RAVEN

WHITEPAPER

Using Smart Contextualization For Successful Digitalization Across Manufacturing Sites



Contents

The importance of human context	3
The current state of operator work environments	4
How Smart Contextualization works	5
Engaging the frontline through collaboration	5
The need for actioned insights	6
Establishing your continuous improvement process	7
Smart Contextualization as the symphony conductor	7
About the author	8

Data alone, without context, is at best unproductive and at worst misleading. This is just as true with industrial data. The growth of industrial IoT, the explosion of big data and the transformational promises of artificial intelligence are all dependent on an assumption that data being fed into these systems contains all of the necessary context required to make informed decisions.

It doesn't. And in many cases, it's far from it.

The importance of human context

Digital data from sensors, PLCs, machines and manufacturing systems all contain information but lack critical context. Why? Because these systems often bypass one of the most important sources of data context on the factory floor —operators and other frontline workers. Human context is the thread that stitches data together and turns it from data into meaningful information.

For example: Imagine one of your key constraint assets is suffering from 2-hour downtimes several times a week causing considerable loss of production. Your senior leadership team is looking at their digital performance dashboards and see that fault codes from the PLCs indicate repetitive mechanical failures. The team asks their generative Al co-pilot what recommendations it would make given these costly asset reliability issues. The GenAl co-pilot suggests investing in rigorous, preventative and predictive maintenance programs. It also suggests that over the past 6 months the production losses accrued to more than the cost of a new machine, making an additional recommendation to replace the offending asset. Actionable insights at their finest.

The problem is, the insights are wrong. If human context was weaved into the data showing up on your leadership's dashboard, they would have found that for the first 30 minutes of each downtime the operator is waiting for a maintenance engineer. When the engineer arrives, they often need a specific part so a further 15 minutes is lost waiting for materials. The engineer then spends just 10 minutes fixing the machine but now the operator is no longer at that specific machine. The operator may even be on their break which is another 30 minutes and possibly longer if the operator isn't diligent about keeping their break to 30 minutes.

In other words, 90% of the two-hour downtime is actually a result of people and process issues. And only 10% of the downtime is actually related to asset reliability. This additional human context changes the equation completely.

By improving communication, monitoring and escalation processes, the downtimes could be reduced to around 20 minutes. This changes the ROI of replacing the machine entirely.

So, the solution is to digitize the human context. Get the operators to provide you and your team context so that you can digitize it and incorporate it into industrial data sets.

Job done.

If it was that easy, this problem would have been solved decades ago. Successfully engaging operators in digital transformation can be tough. Operators expect technology to make their lives easier. They aren't necessarily excited about using it when it places a burden on them.

The current state of operator work environments

In many cases today, operators still use pen-andpaper processes such as spreadsheets to record downtime reasons. Operators are busy. And because of this, they don't necessarily record every single downtime nor provide sufficient context that can be deemed as meaningful. Operators may also leave the task until the end of shift, trying to remember what assets were down and why hours later.

This often leads to inaccurate and incomplete data that usually isn't digitized, or if it is, it sits in an Excel spreadsheet without use by any higher-level systems.

Higher level systems such as MES may provide a user interface for operators to enter downtime reasons and additional context.

However, these interfaces are just a feature of a much broader system and weren't necessarily designed with operators in mind.

Many operators wear gloves and may work in oily, greasy environments. They don't have time to deglove, grab a mouse, navigate menus or manually type in downtime reasons. Yet this is what the majority, if not all, of OEE and production tracking systems expect operators to do.

Historically, this is why it has been difficult to engage operators and other frontline workers in digital transformation initiatives. We have burdened them with manual tasks, provided them with "features" embedded into user interfaces designed by engineers with end goals in mind rather than needs of the frontline.

This is where Smart Contextualization changes the game.



How Smart Contextualization works

Smart Contextualization: The process of building up a fully-contextualized, minute by minute production event timeline for every asset.

The timeline shows exactly where hidden losses are occurring. This is an essential tool for ensuring continuous improvement teams are focusing on the right priorities.

Data is taken from simple I/O such as: part count sensors and combined with PLCs, machine data and data from higher-level systems such as MES and ERP. What makes the process "smart" is that it also brings in human context from operators and other frontline workers. This critical information is then stitched together into a meaningful timeline with real-time loss tree analysis.

Engaging the frontline through collaboration

So, how does Smart Contextualization successfully engage frontline workers? There are three key elements required for successful engagement.

First, you will still have to ask an operator to provide additional context, but it has to be as easy as possible for them to do this. No dropdown menus, scrollbars or manual data entry. Just a single tap on a touchscreen display — two taps if an extra level of granularity is needed. Start simple with just a few high level downtime reasons and then work with operators to build out the other elements of context. Second, build the system with the operators not just for them. If a downtime reason can be automatically tagged instead of entered by a frontline worker, then use AI or background agents to spot these patterns for automation. For example, regular break times can be automatically labelled; microstops due to post-changeover instabilities can be auto-tagged and on interconnected lines, use agents to auto-tag assets impacted by upstream or downstream assets. You shouldn't have to require operators to tag every machine for the same issue.

Lastly, to truly engage an operator there has to be some utility in it for the operator when they provide critical context. For example, it could be something as simple as changing the display colour when the asset is down. When the display is red, this indicates to the supervisor that the asset is down and the operator hasn't provided context. If it's yellow, it means the operator has tagged the downtime and the issue is now with another department (for example, waiting for maintenance). So, by the simple act of tagging a downtime reason the operator is communicating to their supervisor where the bottleneck is.



The system could also send an alert, via email or text, to the relevant department and even handle escalations if the response times exceed a certain threshold. At this point, the operator doesn't even acknowledge the task as downtime tagging, they are actually using the system to accelerate the rectification of a fault.

The result? A highly engaged frontline team providing accurate and detailed human context to higher level reporting tools, that can then be contextualized and used for identifying and rectifying hidden losses.

The need for actioned insights

There's a but. Software alone won't deliver value. Software can provide the high quality, contextualized data but if it just sits in a database or in a shift report and doesn't get used, then it won't lead to value. Everyone who cares about operational excellence talks about "actionable insights" but "actionable" is an adjective — not a verb. What we need are "actioned insights" and for this, Smart Contextualization has to be part of an established continuous improvement culture and process.

> "Continuous improvement should be organic and not something that is done "to" a factory through a centralized organization, but is actually part of the fabric of day-to-day operations."



Establishing your continuous improvement process

An effective process needs to have four key elements: value drivers, data measurement, targets and action. First, a solid understanding of the value drivers on the process, or a value stream map, in order to make sure that the relevant data and context is captured. Second, you need to measure and analyze the contextualized data. The third element is to use these insights to set your improvement targets and the fourth is to drive the action of this through a supportive continuous improvement team and company culture. This CI process should be an integral part of the standard daily work of the plant with frontline teams being active participants. Continuous improvement should be organic and not something that is done "to" a factory through a centralized organization but is actually part of the fabric of day-to-day operations.



In the rapidly evolving landscape of digitalization and Industry 4.0, the role of Smart Data Contextualization emerges as the anchor between raw data and actioned insights. It's not only a technological solution; it's a transformative force that empowers frontline teams and catalyzes a culture of continuous improvement.

Smart Contextualization as the symphony conductor

As we head towards a smarter, more connected future of manufacturing, let us remind ourselves that data without context is just informational noise. Smart Contextualization is the symphony conductor, orchestrating harmony by seamlessly integrating human context with machine-generated data.

In the absence of Smart Contextualization, frontline teams operate in the shadows, navigating blind alleys of misleading data without informed decision-making and untapped opportunities. As we embrace the future, Smart Contextualization can be the guiding force that ensures we don't just collect data — we understand it, contextualize it, and, most importantly, act upon it. Our journey into the future of industry is not just defined by technology; it's defined by the thoughtful integration of human context, making every data point resonate with purpose and possibility.

About the author

Dr. Paul Turner is a recognized subject matter expert and industry leader in Industry 4.0 applications and advanced analytics, with over 30 years of experience in the manufacturing space. He's held operations, product management and consultant roles with Shell, AspenTech, Wipro and EY. He also led Stanley Black & Decker's global manufacturing analytics strategy as Vice President I4.0 Applications and Analytics. Most recently, he held the role of President and Chief Operating Officer at Raven.

Paul has a BSc in Physics from Liverpool University, a PHD in Manufacturing Analytics from Newcastle University, an MBA from Manchester Business School and over 40 publications in the field of AI and analytics in manufacturing.



Your bird's eye view into shop floor processes

Raven helps manufacturers win by empowering frontline, engineering and management teams to make fact-driven productivity improvements on the shop floor, with its automated smart contextualization and OEE software.

Raven combines and analyzes data from machines and input from operators to provide a real-time, meaningful timeline of events with context for everything that's happening on the line — accounting for 100% of production time and OEE losses.

Book a Demo



Contact Us hello@raven.ai raven.ai