AUTOMATION: EXTINCTION EVENT OR EVOLUTIONARY FORCE FOR PLANT OPERATORS

David A. Strobhar, PE
Center for Operator Performance
Beville Engineering, Inc.
Dayton, Ohio USA
Agenda

■ Background
  – Working group at Center for Operator Performance
  – Part of industry trend

■ Knowledge worker
  – What does that mean

■ In process control
  – Changes in nature of work

■ Implications for future
  – Selection
  – Training
  – IT

■ Summary

■ Additional Reading
Agenda

- Background
  - Working group at Center for Operator Performance
  - Part of industry trend
Center for Operator Performance

www.operatorperformance.org
Operator of the future

- It’s not about tasks, but the type of person doing the work
- Need knowledge workers
- Need systems to support them
  - In-time training
  - Access to data
50-Year Trend

- The productivity of knowledge and knowledge workers will not be the only competitive factor in the world economy. It is, however, likely to become the decisive factor, at least for most industries in the developed countries. – Peter Drucker, 1957 [3]

- The most valuable assets of a 20th-century company were its production equipment. The most valuable assets of a 21st-century institution, whether business or non-business, will be its knowledge workers and their productivity. [3]

- Manual workers are a cost. Knowledge workers must be considered an asset. [3]

- The function of technology is often to eliminate manual work...to simply make some physical activities no longer necessary. The knowledge age is made possible by new technologies properly applied and by integrating technologies in such a way that they encourage knowledge sharing within and among communities. [6]

- Mechanization (replacement of human muscles) and automation (replacement of human judgement) [7]

- Auto mechanics (1970s) [2]

- Assembly lines (1980s)
Agenda

- **Background**
  - *Working group at Center for Operator Performance*
  - *Part of industry trend*

- **Knowledge worker**
  - *What does that mean*
Knowledge Worker [6]

- That meant workers basically fell into two categories: knowledge workers (in offices) and manual workers (in factories).
- Industrial worker is being transformed into knowledge worker, who is responsible for understanding the nature of the work and the purpose for which it is done.
- Knowledge always requires context for it to be of value. Context is the bridge that links information together to create knowledge.
- As professionals become part of the work process, many of the tasks once performed by professionals are transferred to technicians, often working under the direction of the professional. Professionals become workers and workers become professionals.
- Collaboration becomes critical. Collaboration requires that people understand what others are doing and how their work fits together with the work of others. It requires a higher level of interdependency for success in the work than cooperative environments do. Collaboration is a win-win situation because all those involved have a common goal.
- The difference between collaboration and cooperation is the difference between playing a team sport and simply playing at the same time. — Collaboration takes place when we all play the same game, with the same goals and a common understanding of what the game is about.
Agenda

■ Background
  - Working group at Center for Operator Performance
  - Part of industry trend

■ Knowledge worker
  - What does that mean

■ In process control
  - Changes in nature of work
<table>
<thead>
<tr>
<th>Was standard for operator</th>
<th>Becoming common</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill lube oil on rotating equipment</td>
<td>Lubrimist</td>
</tr>
<tr>
<td>Start/Stop rotating equipment</td>
<td>DCS</td>
</tr>
<tr>
<td>Open/Close Valves</td>
<td>DCS/Don’t run on bypasses</td>
</tr>
<tr>
<td>Feel for vibration</td>
<td>Internal sensors</td>
</tr>
<tr>
<td>Listen for unusual sounds</td>
<td>Internal sensors</td>
</tr>
<tr>
<td>Use senses to detect problems</td>
<td>Area sensors/ drones</td>
</tr>
<tr>
<td>Start/stop fin fans</td>
<td>Variable speed motors</td>
</tr>
<tr>
<td>Take/Run samples</td>
<td>On-line analyzers/portable meters</td>
</tr>
<tr>
<td>Isolate lines in upset</td>
<td>EIV</td>
</tr>
<tr>
<td>Track equipment status (which pump “on”)</td>
<td>DCS</td>
</tr>
<tr>
<td>Check accuracy of instrumentation</td>
<td>Smart transmitters</td>
</tr>
<tr>
<td>Oversee maintenance</td>
<td></td>
</tr>
<tr>
<td>Prep equipment for maintenance</td>
<td></td>
</tr>
<tr>
<td>Backflush coolers</td>
<td>PLC</td>
</tr>
<tr>
<td>Clean screens and filters</td>
<td></td>
</tr>
<tr>
<td>Detect safety opportunities</td>
<td></td>
</tr>
<tr>
<td>Blowdown KO/boots/drums</td>
<td>Control valves</td>
</tr>
<tr>
<td>Verify line-ups</td>
<td>Valve positioners</td>
</tr>
<tr>
<td>Local readings/ Tank Gauging</td>
<td>Wireless instrumentation</td>
</tr>
</tbody>
</table>
## Change from tasks to activities

<table>
<thead>
<tr>
<th>Function</th>
<th>Previously (task)</th>
<th>Future (Activity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotating equipment reliability</td>
<td>Ensured lube oil, felt for vibration</td>
<td>Collaborate with rotating equipment engineers and maintenance to optimize runtime</td>
</tr>
<tr>
<td>Control performance</td>
<td>Verified instruments on DCS match field</td>
<td>Collaborate with console, instrumentation, and process control to ensure instrument reliability</td>
</tr>
<tr>
<td>Product quality</td>
<td>Took samples</td>
<td>Collaborate with console, lab, and process engineers to reduce variance in product specs</td>
</tr>
</tbody>
</table>
Agenda

■ Background
  – Working group at Center for Operator Performance
  – Part of industry trend

■ Knowledge worker
  – What does that mean

■ In process control
  – Changes in nature of work

■ Implications for future
  – Selection
  – Training
  – IT
### Harvard Business School Case Study

Applicants are given a scenario (production of new model has resulted in more defects, injuries, and low morale) along with data, memos, worker complaints, and control charts. They are to analyze the situation and come up with recommendations.

### Teamwork

Groups of six are told they are small company making circuit boards. They can choose to produce one of five types of circuit boards with varying cost, profit, and difficulty. They are given $25 seed money to start. There is a discussion period and a production period. They must sell the boards along with necessary paperwork to buyer, who can refuse if everything is not correct without explanation. This tests teamwork and handling pressure. (Apparently fights have broken out on this one)

### Personal Touch

As a reward for hitting production goals, Toyota is giving each member of the team $10 that can be used in on a variety of options. The group must make a unanimous decision on which option to pick.

And so a trade that was once largely mechanical is today primarily technical, and therefore requires workers to be skilled computer users, strong readers, and able mathematicians.
Training: Learning, not training

- The idea of knowledge workers stemmed from the old-fashioned practice of getting knowledge from an apprenticeship.
- That practice has taken modern shifts through college learning and internships, with people gaining the specific skills they need in professional, university, and vocational training that translates directly to the workplace.
- But there’s one major difference in today’s modern workplace—we can instantly learn anything, anywhere.
- This new movement is the age of the “learning workers.”
- Instead of having a set of specific skills, learning workers have the skills to learn as they go, adapt, and apply their learning to new situations and issues.
IT: Information technology increases in importance [6]

■ No amount of information or data will answer the question, “Is it a good idea to ...?” But data and information may be required in order to help us answer the question properly.

■ Managing knowledge differs fundamentally from managing information. It is about providing an environment, nurturing community, with supporting technology so that judgements can be made – the work of knowledge workers.

■ An integrated digital environment is one in which there is immediate access to information needed to do work.

■ Information exchange is at the heart of the work community. Information, as it grows and prospers, takes on additional meaning and life.

■ Technology overload - information overload, communication overload, and system feature overload
Agenda

■ Background
  – Working group at Center for Operator Performance
  – Part of industry trend

■ Knowledge worker
  – What does that mean

■ In process control
  – Changes in nature of work

■ Implications for future
  – Selection
  – Training
  – IT

■ Summary
Summary

- Automation is requiring new species of operators.
- Will the change at your plant be evolutionary or revolutionary?
Agenda

- Background
  - Working group at Center for Operator Performance
  - Part of industry trend
- Knowledge worker
  - What does that mean
- In process control
  - Changes in nature of work
- Implications for future
  - Selection
  - Training
  - IT
- Summary
- Additional Reading
Additional Reading