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# People-Centric Approaches to Process Optimization Drive Results

EXECUTIVE SUMMARY

Process optimization can provide a greater ROI, improved output, and increased growth while still being a low-cost initiative. Utilizing existing software and hardware, compiling tacit knowledge from current resources and engaging the existing workforce can all provide opportunities for exponential upward growth. By pairing these variables together and focusing on a people-centric approach, optimization efforts will yield a higher return and eliminate potential future downtime.

THE PEOPLE-OT-IT TRIANGLE

In any given industrial process there are 3 broad and interdependent components that each play an integral part in the success of the process: People, Operations Technology (OT), and Information Technology (IT).

People

Operations Tech

Information Tech
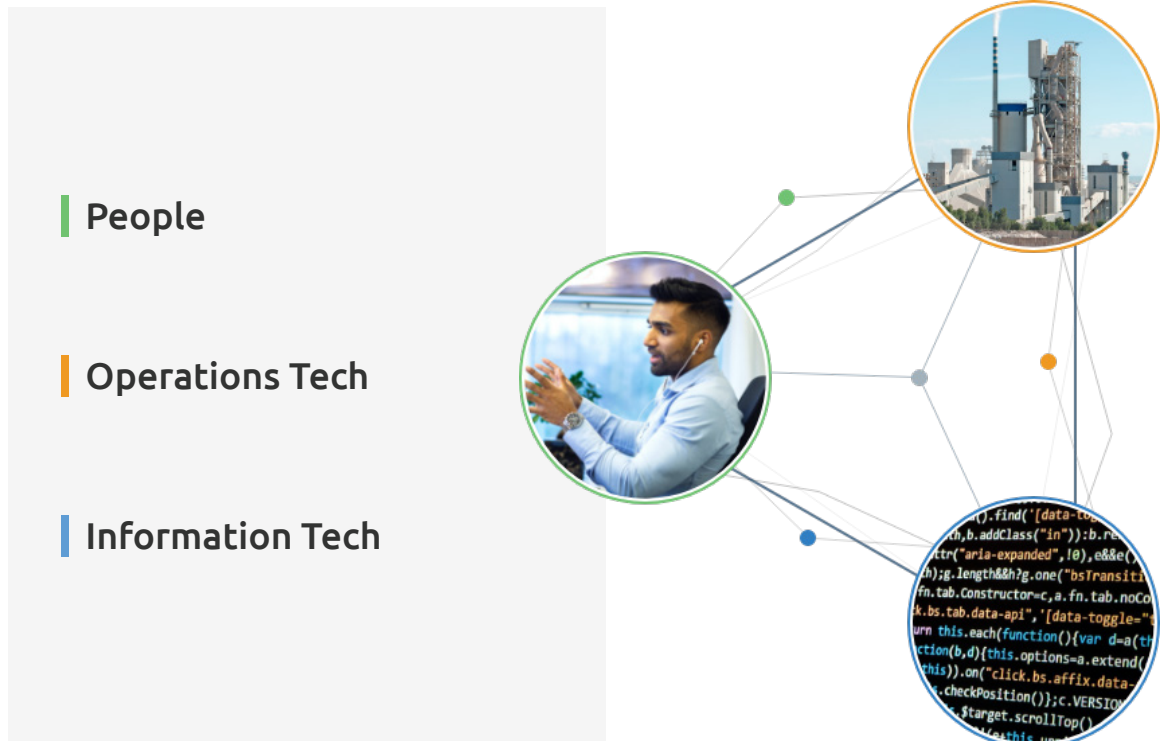
People refers to the human aspect of a process. This includes control operators, process engineers, maintenance staff, and/or plant management from within the enterprise, as well as outside personnel such 3rd party service staff and vendors.

OT refers to the physical hardware that drives or measures a process. Examples of OT includes items like combustion burners, motors, drives and pumps. On the measurement side, OT can include physical meters and instrumentation like accelerometers, flow meters, and level meters. OT can also include the hardware that makes up the supervisory control and data acquisition systems (SCADA).

IT can broadly refer to the software that is used to run and/or optimize the hardware within a process. This can include the supervisory control software, expert systems, data historians, and simulation/virtualization software. IT can also include some hardware such as routers, switches, and other networking equipment.

In order to fully optimize an industrial process, inputs or investments need to be made to each of these 3 components (People, OT, IT). The magnitude and nature of these inputs will directly affect the results that can be achieved in a given optimization project. As such, one of the most costly mistakes plant managers and enterprises can make when evaluating a

solution set is neglecting either one or more of these key components. For example, neglecting the people component can often lead to significantly higher OT or IT expenses in order to achieve a similar ROI, all else being equal.

Balancing the People-OT-IT triangle is a practice that can fully leverage each component and ensure a holistic approach to optimization. Finding the appropriate mix of components is the most effective way to achieve a higher ROI, a faster payback, and more efficient implementation.

BIG RESULTS - MINIMAL DIGITIZATION REQUIRED

It is a common belief among many enterprises that they simply cannot afford to implement a process optimization initiative because of significant the significant costs that can be associated with OT and IT solutions. Big name OT players are pushing and packaging optimization solutions with their hardware, and IT players are often only working with specific hardware and operating under an expensive per annum license model. This begs the question - is this cost barrier to achieving a return from a process optimization project using IT and OT necessary?

The short answer is no, there doesn't have to be. By taking a people-centric approach, significant costs can be mitigated, lowering the barriers to entry for nearly all industries.

According to a 2016 study from Harvard Business Review on the relative digitization of industry sectors, only two industrial sub-sectors were found to have above average levels of digitization relative to the broader sampling - Oil & Gas and Utilities. Both have very robust OPEX budgets that can support expensive investments in OT and IT.

Conversely, the other industrial sub-sectors that were highlighted in the study, chemicals and pharma, basic goods manufacturing, mining, and food and beverage processing, were all found to have below average levels of digitization, as margins are thinner across the board. As such, it is more common-place to see control charts in excel rather than in a PLC or enterprise DCS.

How can plant managers and enterprises break down the digitization cost barrier to achieve an ROI? The key is to leverage the People-OT-IT triangle when evaluating vendors and options:

• Investments in OT can chew up even large OPEX budgets. But, solutions exist that are OT-agnostic. Allowing enterprises to leverage OT investments that were made previously without having to incur the cost of a fully integrated OT/IT stack. This lets enterprises on-board siloed data coming from disparate systems, even if the system is a pen-and-paper control chart.

• Depending on software specs, investments in IT can lock enterprises into extended per annum service agreements. However, leveraging open source solution sets, allow enterprises to maintain autonomy over their control data and ensure that they can have a clean break from a vendor if need be.

• People are often the most overlooked stakeholder in a process optimization project. Does an enterprise train its existing operators and engineering staff to have them manage the project? Does it hire new dedicated engineers? Often times the most cost-efficient method is leveraging an engineering consulting firm. These firms can supplement the existing staff, allowing a clean break or transition to a lean ongoing support retainer after a project realizes an ROI.

By carefully evaluating each piece of the People-OT-IT triangle, enterprises can find solution sets that fit within their OPEX budgets constraints. Lowering this cost barrier to entry, allows enterprises to dip their toes into the process optimization pool with significantly less risk. In doing so, enterprises can take an iterative approach to optimizing their processes. This iterative approach provides plant managers valuable ROI data which can build a stronger case for increases in OPEX budgets and lead to stronger results.

INSTITUTIONALIZE THE KNOWLEDGE BASE

One of the biggest problems that the industrial sector is facing is its aging workforce and the loss of experiential knowledge. As a significant portion of the industrial workforce is nearing retirement age and younger job-seekers are increasingly less likely to fill those positions, companies are often not doing all they can to assure effective transfer of the experiential knowledge that is walking out the door. Broadly speaking, the industrial sector's workforce median age is 15% above the national workforce average. The landscape can be even bleaker looking at industry sub-sectors. Per a 2019 study from Industry Week, 25% of the manufacturing workforce is over the age 55. The power generation and utilities sector has an even higher proportion, with nearly 30% of their workforce being over the age of 55, per a 2018 S&P Global Platts study.

Because of this troubling gap between supply and demand of labor in the industrial sector, forward thinking companies need to start devising plans to capture the tacit knowledge of its aging workforce before it is too late.

Through years of working in the trenches, Operators, engineers, and maintenance staff develop working knowledge about how their plant, or more broadly their enterprises, function. This can be as simple as an operator knowing that during windy months vents need to be closed, or as complicated as knowing best practices for dealing with fluctuating demands as they arise. While most plant managers will contend that all of this knowledge is built into the process control logic that resides within their control systems, the reality is, there are typically very significant gaps between the tacit knowledge that the operators and engineering staff have developed over years of experience and what exists in the logic of their control systems.

The challenge then becomes how to best bridge this gap that exists between the knowledge base of the aging industrial workforce and the logic that resides within the plant or enterprise control systems. One of the significant benefits to taking a people-centric approach to process optimization is the ability it affords enterprises to institutionalize and standardize the knowledge base that the operators and engineering staff have developed. Often, when implementing a process optimization strategy, the focus is on allowing the OT and IT to handle the heavy lifting, and vendors of both will argue that their tech will learn whatever is needed simply by optimizing within the provided process constraints. However, by working more closely with the operators and engineering staff, incorporating their best practices into the logic control systems themselves, enterprises can capture, standardize, and institutionalize the knowledge base they have developed over time.

Imbedding this information into the optimization models allows key learnings and best practices to be institutionalized. When these are institutionalized, it provides a flexible and scalable means of implementing best practices as narrowly as the I/O level and as broadly as an enterprise's entire fleet of plants, with consistency.

Standardizing the knowledge base helps to mitigate the risk of a knowledge and skills loss due to an aging workforce beginning to retire. By ensuring that this information is built into the models, the burden is removed from the operators and engineering staff to disseminate the knowledge to the incoming workforce. In a climate where there are significant concerns about a shortage of incoming workers, the importance of taking a people-centric approach cannot be understated.

SMARTER MODELS LEARN FASTER

Moore's Law states that the processing power of computers, and more broadly technology, doubles every two years. The growing capacity of this processing power has been the catalyst that has allowed artificial intelligence, neural networks, machine learning, and other computationally taxing processes to become feasible. Being able to run these computationally taxing processes in an economical and time-effective manner was what ushered the promise of IIoT and Industry 4.0. However, in an economic climate in which demonstrating a timely return on OPEX budgets is necessitated, Moore's Law simply has not been fast enough.

Neural networks and machine learning work by testing millions of combinations of parameters in order to reach a goal within controlled constraints.

Depending on how complex a process may be, the number of parameters there are, and how strict the constraints are, this iterative phase can take a significant amount of time and processing power even with some of the fastest computers available to date.

To illustrate how long of a process this can be, consider the case of AlphaGo. AlphaGo was an artificial intelligence program that was trained to play the popular strategy board game Go. While Go is a reasonably complex game, in which there are approximately 10100 possible outcomes, it still took between 4 to 6 weeks to train, which occurred on a computer with nearly 2500 more processors than a standard MacBook Pro. Fortunately, there is a way to significantly reduce the training & iteration time for AI modeling and optimization - give it training wheels.

The promise of AI is that when processing millions of possible iterations, AI can essentially teach itself how to operate within constraints as well as how to handle other hiccups that may occur. However, it is more than likely that the operators and engineering staff that work with their specific processes every day already understand some of the best practices to account for periodic hiccups. Rather than waiting for the AI models to eventually teach themselves how to handle these situations, focusing on a people-centric approach gives enterprises a head start by imbedding that knowledge base directly into the models. This time saver allows the model to focus on refining what the engineering staff already knows, rather than teaching itself.

Aside from letting the model reach an optimal solution more quickly, on-boarding tacit knowledge also helps to mitigate risks. The model may run sub-optimally or negatively affect other processes, causing unplanned downtime or additional costs from regulatory sanctions. AI purists will preach that letting the program iterate and teach itself is the preferred method. However, results are achieved in a leaner and more agile manner by ensuring that a people-centric approach is taken to implementing & iterating on the models.

[1] https://hbr.org/2016/04/a-chart-that-shows-which-industries-are-the-most-digital-and-why

[2] https://www.bls.gov/emp/tables/median-age-labor-force.htm

[3] https://www.industryweek.com/talent/article/22028004/what-to-do-about-the-aging-workforce

[4] https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/031318-analysis-creativity-needed-to-fill-us-power-industry-positions-left-by-aging-workforce

[5] https://deepmind.com/blog/article/alphago-zero-starting-scratch