

# Automation Equipment Planning:

A Step by Step Guide for Manufacturers



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# Introduction

As an operations, plant, or project engineer, you've probably been asked to find ways to reduce costs, increase throughput, deliver a safer work environment, or maximize production efficiency. Automation is often the way to go. This step-by-step guide will help you navigate the process and the considerations along the automation journey.

## 1. Identify Opportunities for Automation

Start by looking around your production areas for places where automation could add value. Map out your manufacturing processes in detail, and review each step asking why and how things happen as they do. As you explore your facility, keep a close eye out for the following:

### Barriers to productivity and throughput

Identifying the areas within your process with the largest potential effect on throughput is key. As you investigate, trace problems up and downstream to find root causes, which may be the best opportunities. Some places to start include:

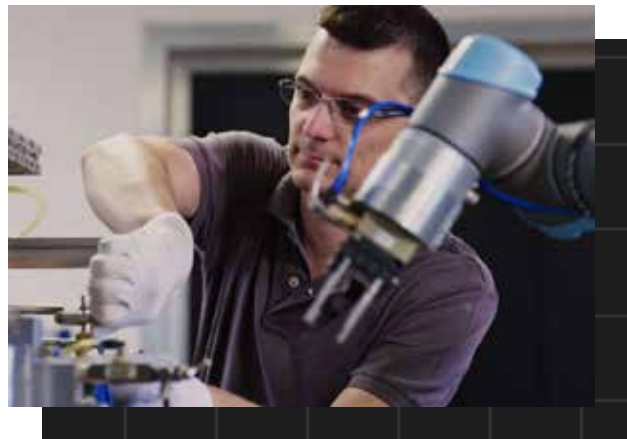
- Bottlenecks that slow production:
  - Equipment or machines needing frequent repairs or adjustments
  - Time-intensive steps (e.g. waiting for material to come up to temperature, time for parts to queue, etc.)
  - Tasks that require multiple operators

- Long changeover times from one product to another
- Quality problems:
  - Processes where parts need to be reworked, causing a negative impact on productivity
  - Processes where parts are consistently scrapped, reducing throughput
  - Processes prone to errors (human or machine)
  - Processes that use poor-quality components

## Operations with excessive costs

Try to find operations or processes that provide the greatest opportunities for reductions in time, labor, movements, steps, or even utility costs. Start with the ideas below, but remember that your specific process may present additional opportunities:

- Labor efficiencies
  - Areas to reduce time spent reworking and performing quality audits
  - Opportunities to assist humans to get the job done faster
  - Changes to processes that allow people to focus on skilled tasks while equipment positions or transports workpieces and performs simple, repetitive tasks
- Materials utilization
  - Improvements to processes that will reduce scrapped parts and wasted raw materials
  - Ways to increase machine and process repeatability so consumables are used more efficiently (e.g. weld wire, shielding gas, adhesives, nuts and bolts, electricity, compressed air, etc.)



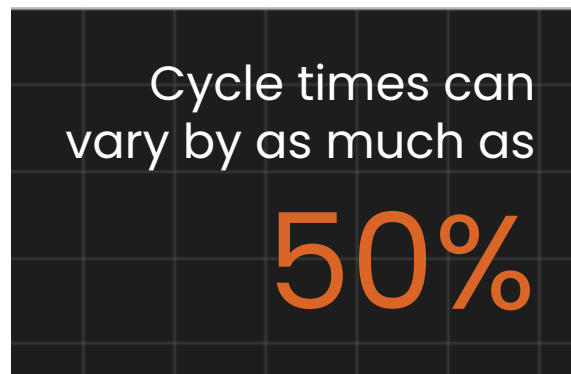
## Health and safety risks

It's challenging to review long-standing processes, but try to observe operations with fresh eyes to identify risks that may have gone undetected. Just because you've always done something one way doesn't make it the best option. Areas to improve worker safety and satisfaction include:

- Tasks requiring prolonged, intense focus or constantly shifting attention
- Boring or tedious tasks that cause workers to lose focus, make errors, or get hurt
- Jobs or locations in your facility with a record of accidents or near misses
- Jobs employees complain about, dislike, or find challenging
- Areas with exposure to gases, dust, or byproducts of the manufacturing process
- Activities with repetitive motion and ergonomic problems, especially over time and repeated exposure

## Quality and consistency challenges

Automation excels at processes where humans are inconsistent or inefficient, either from part to part with the same operator or between operators. Machines can serve as a buffer to reduce human inconsistencies. Some examples are listed here, although you will likely uncover additional unique challenges in your facility. Here are some thoughts to consider:



- No two welders, fabricators, assemblers, or inspectors will perform the same job-alike: cycle times can vary by as much as 50%.
- A single worker has variances in the speed and quality of their work from shift to shift, or even as a single shift progresses.
- Machines create uniformity and enable workers to focus on detail

work by picking, placing, and positioning parts.

- Tool weight causes workers to slow down toward the end of their shift.

## Commonly automated tasks and applications

Opportunities for automation are endless, especially as available technology evolves. The following tasks are good starting points for adding machinery, robotics, or other automated equipment:

- Welding
- Assembly
- Testing/inspection/sorting
- Dispensing and sealing
- Machine tending
- Conveyance
- Painting/coating/dipping
- Palletizing
- Transferring parts/heavy lifting/positioning
- Picking and packing
- Labeling

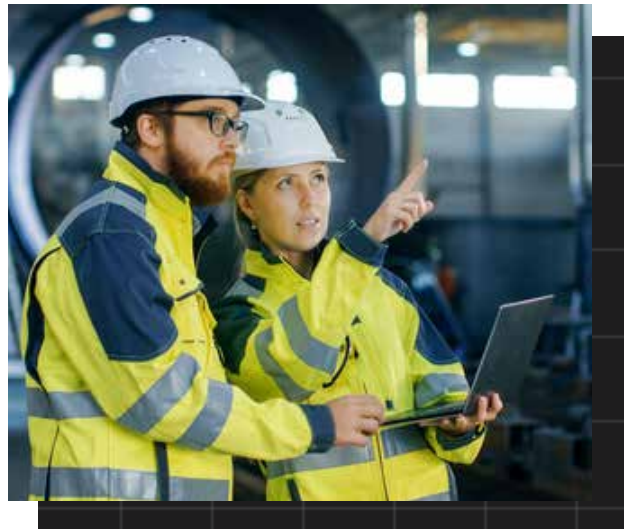
### Notes

# 2. Evaluate Options

Now that you have some opportunities in mind for automating your processes, look at the big picture of your facility and your company. At this stage, it's helpful to anticipate challenges and envision future success.

Questions to ask include:

- What are your roadblocks to success?
  - Have past attempts at automation been unsuccessful?
  - Is there resistance to considering the redesign of parts and processes?
  - Does your decision-making team lack a realistic picture of what automation can (and can't) do?
  - Do you expect push-back from employees as established processes change, or do they feel their job will be threatened?
  - Are there unreasonable limits on time, money, or staff for the project?
- How will you measure success? (e.g. 15% reduction in scrap materials, 100% fewer injury accidents, a measurable increase in revenue tracked to production gains from automation, etc.)
- What resources do you bring to the project?
  - What is your available budget?
  - How much physical space is available?
  - Which of your employees' skills will transfer to the new system? How trainable are they?
  - How much time can you devote to implementation, training, and refining of the new system?



- What resources do you lack?
  - How much training will your employees require? What will training cost in terms of time and budget? Does the vendor provide training?
  - Does your vendor provide technical support throughout the project? Will they provide ongoing support as well?
  - What maintenance do you anticipate? Will this require training or staffing changes?
  - Will your facility require upgrades to wiring, connectivity, communications, or other changes?
- Do any of your identified opportunities for automation seem easier or lower-risk than others? Would one or more of these make good starting points for first-time automation projects?
- What is the impact of not making a change to your current system? You're investing in automation to fix a problem, so what will happen if the problem goes unsolved?

## Notes



# 3. Brainstorm

With a picture of where to add automation and a clear idea of your resources and goals, it's time to assemble a team and brainstorm ideas. Keep in mind the ultimate goal is to create a list of actionable solutions and/or options to research further.



A word of caution: for many people, brainstorming is a fun way to generate ideas, but for others it is stressful. Consider the personalities on your team and be considerate of those who are less comfortable with the uncertainty brainstorming creates. Take some time to plan how you'll work together, including these tips:

- Identify a project manager or team leader early in the process to coordinate, facilitate discussion, and to be a point of contact for vendors.
- Team members with knowledge about different areas of your facility and operations help you keep the whole picture in mind. Try to include:
  - Managers or other supervisors
  - New and experienced production employees
  - Maintenance staff

- Finance and purchasing staff
- Marketing and sales staff for their perspective on the market for your product (if not now, keep them in mind for their input on your market later on). If a product feature or function is affected by a change in the process, market feedback is critical.
- In brainstorming, people's roles and perspectives are more important than their job titles.
- At this stage, you're better off sticking to what you know best: the stops along your production line, how bottlenecks and other challenges impact production, and your vision for the future of your facility.
- Planning how you'll work and laying ground rules will keep you on track. Be it an informal gathering around a whiteboard, a structured collaborative sketching method, or anything in between, these tips will help:

- Encouraging everyone to participate without dismissing any ideas right away, even if they seem outlandish or uninformed, will help creative ideas flow.
- Workable solutions sometimes result from far-out suggestions simply because they push people to think beyond the norm. Give every idea a chance.
- Your sessions will be more productive if members take time to prepare individually and gather information before meeting as a group.
- Progress is not always linear, so view brainstorming as an iterative process. Plan to meet more than once and take time to ponder and research more between sessions.
- If the automation project has a major impact to the organization (e.g. process, people, or money), consider bringing in an independent facilitator. Personalities vary within a group, and it is not uncommon for a stronger personality to dominate the group and drive the discussion. An independent facilitator can control the environment and allow for the free exchange of ideas. One option for this role is an automation equipment supplier.



# 4. Define Your System and Process

Not every idea generated during brainstorming will work. Some are easy to identify quickly, but other ideas that sound workable at first end up failing too. Problems might not surface until you've examined existing processes in more detail or looked at required resources (i.e. money, time, labor, and raw materials). Others must be addressed by outside experts to assess feasibility.

As you refine your plans, consider the following:

- Automation is not all-or-nothing but can be combined with manual work (e.g. conveyors to move parts along quickly from person to person, reducing the need to carry heavy objects, a machine to feed a blank into a press brake, or positioning a small part to be welded by a person).



- Automating a process is not merely a one-to-one substitution where a machine is swapped for a human. It can include changes to the order of steps, operator tasks, materials used, and even other processes up- or downstream.
  - Entire processes, or even the parts being fabricated, may be designed for greater efficiency, production or quality.
- Each installation is custom: the time, money, physical space, and the proprietary nature of your business mean your setup is one-of-a-kind.
  - After installation, the system will likely require some tweaking and debugging to perfect.
  - Many systems are expandable if higher capacity is designed in from the beginning.
  - Some applications are better suited to human workers, such as:

- Tasks requiring dexterity
- Tasks that rely on human senses to complete or to do correctly
- Work where decisions are made on the fly
- Jobs with many or varied inputs (e.g. differing part sizes, custom piecework)
- Applications that are low volume, intricate, or highly detailed
- Your current workforce plays a role in future success with automation, for example:



- Are their skills transferable to an automated environment? If not, how much training is required?
- Do you have staff, or can you recruit and hire staff, for maintenance and support? Are these available through your vendor?
- How will employees react to the changes to roles, mindset and company culture that accompany the new equipment?
- Are employees concerned about job security or glad to be learning new skills?
- You may need to make adjustments within your facility, such as:
  - Adding safety equipment (e.g. light curtains, fencing guards)
  - Providing sufficient space for moving equipment and tooling; allowing room for foot traffic around machines
  - Creating human-machine interaction points that could increase safe machine operation
  - Making upgrades to electrical wiring, connectivity, or communications capabilities
  - Ensuring data integration with ERP, processes, office systems, etc.

# 5. Calculate Return on Investment

A thorough ROI calculation might be more complex than you realize at first. However, even an estimated ROI this early in the process is worth the effort. For example, if your overall production volume remains low, the cost of incorporating automation may not be justified. Take a broad view of ROI including equipment costs, maintenance, ongoing support, training, and human resource expenses, raw materials, and consumable supplies. An automation supplier can help with this process.

A full picture of ROI includes both quantifiable and unquantifiable factors such as:

- Equipment costs, including maintenance over time
- Vendor fees, including consulting, installation, ongoing maintenance, and support
- Structural or other facility changes (e.g. construction, electrical, etc.)
- Changes to costs for materials used (e.g. reduction in waste of consumable materials, more efficient use of raw materials)
- Labor, recruiting, and training
- Productivity increases
- Employee and culture shifts (e.g. job satisfaction, ability to work to an older age due to lighter physical demand and better ergonomics, improved morale due to higher-level tasks, frustration or anxiety over changes to the familiar workplace)
- Appearance and competitiveness (i.e. how the “look and feel” of your new system appeals to customers and potential employees)
- Data and productivity (i.e. computerized and “smart” machines track data to measure productivity closely, locate problems quickly, debug efficiently, and anticipate problems)

For more help calculating ROI, check out our free [ROI calculator](#).

# 6. Lobby Stakeholders

Prioritize with brevity and clarity when presenting automation plans to decision makers. For maximum effectiveness, illustrate data and address any concerns from an executive or stakeholder perspective. Keep these tips in mind as you seek buy-in and approval from decision makers:

- Stakeholders will likely be more receptive if you address how the proposed automation project addresses their specific pain points, which may differ from yours (e.g. an engineer’s interest in reducing machine downtime versus an executive’s focus on better profit margins)



- Facts, figures, and high-level projections, including ROI and improvements to production and strategic growth over time, are easier to grasp quickly than “in the weeds” details.
- It is helpful to demonstrate opportunities to reduce risk (e.g. litigation over defective parts or worker injuries, worker safety, well-being and retention, customer retention/growth, potential increase in market share, and adaptability to market changes).
- Clear and easily understood data should include things like graphs, key figures, 3D conceptual renderings, and bullet points.
- Anticipating questions and being prepared with concise answers in terms relevant to the stakeholder perspective conserves valuable presentation time and keeps the discussion focused.
- Your automation vendor’s knowledge and past experience about what works (or doesn’t) is an excellent resource at this stage.

# 7. Refine Your System and Process

Taking feedback from decision makers into account, you probably have a sense if the project is feasible or needs revision. Cycle back to the decisions you made in step 4, Defining your System and Process, and look for:

- Additional ways to address your goals
- Places to implement automation in stages instead of all at once
- Areas that stand to improve the most from new processes or equipment

Repeat this step as many times as necessary to refine exactly what you need, what can wait, and what is simply not attainable. As you review your goals and resources, keep in mind that automation is not an all-or-nothing concept. You may be able to reach compromises for some processes.

Notes

# 8. Research Automation Suppliers

The best resources for finding and vetting a qualified, reliable supplier are referrals from other manufacturers who have been through this process. Word of mouth conveys the positive and the negative about vendors, so it's a good idea to ask contacts in your industry for their input, especially if they've had success with similar projects. Other ways to get recommendations include:

- Inquiring with distributors you already work with for components or materials, as many maintain directories of vetted suppliers and may have working relationships with them.
- Contacting robotics and component suppliers
- Searching online with Google, industrial supplier portals like ThomasNet.com, trade associations, or regional manufacturing associations
- Asking any "sister" or partner companies you work with



Next, narrow your list of potential suppliers with these questions:

- Are they local? Regional? Nearby vendors provide an advantage in terms of long-term support, ease of access, and building a continued relationship.
- Does the supplier have experience with projects in your industry or with similar goals? Is your project size typical of their regular work?
- How unique or complex is the project? (e.g. installing palletizing equipment versus designing a high-speed bottle labeling process)
- Has the supplier worked with the components you need? Do they use your



preferred technologies? Do they have a specialty? (e.g. vision cameras, conveyors, etc.)

- Will the supplier provide references from past customers?
- Do they provide [ongoing support](#) and, if needed, maintenance and training for the equipment?
- Are they willing to visit your facility to get a feel for your needs?
- Do you see your team working successfully with this supplier in terms of personalities, communication styles, and availability? Do you trust them to value your goals and respect your needs regarding quality and price?
- Are the systems and technologies they use consistent with the engineering and maintenance capabilities in your facility?

## Notes

# 9. Qualify and Secure Bids

Submit a Statement of Work (SOW) to your shortlist of supplier candidates. This is where you'll outline your exact goals and requirements, so suppliers have a sense of the project and the bigger company picture. In addition to this critical document, invite bidders to your facility to make their own observations.

A thorough SOW should include the following:

- Process requirements (i.e. expectations for cycle time, downtime, throughput, quality benchmarks, and anticipated utilization of equipment)
- Overviews of your current process versus goals to attain through automation
- A summary of current challenges and background information
- Long-term expectations (e.g. equipment lifespan, ability to redeploy for other purposes in the future)
- Preferred components, technologies, software, or suppliers
- Timeline requirements
- Ideas for the appearance of the finished system, which contributes to customers' first impression of your production floor
- An invitation to suppliers to quote their own ideas for the project based on their expertise, which should be formally submitted as an alternative or adder
- A non-disclosure agreement, if applicable

# 10. Evaluate Proposed Solutions

Review all proposals closely: you're not just selecting a vendor, but a partner you'll work closely with for months or years. Look for a good working relationship in addition to technical knowledge and experience.

As you review each proposal and your interactions with each vendor so far, consider these factors:

- How well does the proposal match what you asked for?
- What is your estimated timeline for completion?
- How much lead time is needed for equipment and materials?
- How has communication gone so far, and how have different personalities worked together?
- Does the vendor fully understand your project?
- Are details provided in concepts and renderings?
- Is the vendor willing to discuss any deviations from your SOW and their adders, if any?
- Does the vendor appear interested in your success? Is there a sense of mutual trust?
- What is the vendor's warranty?
- What are performance guarantees?
- What are the terms of payment? Are they favorable?
- What are the system parameters by which you measure project success? Were these clearly stated and confirmed in the proposal?
- What does the vendor's team have in terms of their capabilities and internal versus contracted skill sets?
- Did they provide referrals and prior proof of success?

Your goal is to compare "apples-to-apples" between proposed solutions.

- How does the vendor address post-project service? Do they have a service team?
- Does the system solution provide more than just user training? Does the proposal provide service and technician training?
- How well versed is your internal maintenance team on the provided technologies? Do you want the ability to service the equipment internally, will you rely entirely on the vendor, or somewhere in between?

Due to the complex nature of automation solutions and engineering creativity, each supplier's solution may vary in approach. It is critical to break down each supplier's proposal objectively so you can make an informed selection. A good way to do this is to create a table with space for a side-by-side comparison of each point. Summarize each point clearly so you can compare vendors on each one at a glance: your goal is to compare "apples to apples" between proposed solutions, equipment, and offerings (i.e. support, training, and maintenance). Also, be sure to prioritize which factors matter most to you. For example, one vendor may provide extensive training but also a new and unproven design. Does one of these outweigh the other?

Notes

# 11. Select a Vendor

While the time to make changes to the project or ask for “extras” has passed, now is the time to ensure you and your vendor agree on what will be provided. This is especially important if time has passed since you reviewed their proposal.



Prior to signing the contract, you may notify the vendor that you’ve selected them by verbal agreement followed by a letter of intent. This document states that expenses and orders have been authorized and that work may begin. This allows the vendor to get a head start on any preliminary tasks.

At this early stage, it is critical to agree on how your two teams will work together, including the following:

- The procedure for change orders (verbal or written)
- Who the primary contacts and teams are for both parties
- How and when teams will communicate
- How to divide responsibility for tasks
- Schedules for design reviews and customer updates

- Startup and commissioning costs
- Performance and run-off requirements

Your vendor may request information from you before starting work. To avoid slowing the project down, try to provide this information quickly, and be sure it's complete. Be prepared to share:

- CAD models
- Drawings and renderings
- Detailed written descriptions of your processes
- Pictures and videos of your current processes
- Product samples

## Conclusion

Planning and implementing a successful automation project demands a methodical approach. Take an objective look at your current manufacturing processes, be realistic but open-minded about opportunities for automation, and stay mindful of your stated goals. If you evaluate vendor proposals with these in mind, you'll increase the odds of improving your processes and making a timely return on investment.

# Ready to Get Started?

Now that you're equipped with a plan, you'll need to work with your integrator to make your vision a reality. We used our years of field experience to put together a follow-up guide that will help you navigate the path forward and give you practical tips for working with your selected integrator.

Download the Guide



Notes



## Notes