Industry 4.0 Starts On The Plant Floor*

*Not Upstairs

A Forbes magazine article last year stated, "84% of companies fail at digital transformation 1." Wow. So much for the fourth industrial revolution. But wait, there has to be reasons for such dramatic failure rates. What's the root-cause analysis here? What allows the 16% to succeed? There has to be common reasons 84% don't. Indeed, there are. Likely numerous different reasons for every different company. However, there are a few very common reasons among them all. And it begins upstairs, where perhaps it really should start on the plant floor.

Now, I'm not suggesting let the floor operators run the show of developing a new process initiative. But think from the floor up. Rather than conceive an idea upstairs, hand it off to a committee who will work out how this new initiative will make life greater and more profitable—from their perspective. That is, the perspective of how IT should architect a new process; then taking these goals to IT to determine the workings, talent and resources needed—from their perspective. That is, their perspective of how a factory worker should use said process. After a wonderful new IT system is engineered, the system is then given to integration, process, and control engineers to implement—who may or may not have a clue as to what development actually intends, and lastly to train the floor line operators to use—AS IS. To the line operator, little of this may make sense or has any bearing on what they are actually doing. Or, it may be a convoluted way to do something. Or, the process may have all the functionality needed, training fills in any holes, however, the interface is haphazardly assembled so it takes extra time to figure out what goes with what and what to do next.

Problem with a case like this is nobody asked the floor personnel what would work for them. The system speaks in foreign jargon (dev-speak), for processes that make no sense (unless you are in sales). The icons are the same icons used on other systems, but have different meanings—what might they actually mean here? There are extra, unnecessary steps in the process which if anyone had consulted the line worker would have been able to easily avoid.

Bottom line, if the system is unreal to actual needs of users there will be mistakes, there will be frustrations, there will be abandonment. Fixing something already developed is 10x more expensive than getting it right to begin with—which means costly repairs, or it doesn't ever get fixed. To top it off, some bosses don't really buy into this "Industry 4.0" thing in the first place. Sure, shareholders expect it—because everyone is doing it, but upstairs they just don't foresee (understand) how this Industrial Internet of Things has any bearing on their company. So if the leader is not serious, no one else will be either.

Virtually every global company is on a journey to digital transformation. So back to considering, "84% of companies fail at digital transformation." Surely not consulting the user is a primary factor. Mistakenly, many companies first rely on IT for this transformative journey—but this transformation is more than a software solution or a new kind of computer system. It's a process. It's a cultural shift. IT is a part of it. An important part for sure, but just a part. Consider IT sees things largely from the perspective of… developers. There's nothing wrong with developers or the way they think, but it's unlikely they think like the typical end-user—unless of course you are developing software for developers. Aside from the business aspects of taking a new initiative, of introducing new processes—final success relies not only on the features and benefits, but in large part on the experience. Does it work? Is it buggy? Is there pain in making it work? Do users have to invent workarounds? Is it a pleasure? Is it just a shiny object? In manufacturing, this feedback comes from the floor.

From the above mentioned Forbes article, Michael Gale, a recognized expert in integrated technology marketing states, "One of the most basic impediment to moving forward on the road to digital transformation is whether or not enough people within the organization are aware of the challenges. Because if they're not aware of the challenges the probable truth becomes they're either going to trip up, fall over and be massively disappointed when it comes to doing it. Basic awareness about those challenges is probably the key indication of how well the process will be successful." Gale goes on to further stress how the inability to change culture is also a big factor in failure. Taking new ways of doing things and trying to make it work the old way you've been doing things just doesn't work.

Sure it's proper to come up with ideas and new initiatives upstairs, but consider next—who will be using this new idea. How they will use it. GetElastic2 cites the same Forbes article and further states the #1 reason companies fail is, "Not investing in experiences customers really want. Successful projects aren't built around shiny objects. They deliver true value to customers. Approach transformation from the customer's point of view." On the floor, the customer is the team lead, the process engineer, the line operator.

Tayo Abinusawa, a leading expert in digital transformation, writing for Kurtosys 3, also quoting the Forbes article, as well as a McKinsey report that cites a 70% failure rate, says, "Technology is an enabler not the solution… People are the most important determinant of success." Abinusawa also observes, "Most companies focus too much on the technology. They believe that once the technology (whatever, it is: cloud, social, big data & analytics, mobile or even IOT) has been implemented, it will function as smoothly as the demo. However, they fail to remember that a software demo does not take into consideration the people, data, processes and culture of their organization."

These are some important points to consider. First, a culture shift, if it's not there already, is required to implement new processes. Ideas and new initiatives do have to have sign off and support from upstairs, for underlings look upward—through the shadow of leadership—for cues as to expectations, norms, habits, strategies and techniques. "Shadow of the leader is when management and organizational culture reflect the style of its leader. 4"This is almost always the case in company culture! And this is paramount to transformation. If the leader doesn't buy in, neither will anyone else.

The next important issue, the foundation of a successful transformation, or the implementation of a new process is—the end user. If an HMI or any kind of interface the user must interact with is confusing, too busy, disjointed, or indecipherable—mistakes will happen! And mistakes can be very, very costly in any number of ways. Clean, modern, user-friendly interfaces and processes are also paramount. It's has to make sense. It has to be mentally-ergonomic.

Thirdly, transformation is a continuous, collaborative process. When transforming, it's prudent to work with trusted partners who will stay with you every step of the way—rather than companies who just hands you a software package and an 800 number to solve your problems. Akin to what Abinusawa observed, you want a transformation partner who will, "Take into consideration the people, data, processes and culture of their organization." A company who will be at your beck and call when issues arise, who aren't bothered by your need for help or any inexperience. A crew that knows what you need even if you don't. Also, a partner who understands that in manufacturing, "the user" is the main focus to addressing successful implementation of new processes, new software implementation, and the transformation into Industry 4.0. And yes, there are such partners!

In digital transformation, as well as in implementing new manufacturing systems—all of which are very complex endeavors with a lot of moving pieces—cooperation between numerous players is needed. One group does this, another does that, while yet another group does neither this or that but must operate within it. And all these players must be in sync or the whole thing falls apart. The first group blames the second group who claims the users don't know what they are doing. And they don't! They don't know what they are doing because it only makes sense to the software developers. "We'll pick that up in training" is too many times the fix. Even if that were a legitimate response to not solving a problem, "training" is the wrong solution. The software and its processes should be initiative enough to not need training. This goes for big and small companies alike, big and small initiatives alike, big and small processes alike. Training should always be minimized, not used as a catchall solution. The processes and user interfaces should ideally be simple enough to just grasp. Of course this is not always the case as some processes are very complex by their very nature. Nonetheless, one of the first considerations developers of software and processes should look at is the end user. Design for that target. Partner with the floor before even pounding code.

Briefly stated, but equally important is the number of diverse players that must work together—in sync—to make the magic happen. One group integrates the ERP into the process; an outside company provides a tracking system; a third party error-proofing system is integrated; robots are added, and yet another company is needed for assembly procedures. Custom PLC mapping is needed. A separate application is required to speak to the Andon boards; another for BI reports; another for OEE aggregation; an outside system for work instructions; and yet another for documentation. Plus, there are numerous IO devices; AR systems; and whatever technological developments that lie around the corner.
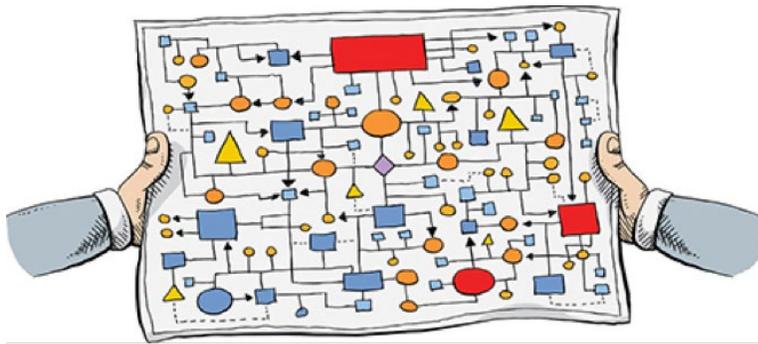

And, all these diverse systems, devices and companies must work in sync together. Lots of opportunity for missteps, and for finger-pointing. However, when you find an outside company which has taken the initiative to smartly combine most everything needed for a fully, integrated manufacturing execution system (MES) into a modern, scalable, modular system; one that approaches development from the perspective of the user; a company who works with you all along the way and into the future, and doesn't leave you hanging—then you are on your way to a very successful digital transformation into Industry 4.0—no matter how big or small you are. I want to illustrate such a process—how it works, and how it makes sense. One such a company is eFlex Systems in Rochester Hills, MI of whom I will use in reference.

With over 30 years of lean manufacturing software development experience, eFlex has that all-encompassing software suite which allows companies great and small to make a seamless transition into the digital realm no matter where one is currently at in their manufacturing procedures. Thus, I will use eFlex and their products to illustrate the principles touted above. For large companies that may already have made the transformation, in the process of, or thinking about doing so, the complete enterprise suite can immediately give them everything needed. For a smaller company or one just wanting to dip their toes into the digital pond, they can start out with any of the components, such as, let's say—start with an integrated, work instruction component.

We'll start this examination with a famously, faux company just wishing to dip their toes. The Acme Corporation (e.g. Wile E. Coyote's favorite company) has finally decided to cross over into the digital realm. After dizzily interviewing dozens of companies each with a part of the solution, settles upon the eFlex enterprise suite—cloud version, all the solutions compatible and integrated under one suite. Acme could immediately go full steam ahead for a full transformation, but they are a bit skittish. The demos look great. All the features, benefits and capability are promising. However, Acme has gotten itself burned before by unmet promises. Acme decides to take it step-by-step, even though friends at a Fortune 100 manufacturer vouch for eFlex. Step-by-step. No problem. Let's start with work instructions. Not just any work instruction solution, but one which does go beyond "paperless." eFlex System's JEM Digital Work Instruction.
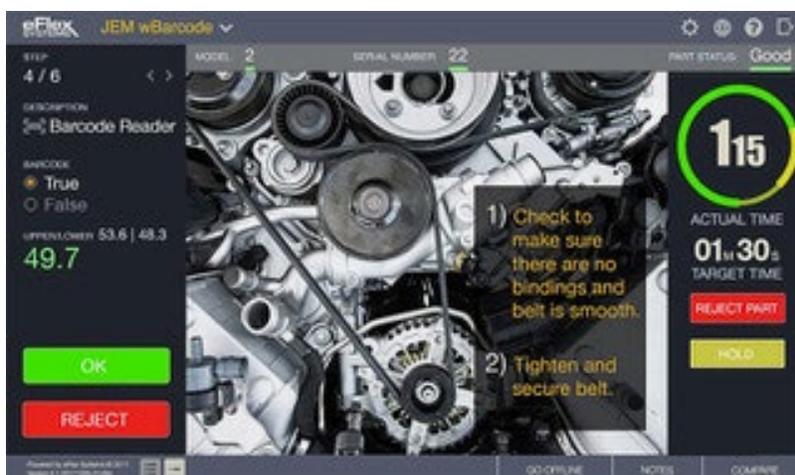
JEM is such a product designed first and foremost with the line operator in mind. In its simplicity, the operator can focus on either the task list, or work instructions, or sport both. The task list on screen-left shows all the tasks for an operation, including readings for task type, any process data for the task, task status, and timestamp. In addition, the middle section sports images and/or instructions which can be imported from remote depositories, or created right within JEM with its very robust image/work instruction editor. A cycle timer on the screen-right clearly displays target time and actual time with user-configured warning settings (e.g. the timer turns yellow at 70% to target time, and turns red when going over). Alternatively, to simplify further, JEM can be toggled to a single-task view (as shown above) with a larger work instruction view and larger data display focusing on a single task.

JEM is the perfect starter product. In addition to viewing work instructions, JEM can communicate with PLCs or servers—executing commands and interacting directly with the operator—such as with barcode scanners, manually entering process data, task timers. Or ok'ing or rejecting a task. Interacting with augmented reality (AR) systems such as OPS Solutions' Light Guide System is quite doable. All the process data and interactions are recorded, saved, queried and aggregated in numerous ways: reports, monitors, Andon boards, warning lights, and more. JEM also works in tandem with lots of tools and fully connected IO devices, all or any of which can be added to the process at any time, or reconfigured at whim.

JEM is easily configured. Go offline and the screen is completely editable. Work instructions are also easily imported or created within JEM's Work Instruction Editor (WIE). JEM's WIE is a full function app in its own, allowing import, or creation with a great selection of editing tools; templates; and a robust library to store and select from. JEM can also access files from remote repositories. Make a change at the repository and it is reflected immediately thousands of miles away at the JEM station. WIE also sports an intuitive approval system, allowing creators to create and assign, with the approver's approval instantly making the work instruction live.
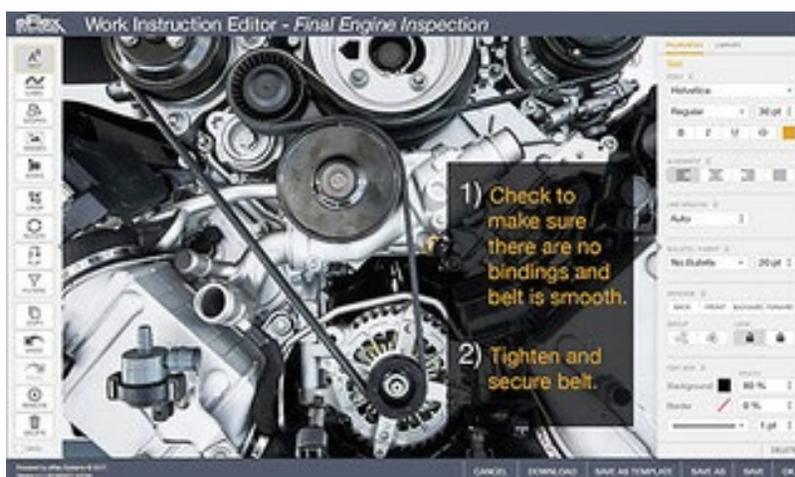
JEM can be local or cloud-based, with the later allowing numerous principals to check the station or its data from virtually anywhere. On a business trip and need to check on statuses? No problem. Off-site and need to troubleshoot an issue? Easy. Need to monitor multiple stations at once from IT? You've come to the right product.

Acme is delighted. Everything they hoped for, works great. The couple times they needed help, eFlex support was there, even flew in once to make sure Acme had everything configured properly (a tool cable was bad). Acme is ready to transform further. Next step? Let's go full assembly and traceability functionality.

Though it may not seem like it, Acme is a very complex company with a wide range of diverse products. From anvils with a few base models to rocket-propelled, wizzy-wigs with unlimited options and configurations. Sounds like we need a wide range of products to make this happen. We have to tie into Acme's ERP system, decode and disseminate Acme's BOMs, instruct each station, and each kind of station: manual, automatic, dial, diagnostic. In addition, track and trace each part and component through the entire production, error proof each task, collect and store its process data, query it for numerous purposes—real time and historical. The system directs and confirms each JEM station has the right part, at the right place, and at the right time—while accurately instructing each operator of their tasks, then send the part to the right station afterward. And to cap it off, Acme has a whole range of characters working for them. This system, its configurations, the ability to quickly reconfigure and rebalance lines, and its entire operation has to be pretty easy to use for some of Acme's characters (think Taz). With some of them, training only goes as far as leaving the classroom.

So, what's next? Plug two more eFlex products into JEM: Assembly, and Track & Trace. Then continue on with the full suite.


Assembly provides a flexible solution to quickly reconfigure and rebalance lines in minutes—not days. Good thing we have this product. Demand for invisible pills and disintegration guns just dropped, while wizzy-wigs and anvils are on the rise. We have orders for three Model Xs, five Model Ys and 25 Model Z varieties. Acme engineers reconfigure the lines quickly with no programming necessary—and are able to meet market demand, reduce downtime and minimize costs. It's great having a lean and efficient operation. But wait. Are compliance standards being met? You bet!

Track & Trace is enabling, enforcing and tracking our quality process. Pre-requisites are being met at every station, and part genealogy is recorded for every build. Regulatory and compliance standards are met, and the brand remains consistent.

For Acme parts that are not serialized, eFlex's Kitting product helps error proof operations. Operators configure kits line-side or off-site and integrate them into the manufacturing process. Due to the flexibility of the system, engineers can quickly add or change pick sensors, indicators, barcode readers, door switches and more—without programming—eliminating downtime. Acme is able to deliver the right part, to the right place, at the right time—maintaining all quality standards.

Vision adds a layer of error-proofing, as well as maintains a level of historical validation. Quickly and easily manage and retrieve thousands of daily production images while adding protection against damage claims or warranty issues. Oh no! Acme just received a damage claim from a customer that their rocket-powered wizzy-wig was damaged upon arrival, and there were two parts missing from the box. The Acme plant manager quickly uses Vision's advanced search criteria and views all images associated with the product build—including the end-of-line inspection image. Hmmm. Images look good and all the parts were provided for. Looks like something happened during or after delivery, and Acme is not responsible for the damage claim (though Acme did send the customer the two missing parts—no charge). Likely, it's that cracked hare behind this discrepancy.
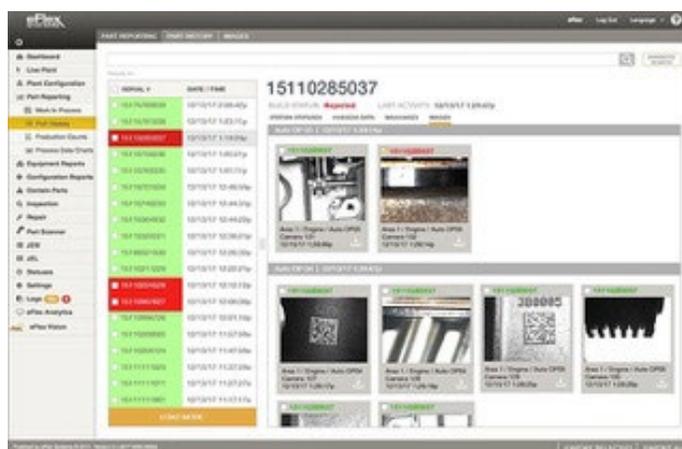
As the old mining legend Yosemite Sam once said, "There's gold in them thar hills." So it is with the data in them thar stations. eFlex's Quality and OEE apps mine, augments, processes and stores this valuable data for a myriad of queries and uses, easily extracted with the app's business intelligence reporting.

Analytics is eFlex's easy-to-use, user-configurable app that gathers and redistributes all this gold into real-time, web-based displays such as station monitors, or ultra-modern Andon boards, as well as real-time reports viewable anywhere, anytime on any smartphone, tablet, or computer. Imagination is the limit to Analytics' uses.

In summary, Acme is quite pleased. Their needs were met, and expectations exceeded. Everything works seamlessly together. The work instructions are clear and concise. The line operators understand their tasks even when each operation has different options, configurations, and are constantly changing. Each station validates each new part and error proofs the tasks within it. One eager team lead was even checking OEE stats for her group—while on her honeymoon in Aruba. With the one incident where an Acme Disintegrating Pistol had a mishap, investigators were able to take a serial number from one of the pistol's parts, trace it to the factory it was made, the stations it ran through and pinpoint the exact discrepancy. Furthermore, Acme was able to recall each product that went through the same procedure and was likewise effected. No other reported mishaps. Acme added eFlex products incrementally until they had the full suite. And, because production is streamlined and automated, production costs were saved, so retail cost was lowered, and sales for anvils have shot through the roof (if you can imagine that).

In actual summary, most if not almost all companies big and small are embarking upon the digital transformation journey—even though 70%-84% of attempts are likely to fail—unless leaders embrace a different way to view and do things. Exceptions aside, all companies must try—or become irrelevant. The causes for failure can be numerous, but there are some common causes that can be easily avoided. Leaders need to embrace this initiative, for the shadow they cast effects everyone beneath them. Own it. Delegate it. Make it happen. Choose your partners and consultants wisely. Use well-integrated systems and products. And, by all means, begin on the floor.

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2. *Top 3 Reasons Why 84% of Digital Transformation Projects Fail*
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Kurtosys -12-21-16
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4. *What is Shadow Of The Leader?*
Simplicable - October 27, 2016
https://simplicable.com/new/shadow-of-the-leader