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Small Manufacturers Can Overcome Custom Automation Challenges

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HANDOUT

List of pitfalls that small manufacturing companies may typically face and should plan to avoid for successful automation projects

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Automation Projects at Small Manufacturers

Pitfalls

The wave of automation has swept across industries, promising increased efficiency, reduced overheads, and amplified production capabilities. Small manufacturers, navigating the challenges of competition and scalability, find automation a potential ally. However, the journey to effective automation has overwhelming challenges. Recognizing these challenges, understanding their implications, and crafting strategies to navigate them are fundamental for successful automation project execution.

A) Pitfalls at the start

1. The Crucial Role of the Automation Team Leader

A successful automation project often hinges on the person helming it. Believing that the Automation Team Leader can juggle this immense responsibility alongside their regular duties is a grave miscalculation.

Automation projects are multifaceted. They require meticulous planning, comprehensive understanding, and the ability to foresee challenges. Stretching the leader thin, with divided attention, compromises the project's integrity and undermines the chances of success. Top management of manufacturing companies should recognize the demanding nature of this role and allocate resources, time, and training to ensure the leader can focus solely on the automation initiative.

2. The Importance of Direct Communication Channels

Effective communication is the linchpin of any successful organizational change. In the context of automation, this becomes even more pivotal. Armed with insights into the project's nuances, the Automation Team Leader should have direct access to top-tier decision-makers.

Burying the leader under multiple layers of bureaucracy not only hampers swift decision-making but can also dilute the essence of the information as it traverses through the hierarchy. Top management can ensure the project stays on course by

providing open, direct communication channels, especially when challenges arise.

3. **Valuing On-ground Insights**

   Automation is more than just a top-down approach. It must include ground-level insights. The workers on the shop floor, the personnel in manufacturing and operations, carry a wealth of experiential knowledge. Their involvement ensures that automation strategies are rooted in the day-to-day realities of the business.

   Manufacturers must foster an inclusive environment where feedback is encouraged. The insights of those closest to the processes become critical inputs into the automation project blueprint.

4. **Strategically Selecting the Initial Automation Project**

   The adage, "Well begun is half done," resonates when choosing the first automation project. Two common pitfalls to be wary of are:

   - *Over-reliance on External Recommendations*: While third-party consultants bring a fresh perspective, they may have vested interests and bias towards pushing automation projects that are in their wheel house than what is truly needed by the company. Manufacturers must balance external advice with rigorous in-house evaluations to choose the most appropriate project.
   - *Automating Complex Processes First*: Diving headfirst into automating the most intricate process can be counterproductive. Such endeavors, laden with challenges, can demoralize the team if they encounter roadblocks. A better approach is to select a project that balances their immediate pressing needs, complexity and feasibility, setting a positive precedent for subsequent projects.

5. **Outsourcing: A Double-Edged Sword**

   Outsourcing portions of the automation project can offer expertise and reduce the burden on in-house teams. But it's vital to understand its potential drawbacks:

   - *Ambiguity in Accountability*: Without clearly defined roles and expectations, issues can lead to protracted blame games between in-house teams and external partners.
   - *Potential Quality Compromises*: The bid to be competitive might push third parties to provide low cost quotations that are favored to win bids, but possibly provide sub-optimal solutions.

- *Bridging the Knowledge Gap:* External integrators may need an intricate understanding of a manufacturer's unique processes, products, or cultural nuances. Manufacturers must ensure a seamless knowledge transfer to bridge this gap.

6. Emphasizing In-house Technological Proficiency

Automation solutions are only as effective as the people operating them. Manufacturers must plan for and invest in training programs, ensuring their teams are well-versed with the new systems and technologies.

Failing to budget for adequate (don't cheap out) investments in employee training and development can result in a workforce that will be ill-equipped to work alongside new technologies, hindering the potential benefits of automation.

7. The Human Element of Automation

While the technical aspects of automation are paramount, the human element is more fundamental. Manufacturers must anticipate resistance, manage apprehensions, and ensure a smooth transition for their workforce.

8. Ignoring Scalability and Future Adaptability

Small manufacturers must only select an automation project that meets current needs and scales or adapts to future needs. The initial project should solve immediate concerns and serve as a building block for future expansions and adaptations.

9. Neglecting a Robust Risk Management Strategy

Often, small manufacturers jump into automation without a comprehensive risk management strategy. Identifying potential risks early on and developing strategies to mitigate them is essential, ensuring the project doesn't derail amidst unforeseen challenges.

10. Overlooking Maintenance Aspects

Maintenance is often an overlooked aspect. Automation systems require regular upkeep to function optimally. Ignoring the impact of maintenance complexity, costs and other considerations can lead to system downtimes and higher long-term costs.

Prepare a list of consumables and wear items and assess these costs, including that of keeping a stock of these on the shelf ready to be put in service when breakdowns happen. Then budget them into the project proposal.

11. Insufficient Budgeting and Resource Allocation

An automation project can quickly become a financial drain if not budgeted correctly. Manufacturers should avoid underestimating the financial resources required, accounting for hidden costs and potential overruns to prevent financial strains later.

12. Not Establishing Clear Metrics for Success

Failing to establish clear, measurable success metrics, such as a well-defined ROI, can make it challenging to evaluate the project's effectiveness. Defining what success looks like, including productivity increases, cost savings, or quality improvements, and continually measuring performance against these metrics is crucial.

13. Ignoring the Need for Continuous Improvement

Automation is not a 'set it and forget it' endeavor. Avoid the pitfall of considering the project complete once implemented. Instead, foster a culture of continuous improvement, where processes are regularly reviewed and optimized based on real-world data and feedback.

14. Failing to Develop a Comprehensive Change Management Plan

Automation projects bring about substantial changes, both in processes and organizational dynamics. Manufacturers should pay attention to developing a comprehensive change management plan that outlines the steps for a smooth transition and addresses potential resistance.

15. Not Leveraging Industry Networking and Partnerships

Sometimes, manufacturers ignore the benefits of networking with industry peers or forming partnerships. Leveraging these networks can provide valuable insights, avoidable mistakes, best-practices advice, and even collaboration opportunities that can enhance the success of the automation project.

For small manufacturers, automation isn't just a technological upgrade; it's a transformative journey. Manufacturers can harness the power of automation by understanding the challenges, proactively addressing them, and ensuring a holistic approach, paving the way for sustainable growth and enhanced operational efficiency.

B) Pitfalls in Planning and Design

Automation projects have become a beacon of efficiency and productivity in the rapidly evolving manufacturing landscape, especially for small manufacturers. Automating processes can offer substantial benefits for small manufacturers aiming to stay competitive. However, success in automation requires meticulous design planning. Failing to consider critical aspects can lead to costly errors and suboptimal outcomes.

1. **Lack of Clear Design Documentation and Performance Specifications:**

   Meticulous documentation is the backbone of successful automation. Clear design documentation and performance specifications are like the blueprint of a building. If they're vague or missing, then the entire structure becomes shaky. For instance, imagine a small manufacturer automating their packaging process. Without specifying the required packaging speed, dimensions, and weight tolerance in the design documents, the automation equipment, when built, might not align with the production requirements, leading to inefficiencies or equipment failure.

   Or, say, if torque requirements for a specific assembly are missing or overlooked, the automation system might not achieve the necessary force, leading to either product damage or under-torquing.

2. **Incomplete Analysis of Specifications:**

   Beyond just having specifications, understanding them is vital. Suppose a manufacturer fails to recognize that a proposed robot's reach doesn't match the workspace required, as defined in the prints. In that case, it could result in costly modifications later or even complete project abandonment.

   Let's say a small manufacturer is automating a welding process. Failure to analyze the compatibility and limits of the automation equipment with the existing welding prints and specifications can lead to issues. For instance, if the welding process requires specific positioning of the welding torch, and the automation equipment doesn't accommodate this, the resulting welds might not meet quality standards. What human welders can adjust for easily in component variability, a welding robot will, in contrast, follow a pre-programmed path.

3. **Overlooking Off-Print Assumptions:**

   "Silent" specifications—those inherent practices known only to experienced operators and not documented—can trip up automated systems. In any manual process, operators develop intuitive workarounds over time. For instance, an operator might apply extra pressure at a particular machine point due to known inconsistencies. Ignoring these tacit insights during automation could lead to process breakdowns.

In an assembly line automation project, overlooking the fact that operators have been doing an off-line test and minor adjustments to parts before assembly can be catastrophic. If the automation system doesn't account for these tests and has the necessary provisions for performing them, it could lead to misaligned parts, reduced product quality, and increased scrap rates. (See more on this in A-3)

4. Treating Designs as Immutable:

Automation often requires rethinking existing designs. For example, if a component's positioning makes automated gripping challenging, a slight design modification might save costs on complex grippers and reduce the likelihood of handling errors.

Consider a scenario where a small manufacturer is automating a precision cutting process. Suppose the initial design places cutting features in challenging locations to automate. In that case, the automation system might require intricate and expensive mechanisms to achieve the desired precision. Requesting design tweaks to place these features more strategically could simplify the automation process and lower costs.

5. Overlooking Alternative Joining Mechanisms:

An existing assembly line's non-automated process may have operators manually insert bolts or screws. Using rivets or spot welds might be quicker, require less precision than bolts, and could accelerate production times. It would also reduce the need for sophisticated, high-precision machinery for automated bolt installation. By ignoring the benefits of one method over the other, manufacturers might miss out on cost savings or improved quality that a different joining mechanism could provide.

6. Expecting Automation to Fix Quality Issues:

By design, automated systems require consistent products going through the system. Asking them to compensate for inherent quality issues, like inconsistent raw material sizes or large variability in dimensions, can lead to frequent stoppages. Addressing root causes of the deviations rather than relying on automation to adapt to the variability, which is a cost-prohibitive proposition, is more advisable.

A small manufacturer automating a painting process cannot rely solely on automation to cover up underlying poor surface preparation issues. Suppose the surfaces are not adequately cleaned before painting. In that case, the automation process, without the benefit of a human eye looking out for areas requiring extra

touch-ups, for example, will amplify the defects generated from improper surface cleaning, leading to poor-quality finished products.

7. **Lack of Standardization:**

   While adaptability is commendable, designing an automation system to handle every conceivable variant could make it prohibitively expensive and complex. Suppose a small manufacturer aims to automate a product assembly line. Creating the automation system to accommodate various product design variations might result in a complex and costly setup. Striking a balance between flexibility and practicality is essential.

   Imagine if every product variant required a unique automation setup. The time and costs would be prohibitive. Grouping like components and modifying designs to make near-alike parts identical can make automation less expensive. Components and processes can be seamlessly integrated into a single automated system, rather than multiple, and lead to less need for changeovers and reduced downtime. Consider manual interventions for rare exceptions.

8. **Failure to Combine Short-Run Jobs:**

   Combining similar short-run tasks can optimize machine usage. Instead of having frequent machine setups (each of which can introduce errors), one approach may be to combine tasks to streamline processes and make automation more viable, even for small batches.

   If commonizing processes is not possible, reducing the changeover time, such as using a common datum for various-sized parts, as one of many options, may make it possible to automate short-run jobs.

9. **Overlooking Product Lifecycle:**

   It's impractical to invest heavily in automating a product that's nearing the end of its lifecycle. Such foresight ensures that the automated machinery remains relevant and doesn't become obsolete prematurely.

   For example, the manufacturer automating the production of an electronic component should consider its future iterations. Suppose it is rumored that the part will be redesigned soon to be smaller or more efficient. In that case, the automation system must be designed with adaptability in mind to prevent equipment obsolescence.

10. **Feeding Problems:**

    Part-feeding system ensures smooth operations. But if components aren't consistent with specifications (for instance, bent or deformed, oversized, with burrs, etc.), jams and stoppages can occur.

For example, suppose a packaging automation project's feeding mechanism is not designed with precision components. In that case, parts might deviate from the intended orientation. That could lead to packaging defects, misaligned labels, and operational stoppages.

11. Underestimating Modular Subassemblies:

Suppose a manufacturer is automating a conveyor system. Instead of using standard modular conveyor sections, they custom-build every section. That increases design and manufacturing time and makes future modifications or expansions challenging. When the conveyor line is down, a modular system is more straightforward to troubleshoot or replace (to keep the line running) than a custom-built one.

Modular, off-the-shelf systems can be easily procured, upgraded, or replaced. Instead of designing an entire automation system from the ground up, build the design around time-tested, off-the-shelf modular assemblies, which are often complex works of engineering. Imagine how significantly the design time is reduced by avoiding designing and building such a complex assembly. On top of that, if a component fails, modular designs allow for targeted updates, ensuring the longevity and adaptability of the entire automation system.

12. Process Considerations:

Every stage of a process impacts automation. For example, when automating a machining process that involves metal shavings, deciding between manual pick-up and automated chip collection can significantly impact cleanliness and efficiency. Say the existing process consists of manually picking parts from a bin. In the automated process, if the parts are fed from a hopper system, then any metal shavings or other debris that would have otherwise stayed at the bottom of the bin is introduced into the sophisticated automation system. Understanding these nuances can guide more effective automation strategies.

13. Materials:

The choice of materials, like for example, magnetic steel vs. non-magnetic stainless steel, impacts automation. Magnetic steel might be easier for robotic pick-up using magnetic grippers. In contrast, stainless steel might require vacuum or mechanical grippers. Such considerations are essential and influence automation system costs, automation speed, and efficiency.

14. Excessive Wear due to Process Complexity:

In an automation project involving bowl feeders or similar complex material handling with multiple intricate movements, parts can undergo excessive wear due

to the complexity of the process. Components falling off the tracks and being re-fed repeatedly can cause part wear and surface damage. Simplifying the process or incorporating abrasion and impact-minimizing materials in the material handling systems can extend the longevity of the automation system.

15. Poor Integration with Existing Systems:

Ensuring seamless integration with other systems, such as Enterprise Resource Planning (ERP) software or inventory management systems, is crucial when automating a process within an existing manufacturing environment. This integration is necessary to ensure data consistency and operational inefficiencies.

16. Ignoring Operator Training Needs:

Automation often requires a shift in the roles and responsibilities of operators. Failing to provide adequate training to employees on operating and maintaining the new automated equipment can lead to underutilization of the technology and increased downtime.

17. Inadequate Safety Measures:

Safety should be a top priority in automation projects. Failing to design proper safety features and protocols can lead to accidents, injuries, and potential legal liabilities.

18. Disregarding Environmental Impact:

Small manufacturers should consider the environmental impact of their automation projects. Failure to do so could result in non-compliance with environmental regulations or missed opportunities for cost-saving through sustainable practices.

19. Ignoring Cybersecurity Concerns:

As automation systems become increasingly connected, they become vulnerable to cyberattacks. Small manufacturers must design into their automation systems, and invest in cybersecurity measures to protect sensitive data and prevent disruptions caused by malicious activities.

20. Inadequate Documentation of Changes:

Any changes made to the automation system should be meticulously documented throughout the design and implementation phases. Failure to do so can cause confusion, difficulties in troubleshooting, and challenges in future system upgrades.

21. Underestimating Regulatory Compliance:

Depending on the industry, there may be specific regulations governing automation equipment. Small manufacturers must ensure their automation systems are designed to comply with relevant industry standards and regulations to avoid legal issues and fines.

22. Ineffective Communication Among Stakeholders:

Effective communication among all stakeholders, including engineers, operators, and management, is crucial. Miscommunication can lead to misunderstandings, delays, and costly design revisions.

23. Failure to Consider Ergonomics:

Neglecting ergonomic considerations in the design of automation systems can lead to worker discomfort, fatigue, and injuries over time. Small manufacturers should ensure that the automated processes consider their employees' well-being.

These examples highlight the potential pitfalls that small manufacturers must be vigilant about when planning automation projects. Unless one thinks of such eventualities at the start, when designing the automation system, the result will be a poorly designed, costly, problem-prone automation system. By addressing these pitfalls head-on and seeking iterative feedback during the design phase from all parties involved, manufacturers can build robust, efficient, and cost-effective automated systems.

Automation in small manufacturing demands careful planning and a nuanced understanding of existing processes.

C) Make Vs Buy Decision in Automation Projects

In the rapidly evolving manufacturing sector, small manufacturers find themselves at a critical crossroads when deliberating between making or buying automation projects. Automation stands as a pivotal aspect that can potentially escalate their operations to new heights of efficiency and innovation. However, this journey involves a significant decision-making process where an accurate weighing of pros and cons is imperative. Here, we dissect the reasons why a company might opt to either manufacture in-house or procure from a seasoned machine builder.

Reasons to Make In-house

1. **Intimate Knowledge of Product Application/Process:**

   In the realm of small manufacturing, an intricate understanding of product applications and processes can be a catalyst for successful automation projects. Teams that are deeply rooted in the day-to-day operational dynamics have a finger on the pulse of the product cycle, which may foster a more nuanced and effective design approach. Their profound knowledge can potentially translate into systems that align seamlessly with existing workflows, thereby promoting efficiency and accuracy in automation endeavors.

2. **Addressing Complexities and Uncertainties:**

   The manufacturing landscape is often dotted with complexities and uncertainties. In such a scenario, leaning towards in-house manufacturing can be seen as a prudent strategy. When complexities scale up, the internal team, with their firsthand experience, can potentially navigate these intricacies more adeptly compared to an external entity. This insider perspective allows for a smoother adaptation to unforeseen changes, fostering a robust and flexible automation system.

3. **High-Quoting and Reluctance from Machine Builders:**

   Engaging machine builders for complex projects sometimes culminates in either high quotes or outright refusals. Machine builders might shy away from projects that require a significant investment of time and resources, leaving manufacturers in a tight spot. In these instances, making automation projects in-house stands as a viable and sometimes necessary alternative.

4. **Maintaining a Competitive Edge through Trade Secrets:**

   In a competitive market, maintaining trade secrets can be the linchpin for success. By choosing to make in-house, companies can closely guard their unique machine designs and proprietary processes. This approach not only helps in fostering innovation but also in keeping potential competitors at bay, ensuring a distinct market position.

5. **Mitigating the Risks of Unfinished Products:**

   Investing in an automation project that hasn't been fully debugged or run-off can be a risky venture. An in-house approach provides the luxury of a more thorough testing phase, where potential glitches can be identified and rectified before full-scale implementation. This way, companies can avoid the pitfalls associated with accepting prematurely finished products.

6. **Skill Gap:**

   Manufacturing companies may need more skill when attempting to undertake in-house automation projects. Developing automation systems often requires specialized knowledge and skills, which their current team may not possess. Training existing staff or hiring new specialists can be both time-consuming and costly.

7. **Resource Allocation:**

   In-house projects often require a substantial allocation of resources. Companies may need help diverting resources from production-critical areas to focus on the development of the automation project, potentially impacting their overall operations.

8. **Scalability Concerns:**

   When creating automation projects internally, companies might need help to scale the projects up or down according to changing demands. In-house teams have the flexibility to adapt quickly, avoiding delays and increased costs. Outside vendors will not be readily available at the appropriate time.

9. **Compatibility Issues:**

   Purchasing automation projects from external builders can sometimes lead to compatibility issues with the existing manufacturing setup. The newly acquired system may integrate differently with the current processes, requiring further adjustments and fine-tuning, which can be time-consuming.

10. Dependence on Vendor:

Buying from a machine builder often means a certain level of dependence on the vendor for maintenance, updates, and troubleshooting. This reliance can sometimes lead to challenges, especially if the vendor is unable to provide timely support or if they go out of business.

11. Limited Customization:

While machine builders offer various solutions, they might not always align perfectly with the company's specific needs. The scope for customization might be limited, forcing the company to adjust its processes to fit the purchased solution rather than having a solution tailored precisely to its needs.

12. Intellectual Property Concerns:

When a company buys an automation solution from a machine builder, it may not own the intellectual property rights to the technology. That could potentially limit the company's ability to modify or adapt the solution in the future, hindering further innovation and adaptation to changing market demands.

Reasons to Buy from a Machine Builder

1. Leveraging Experience in Machine Building:

Machine builders come with a wealth of experience in constructing diverse machines effectively and efficiently. By choosing to buy, small manufacturers can tap into this repository of knowledge, ensuring a more streamlined and expertly guided project development process. The learning curve gets significantly shortened, allowing for a quicker transition to automated systems.

2. Technological Expertise and Effective Debugging:

Machine builders are often at the forefront of technological advancements. Their deep-seated knowledge about the latest technologies can be a boon for manufacturers looking to modernize their processes. Moreover, their expertise extends to debugging, where they can swiftly identify and correct issues, guaranteeing a smoother and more reliable operational flow.

3. **Infusion of Fresh Perspectives and Innovative Solutions:**

   Collaborating with machine builders can be a pathway to new perspectives and innovative solutions. Their external vantage point often facilitates a break from traditional in-house approaches, paving the way for fresh ideas and methodologies. This collaboration can foster a more vibrant and dynamic automation strategy, potentially creating automation systems with new realms of productivity and innovation.

4. **Cost-Effectiveness and Reliability through Standard Subassemblies:**

   Machine builders frequently employ standard subassemblies, which are a gateway to cost reductions and increased reliability. These standard components can be more easily replaced and maintained, reducing downtime and promoting a more continuous workflow. Moreover, this standardization often translates into reduced costs, making automation projects more financially viable.

5. **Double-Checking of Design Concepts:**

   Buying from machine builders usually involves a collaborative dialogue where automation team's design concepts are put under scrutiny. This double-checking process can be a safeguard against potential design flaws, ensuring a more foolproof and robust automation system. It fosters a culture of continuous improvement, where feedback is valued and integrated, enhancing the overall quality and efficacy of the project.

6. **Economic Viability in the Long Run:**

   Maintaining an in-house machine-building experience can be a costly affair. When manufacturers buy from machine builders, they can potentially save on the costs associated with maintaining a team of experts for machine development. This cost-saving aspect can have significant financial benefits in the long run, allowing resources to be channeled into other critical areas of the business.

In summary, the make-vs-buy decision in automation projects for small manufacturers hinges on a careful consideration of various factors including expertise, cost-effectiveness, and the nature of the project. While making in-house provides control and a deep integration with existing processes, buying brings in expertise and fresh perspectives, often at a lower cost. Manufacturers must weigh these aspects diligently, carving out a path that balances their strategic objectives and operational dynamics. Through a well-calibrated approach, small manufacturers can successfully implement automation systems.

D) Pitfalls During Building and Debugging an Automation Project

Implementing an automation project right after its design phase can be pivotal for small manufacturing companies. This phase has opportunities to refine, adjust, and fine-tune the project before full-scale operation. Addressing potential pitfalls during this phase can help set a solid foundation for a successful automation project. Let's delve into these challenges with concrete manufacturing-related examples:

1. **Poor Planning Against Pitfalls of Earlier Steps:**

   Failing to plan for and eliminate the pitfalls listed in the steps for project selection, design and planning, make-vs-buy, etc., will show up at the build and debug stage. This stage is historically the most underestimated in terms of the time budgeted. Statistically, companies spend double the amount of time budgeted for this stage. Spending more time planning against all the abovementioned pitfalls is imperative for a relatively smooth build and debug phase.

2. **Failure to Run Pilot Projects and Mock-ups:**

   Before implementing an automation project in full swing, failing to run pilot projects can cause a substantial setback. That could be likened to installing a new conveyor belt system without testing its efficiency and safety on a smaller scale. Undertaking mock-ups or pilot projects at this stage can help identify potential flaws and offer insights to enhance the system before a larger-scale deployment.

3. **Not Carefully Vetting and Regularly Monitoring a 3rd Party Machine Builder:**

   When building and debugging, relying heavily on a third-party machine builder without due diligence and regular oversight can pose significant risks. It might be akin to encountering discrepancies in machine specifications and actual output, leading to potential delays and increased costs. Regular interactions and progress monitoring with the third-party builder can prevent such pitfalls, ensuring project goals and outcomes are aligned.

4. **Lack of Proper Pre-Award Planning:**

   In the hustle to get the project off the ground, rushing the pre-award planning stage can potentially lead to unforeseen challenges. For instance, hastily awarding contracts without analyzing vendor competencies might result in mismatched expertise and project demands. A comprehensive pre-award planning process can help align the right resources, thus avoiding costly missteps during the project execution phase.

5. **Failure to Have Long Equipment Run-Off:**

   Before going full throttle, failing to run long equipment run-offs can sometimes overlook critical performance issues. Imagine the newly installed robotic arms malfunctioning during peak production hours due to overlooked minor glitches during testing. To avoid situations like that, a minimum of 8-hour run-offs can be implemented to closely observe equipment performance and rectify discrepancies before the final handover.

6. **Failure to Schedule Additional Materials to be Available:**

   At the outset, not having a buffer of additional materials could halt the debugging process unexpectedly. Or, worse yet, it could lead to a short and inadequate debugging run on the newly built automation system. That will cause all the downsides listed in the previous point. To prevent this, scheduling additional materials to be available for the entire run-off period is imperative. If the parts required during the run-off are made in-house, then the materials planning department has to ensure that they order enough to cover regular production and the extra needed for the run-off. If the parts are sourced from outside suppliers, then Purchasing must ensure they give these suppliers enough lead time to produce the additional volume.

7. **Inadequate Involvement of Quality Personnel:**

   At the building and debugging phase, bypassing the involvement of quality personnel can compromise product standards. For instance, overlooking the calibration of sensors in a quality check module might result in defects going unnoticed. Engaging quality personnel actively during this phase can be instrumental in achieving product and process excellence.

8. **Not Maintaining Detailed Records and Data During the Build:**

   As the project unfolds, neglecting detailed record-keeping can be a missed opportunity to capture valuable insights. Picture a scenario where variations in machine performance go undocumented, potentially leading to repeated issues. Keeping meticulous records of events, causes, and fixes, can offer a wealth of data to be analyzed for improvements and optimizations.

9. **Not Running Process Capability Studies:**

   During the building and debugging phase, not conducting process capability studies can leave gaps in understanding the capabilities and limitations of the new system. Not knowing the optimum operating parameters of a newly installed machine can lead to sub-optimal performance. Conducting process capability studies at this juncture can provide vital data that helps fine-tune the operations of

the new automation system for maximum efficiency and minimal product rejections.

10. Inadequate Communication Channels:

A common pitfall during the build phase is the need for more transparent and efficient communication channels among different teams involved in the project. Suppose the design team is not in sync with the production team; this can result in a mismatch of expectations and deliverables. Setting up regular coordination meetings and creating platforms for seamless communication can be instrumental in averting misunderstandings and ensuring a cohesive approach to the project.

11. Failing to Set Up a Robust Feedback Mechanism:

During the build phase, it's essential to have a feedback mechanism in place to gather insights and observations from the ground level. For instance, workers on the shop floor might notice specific inefficiencies or glitches in the newly automated systems. Without a robust feedback mechanism, these valuable insights might be lost, missing the opportunity to enhance the system based on real-time feedback.

12. Not Allocating Contingency Time and Budget:

Automation projects sometimes encounter unforeseen challenges that cause delays and increase costs. Not setting aside contingency time and budget can be a significant pitfall. For instance, unexpected structural adjustments when installing new automated welding stations require additional time and resources. A contingency plan helps address these unforeseen issues without derailing the project.

The phase of executing and building an automation project fresh out of the design stage is a critical juncture in the life cycle of manufacturing ventures. By acknowledging and addressing potential pitfalls, small manufacturing companies can steer their automation projects toward a trajectory of success. A foresighted approach and meticulous planning can transform these pitfalls into stepping stones, fostering a culture of excellence and innovation in the manufacturing landscape.