WHITE PAPER

10 trends for industrial decision support systems

WHY TECHNOLOGY EVOLUTION, GENERATIONAL WORKFORCE CHANGES, AND COMPETITIVE CHALLENGES REQUIRE INNOVATIVE APPROACHES

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10 Trends for Industrial Decision Support Systems

Including 2 Case Studies from Users Leveraging the Trends for Big Savings

Introduction

We've all heard the management mantra, "You can only manage what you measure". We see this in our personal lives all the time. If we decide to lose some weight, the first thing we do is jump on a scale. As we start losing weight, we're encouraged to do even better. A wearable fitness device takes our weight loss program to a whole new level by adding additional health related measurements, encouraging us even further. The result of this measurement drives our behavior. In fact, in many cases, the mere act of measuring has a positive effect on behavioral outcome. This is known as the Hawthorne effect.

In our professional lives as Business or Operations Managers, this measurement effect is no different. In order to manage a process, we need to measure the results of that process. If we start measuring the production output of a machine, the people responsible for running and maintaining that machine are more likely to pay attention and take the necessary decisions to improve its performance. If we logged these measurements over time, we could look back at the effect of certain decisions. Together with an understanding of these effects, the historical data could be used to make more calculated fact-based decisions going forward.

Market Demands Increase Need for Scalability

What happens when we scale this scenario? Like adding a wearable fitness device to our personal weight loss program, what if we monitor additional performance related measurements on our machine? Or, what if we decide to monitor all 53 machines on the shop floor. What about the quantity of rework or rejected product on each machine? What about the electricity or water used by each machine? Very quickly, a measurement-focused organization will need a system to handle the volumes of data being collected, calculated and used to support decisions being made in near real time.

A system of this nature is known as a Decision Support System. A Decision Support System is an information system that supports business and organizational decision making activities. There are many such systems available to measurement-focused organizations for the management and presentation of their data.

Spreadsheets, a Common Approach

In fact, it's not uncommon for many organizations to turn to a set of spreadsheets. However, as tempting as it is to fall back on a spreadsheet-based "Decision Support System", there are a number of reasons most users of spreadsheets eventually feel limited by the tool every professional knows.

Multi-User Challenges

Only one person can be in the workbook at a time, even when you store the workbook on the network. The other person receives the dreaded "This workbook is in use by Joe Smith, would you like to open a read only copy". You call Joe and he's gone to a meeting, leaving the workbook open by accident. Now you have to come back to do your work.

Accuracy of Data

Data in the spreadsheet is usually manually entered, or imported from a CSV, or copy/pasted from some other digital reporting system. The risk of human error is high. The people usually doing this work have multiple other demands on their time, and all it takes is one untimely distraction, and the potential for loss of validity of information is high.

Auditability

Although you can restrict usage, and ask your users to mark when they make changes, or fill out a revision log, there is no clean, easy way to know who did what in a large spreadsheet workbook.

Comments on cells are nice, but what if you need to easily see the history of changes made to a data point over time and how made them, and any comments they made when making the change? You are dependent on an over-worked human to insure they always get it right.

System Breakage

Everyone knows how to edit a spreadsheet. Problem is, everyone thinks they are a spreadsheet expert. Reality is, the more complex the number of tabs, interlocking formulae in a spreadsheet, or worse between workbooks, the higher the chance of problems. Without any accountability for who made changes, one accidental or well-meaning formula change results in "#REF" errors in cells all over the system. Although you can lock the workbook from editing, the chance still exists, and without an audit-trail, you are left with the risk of a mess.

Cost & Time Realities Often Interfere with Progress

Many companies have big dreams, and big visions, but when they look at their options to move past spreadsheets, they realize the costs to receive any value quickly run into the 10's or 100's of thousands of dollars, and they will spend at least 6 months in implementation. With competing demands for capital, staffing challenges due to generational change, they often quickly just decide to deal with the limitations of spreadsheets and keep using them.

Cost to entry must be measured in thousands of dollars, not 10's or 100's of thousands, and time to implement needs to be days and weeks, not months

A key overall characteristic of a leading Industrial Decision Support system for manufacturers who are ready to move off of spreadsheets is reasonable cost of entry with license prices in the thousands of dollars and time to implement, resulting in time to value, measured in days or weeks, not months.

10 Trends seen in Leading Industrial Decision Support Systems

So let's discuss now what the leading Decision Support Systems are doing to help measurement-focused organizations stay on top of their game.

1. Systematization

The first thing that happens when users realize the need to move past paper and spreadsheets is they realize that just like their industrial operations, it's about the process, the system, and that their ad-hoc spreadsheet "system" has hit its limits. Whether it's the scale, frustrations with multiple users, or lack of accountability, they realize it's time to take a more orderly approach. The challenge becomes how to do that, without giving up the ability to easily add manual data, add new measures and calculations, without getting stuck in a report factory where users are waiting on IT to make the reports they need.

The first step is for the user to realize that what they have been building and maintaining in a spreadsheet that is a 5 Mb workbook with 50 tabs, is what's called an **O**perational **D**ata **S**tore, or ODS. Yes your trusted spreadsheet is a database. It's not relational, it's not fancy, but it works and it does store and organize your data.

The ODS is quite simply a database designed to collate data from multiple sources. This single database stores key information from disparate operational systems. For example, your operation may rely on Production Recording Systems, Laboratory Management Systems, Utility reporting systems, Building Management Systems, Weighbridge Systems, and Planning Systems, each performing a specific function, but not interacting with each other.

However, for you and your operations team to make informed decisions, you should be aggregating and contextualizing key data from each of these systems into your single ODS, from which you can consume consolidated reporting. You may need to compare this month's results to last month, or to the same month last year. The ODS will have already summarized that data for you, thus efficiently providing the information for your comparison, rather than placing additional data retrieval load on your data sources. The ODS becomes the single source of data for presentation, or for further integration into your data warehouse and ERP Systems.

Beware the Custom Solution

Being recognized as a critical operational management system for decision support, the operational data store, calculation & aggregation, and reporting solutions are often implemented by measurement-focused organizations in some form or another. They are generally custom built for a specific set of data sources, or for a specific industry. Most of

the time people turn to a custom solution, it's because they have found, or believe that no configurable off-the-shelf software exists for their unique needs, or the solutions they have seen have costs and times to implement that far exceed what they can handle.

Custom solutions are generally implemented and maintained by the organizations internal IT or Systems personnel, or an external system integrator or consultancy. While this custom "in-house" approach provides a high degree of flexibility, it unfortunately increases the initial implementation time, the ongoing time and cost to tweak the system, the risk of untested scalability downtime, and ultimately the total cost of ownership.

Configurable Off-the-Shelf Takes it to Next Level

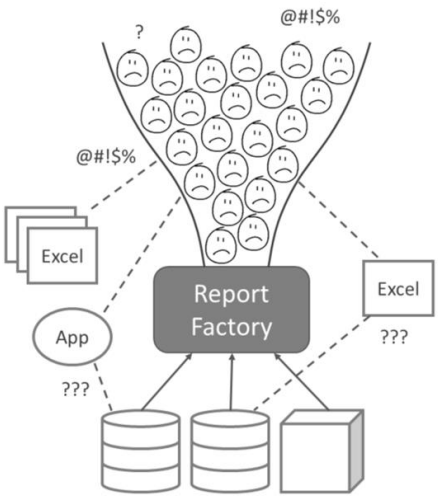
Leading Decision Support Systems have acknowledged the importance of the ODS, but have taken it to the next level with highly configurable, easily understandable off-the-shelf software. Within these systems, the central ODS component has been organized and structured for reusability and repeatability and are based off of standard production ready , highly scalable databases such as Microsoft SQL Server.

The result being a generic data structure that caters to most industries, while maintaining the flexibility to configure data models aligned to industry standards like S88 or S95 where required. By removing the custom designed ODS, these Decision Support Systems can be implemented quickly with little risk, thus adding immediate value to a measurement-focused organization. Implementation costs are lowered by between 50% and 80%, while long term sustainability is vastly improved.

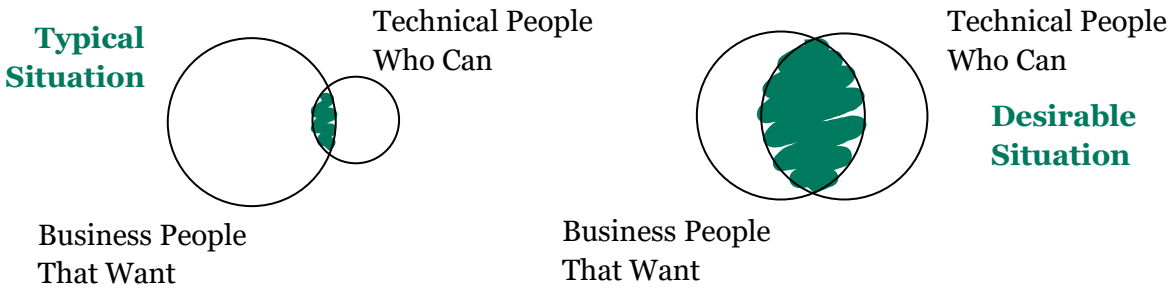
Whether the ODS feeds into a data warehouse, or is reported from directly, the systematized nature has proven to be the most successful in terms of time, cost, scalability and the provision of long term value.

2. Promoting Self-Service

Isn't it ironic that the highly technical employee, the person who is able to retrieve any data in any format, sliced and diced any which way, is sometimes the employee least likely to want that data? And yet, the Business or Operations Manager, the person who really needs that information to make key decisions, is the employee who can't retrieve it herself. The person who really needs it is stuck waiting on the Report Factory to create the needed reports. When the users are stuck waiting, they eventually get frustrated, and break out of the factory, and start using spreadsheets, or some other application. The result just trades one set of problems for another. The users aren't waiting, but they can end up with multiple versions of the truth, lack of accountability, and systems that don't handle staffing changes well.



As seen below the Venn diagram on the left describes these sets of people, where the sweet spot of overlap is really small.



The leading Decision Support Systems are designed in such a way that using their tools grows the set of people who can get the answers they need, increasing the sweet spot of overlap (the diagram on the right). Using the latest in user interface design, software tools are becoming easier to work with. Designers have moved into an era of caring for their end users, resulting in software that feels natural and intuitive to work with. It is this promotion of self-service tooling that has enabled measurement-focused organizations to move away from the IT Report Factory, putting you and me, the Business and Operations Managers, in control.

Like with most software systems, this trend for Decision Support Systems to become more self-service in nature is increasingly critical for our younger employees. These employees are tech savvy and want answers now! They have grown up with high levels of technology and are accustomed to doing things themselves. The leading Decision Support Systems cater to this need.

3. Employing Bots

Bots? Yes, software robots. Picking up on our example from earlier, while measuring the production output of one of our machines, we also log this measurement to our ODS, so that we can report on it historically, thus enabling our fact-based decisions going forward. If our measurement period was daily, we could read the value from our machine each morning and record the value in our system (think Excel spreadsheet system). Now scale this up to a few hundred machines. Suddenly this task becomes time consuming and prone to error. What if we needed an hourly measurement period instead of daily?

Bots are software modules in the Industrial Decision Support System that automate for you what you've been doing by hand in spreadsheets: exporting data from other systems, pulling it into the spreadsheet, and summarizing it. Bots never sleep, never get sick, they just keep working

Decision Support Systems automate the collection of data from disparate sources into their ODS by employing multiple software bots. These bots are instructed to collect specific information from various data sources, perform validation against business rules, and then store that information in a specific placeholder within the ODS. Many will know this process as Extract, Transform, Load, or ETL. It is the repetitive data collation process that happens in the background, unattended.

Using our example for an hourly measurement period, the bot responsible for recording our machine's production output will interrogate the raw data source containing real time data for our machine. The bot will aggregate the raw data, providing the ODS with a summary for the last hour. As and when the next hour passes, the bot will repeat the process, completely automating the task of data collection and collation.

The leading Decision Support Systems allow individual bots to be set "back in time" to collect historical data where it exists. On completion of this historical data processing, the bots will resume their primary task of collecting and collating new data as it becomes available. Being able to set individual bots "back in time" allows these Decision Support Systems to be implemented today, but collect and analyze information from years of historical data, providing a wealth of information that would have otherwise been hidden in the archives.

4. Understanding Industrial Data

In industrial operations, we don't often obey a standard day. Our production days are measured with an offset, say 06h00 to 06h00, to accommodate human friendly shift patterns. Many Decision Support Systems ignore this requirement of industrial operations. However, Industrial Decision Support Systems are built from the ground up with this requirement in mind and allow calendars and shift patterns to be configured to match the reporting needs. Shift pattern definitions are flexible enough to handle the changes to an operation's shift requirement.

Industrial Decision Support Systems understand Industrial data. What are Industrial data? Many will know the term "Tag Historian". Tag Historians are incredibly powerful software systems that store high resolution historical data, captured from real time industrial automation systems, sensors and actuators. These systems store Industrial data and are becoming increasingly powerful. A tag is a point of interest, a temperature, a flow rate, a pump status, or even a machine's current batch number. The values of millions of these tags can be stored at millisecond resolution in a Tag Historian. The Internet of Things (IoT) is here in the sense that low cost, connected sensing devices, whether they are connected to the Internet or just your

Industrial Data Comes from Many Sources:

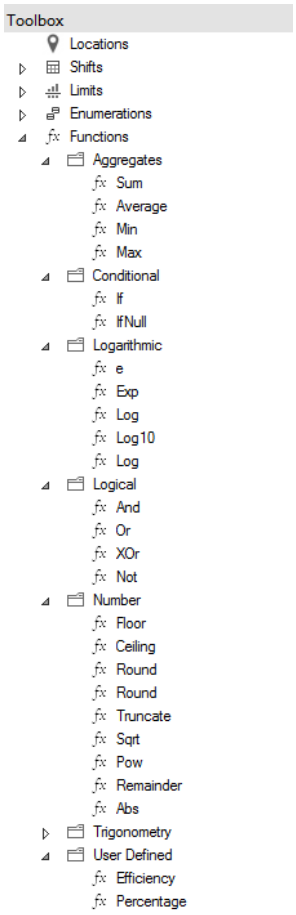
- *Process Historians*
- *SQL databases*
- *ERP systems*
- *MES systems*
- *Web Services*
- *Manual data entry*

private plant network, are here and are creating new data sources for you to consume. Many of the preferred Historians we see our users using are ready to handle this next wave of Industrial data.

The primary context of Industrial data is time. A tag's value changes over time, and a Historian records all these changes against time. From a troubleshooting perspective, Historians are very useful to establish exactly what happened when. For example, what was the temperature and pressure when that pump failed? Invaluable information can be found encoded in the time-based data. For example, when did the batch start and finish? What was the average pressure for that batch? How often did my machine stop during that hour? Why did it stop? All kinds of answers lie hidden amongst the ocean of Industrial data.

Industrial Decision Support Systems not only summarize and contextualize these vast amounts of data into their ODSs, but the leading ones inherently understand this Industrial data. What does it mean to understand Industrial data? Systems that understand industrial data don't only collect data from standard SQL databases, but also understand how to "lift" information out of the time-based Tag Historian data. The bots understand when a batch has started or ended. They know when a machine has stopped and why. They monitor the Shift Teams' performance during the night. They're almost a bit creepy, but they're efficient!

5. Building the Calculation "Bridge"



Like spreadsheets, one of the most powerful and used capabilities of a Decision Support System is the ability to define calculations using formulae and functions. Once data has been collected from various data sources and stored in the ODS, further operations can be performed on this data for analysis and reporting. Standard calculations that you would do in Excel spreadsheets are available in these Decision Support Systems. Similar to the data collection bots, calculation bots are configured to perform rollups, expression calculations, moving window calculations, etc.

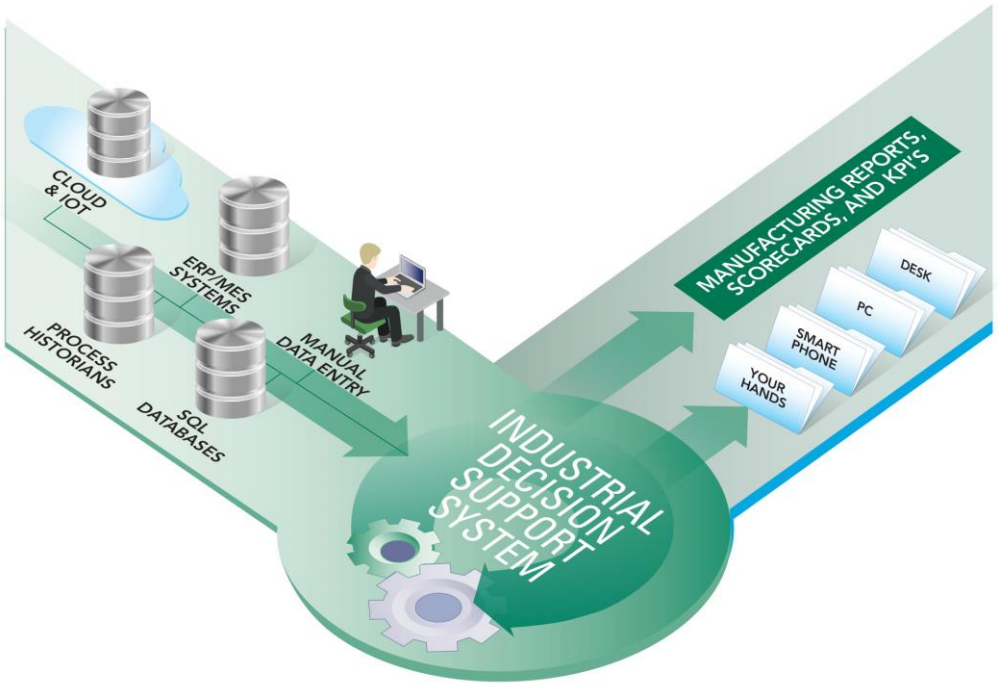
The leading Decision Support Systems allow for the creation of User Defined Functions, or UDFs. These are useful for encapsulating corporate memory in terms of calculating something in a specific way. For example, a measurement-focused organization may have tweaked the formula for Overall Equipment Effectiveness (OEE) and want all OEE calculations to use "their way of doing things". A UDF for their OEE calculation method can be created and then used consistently by all the OEE bots configured in the system.

Leading Decision Support Systems allow for the nesting of these calculations. For example, the result of one calculation can be used as an input into other calculations. This should be standard

functionality, but you'll be surprised at how many don't support it.

One of the greatest characteristics of Decision Support Systems is the ability to perform calculations on data that have come from separate sources and generate outputs in a variety for formats.

For example, a Production Reliability bot could collect data from the Planning System for today's planned production, as well as an actual production output from the Tag Historian, and then calculate a ratio of the two values to indicate the machine's Production Reliability against the plan. This "inter-data source" calculation capability allows for the bridging of multiple data sources in the generation of KPIs, reports and dashboards.



6. Giving Perspective

When those Decision Support System bots determine that a new batch of juice concentrate has just started, wouldn't it be great if the bots could also tell us what the Batch Number is or what flavor of juice is being made or which operator is on shift?

Work Orders

Filler 1

Work Order	Period Start	Period End	Product	Production	Reject	Quality	Efficiency
FL001150170	2015-10-03 12:44:25	2015-10-03 18:45:23	Grape	224671 bottles	2103 bottles	99.1 %	110.9 %
FL001150171	2015-10-03 20:34:37	2015-10-04 03:24:04	Strawberry	256914 bottles	2113 bottles	99.2 %	111.6 %
FL001150172	2015-10-04 04:54:48	2015-10-04 12:18:12	Strawberry	247142 bottles	4124 bottles	98.4 %	100.0 %
FL001150173	2015-10-04 13:50:50	2015-10-04 21:33:09	Strawberry	262213 bottles	3549 bottles	98.7 %	101.4 %
FL001150174	2015-10-04 22:54:35	2015-10-05 06:53:10	Apple	275656 bottles	2444 bottles	99.1 %	102.5 %

With this additional data, when we compare the average processing temperature per juice concentrate batch, we can slice and dice our analysis by flavor or operator. Or we can drill down to the specific Batch Number report to investigate any inconsistencies.

Daily Production

				Sep 28	Sep 29	Sep 30	Oct 1	Oct 2	Oct 3	Oct 4
Product										
Filler 1 Total Production	Apple		bottles		232654			78878	213185	243235
	Grape		bottles	655	488506	665522	338947	476670	226774	
	Raspberry		bottles	500567			206245			
	Strawberry		bottles	247207			134705	94575	264955	511100

This contextual overlay of additional information is critical to enhancing the decision support process, offering additional information that can enhance understanding. Contextualizing the data collected or calculated is a standard feature in the leading Industrial Decision Support Systems.

7. Embracing Manual Data Entry

It is surprising how many Decision Support Systems don't allow for the manual entry or adjustment of data collected into the ODS. This fundamental functionality is either forgotten, or even arrogantly dismissed. Without the ability to manually enter data into the Decision Support System, or retrospectively validate and update collected data, with appropriate permissions, the system's usability will be drastically reduced, and its use will decline to almost nothing. It is for this exact reason that spreadsheets are so widely used and accepted, because the data is easily entered and updated. People need to feel control over their systems, even if they never experience the need to change their data.

Example Scenario – Failed Field Device

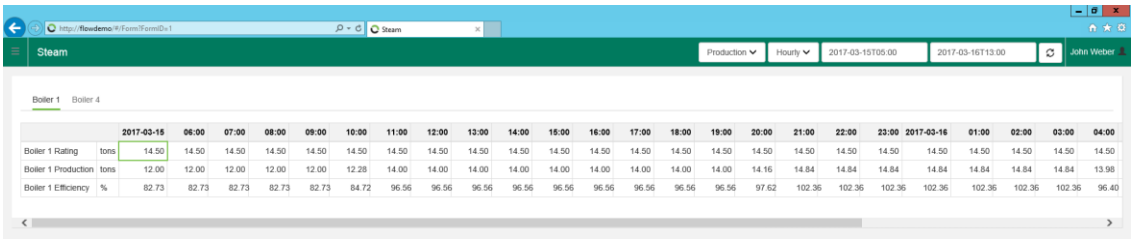
In operations, we may have a bot collecting the hourly average flow rate for one of our critical processes. The underlying flow meter providing the real time data needs to be swopped out for preventative maintenance and calibration. During the time that the meter is removed and replaced, our real time data is lost and our bot records NULL (i.e. blank or missing) data for part of an hour or two, depending on how long the swap out procedure has taken. If we are using the results of this data for any rollups or our KPI calculations in our Decision Support System, we would have introduced and presented erroneous information. The Decision Support System will handle this scenario by highlighting the bad or suspect quality results, as well as encourage a manual correction. The manual correction will be performed at the lowest level possible

Users of Manual Data Entry should not be excluded from the benefits of a systematized Operational Data Store & modern Industrial Decision Support Systems – they must be embraced

(i.e. the NULL data for the hourly average flow rate), so that any rollups or calculations that depend on it are immediately recalculated.

Manual Data Entry is Here to Stay

There are scenarios where it is just not possible to automate the measurement of a process, and the only option is regular manual measurement. We are reminded of the "old days" where measurements were recorded on a clipboard and then manually transferred into a computer system. Instances of these "old days" are still prevalent in many organizations, and that is acceptable even. It is known that for certain continuous improvement measures, the person recording the value is positively influenced to action by the recording of the data and seeing their latest result next to the prior period result. At the same time, in some organizations, manual entry is really the only practical solution at this stage in their measurement-focused operational excellence journey. These users should not be excluded.



Manual data entry using a tabbed spreadsheet paradigm from a web browser insures adoption by users used to entering data into spreadsheets.

Leading Decision Support Systems embrace manual entry. They provide spreadsheet-like data entry forms where users comfortably enter and adjust data as needed. Of course, critical to this functionality is the provision of an audit trail and the ability to provide commentary where necessary, which is something that spreadsheets lack. Although spreadsheets offer comment tools, it's difficult at best to see the comments and if more than one user has made comments on the same data point, it's next to impossible to manage.

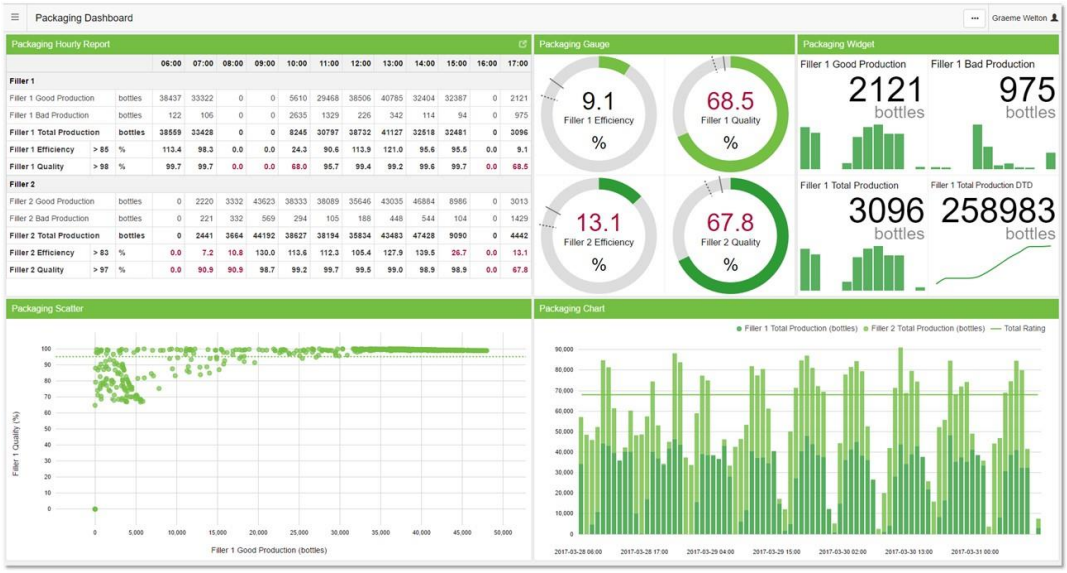
8. Seeing and Understanding

The Decision Support System is a master at collecting, calculating, contextualizing and storing vast amounts of data. But ultimately we need to see and understand this data to be able to make informed decisions. The Decision Support System doesn't necessarily require its own visualization component, but more importantly, it needs to have an open ODS that can be accessed by leading visual analytics tools. Many measurement-focused organizations have standardized on one or more visual analytics tools, depending on their type of business. The leading Decision Support Systems

An Industrial Decision Support System Should Support Visualization using a wide range of tools including but not limited to

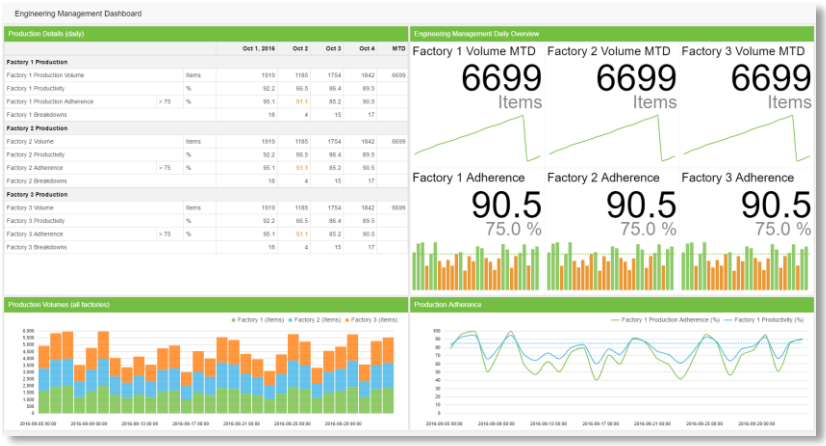
- *Built In Tools*
- *SQL Reporting Services*
- *Tableau*
- *QlikView*
- *Dream Report*
- *Any tool that can query a SOL data source*

integrate into these tools, or at least provide mechanisms for these tools to access the rich information they contain, rather than limiting the user to the built-in visualization provided by the Decision Support System. This allows new Decision Support Systems to be implemented behind the scenes, while serving their visual information via the tools operational staffs are already familiar with.



An example of an auto-updating visual dashboard displaying key information for a packaging operation.

Effective visualization of the data is what turns them into information. Visualization is the key destination for a Decision Support System. The trend is to merge boardroom analytics into operational shop floor communication using best-practice dashboard visualization.

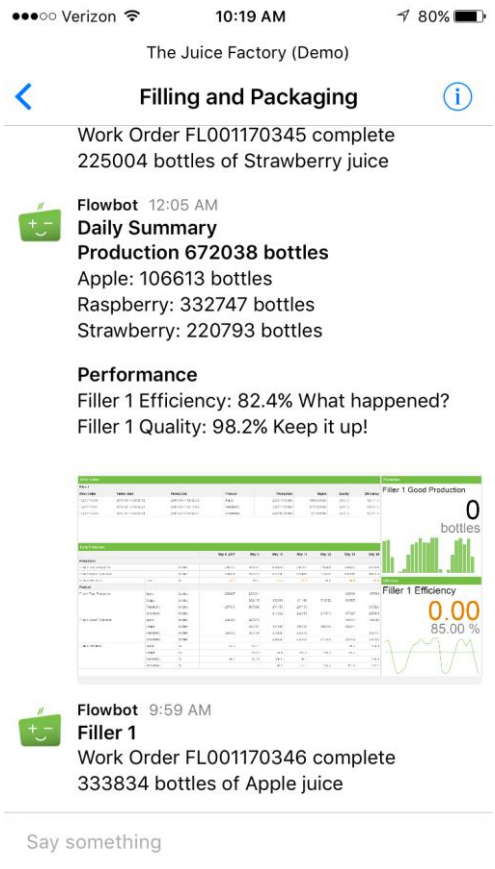


Measurement-focused organizations are embracing this trend to create more informed operational staff. Informed employees feel empowered to take ownership and make decisions. The result is a shortening of the time it takes for a better quality decision to be made. These organizations are moving the decision making process to "the edge", to the shop floor where their impact is most effective. To do this successfully, the visual dashboards presented to "the edge" must intuitively drive, encourage and motivate the decision making process.

Stephen Few defines a dashboard as "a visual display of the most important information that can be monitored at a glance". For operational staff, an auto-updating dashboard provides the information they need to keep their processes running optimally.

9. Being Social

The network of bots making up a Decision Support System tirelessly work in the background to collect data, perform calculations, record events and accumulate contextual information. In a sense, they "know" what is happening in your operation, and they "know" these things in real time. Wouldn't it be great if these bots could let us know when important events happen? Oh, and when they do, add some context to their messages?



Yes, the Decision Support System is becoming social. The leading Decision Support Systems are doing this already. They notify groups of people of certain events, or send them certain information periodically. The short social message containing real, relevant information is the modern report, augmenting the social nature of our smart device lifestyle. They are delivered to you when you need them via email, SMS, Twitter or even Slack integration. As Business or Operations Managers, receiving pertinent pieces of information about our processes in this manner ensures we are "in the loop" without having to constantly monitor reports and dashboards.

This trend is fairly new, but initial users are seeing promising results.

10. Recognize, Support & Enable the Bigger Picture

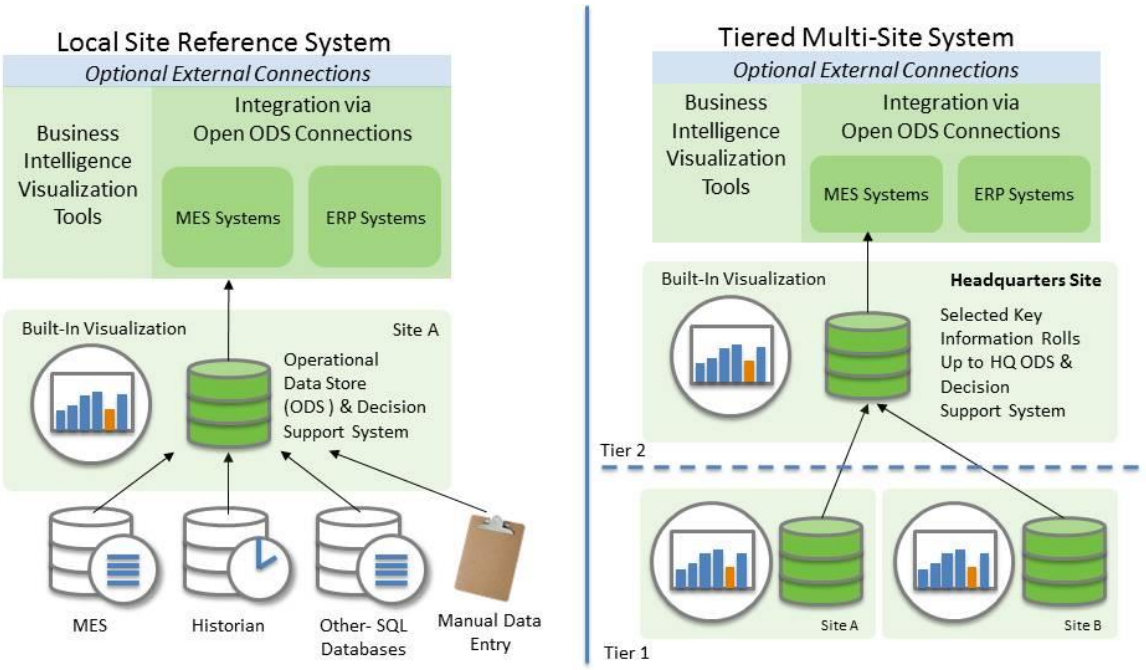
One of the biggest reasons for failure of projects intended to deliver on visualization, OEE, or decision support systems is the fact that too often, the manufacturing IT goals and business goals have not been properly aligned for vision and purpose. The historical silos of IT and Operations Technology (OT) have kept these two parties apart at best, and sometimes at odds with each other.

Leading companies have found ways for IT and OT to work together under a common vision for the business, with alignment between business and manufacturing goals. If you aren't already in a unified IT/OT organization, no matter which side you're on, take the time to ask yourself if you know the vision and goals of that other part of the business is. Factor the bigger picture into how you implement to move beyond spreadsheets for your Industrial Decision Support system.

To support an overall digital transformation initiative, whatever you implement now because you must move beyond spreadsheets, needs to be open and not a dead end solution, so that as your business' journey continues, you can evolve your systems with it.

For multi-site measurement-focused organizations, site-based Decision Support Systems play a pivotal role in each individual site's operations management. These Tier 1 implementations provide operational autonomy in terms of their individual initiatives and focus areas, while insuring they support corporate wide metrics, goals and initiatives.

Leading measurement-focused organizations with regionally, nationally or even globally distributed operations are hooking into their Tier 1 Decision Support Systems to automatically collect and contextualize information into an enterprise level Tier 2 Decision Support System. Using this information from multiple sites, these organizations compare performance across the organization, share learnings and best practices with under-performing sites and manage their supply chain.



Leading Decision Support Systems are already providing a Tier 2 architecture that allows for the integration of key Tier 1 information into a higher level implementation. The Tier 2 architecture need not replicate all the information collected and calculated at the individual Tier 1 sites, but rather select specific information to be pulled into the Headquarters level. For example, the "Juice Factory" Headquarters could pull the production numbers for each juice flavor from each of their 21 factories across the country. Combining this information with their ERP system, they could effectively produce real time flavor supply vs demand production planning, with a geographic location context.

Tier 2 Decision Support Systems become the ideal staging system before enterprise level data warehousing. The Headquarters' Decision Support Systems offer that final data validation opportunity before integration into ERP level systems.

Integration points must utilize easily understood, open, standards based interfaces for data ingestion and sharing with upstream business systems, otherwise the cost objectives for the user wanting to move off of spreadsheets will not be met. Open standards-based connections also insure that the system does not become a dead-end point solution. Rather, the system should enable the use of best-of-breed systems at each level of the organization.

Multi-site measurement-focused organizations are recognizing the role Decision Support Systems play in automating the collection and calculation of data from their operations in a consistent, standardized and well-structured manner. These systems are enabling the real time bigger picture.

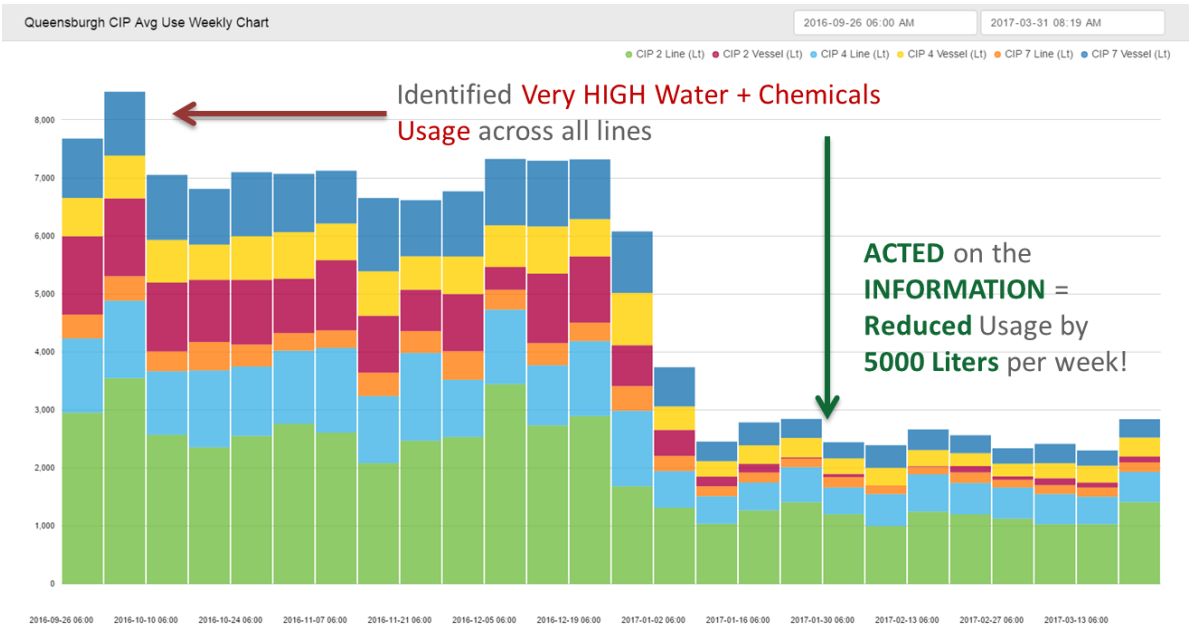
Case Study – Dairy Operations: 20% CIP time reduction, reduced cleaning materials usage, 8 hours engineering time savings per week

A global dairy processor was looking to reduce their utilities usage by tracking usage by line and process area. At the outset of the project though, they started using existing data sources in a Wonderware Historian that were tracking production volumes, stock level, and Clean In Place (CIP) durations, water usage, caustic charge, caustic reclaim, concentrations, flow, acid charge, acid reclaim, and temperatures.

Rather than export that data from the historian, they connected the historian to an off-the-shelf software application, and created reports of CIP runs as shown below.

Period Start	Period End	Duration	Water Use	Caustic Charge	Caustic Reclaim	Caustic Use	Caustic Temperature	Caustic Concentration	Caustic Flow	Acid Charge	Acid Reclaim
2017-03-30 09:38:56	2017-03-30 11:19:38	101 min	5413 Lt	1291 Lt	1211 Lt	81 Lt	78.87 °C	1.60 %	18379 Lt/Hr	1237 Lt	1205 Lt
2017-03-30 12:36:03	2017-03-30 13:12:06	36 min	2803 Lt	493 Lt	502 Lt	-10 Lt	82.64 °C	1.93 %	23552 Lt/Hr	505 Lt	502 Lt
2017-03-30 15:02:10	2017-03-30 15:50:31	48 min	3455 Lt	607 Lt	158 Lt	449 Lt	77.79 °C	1.06 %	15019 Lt/Hr	574 Lt	507 Lt
2017-03-30 16:08:38	2017-03-30 16:44:38	36 min	1813 Lt	295 Lt	306 Lt	-11 Lt	82.17 °C	1.91 %	14294 Lt/Hr	284 Lt	305 Lt
2017-03-30 16:46:59	2017-03-30 17:24:36	38 min	1806 Lt	300 Lt	302 Lt	-1 Lt	82.78 °C	1.92 %	12412 Lt/Hr	293 Lt	304 Lt
2017-03-30 22:16:34	2017-03-30 22:57:20	41 min	1644 Lt	257 Lt	244 Lt	13 Lt	79.62 °C	1.95 %	8702 Lt/Hr	197 Lt	198 Lt
2017-03-31 04:07:28	2017-03-31 04:51:19	44 min	3397 Lt	1268 Lt	1223 Lt	45 Lt	81.84 °C	1.60 %	18701 Lt/Hr	0 Lt	0 Lt
2017-03-31 12:45:06	2017-03-31 13:27:39	43 min	3400 Lt	1195 Lt	1203 Lt	-7 Lt	81.89 °C	1.57 %	18434 Lt/Hr	0 Lt	0 Lt
Run											
Period Start	Period End	Duration	Water Use	Caustic Charge	Caustic Reclaim	Caustic Use	Caustic Temperature	Caustic Concentration	Caustic Flow	Acid Charge	Acid Reclaim
2017-03-30 06:30:02	2017-03-30 07:08:27	38 min	1433 Lt	565 Lt	359 Lt	206 Lt	80.09 °C	1.74 %	23197.92 Lt/Hr	567 Lt	348 Lt
2017-03-30 11:51:04	2017-03-30 12:34:39	44 min	1367 Lt	767 Lt	387 Lt	380 Lt	79.10 °C	1.79 %	23491.70 Lt/Hr	567 Lt	379 Lt
2017-03-31 07:00:50	2017-03-31 07:42:36	42 min	1936 Lt	608 Lt	416 Lt	191 Lt	81.76 °C	1.79 %	23706.82 Lt/Hr	611 Lt	433 Lt
2017-03-31 14:54:24	2017-03-31 15:14:17	20 min	751 Lt	550 Lt	359 Lt	191 Lt	74.37 °C	1.72 %	23117.68 Lt/Hr	0 Lt	0 Lt

Immediately they started noticing that the usage of caustic, acid, and water were much higher than expected, across all lines, which they did not have visibility into before. What they found was that flowmeters across all lines were configured with pulse lengths shorter than the PLC scan time, resulting in under-measurement of the water usage at the point of operations. The monitoring of water meters feeding the lines made the disparity visible. Subsequent correction of the issue, as shown below, resulted in a signification reduction in water usage and a 20% reduction in CIP time.



The savings from wasted acid, caustic, and reduction in CIP time alone generated an ROI on the user's investment in an off-the-shelf tool.

As they continued to pull more data into the system, they found that they have saved 8 engineering hours a week that used to be spent manually assembling information for reports and decisions.

Below is an example of the utilities reports, which the user eventually did get to making, after they stumbled upon the CIP savings as soon as they implemented their first pilot project.

Pinetown Daily Water Use — 2017-03-27 06:00 AM — 2017-04-02 07:12 AM

		Mar 27, 2017	Mar 28	Mar 29	Mar 30	Mar 31	Apr 1	WTD	MTD	YTD
Total										
Total Water Use		**62783**	**44206**	**66891**	**56806**	**68880**	**59795**	**359361**	**59795**	**19495345**
CIP										
CIP Water Use		57912	32729	50974	49005	54406	43716	288742	43716	15179748
CIPA Line Water Use	Lt	7470	3851	8001	4955	3815	3775	31867	3775	1541605
CIPA Vessel Water Use	Lt	14674	11003	17233	10536	15887	17040	86374	17040	4598835
CIPB Line Water Use	Lt	16931	11653	11388	20329	16852	12673	89827	12673	4872175
CIPB Vessel Water Use	Lt	5812	3089	3528	3814	6893	4973	28109	4973	1098822
Stork ICIP Water Use	Lt	0	2593	5110	2631	5116	5256	20705	5256	1276768
Stork CIP Water Use	Lt	13024	540	5714	6740	5843	0	31860	0	1801919
Processing										
Processing Water Use		4225	10933	15289	7800	13716	15413	67377	15413	4163834
Stork Production Water Use	Lt	758	2060	3982	2577	2636	4367	16380	4367	1061249
Stork non Production Water Use	Lt	3159	3337	4957	3225	3314	4480	22473	4480	1166726
Thermisor Water Use	Lt	303	4145	5358	1786	7003	5392	23988	5392	1632352
Thermisor non Production Water Use	Lt	5	5	5	18	12	10	56	10	12861
Cream cooler Water Use	Lt	0	1386	987	194	750	1163	4480	1163	159789
Cream Export										
Milk Reception										
Bay1 Water Use	Lt	646	543	628	0	758	666	3242	666	164194

Case Study – Food Processing

A seafood processing company located at a remote site in an island nation sought to better understand their energy usage, particularly steam and electricity. Due to their remote location, they generate their own power from diesel fuel, which they buy on long term contracts, so it is easy for them assign a cost to their power generation.

They had been attempting to roughly track their costs using a spreadsheet, but sought to leverage data in their process historian to automate and try to get a better understanding.

Because steam, which is generated ultimately from the diesel fuel using boilers, is a key part of their fish processing, they connected to historical data on steam usage on each processing line in the facility and steam output from the boiler. They were able to backfill several months of data, and quickly discovered that they had a problem. The sum of steam consumed at each line was not adding up to the steam output from the boiler. The result was that a leak, which they knew about but thought was inconsequential, was costing them $12,000 per week. They achieved an ROI on their investment in an off-the-shelf application quickly, and have since used the same tool to automate production reporting and all of their utilities reporting.

Conclusions

Always start with a clear vision of what you are trying to accomplish for your system. Make sure you've considered the needs of other stakeholders in your decision, which might cross between traditional IT and OT boundaries. If you recognize their concerns, then you can factor them into your choices.

Industrial Decision Support Systems are critical to organizations that live by the operational excellence management mantra, "You can only manage what you measure". Decision Support Systems make use of a central ODS, which systemically stores the data collected, calculated and contextualized from multiple sources. The ODS provides a single source of summarized, aggregated and calculated information that is presented via built-in or integrated visual analytics tools.

Affordable entry points for software licenses and implementation time and cost are a key component of an Industrial Decision Support System for companies that presently depend on spreadsheets or custom applications for their operational insight.

A clear path for integration with enterprise class MES & ERP systems is a must so that you do not end up in a point solution that has a dead end as you grow.

Industrial Decision Support Systems not only understand the context of industrial reporting periods and shift patterns, but also the vast amounts of industrial data that is accumulated in Tag Historians. Leading Decision Support Systems embrace the manual entry of data, providing spreadsheet-like forms that people understand and accept and treat manually entered data with the same respect as automatically collected data, recognizing the reality of each business' operations and needs.

Leading Decision Support Systems have acknowledged “the modern report”, augmenting our smart device lifestyle, the timely short social message containing pertinent information critical to business and operations managers staying in the loop.

Decision Support Systems offering Tier 2 capability provide measurement-focused organizations automatic collection and calculation of data from their operations’ Tier 1 systems in a consistent, standardized and well-structured manner, offering them multi-site comparisons and real time big picture supply chain management.

The case studies in this paper are a small sampling of the ways that Software Toolbox has worked with users who in their automation journey are ready to move beyond spreadsheets, but are limited in time and budget for more sophisticated systems.

Ready to Learn More?

For a free evaluation of your situation or demonstration of Software Toolbox’s offerings for users ready to move beyond spreadsheets, visit our website focused on this topic.

If you have questions about this paper please email us at whitepapers@softwaretoolbox.com, and we’ll insure that the authors receive your inquiry and respond promptly.

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