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Empowered Heat Treat Operators; using mobility solutions & data analytics to make workers more productive

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Abstract

Millennials (generation Y and beyond) are more socially conscious, more impatient and highly value individuality. They are digital natives – born into the world where technology is ubiquitous. They have grown up with the world at their fingertips.

In a short period, these digital natives will make up the majority of the workforce, and this means moving from an average workforce age of 50+ to a new guard of 20+ somethings who have vastly less experience and very different working practices. Bridging this gap will require digital tools to not only capture the knowledge of older workers before they retire but also make it available to the new generation in a way that supports their preference for digital work practices.

As the crew changes, so must the Heat Treat plant. Industry 4.0 and IIoT practices are enabling an evolution of smart connected products and solutions to provide the right information in the right place at the right time.

This paper will outline the drivers for connected products and solutions and will provide an overview of the digital tools being used today to enable the next generation of operators to become more productive.

Introduction

"One of the biggest challenges for organizations in the coming years will be the retirement of more than 75 million older workers and their replacement by a comparable number of young people entering the workforce." [1]

On January 1, 2011, the oldest US Baby Boomers turned 65. Approximately 10,000 more boomers will continue to pass this milestone age on a daily basis until the year 2030 [2]. The experience drain through retirement from manufacturing is accelerating!

From recent Census data Millennials, born 1981-1997, with 75 million members, now outnumber the Baby Boomers (born 1946-1964). The Generation X group, born 1965-1980, is stuck in the middle and has fewer members, approximately 66 million. Immigration is set to top up the level of Millennials to take it over 80 million members by 2036. [3]

These generational changes will affect a typical Heat Treat plant. Analysis of data for current "Heat Treatment" job profiles on LinkedIn [4] show 58% of profiles have greater than ten years' experience. Only 6% of profiles have less than two years. The demographic changes that will occur over the next decade will radically modify the experience levels within a Heat Treat operation.

It is important to understand the makeup of tomorrow's workforce and how this differs to the workforce of today to prepare for upcoming changes. Equally as important is to know how equipment and technology trends can potentially provide solutions to address the inevitable experience gap.

Generational Trends

A summary of key issues within each workforce group can help understanding of generational trends. [1]

- Baby Boomers had the impact of civil rights, the Women's movement, and the Vietnam War.
- Generation X experienced the AIDS epidemic, economic uncertainty and the fall of the Soviet Union. Job losses were more evident from aggressive downsizing, and on a home front, divorce rates went up.
- Millennials watched as Enron and other iconic companies collapsed due to unethical leadership.

The following paragraphs examine some of the modern views of the makeup of generations but it is important to recognize that there is an overall lack of empirical evidence of generational differences and most of the current literature relies on anecdotal accounts and qualitative interviews. [1]

Millennials are individualistic and value equality and tolerance. A new U.S. Census Report analyzing trends in American Adults (aged 18-34) indicate this group is more educated, have more debt, and make less money than previous generations at the same age. More than half think marriage and children are not key steps in becoming an adult, while "more than 9 out of 10 Americans believe that finishing school and gainful employment are significant milestones of adulthood." [5]

Millennials, the first generation of digital natives have been tagged with both positive and negative qualities in the mainstream media. Collaborative behavior, technical skills and use of social media are seen as strengths. Strong views on individuality in work practices and customized work schedules to fit around their needs are not shared by the Baby Boomers who have generally accepted the need to fit in with a specified work routine. [6]

Companies are panicking that they don't have the tips and tricks to manage this new group and have turned to expensive so-called millennial experts. The Millennial is perceived to be harder to manage and retain than previous generations. Most important to the Millennial includes flexible schedules, purposeful work, regular feedback. Part of this could be to do with life-stage/early career requirements. [7]

Older employees may look for money and an innovative environment for selecting a new employer, but for millennials, company values are essential. Flexible schedules, a standard 'millennial' requirement, are also being sought by baby boomers as they near retirement. Making an impact is something that is also a top career goal across all generations. From a motivation standpoint, appreciation for a job well done (when done sincerely) is required across all age groups and can be a key factor in boosting tenure. [8]

There is an argument that many of the traits associated with Millennials are the direct result of economic conditions rather than due to fundamental differences in their aspirations. The hallmarks of the American dream, home, and car ownership are now seen as a later-life reality for this generation due to student debt and lower earning potential. This group is highly educated, but there is an education gap between this group and the baby-boomers particularly in STEM (Science, Technology, Engineering, Math) subjects. [9]

The different generations have had vastly different exposure to technology. The Baby Boomers have 'acquired' technology, the Gen X'ers have assimilated to innovations, and technology just forms a way of life for the millennial era.

Indeed, some traits run through the different generational groups, but the key issue remains that the workforce (in a relatively short period) will go from one rich with experience in years and job skills to a much younger, inexperienced but more technology-savvy workforce.

Equipment Trends

Over 25 years ago you could find a small blackboard by each furnace with chalk-written details of the process run. The time noted on the board served as a reminder to manually unload the furnace. A filing cabinet full of hand-written or typed indexed cards formed the primary method to try to ensure repeatable processes. Historically Heat Treat plants fell into the 3D's of manufacturing; Dirty, Dangerous and Dull.

Fast-forward to today and the process is usually computer controlled, and process details managed via selecting a desired computer controlled recipe. A common trend is having a central view improving visibility across multiple furnaces (e.g. SCADA – Supervisory Control and Data Acquisition). The production route throughout the plant is controlled by a Shop Traveler/Production Route Card generated by a dedicated ERP (Enterprise Resource Planning) style computer program. Modern ERP systems can share this information via the use of tablets/iPads used on the shop floor, but it is still common for the Route Card to be printed and manually signed-off at each stage of the process.

Newer Vacuum-based processes; from Vacuum Carburizing through to novel PVD Coating technologies have started to clean-up the Heat Treat department and also extend the use of advanced technology including; advanced algorithms, situational awareness / high-performance HMI's, remote process view and monitoring.

Baby boomers and to a lesser extent Gen X's have exposure to all the changes from using and working with paper-based methods through to the latest fully electronic systems. Millennials are unlikely to have ever experienced an entirely manual process.

Technology Trends

Today's systems should be designed to take maximum advantage of the multitasking appetite of the millennial mindset as well as their inherent digital prowess.

The plant is moving from being **device-centric.**

- Fixed information about the device/machine
- Linked to status of machine only – no big picture view
- Simple diagnostics – no insight

To being **user-centric.**

- Information adapted to user profile & their physical location
- Combining multiple information sources
- Analytics to provide insight
- Not fixed to equipment – mobile/ wearable

The goal is to provide the right information in the right place (to the right person) at the right time.

There are four major technology and market changes driving digitization in industries:

1. Connectivity; standards-driven connectivity has allowed for the large scale deployment of cost-

effective wireless sensors and has rapidly increased the deployment of IIoT and connected devices.

2. Mobility; communication from smart devices has become pervasive. User experiences are natural and productive and allow for user-recognition (the buildings, machines, etc. recognize the user because of their mobile device).

3. Cloud; all about sharing data and working at the same time on the same database to improve efficiency. This was not possible before. It also means that large companies can employ specialists regardless of their location and manage their facilities and assets, anywhere, remotely.

4. Analytics is increasingly being used in Industry to provide "context" for operators to become real-time business decision makers. This optimization is at every level of a company

Retooling the Heat Treat Plant for Millennials

Business benefits are realized by leveraging technology trends to:

1. Reduce the impact of an experience gap, and
2. Place the right information in the hands of the operators, at the right time.

The following outlines key areas where technology solutions are available to an Operator:

Safety; viewing real-time information about the overall health of equipment can enable an informed decision to be made to take a faulty machine out of service before a hazardous condition occurs.

Maintenance; using analytics tools, early warning signs of machine failure can be acted on giving the maintenance team time to schedule repairs and purchase parts necessary to undertake that repair. Maintenance periods can be adjusted to actual conditions rather than following an inexact method of accumulated hours of operation.

The drive towards connected devices and lower-cost sensors has improved the affordability of this type of solution.

The maintenance activity can be streamlined by using Augmented Reality Solutions. One example is the Vijeo 360 AR (from Schneider Electric) gives a virtual view of the control panel, allowing quicker and safer debugging of maintenance issues.

Reliability; increased monitoring of machinery has the added benefit of fewer unexpected or catastrophic failures.

Quality; real-time views of the process, quality results, and equipment performance can prompt when quick recovery actions are required. After-the-fact expensive post mortems on quality rejects and rework become redundant. Machine vision and data analytics can provide an experienced eye when investigating microstructural properties. Information related to compliance status (calibration, TUS, SAT, etc.) can ensure all relevant checks are made before processing work for regulated industries.

One example of digital technology related to Heat Treatment regulations is the eCAT^{TM} Eurotherm Online Services (EOS) solution for calibration [10]. This digital solution enables direct input of calibration data into a tablet and instant creation of calibration certificates. The system has embedded workflow technology to aid the Calibration Tech through the calibration process. A Calibration label with a QR Code is printed at the end of calibration, and this is used to provide a link between the physical and digital worlds allowing a quick scan to view relevant calibration records instantly. A dashboard of compliance at the instrument level, Furnace and entire plant is immediately available.

Business benefit of Retooling the Heat Treat Plant

Cost savings are achieved by avoiding expensive repairs to equipment through reduced unplanned overtime and eliminating premiums for unscheduled deliveries (of emergency parts).

Increased Revenue is realized through fewer unexpected and severe failures, reduction in production stoppages and the resultant freed up capacity provides the possibility of increasing revenue per furnace.

Peace of mind is obtained through a good knowledge of machine health, and this enables better planning, budgeting, maintenance schedules and productivity estimates.

Conclusions

The Millennial generation will form the majority of the workforce going forward. These individuals are very different from past generations; they are inexperienced in factory operations but technology savvy. Time is not an extendable resource, and this group is reluctant just to increase hours at work. They use time efficiently through leveraging technology.

Higher technology processes help provide a more attractive workplace, and trends centered around the user certainly fall in line with the requirements of digital natives.

Businesses that embrace technology and tech-savvy operators will ultimately benefit through lower costs of processing and higher revenue potential.

References

[1] Twenge, J.M. et al. (2010, September) "Generational Differences in Work Values: Leisure and Extrinsic Values Increasing, Social and Intrinsic Values Decreasing" Journal of Management, Vol. 36 No. 5

[2] Cohn, D'V., Taylor, P., (2010, December 20)"Baby Boomers Approach 65 – Glumly." Retrieved from http://www.pewsocialtrends.org/2010/12/20/baby-boomers-approach-65-glumly/

[3] Fry, R., (2016, April 25)"Millennials overtake Baby Boomers as America's largest generation." Retrieved from http://www.pewresearch.org/fact-tank/2016/04/25/millennials-overtake-baby-boomers/

[4] Sales Navigator https://www.Linkedin.com (Search string "Heat Treatment" for all US Profiles: accessed 2017, July 22)

[5] Cummings, W. (2017, April 19) "Millennials differ from other generations in almost every regard." Retrieved from https://www.usatoday.com/story/news/nation/2017/04/19/young-americans-census-report-millenials/100640966/

[6] Cummings W. (2017, May 11) "The malignant myth of the Millennial" Retrieved from https://www.usatoday.com/story/news/nation/2017/05/11/millennial-myth/100982920/

[7] Gellman, L. (2016, May 18) "Helping Bosses Decode Millennials – for $20,000 an Hour" Retrieved from https://www.wsj.com/articles/helping-bosses-decode-millennialsfor-20-000-an-hour-1463505666

[8] Sturt, D., Nordstrom, T., (2016, Aug 16) "Generational Differences: When They Matter, And When They Don't" Retrieved from https://www.forbes.com/sites/davidsturt/2016/08/16/generational-differences-when-they-matter-and-when-they-dont/2/#8a2e5dc64df3

[9] Buckley, Dr. F. et al. (2015, October 16) "A new understanding of Millennials: Generational differences reexamined." Retrieved from https://dupress.deloitte.com/dup-us-en/economy/issues-by-the-numbers/understanding-millennials-generational-differences.html

[10] Paramjit Chana, David Mitchell, Karl Haigh, U.S. Patent US20160247387 A1