Visual Management

Increase your company's profitability through insight

Kaizen, lean manufacturing, six-sigma, total quality management, continuous improvement – all of these terms refer, in some form or another, to the efforts of companies as they strive to become more competitive in a global economy. While various strategies are implemented in order to improve productivity, they all have two things in common: the collection of KPIs – key performance indicators – and the communication of those KPIs to the people who can most affect improvement – the production floor personnel. However, this data doesn't do any good unless everyone can see it, particularly those that are responsible for it and those that are judging other's performance based on it. That's where visual management comes into play.

Even if a company doesn't employ formal continuous improvement initiatives or quality processes, efficiency gains can be realized by borrowing the lessons learned from the visual management techniques of those processes. The best part is that months or years aren't required to realize the gains. Visual management techniques can be deployed very quickly, without a huge investment in software or changes to existing processes, allowing a profit increase in short order.

What is visual management?

Visual management is the process of displaying critical information "so that anyone entering a work place, even those who are unfamiliar with the detail of the processes, can very rapidly see what is going on, understand it and see what is under control and what isn't. Essentially, the current status of the operation can be assessed, at a glance."[1]

On the factory floor, visual management can take shape in the form of key performance indicators that relate to production quantity, speed and quality, as well as machine uptime and downtime. Values such as Count, Good Count and Bad Count, Shift Totals, Reject Ratio and Rate communicate a process' or an operator's performance. In keeping with visual management's requirement that the information can be seen at a glance, the information is shown on large displays that can be seen from a distance and by more personnel than just the machine operator.

Many companies, whether or not they practice continuous improvement, want production to flow uninterrupted, and have therefore adopted some form of andon, a term that refers to a system used to notify management, maintenance and other personnel of a process or quality issue. The green, yellow and red light "stacks" or "towers" seen in a production facility are andon messaging in action. Mounted up high, these simple andon systems allow everyone to see the status of virtually every machine in a room. A green light means the machine is running well, while a yellow light usually indicates the machine is running but requires attention. A red light almost always means that the process has stopped and requires immediate attention. While stack lights are convenient, they provide little information other than crude status, and many facilities have therefore adopted displays that provide detailed messages regarding machine status.

How does visual management improve efficiency?

In any process, information is critical – it allows people to know where they are, where they are going and if problems are occurring that could be prevented. No one would consider driving a car without a dashboard, and few would operate a machine that wasn't equipped with the appropriate indicator lights, panel meters and LCD touchscreens. However, like a car's dashboard, panel meters and touchscreens are only for a single operator. While both are forms of visual management, they lack some of the phenomenon that occurs by having the information publicly available.

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[1] http://www.ad-esse.com/resources/documents/Articles/visual_man.pdf

By having key performance indicators on display, the operators know what their performance is, but more importantly, they know that everyone else knows what their performance is. This allows the operator(s) to take pride of ownership in their contribution to the company. It also provides actionable information to supervisors, allowing them to determine, in real time, areas that are in need of improvement. Andon messages that communicate process problems across a facility ensure that everyone is aware of a given issue, drastically reducing downtime.

Visual management put into practice

A real-world example of visual management deployment is reported by a contract packaging company which uses teams of workers to assemble packages. This company determines quotes for new jobs based upon prior time studies. Considering the unique nature of every project, the ability to make a profit on a given job is dependent on the workers being able to set up the line for the new run within a short period of time, as well as the ability to maintain the assumed rate of production for the entirety of the job. However, without real-time information, the company has no way to confirm if the assumptions made during the quoting process are being met. By installing a large LED display on each line, the targeted production rates are displayed, along with elapsed time during changeover periods. As a result, supervisors are now able to take immediate action if changeovers are taking too long or when workers are failing to meet the required packaging rates. The company has experienced 10-15% faster completion times resulting in a dramatic increase in profit.

Potential Profitability—Determining the Savings Potential

The amount of increased profit a given company stands to gain depends quite largely on the company, and its existing processes. Consider any given line or machine within your facility, and consider the financial impact if its output could be increased by 1, 5, 10 or even 20%. What would the financial impact be if downtime could be reduced by as much as 15%? Companies considering implementing productivity displays should take the time to come up with the numbers. Just how little improvement is necessary to realize an attractive return may be surprising. Further, since some solutions cost only a few thousand dollars, there is very little risk involved for what is a potentially large return.

When determining the savings potential, don't forget to include all of the costs that downtime can incur. Sure, there are labor and utility costs, but what about scrap? Some continuous processes require a process to run start to finish, and an interruption means waste product. In some cases, andon messaging can inform of potential machine damage or wear, such as when preventative maintenance schedules are ignored. Managers should consider all of the factors that are unique to their processes when calculating the savings.

Is visual management new?

The value of visual management has been known at least since the time of the Toyota Production System, which was Toyota's revolutionary "socio-technical system for manufacturing"[2] developed "between 1948 and about 1975". One of the 14 principles created by Toyota was the requirement to implement visual control so issues are not hidden.

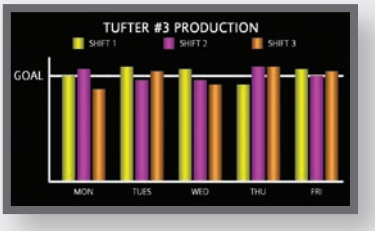
Of course, over the years the methods for collecting and communicating KPIs have evolved considerably. Early on, data was collected by a person equipped with a pencil, a stop watch and a clipboard. The information they collected was then transferred to large chalkboards. Chalkboards gave way to electronic counters and panel meters with large LED displays, allowing the KPIs to be viewed over greater distances. Eventually, multi-color, graphical marquees replaced simple LED displays, but their cost could be somewhat prohibitive. Today, large LCD TVs, with their ever-falling prices, have become the obvious choice for displaying plant-floor KPIs.

[2] http://www.strategosinc.com/toyota_production.htm

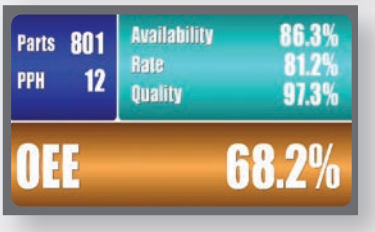
Common KPIs and how to determine which indicators to track

The key performance indicators that a specific company should use will of course vary. The following is a list of common KPIs used on the plant floor:

- **Count** (Good or Bad)
  One of the most important metrics is how much product has been produced thus far. The count can refer to the amount of product produced since the last machine changeover or for the entire shift or week. To invoke a competitive spirit in their employees, many companies will compare each of the co-worker's or shift's output against the others.
- **Reject Ratio**
  Everyone's process will occasionally produce scrap. Knowing whether or not the amount of scrap product being produced is within tolerable limits is critical to maintaining profitability.
- **Rate**
  If your machine or process produces goods at a variable rate, it's important to know if the operators are maintaining an ideal speed. Too slow, and profit drops; too fast, and quality issues may arise.
- **Targets**
  Properly motivated employees know exactly what's expected of them – plant floor personnel are no exception. Therefore, many companies opt to display target values for output, rate and quality.
- **Takt Time**
  Takt time is the amount of time, or cycle time, for the completion of a task. This could be the time it takes to produce a product, but more likely it's the cycle time of a specific operation on the product. By displaying takt time, manufacturers can quickly determine where the constraints or bottlenecks are within a process.
- **OEE** – Overall Equipment Effectiveness
  OEE is a metric that indicates the utilization of resources. Production managers are interested in seeing the value of this metric increase, as it indicates more efficient utilization of the available personnel, machinery, etc. The formula for OEE is OEE = Availability x Performance x Quality
- **Downtime**
  Whether it's due to a breakdown, or simply a machine changeover, downtime is one of the most important metrics that can be displayed. When the machines are down, money isn't being made – reducing these periods is an easy way to increase profitability. Many companies that track downtime require their operators to enter a "reason code", via keypad, pushbutton, or even a bar code scanner, so that the information can be reviewed at a later time.



LINE	GOAL	PRODUCED	BAD	GOOD	SHORTFALL	PERCENT
1	1000	852	12	840	160	84 %
2	750	46	3	43	707	5 %
3	900	801	12	789	111	87 %
4	5000	4527	55	4472	528	89 %
5	1250	757	10	747	503	59 %
6	6500	5586	214	5372	503	82 %
7	5000	4489	76	4413	587	88 %
8	3500	75	2	73	3427	2 %



Available Solutions—from simple to sophisticated

Solutions for displaying KPIs and andon messages range from machine status via simple stack lights that cost under $100, to complete PC-based production monitoring solutions that cost in excess of $100K.

- **Large 7-segment LED displays**
  For simplicity, it's hard to beat what are effectively just panel meters, but with large LED displays. Their sheer brightness and contrast makes them viable for viewing critical values over very long distances. Sizes range from just over an inch, to as large as four inches. The former are easily visible at 70 feet, while the latter are readable at up to 180 feet. Different versions of these large displays are offered to accept standard digital, analog or serial inputs, making them easy to use. Because these displays can't provide descriptive text, they're best used when only a single KPI is of interest.

LED marquees

LED marquees are displays manufactured with a matrix of single LEDs, in various resolutions. Over the last decade, multi-color LED marquees have become a common method of displaying plant floor information. Their ability to display multiple lines of information, combined with the ability to display text, make them ideal for displaying more than one KPI. By allowing the display to change colors, e.g. from green to red, users can more easily draw attention to the display if critical messages must be communicated quickly, e.g. line down messages.

The most important criteria when selecting a marquee is how it collects the data. Some manufacturers offer models with digital inputs, while others offer only a serial slave interface. The latter will typically require the user to write the necessary code to "talk" to the display, commanding it to display specific characters in specific formats. The more clever models offer built-in communications drivers, and can communicate directly with automation devices such as PLCs, motor drives, etc. This allows them to collect and format the data to be displayed.

While more advanced than 7-segment LED displays, LED marquees are still somewhat limited in their ability to display more sophisticated images such as trend lines and bar graphs. Their cost also makes them prohibitive, particularly in the larger sizes.

Television-based solutions

The latest trend in production displays arises from the ever-falling cost of consumer-grade televisions. With their ability to display images in high-definition, flat screen TVs are quickly becoming the most common method of displaying information on the plant-floor. Early on, savvy users made use of TVs by running SCADA software on a dedicated PC – the TV was simply connected as a monitor. Today, dedicated solutions are available for connecting, collecting and displaying plant floor data on any TV.

Advanced Functionality

When selecting a system to display process performance data, managers should consider what other functionality modern solutions provide. Since productivity displays must collect data from automation devices, it makes sense that today's more capable products offer built-in data loggers. By having the ability to review historical production trends, supervisors and management can easily determine if the initiatives they've put in place have been effective, and of those initiatives, which were most profitable. By logging the causes of line-down events, management can determine which lines are most problematic, as well as how to resolve the most common issues.

Today's solutions also offer the ability to keep remote personnel informed via a web-based interface, allowing on-call maintenance or travelling managers to keep abreast of their processes' performance. These devices also offer the ability to send status updates and alerts via text messages or email for the ultimate in andon communication.

Implementing a Solution to Improve Process Efficiency

Regardless of the technology – 7-segment LED or high-definition TV with logging and remote notifications – the most important point to remember is that information, when communicated to the appropriate personnel, increases efficiency and reduces downtime. Since various solutions can be had for as little as a few thousand dollars, and can represent a significant increase in profitability, there's a compelling reason to implement visual management in most facilities.

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