ONLINE SURVEY
Robots in Manufacturing
Industry Insights
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## Respondent Profile

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Executive Summary

Study: Robotics improve productivity. So why don’t smaller plants use them?

Smaller manufacturers have been slower to embrace the use of robots within their facilities, the overall use of robotics is seen by manufacturers of all sizes as a driver of improved productivity.

Those are the key findings of a new study, conducted by Machine Design in partnership with Schmersal, that looked at prevailing opinions around robots, their perception among manufacturing workers, and their use within facilities.

That robots would be seen as more productive isn’t a huge surprise; their impact on manufacturing has been predicted by both academics and popular culture for decades. As robots increasingly are used to supplement operations, how and where they are deployed continues to evolve. Whether to relieve existing workers from repetitive or dangerous tasks, to supplement worker shortages or to work along with humans to perform tasks more efficiently, robots are finding a home within the manufacturing sector.

The perception of how and why robots are utilized varies depending on the operational role. Management and line workers agree in one area: 62% of managers and 61% of line workers see robots as a way to improve output. It’s also a strategic advantage, as 59% of managers see robot use increasing in the future. Slightly more workers (38%) than managers (32%) feel robots will help plants overcome a looming worker shortage. Surprisingly, while 29% of workers feel robots are simply a way to replace human workers, 7% of managers see robots as nothing more than a “necessary evil”.

Despite the availability of smaller, more versatile and less expensive robots, smaller plants have lagged well behind larger facilities in robot deployment. In the area of mobile robotics, 41% of facilities of more than 1,000 employees utilize automated guided vehicles (AGVs) or other mobile robots; just 11% of plants with fewer than 100 employees use the same strategy.

The same is true for investment in robotics; 59% of large facilities and 67% of mid-sized plants plan to increase investment in robotics, while just 51% of small plants see their investment going up.

One thing all respondents agreed on: the necessity for external expertise to help deliver a strategy around use, deployment and training for plant personnel. While 58% of all respondents use their own engineering and maintenance teams for robot deployment, 42% utilize a machine builder or OEM, 36% work with a robot manufacturer and 33% employ a third-party integrator. It is somewhat surprising that half of all large manufacturers doing robot deployment use one or all of those resources in their deployment.

Bob Vavra, Senior Content Director
Machine Design | Hydraulics & Pneumatics
Introduction & Methodology

OVERVIEW
Methodology, data collection and analysis by Machine Design on behalf of Schmersal, Inc. Data collected March 5 through 18, 2020.

Methodology conforms to accepted marketing research methods, practices and procedures.

METHODOLOGY
On March 5, 2020, Informa Engage emailed invitations to participate in an online survey to users of Machine Design.

By March 18, 2020, Informa Engage had received 323 completed, qualified surveys. Only respondents who currently use or plan to use robots in their facilities were qualified to answer the survey.

RESPONSIVE MOTIVATION
To encourage prompt response and increase the response rate overall, a live link to the survey was included in the email invitation to route respondents directly to the online survey.

The invitations and survey were branded with the Machine Design logo in an effort to capitalize on user affinity for this valued brand.

Each respondent was afforded the opportunity to enter a drawing for one of four $100 Visa gift cards.
Respondent Profile
Industry and Job Function

Respondents are likely to work in general manufacturing, for an OEM, or in the automotive industry. Nearly half of respondents indicate their job title/function is design engineer. More than two in three are involved in specifying, selecting or influencing the purchase of robotic equipment ad/or robotics safety components.

**Question: Which best describes the industry you work in?**
Base: All respondents (n=323).

- General Manufacturing: 24%
- OEM/Machine Builder: 16%
- Automotive: 14%
- Packaging: 3%
- Material Handling: 3%
- Food & Beverage: 2%
- Other: 39%

**Question: What is your job title/function?**
Base: All respondents (n=323).

- Design Engineer: 46%
- Production Engineer: 8%
- Maintenance: 5%
- Plant Manager: 3%
- Safety Supervisor: 1%
- Other: 37%

**Question: Are you involved in specifying, selecting, or influencing the purchase of robotic equipment and/or robotics safety components?**
Base: All respondents (n=322).

- Yes: 69%
- No: 31%
Company Size and Location

One third of respondents work for a company with more than 1,000 employees. Twenty-seven percent work for a mid-sized company and 39% indicate their company has 100 or fewer employees. Respondents are located across the country, with the largest percentage in the Midwest.

**Question: What best describes your company size?**
*Base: All respondents (n=323).*

- More than 1,000 employees: 34%
- 501 to 1,000 employees: 9%
- 101 to 500 employees: 18%
- 50 to 100 employees: 11%
- Fewer than 50 employees: 28%

**Question: In which state are you located?**
*Base: All respondents (n=323).*

- Midwest (WI, MI, IL, IN, OH, MO, MN, IA): 26%
- Northeast (ME, NH, VT, MA, RI, CT, NY, PA, NJ): 14%
- Pacific (AK, WA, OR, CA, HI): 12%
- Southwest (OK, TX, AZ, NM): 7%
- Southeast (NC, SC, GA, FL): 6%
- Mountain (ID, MT, WY, NV, UT, CO): 3%
- Mid-Atlantic (DE, MD, DC, VA, WV): 3%
- South (KY, TN, MS, AL, AR, LA): 2%
- Plains (ND, SD, NE, KS): 1%
- Outside US: 26%
Key Findings
Use of Robots

The majority of respondents are currently using or testing the use of robots in their operations. Robot use is likely confined to less than 25% of a respondent’s facility.

**Robotics Strategy**

- We use robots to perform manual, repetitive, or dangerous tasks: 38%
- We are testing how best to deploy robots in our operation: 16%
- We are starting to research how robots can help our operation: 40%
- We are a fully robotic operation with humans to do repairs and other functions: 6%

**Percentage of Facility Using Robots**

- Less than 25%: 76%
- 25-50%: 16%
- 50-75%: 13%
- Over 75%: 11%

**Question:** What is your robotics strategy?
*Base: All respondents (n=323).*

**Question:** What percentage of your facility uses robots?
*Base: All respondents (n=322).*
Perception of Robots

Plant management and plant workers view robots as a way to improve productivity. Plant management is likely to consider robots a valuable part of their future strategy. Neither management nor workers have an overall negative view of robots.

**Management Perception**
- A way to improve productivity: 62%
- A valuable part of our future strategy: 59%
- A way to overcome worker shortages and improve safety: 32%
- A necessary evil: 7%
- Other: 10%

**Worker Perception**
- A way to improve productivity: 61%
- A way to overcome worker shortages and improve safety: 38%
- A way to replace workers: 29%
- Other: 11%

**Question:** How do your plant management view robots?
*Base: All respondents (n=322). Multiple answers allowed.*

**Question:** How do workers view robots?
*Base: All respondents (n=321). Multiple answers allowed.*
Use of Mobile Robots and AGVs

The majority of plants do not use mobile robots or automated guided vehicles. Large companies are most likely to have these in use.

Question: Does your plant use mobile robots or automated guided vehicles (AGVs)?
Base: All respondents (n=322).

- Yes: 25%, 41%, 24%, 11%
- No: 75%, 59%, 76%, 89%
Resources for Integrating Robots into Operations

Companies are most likely to use their own maintenance or engineering team to integrate robots into their operations. Half of large companies also use a third party integration team.

Question: What resources does your company use as you integrate robots into your operations?
Base: All respondents (n=320). Multiple answers allowed.
Robot Hazard Identification

Companies are likely to assess the hazards associated with the use of robots/cobots/AGVs internally. Among large companies, a majority also use robot supplier recommendations and/or OEM/machine builder recommendations.

Question: How do you determine any hazards associated with the robots/cobots/AGVs you use?

Base: All respondents (n=320). Multiple answers allowed.
The majority of respondents have implemented hard guarding to ensure safe interaction with robots. Large companies are also likely to have implanted safety light curtains and/or safety laser scanners. Half of respondents have implemented safety light curtains to ensure safe interaction with cobots.

**Question:** What types of safety measures have you implemented to ensure safe interaction with robots?

*Base: All respondents (n=316). Multiple answers allowed.*

**Robots**

- Hard guarding: 77% (88% for more than 1,000 employees), 65% (79% for 101-1,000 employees), 18% (30% for 100 or fewer employees)
- Safety light curtains: 47% (48% for more than 1,000 employees), 30% (34% for 101-1,000 employees), 18% (27% for 100 or fewer employees)
- Safety laser scanner: 35% (34% for more than 1,000 employees), 30% (32% for 101-1,000 employees), 18% (20% for 100 or fewer employees)
- Safety mats: 30% (30% for more than 1,000 employees), 27% (28% for 101-1,000 employees), 21% (21% for 100 or fewer employees)
- Other: 9% (9% for more than 1,000 employees), 9% (17% for 101-1,000 employees), 17% (29% for 100 or fewer employees)

**Cobots**

- Safety light curtains: 58% (51% for more than 1,000 employees), 42% (42% for 101-1,000 employees), 34% (30% for 100 or fewer employees)
- Safety laser scanner: 34% (30% for more than 1,000 employees), 52% (52% for 101-1,000 employees), 21% (21% for 100 or fewer employees)
- Other: 36% (36% for more than 1,000 employees), 38% (38% for 101-1,000 employees), 43% (43% for 100 or fewer employees)

**Question:** What types of safety measures have you implemented to ensure safe interaction with cobots?

*Base: All respondents (n=270). Multiple answers allowed.*
An increase in robotic investment is expected through 2020. Large companies are most likely to expect investments to greatly increase.

Question: How will your robotic investment change in 2020?

Base: All respondents (n=323).
Write-in Comments
Write-in comments

What is your job title/function? Other responses:

- Application Engineer
- Architect
- Automation Engineer
- Automation Specialist
- CAD/CAM System Specialist
- CEO – 7 mentions
- Chief Creative
- Consultant – 6 mentions
- CTO – 2 mentions
- Deputy General Manager
- Designer
- Director of Engineering – 2 mentions
- Director Strategy
- Director, Sys Dev
- E/I Supervisor
- Educator – 8 mentions
- Electrical Design
- Electrical technician
- Engineer
- Engineer - VP Sales
- Engineering Architect
- Engineering Manager – 3 mentions
- Engineering Technician – 2 mentions
- Executive Management
- Founder with Engineering background
- Freelance Technical Consultant
- HSE Engineering Technician
- I am Senior Advisor
- International Operations Manager
- Investor
- Lab Supervisor
- Logistic
- Manager
- Managing Director
- Manufacturing Engineer – 4 mentions
- Marketing
- Mechanical Designer
- OEM support
- Owner – 6 mentions
- Packaging Machines - coordinator
- President
- Principal, Engineer, President
- Process engineer
- Product Development Engineer
- Product development specialist
- Product Manager
- Program Manager
- Programmer
- Project Engineer
- Project Manager
- Purchasing
- QA and Product Safety Engineer
- Quality Engineer – 3 mentions
- Quality Manager
- R&D – 5 mentions
- Reliability
- Research Chemist
- Research Engineer
- Research professor
- Sales Development
- Self research
- Senior director in data analytics
- Senior Mechanical Generator Engineer
- Senior Project Manager
- Service tech
- Software Engineer
- Solutions & development engineer
- Sr Systems Engr
- Student – 2 mentions
- system analyst
- Systems engineer
- Technical consultant
- Technical Sales Engineer
- Technical Specialist
- Technopreneur
- Test engineer
- Tool Room Supervisor
- Training Manager
- VP, Engineering
- Welding Engineer
Write-in comments

Which best describes the industry you work in? Other responses:

- Access Technology
- Aerospace – 18 mentions
- Agriculture
- Aircraft Maintenance, Repair, and Upgrades
- All of the above
- Bio-mass processing
- Biotech
- Bonding of specialty metals
- Cable car ski lift
- Chocolate and Nuts Products
- Community College
- concrete products
- Construction – 2 mentions
- Consultants
- Consulting Engineers
- Consumer Goods
- Consumer products
- Consumer, HVAC
- Design and Development of Embedded Systems
die caster
- disaster relief
- Disposable Medical Device
- Distributor
- Education – 11 mentions
- Effects
- Electric energy sector
- Electrical components manufacturing
- Electrical distribution
- electronics Aerospace & Defense
- Electronics manufacturing
- Energy/Utilities
- Engineering Firm
- Experimental Sonic Weapon
- FFRDC
- Fluid Handling
- Gas
- healthcare
- Heavy Construction
- Hot Cells - Radioactive Materials
- Human Robot manufacturing company
- HVAC
- HVAC Component Manufacturer
- Hydraulics oil dynamic components
- Industrial automation – 2 mentions
- industrial conglomerate
- Insurance/Finance
- manufacturing job shop
- Mechanical formation
- Mechatronics
- Medical Devices – 11 mentions
- Metals
- Metrology products - fine precision engineering
- Military/LEO
- Mineral Exploration
- Musician’s Equipment
- Nuclear
- OEM manufacture, design, development/ medical equipment & instruments
- Off highway equipment
- oil / gas petroleum
- Oil Exploration
- Our products are used in automotive, material handling and wind power generation
- Pneumatic Automation Product Manufacturing
- postal, logistics
- Power Generation OEM
- Primary Metals
- R&D – 4 mentions
- railways transportation
- Refinery & Petrochemical
- Research – 3 mentions
- Semiconductor
- Sound
- Specialized manufacturing
- startup
- Storm water Civil Hydraulics
- Surgical Robotics
- Textile
- Tooling Industry/CNC Machine Toolmaker
- transportation
- wood products
Write-in comments

How does your plant management view robots? Other responses:

- "newfangled contraptions"
- A way to increase accurate assembly
- A way to replace workers
- By customer request
- Capacity to build to high accuracy
- Clueless
- Consistent Quality
- Create better materials
- Different clients have different thoughts
- Glitzy highlight of the tour
- ignorant
- Let me know if it works.
- Mining, construction, agriculture
- Necessary to the evolution of precision surgical devices
- Necessary tool
- Profits
- Quality improvement, low cost manufacturing
- Quality improvement
- Repeat clean room applications
- Safety
- Seriously valuable in related programs and classes for STEM students
- Training students
- Unnecessary cost
- Used for hazardous tasks
- Worth examining

How do workers view robots? Other responses:

- A way to eliminate repetitive, monotonous jobs
- A way to improve patient outcomes and minimize procedure time
- A way to perform tests that people either can't do or can't do for extended periods of time.
- Competency
- Curiosity
- Employment opportunities
- Entertainment.
- Great way to alleviate monotonous jobs
- Improve working conditions & safety
- Necessary
- necessary to compete
- Necessary tool
- No Threat
- Not very effective
- Only used on machine builds.
- Remotely operated
- Safety is paramount.
- Something to break
- To improve safe and increased consistency in quality production
- To provide better more consistent service to customers
- Uncertainty
- unconfirmed failures
- Under Commissioning
- Unique niche
- Valuable teaching aid and skill set development
- We like to build those and their supporting technologies
- Workers want to do more thought-oriented tasks, happy to have machine do repetitive grunt work

For hundreds of reasons, they are here to stay, let's get on board.
Write-in comments

What resources does your company use as you integrate robots into your operations? (Other responses)

- As architect, I need to know what machines can do in factories, and how to facilitate them
- Depends on project
- Education
- Internal design build
- Mechanical Engineering and Mechatronics Programs
- Mix of buy and build
- R & D
- Remember the contest between John Henry and the steam hammer?
- Research
- Robotics find a useful application in automated inspection machines that we build for our customers
- Use of Machine Design Information
- We are the "resources"

How do you determine any hazards associated with the robots/cobots/AGVs you use? (Other responses)

- all means available
- All of the above
- Design Walkthroughs
- OSHA rules & regulations
- Program in review.
- Under Commissioning
- We completely ignore them.
Write-in comments

What types of safety measures have you implemented to ensure safe interaction with robots? (Other responses)

- AI VISION SYSTEMS
- Aware Systems
- Combination
- Complete understanding
- Depends on the machine
- Electrical protection devices.
- Floor colors
- Lab precautions
- Limit switches / kill switches
- Line of sight -Visual by two observers-site

- Lots of very small stuff so there is a low probability of human/robot interaction
- mapping
- optic sensors and haptic feedback
- Power management and safety procedures
- proximity sensors
- rigorous testing of software failure modes
- roped off area
- safety fence

- Safety PLC, Safety rated valves (spool monitoring)
- Safety/ Welding curtains and limited access.
- Sensors
- Step by step programming of two robots to avoid collision
- Training
- Under commissioning
- Various lock-out, SW, FW, sensors, etc.
- We stay the hell out of their way!
- We use collaborative robots

What types of safety measures have you implemented to ensure safe interaction with cobots? (Other responses)

- AI
- AI VISION SYSTEMS + ROBOT SOFTWARE
- As appropriate
- Aware Systems
- Common sense
- Drapping to avoid contamination or infection
- Electronic Safety Monitors
- Force and speed limitations

- Hard guarding – 2 mentions
- Kill switches & software controls
- Limited movement area; physical dividers; conveyor use
- Pinch point awareness
- Procedures and power management
- Sensors
- Step by step programming of two robots to avoid collision (same answer as the previous question: Programming by robots vendor and approved thru demonstration by the internal Program Manager
- Tag out, lock out
- Training
- We stay home.

- Drapping to avoid contamination or infection
- Force and speed limitations
- Lots of very small stuff so there is a low probability of human/robot interaction
- mapping
- optic sensors and haptic feedback
- Power management and safety procedures
- proximity sensors
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Thank you!