amount of embedded software in products, combined with the modern infrastructure of the Industrial Internet/Industry 4.0 and Internet of Things, industrial equipment continues to become more sophisticated. The opportunities for more services and differentiated features become endless. This also creates new opportunities for the servitization of industrial equipment. Coupled with technologies such as 3D printing or additive manufacturing, companies have the potential to completely rethink their service models.

Companies who are able to innovate will be best positioned to meet their goals for growth.

Capitalizing on these trends starts with innovation in product development. Companies who are able to innovate will be best positioned to meet their goals for growth. Companies who ignore innovation or are too focused on the day-to-day operations without planning for the future risk losing market share to more innovative competitors.

As Tech-Clarity's Creating the Environment to Innovate points out, "To drive innovation, companies must put strategies in place to improve the way that people, processes, and tools enable and contribute to innovation." With the right culture, processes, and technology in place, companies can transform their business to become more innovative. However, this will not happen overnight. As Parker Hannifin, a leading manufacturer of motion and control technologies, has found, "*Becoming truly effective at innovation is a journey*," says Bill Beane, Senior Director of Corporate Technology Ventures and Innovation Systems at Parker Hannifin. Yet, with the right focus, leadership, and investments, companies can reap the benefits.

To drive innovation, companies must put strategies in place to improve the way that people, processes, and tools enable and contribute to innovation

Clarify the Meaning of Innovation

There are different types of innovation and it is such a broad term, a common meaning should be defined. Bill Beane from Parker Hannifin shares his thoughts on the different types of innovation, "*There are two major kinds of efforts in product development. One is*

incremental innovation where the company is concerned about the current health of the business and looks after the mature products, or 'cash cows.' This pays the bills, but all too often does not drive great opportunity for growth. The other is breakthrough innovations that are much more radical. This type of innovation typically commands higher value and leads to new business." Companies should focus on both types of innovation. The second type is what we are referring to as transformational innovation. This type of innovation drives future growth, but companies often struggle to give it enough attention. In a study conducted by the Harvard Business Review titled, Managing Your Innovation Portfolio[1], they found that high performers allocate 70% of their resources on incremental innovation. However, these efforts only represent 10% of the long-term return on the innovation investment. Conversely, 10% of the resources were focused on transformational innovation, which translated to 70% of the long-term cumulative innovation investment. Clearly the investments in transformational innovation have the potential to be far more profitable and this is why innovative companies view it as critical to their business.

Incremental innovation pays the bills, but does not drive opportunity for growth. Breakthrough innovation commands higher value and leads to new business.
Bill Beane, Senior Director, Parker Hannifin

GEA Group is one of the largest suppliers for the food processing industry. Lars Northeved, CIO of GEA Process Engineering at GEA Group shares his thoughts on why transformational innovation is so important to GEA Group. "*One of our company goals is to be in the top 3 of all the sectors we are in. To maintain that, we can't just make cheaper products*," says Northeved. "*Without innovation, we would risk losing our market leading position, slide into the commodity market, and lose our margins*."

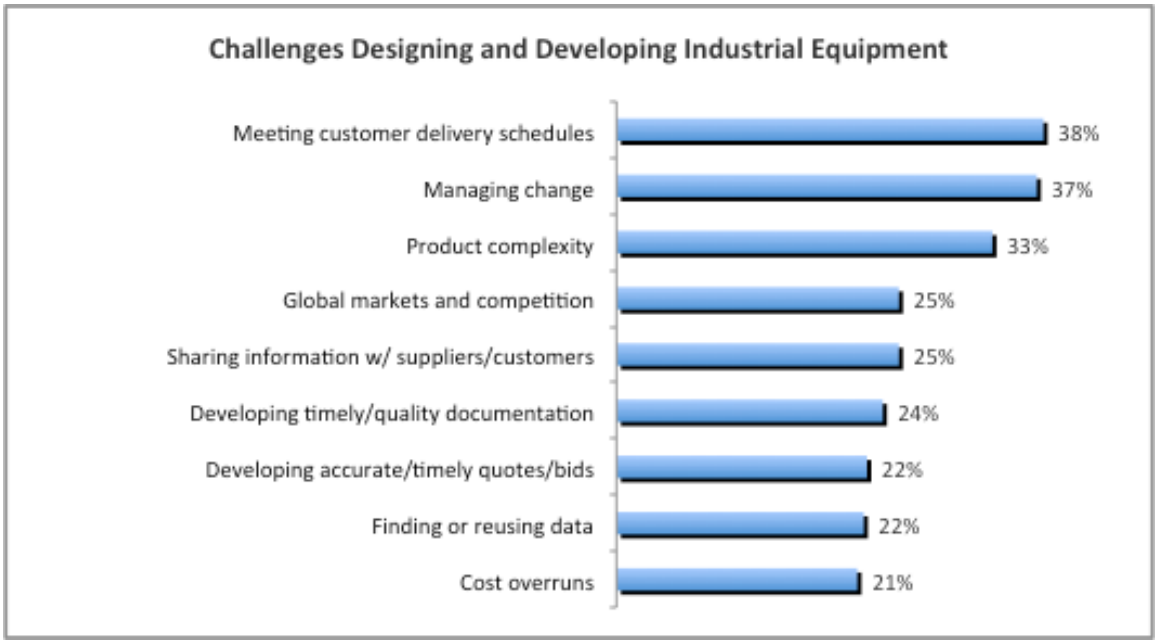
Without innovation, we would risk losing our market leading position, slide into the commodity market, and lose our margins.
Lars Northeved, CIO, GEA Process Engineering, GEA Group

Identify Challenges that Hurt Innovation Success

While innovation is important to future success, it is very difficult to make it a priority when there are already too many daily pressures that must be dealt with. Tech-Clarity's Best Practices for Developing Industrial Equipment finds simply meeting customer

[1] Bansi Nagji and Geoff Tuff, "Managing Your Innovation Portfolio," *Harvard Business Review*, May 2012

delivery schedules is a top challenge. All the associated work that goes with that, such as managing change and product complexity, adds further challenge (Figure 1). As Tech-Clarity's The Five Dimensions of Product Complexity explains, many of these challenges are amplified in a customized environment, which is common for industrial equipment manufacturers.



Beyond making time for innovation, there may be other innovation related challenges. For example, innovation is not always predictable so budgeting can be a challenge. "*Planning for innovation can be difficult because you are never sure when you will have a good idea. When the idea comes, it is random, but the budget and resources are set*," says Flynn from Joy Global. He further comments on why this creates challenges. "*You may say, 'This is a great idea and we will need X amount of money to develop it,' but there is no money left in the budget. There are always competing priorities for budget such as new computers, new machinery, new hires, so it becomes hard to reserve funds for something as intangible as innovation. This is even more tricky because there is no guarantee the idea will be successful and you do not know how long it will be before the business sees a return on that money*."

Fortunately, with the right people, processes, and technology in place, innovation can be a little more predictable and it becomes easier to validate new ideas earlier to either eliminate them or invest further.

Identifying the right ideas can also be difficult. "*Prioritizing ideas that can be commercialized can be a challenge*," comments GEA Group's Northeved. "*We need to identify which ideas we can turn into money and which ones won't. We may have some good ideas, but if they will not make us money, we need to remove them from the pipeline*." Fortunately, with the right people, processes, and technology in place, innovation can be a little more predictable and it becomes easier to validate new ideas earlier to either eliminate them or invest further.

Establish a Culture of Innovation

Creating a culture of innovation must start from the top. Not only should executives have at least a five year growth plan, but they also must recognize that achieving that plan requires making innovation a priority. When belief in the importance of innovation comes from the top, it will trickle down to the rest of the company.

Creating a culture of innovation must start from the top.

The right people are also important for a culture of innovation. As Tech-Clarity's Creating the Environment to Innovate points out, "*Clearly innovators must be knowledgeable, but innovation success requires more than technical and market competence. People who bring the wrong mindset to an innovation role will develop incremental innovation at best. People must be willing to fail and work with fewer constraints, particularly in the front end of innovation and when looking for breakthroughs.....an innovation culture takes more than just executive sponsorship, it requires a unique culture where people can think differently and be free to innovate*." Successful innovators cannot be more concerned with failure than success. This philosophy must also come from the top. Executives should allow failures so that people are not afraid to experiment. Even when something fails, it is a learning experience and that learning can be applied to future projects.

Successful innovators cannot be more concerned with failure than success. This philosophy must also come from the top. Executives should allow failures so that people are not afraid to experiment.

Innovators need to have the right skills, and they must be empowered. "*You have to have people who have the time to think out of the box. They also need to have the ability to mentally experiment*," comments Flynn at Joy Global. "*For example, a person could say, 'I have an idea for a new widget.' Then they should be able to experiment with shape and model it in CAD. Next they could look at materials such as plastic, and validate if it will perform under the required temperature range. They need to have both the tools and brain power to flesh out the ideas 1) quickly and 2) at a low cost*."

Incentives further promote a culture of innovation. This has proven very successful at GEA Group. "*Every year we hold a couple of innovation contests to stimulate various stages in the innovation process. The financial rewards are quite substantial and help us to either accelerate the launch of new products or serve as a basis for early ideation and conceptualization work*," explains Northeved. "*The contests get everyone excited about innovation and encourage people to contribute*."

Anther idea is to financially reward and recognize employees for patents. Joy Global has found this works very well. "*We give employees a financial reward for patentable ideas*," comments Flynn. "*If after submitting an idea it becomes a patent, they get the reward and a plaque recognizing them. It is a company-wide process and anyone can submit an idea*."

Communication is key to innovation. Most new ideas and technologies are not developed in a vacuum. They are inspired by others.
Paul Susalla, Director, Parker Hannifin

Communication is also an important part of fostering a culture of innovation, which has been a focus area for Parker Hannifin. "*We recognized that if Parker only knew what Parker knew, we would have lots of greater activities going on around creativity and innovation*," says Beane. "*We also needed to look at, 'Is there a way to avoid reinventing the wheel.' We've put people in place to help foster an awareness of the ideas under development so then others can join in on those activities. This helps to provide centralized guidance and support for decentralized projects, minimize the investment while enhancing the return, and ideally several groups will benefit*." Paul Susalla, Corporate Manufacturing Technology Advancement Director at Parker Hannifin, adds to this, "*Communication is key to innovation. Most new ideas and technologies are not developed in a vacuum. They are inspired by others. Someone may come up with a great idea to do something better, but then the idea evolves as others build upon it*."

Invest in the Concept Phase

A good pipeline of ideas is more likely to result in the next great innovation, but the key is identifying which ideas have potential for commercial success. A study published in Fortune Magazine titled, 4 Keys to Growth through Transformational Innovation[2], highlights the importance of having the right processes and technology in place to manage the idea to concept phase. The study finds that leading firms spend 40% more

[2] Michael Griffin, Doug Eckstein and Randeep Rathindran, "4 Keys to Growth through Transformational Innovation," Fortune Magazine, October 2012

time than their peers moving from idea to concept. Investing this time up front means they can bring concepts to market 10% faster than other companies because the concepts are more robust. "*Even more importantly, these companies have much higher success rates on their breakthrough projects than their peers; a whopping 28 percentage point advantage*."

While ideas can and should come from anyone, some thought should be given to the organizational structure for developing those ideas into concepts. One approach may be to have a dedicated group, which is what Joy Global does. "*Establishing a dedicated group was one of the things we changed*," says Flynn. "*Previously people had to do sales order work, lifecycle management, and other day-to-day activities. Those things always trump innovation so we created my group to get those ongoing concepts done*." It might seem difficult to convince others to take this approach, but Flynn describes how they did it at Joy Global. "*We were able to justify the dedicated team when we noticed our innovation cycles were way too long*," explains Flynn. "*Plus, without dedicated efforts, the concepts were less optimized so they cost more due to a lot of expensive in-the-field changes. Changing a machine underground in Siberia is not a nice task. With my team, we can get our innovations out more quickly and at less cost to the company*."

While ideas can and should come from anyone, some thought should be given to the organizational structure for developing those ideas into concepts.

Another approach is to spread out the responsibilities. Paul Susalla explains how this works at Parker Hannifin. "*We strive for a culture where it is not any one person's job. If you think about innovation, the goal is to get to a better outcome. There will be all kinds of people with specialized skills that may need to get involved and by spreading out the responsibilities, we can get the right people involved*." Bill Beane describes how Parker Hannifin balances innovation tasks with day-to-day work. "*To ensure we stay focused on innovation, everyone has goals related to innovation*." Adds Beane, "*We measure one of the key outcomes of innovation as profitable growth. General managers have growth targets, engineering mangers do, and so on. The teams understand this and balance the various activities, near-term and long-term, and this is how we expect to get better*."

Define Processes

While innovation, particularly ideation, tends to be very unstructured and unpredictable, established processes provide guidance and a framework to stay focused on the ideas that have the best chance of commercial success. Defined processes also help to weed out ideas that seem like they will have less of a return. Acknowledging the adjustments as ideas evolve, GEA Group's Northeved comments, "*At the front end, our process tends to be a more learning approach using creative methods to inspire people to think out-of-the-box, but once the idea is moved into the pipeline, the process becomes very structured*."

That structured approach can have checkpoints to ensure the right ideas move forward while others are removed from the pipeline. "*We use a stage gate process to direct and focus our thought process around innovation*," says Beane from Parker Hannifin.

As ideas enter the formal process, they should be prioritized. Prioritization helps maintain focus on the ideas that have the greatest chance of commercial success. To support prioritization, solicit feedback from multiple sources. "*We prioritize our ideas based on what has the most commercial potential. To validate commercial potential, people in an appropriate customer facing, commercial role evaluate the idea. For example, if it is an idea around cheeses, a 'cheese person' will evaluate it*," explains Northeved at GEA Group. In addition to customer facing roles, technical people should also be involved. Also, ideas should be evaluated with objective criteria so that prioritization does not become subjective.

Prioritization helps maintain focus on the ideas that have the greatest chance of commercial success.

Joy Global also uses a stage gate process to manage the process of moving an idea through the pipeline. "*Phase 1 is our ideation phase and anyone can come up with an idea*," describes Flynn. "*For an idea to move forward, a VP sponsors the project. It enters our NPD (New Product Development) system and product managers responsible for the product line review it.*" Flynn goes on to describe criteria, such as pricing potential, that are used to evaluate an idea. Once the VP agrees to sponsor the idea, it goes to engineering where they evaluate the time and money required to get the idea off the ground. "*To ensure we do not waste too much time on wrong ideas, we revisit this criteria at each stage gate in case we have misjudged the cost, time, or resources required to commercialize the idea*," says Flynn. "*In addition, every month, sponsoring VPs review their projects to ensure they are progressing as expected*."

Take Advantage of Available Technologies

To address the challenges industrial equipment manufacturers face and to free up resources for innovation, companies should establish a foundation for efficient product development. Document processes and identify bottlenecks that hurt efficiency.

When time isn't wasted on non-value added activities such as hunting for information or reinventing the wheel, that time can then be invested in innovation activities.

Establish methods to easily find information and maximize reuse, using technology as needed to support search capabilities. When time isn't wasted on non-value added

activities such as hunting for information or reinventing the wheel, that time can then be invested in innovation activities.

Technology tools improve efficiency so more iterations can be evaluated in less time. This leads to a more optimal concept, which saves time during detailed design. Optimizing during the concept stage reduces risk because there is more confidence in the design before it moves on to later stages. There are a variety of tools to support this.

Technology tools improve efficiency so more iterations can be evaluated in less time. This leads to a more optimal concept, which saves time during detailed design.

Innovation starts with a funnel of ideas and these ideas can be captured with an idea database. "*To support the ideation front end of our development process, we use an idea database*," comments Beane at Parker Hannifin. "*With this tool, someone can propose an idea and others can suggest improvements. It provides a way to collaborate and screen ideas before starting anything formal*."

Project management and portfolio management tools can also play a valuable role in providing guidance. Project management tools help to provide a framework to manage a project. They can be very helpful to support a stage gate process. Business tools like portfolio management can help companies compare apples to apples and evaluate the potential value of the innovation. The toolsets can be complementary as portfolio management helps to pick the right projects while project management help to manage the project right.

Design tools can be key for innovation. "*We use a variety of different design tools including CAD and FEA*," says Parker Hannifin's Bill Beane. "*The speed and accuracy with which we can sketch something is very useful. Then we can produce a photorealistic image, which gives customers a true sense of what the product will look like. This allows us to get very interesting feedback from customers*." Beane doesn't expect it to end there either. He adds, "*In the future, we expect to 3D print select examples to give the customer something even more tangible*."

Without technologies such as CAD, CFD, and other simulation tools we would not be able to evaluate multiple concepts. In theory, we could innovate without those tools, but it would take too long and cost too much.
Chris Flynn, Director of Engineering of Underground Mining, Joy Global

Joy Global also finds design tools a valuable enabler for innovation. "*We try to do as much as we can in the virtual world during the concept phase. We do not buy anything*

until after CAD models and simulations are done," says Flynn. He explains how design tools make it possible to evaluate more options, which leads to better results. "*We might have 20 concepts which we whittle down to 3 or 5. This work can be done in parallel until we come up with the winning idea*," explains Flynn. "*Without technologies such as CAD, CFD, and other simulation tools we would not be able to evaluate multiple concepts. This approach enables us to innovate. In theory, we could innovate without those tools, but it would take too long and cost too much. Rather than 3 or 5 concepts, we would push ahead with a single idea without looking at other options*." Flynn also describes how design tools help at a business level. "*With this approach there is less risk because you are only investing time, which does cost something, but not as much as building something and you can afford to throw it away before investing in materials and equipment*."

Lars Northeved at GEA Group describes the positive impact design tools, particularly CAE (computer aided engineering), have had on innovation. "*Our simulation tools play a valuable role in our innovation processes. We can simulate various scenarios to understand how the product will behave*," says Northeved. "*As we evaluate different scenarios we can evolve and optimize the idea. Plus we have better documentation to support the innovation if we decide to patent it*."

Our simulation tools play a valuable role in our innovation processes. We can simulate various scenarios to understand how the product will behave. As we evaluate different scenarios we can evolve and optimize the idea.
Lars Northeved, CIO, GEA Process Engineering, GEA Group

Rapid prototyping also has a role in innovation as Paul Susalla at Parker Hannifin explains. "*Rapid prototyping contributes to our innovation processes. Let's say we want to try something out with a new design, for example, a casting. Traditionally, it would take 3-4 months before we had something to test. With rapid prototyping, we can test out a concept in just a couple of weeks*."

Rapid prototyping contributes to our innovation processes. Traditionally, it would take 3-4 months before we had something to test. With rapid prototyping, we can test out a concept in just a couple of weeks.
Paul Susalla, Director, Parker Hannifin

Finally, collaboration tools can help to tie it all together. So much of innovation comes from building off of ideas from others. Communication is key to making this happen. Part of that is making design information centrally available. This can include data management tools that not only manage and store information, but also make it easier to find. Visualization tools can make it easier to collaborate and share design models even

with those who may not have access to CAD. Solutions that take advantage of cloud technologies can also help to securely share information both internally and externally, without putting the burden on the internal IT department to manage the infrastructure.

Conclusion

Innovation, particularly transformative innovation, is critical for industrial equipment manufacturers to stand out and remain competitive. It is needed to ensure the future revenue streams for the company. However, sparing resources for innovation can be a challenge. Companies who lose focus on innovation or are so consumed with daily operations, put themselves at a significant competitive disadvantage. They risk losing market share to their more innovative competitors.

Companies who lose focus on innovation or are so consumed with daily operations, put themselves at a significant competitive disadvantage.

To become more innovative, companies must establish a culture of innovation. Fostering the right mindset, with the right skills will lead to a free flow of more innovative ideas. Processes are also important. First, existing processes need to be examined for bottlenecks and areas that hurt efficiency. Addressing this will enable resources so that they have the bandwidth to also focus on innovation. Processes also need to be established to support innovation so that the company stays focused on the right ideas and ideas that have less chance of commercial success are weeded out. Finally, technology is critical. Technology improves efficiency, provides guidance, and makes it possible to evaluate more ideas in less time to arrive at a more optimal solution. With this combination of people, process, and technology companies will be better positioned to focus on the transformative innovation that will lead to greater profitability.

Recommendations

Based on industry experience and research for this report, Tech-Clarity offers the following recommendations:

- Make transformational innovation a corporate goal and empower employees to focus on it
- Establish a foundation for efficient product development
- Create a culture of innovation
- Focus on success, not failures
- Spend enough time during the concept phase to optimize concepts before they move to detailed design
- Prioritize ideas based on which ones have the greatest potential for commercial success

- Use objective criteria and feedback from multiple sources to prioritize ideas
- Implement a stage gate process to regularly evaluate innovation projects to make sure it continues to make sense to invest in them
- Use design tools such as CAD and simulation to evaluate multiple concepts and arrive at the best solution
- Create more time for innovation by removing bottlenecks and improving engineering efficiency by supporting more design reuse, greater design automation, and the ability to quickly find existing designs
- Consider rapid prototyping, 3D printing, and additive manufacturing as quick and inexpensive ways to validate concepts

About the Author

Michelle Boucher is the Vice President of Research for Engineering Software for research firm Tech-Clarity. Michelle has spent over 20 years in various roles in engineering, marketing, management, and as an analyst. She has broad experience with topics such as product design, simulation, systems engineering, mechatronics, embedded systems, PCB design, improving product performance, process improvement, and mass customization. She graduated magna cum laude with an MBA from Babson College and earned a BS in Mechanical Engineering, with distinction, from Worcester Polytechnic Institute.

Michelle began her career holding various roles as a mechanical engineer at Pratt & Whitney and KONA (now Synventive Molding Solutions). She then spent over 10 years at PTC, a leading MCAD and PLM solution provider. While at PTC, she developed a deep understanding of end user needs through roles in technical support, management, and product marketing. She worked in technical marketing at Moldflow Corporation (acquired by Autodesk), the market leader in injection molding simulation. Here she was instrumental in developing product positioning and go-to-market messages. Michelle then joined Aberdeen Group and covered product innovation, product development, and engineering processes, eventually running the Product Innovation and Engineering practice.

Michelle is an experienced researcher and author. She has benchmarked over 7000 product development professionals and published over 90 reports on product development best practices. She focuses on helping companies manage the complexity of today's products, markets, design environments, and value chains to achieve higher profitability.