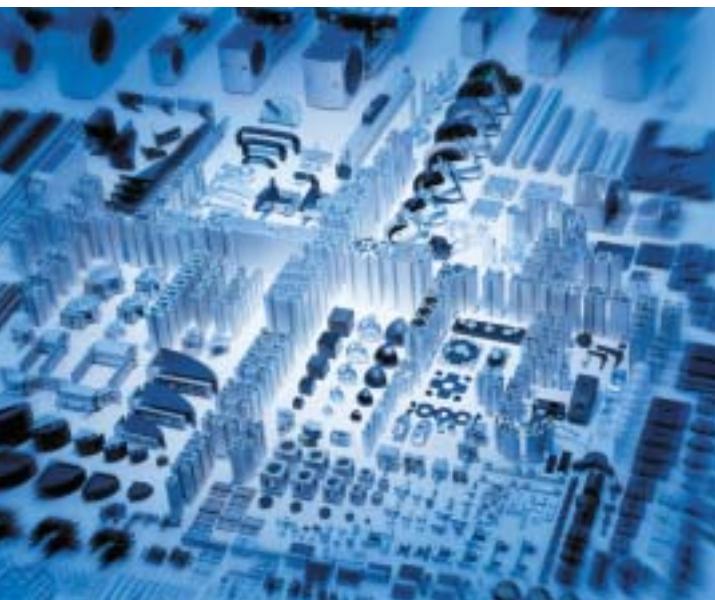


Do-It-Yourself Automation

There are pros and cons to in-house projects.



A modular aluminum framing system can provide the building blocks for do-it-yourself automation projects. Photo courtesy Bosch Rexroth Corp.

Faced with a “simple” plumbing problem, such as installing a new faucet, many homeowners choose to do-it-themselves. For some people, this can be a cost-effective and personally satisfying experience. For others, it can mean frustration and endless trips to the hardware store.

Manufacturing engineers have a similar choice when faced with automation projects. Sometimes, the best solution to an assembly challenge is not available off-the-shelf. When turnkey systems don’t cut it, engineers may want to consider the build-it-yourself alternative. But, without the right type of game plan, an in-house project can easily turn into an expensive, time-consuming nightmare.

Do-it-yourself automation has pros and cons that must be carefully considered before tackling a project. Assemblers can benefit by building their own equipment, with advantages such as potential cost savings and a competitive edge. But, the in-house route can create numerous headaches, such as time and resource allocation issues.

According to ASSEMBLY magazine’s eighth annual capital equipment spending survey (December 2003, p.34), manufacturers build more than one-third of their assembly equipment.

In 2003, manufacturers met 42 percent of their assembly system needs with in-house equipment. However, the do-it-yourself philosophy varies by industry. For instance, 50 percent of machinery manufacturers turn to internal sources for their equipment needs. On the other hand, 75 percent of electric and electronic equipment manufacturers buy from machine builders and systems integrators.

There is no one-size-fits-all approach to the build-or-buy question. The answer depends on factors such as time constraints, the size and structure of the manufacturer and its engineering department, the production process and the assembly application.

“Company culture and history play a role in this decision,” says Steve Botos, vice president of sales and marketing at Aerotech Inc. (Pittsburgh). “Two companies in the same industry can have two completely different approaches to the in-house, out-of-house decision.”

According to Walt Hessler, vice president of sales and marketing at PHD Inc. (Fort Wayne, IN), “the big question is ‘do we have the expertise and staff to tackle an in-house project?’ For some companies, it’s not an option; it would be ludicrous to do it in-house.”

Leaning In

Lean manufacturing principles tout the benefits of using simple equipment that fits exact requirements and reduces waste. Machine design is more focused on simplifying manufacturing processes for maximum reliability, such as zero unscheduled downtime; reduced operator skill requirements for ease of operation;

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and the flexibility to process a variety of part dimensions.

“You don’t always need one machine that does everything,” explains Jamie Flinchbaugh, a partner at the Lean Learning Center (Novi, MI). “For unique applications, the in-house approach may make sense. Some companies simply can’t find what they want off the shelf.”

Most manufacturers pursuing the do-it-yourself route are Fortune 500 companies.

“These manufacturers typically have large in-house engineering and manufacturing departments,” says Mark Dinges, product manager for conveyors at Bosch Rexroth Corp. (Buchanan, MI).

Boeing (Chicago) is a good example of a manufacturer that believes in building its own equipment. The company has developed in-house “moonshine” shops that prototype equipment, then actually build devices and put them into production. “We can build 90 percent of anything that we can buy,” claims Mike Herscher, lean enterprise office leader at Boeing Commercial Airplanes (Seattle).

By using homemade machines, Boeing has saved millions of dollars in capital equipment expenses. Boeing uses the moonshine shops to create right-sized production equipment that is designed for a specific purpose or process. Engineers have built a wide variety of devices, such as conveyors, fastening equipment and machine tools.

Employees who staff the moonshine shops are chosen for their ability to think outside the box. Herscher says they tend to be individuals who enjoy taking apart motorcycles or repairing mechanical watches and clocks in their spare time.

“They’re [located] in the factory that’s building the part they’re building equipment for; they’re not a separate group off-site somewhere,” says Herscher. The “moonshiners” brainstorm ways to develop space-, time- and cost-efficient equipment.



There is no one-size-fits-all approach to the build-or-buy question. The answer depends on factors such as time constraints, production processes and assembly applications. Photo courtesy ATS Automation Tooling Systems Inc.

Of course, not every manufacturer has the resources or unique requirements of Boeing. Some companies are so lean that they no longer have the internal resources needed to build equipment in-house.

Most observers claim they see fewer manufacturers tackling automation projects in-house today. “With recent downsizings and outsourcing, fewer companies have the requisite in-house capability and resources to get the process up and running quickly,” says Don Penkala, president of Granite Bay Consulting Inc. (Granite Bay, CA). “Once the need for such a project has been recognized by senior management, the project is time-critical from a competitive standpoint.” Therefore, tying up resources may simply not be cost-effective.

Less Time to Tinker

Traditionally, an “Erector Set mentality” has permeated the manufacturing engineering community. Most engineers prefer to tinker around and build things themselves.

“Engineers are curious by nature, so the desire to ‘tinker’ or understand the world around them will never go away entirely—nor should it,” says Botos. “It’s this nature that makes engineers what they are. [However], the reality of today’s business demands that the tinkering be supportive of project goals or toward some end which benefits the organization.”

“Engineers will always love to experiment with alternative designs, and

forward-thinking companies will provide the support to encourage this vital activity,” adds Penkala. “Unfortunately, with staffs at many plants operating bare-bones, only mission-critical work is being accomplished. The long-term result may be a costly erosion in factory automation, equipment development and production engineering know-how at many of America’s plants.”

The sobering reality of today’s business climate has put the kibosh on do-it-yourself automation. And, there’s also a new mindset in the engineering community that frowns upon hands-on projects. Indeed, many engineers are younger and less experienced than in the past.

“Younger engineers are not as enthused about tinkering,” says Dick Shore, president of Automation & Modular Components Inc. (Auburn Hills, MI). “Unfortunately, they often don’t have veteran engineers to learn from.”

In many cases, the time allocated to building assembly systems is much shorter today, due to shorter product development cycles and increased time-to-market pressures. “Time to market is an important competitive advantage for any company, but is more acutely so for industries with fast product lifecycles,” notes Botos.

“The total number of manufacturers tackling automation projects [in-house] remains relatively low and has not grown over the last few years,” adds Dinges. “As product development times continue to

shrink, more manufacturers rely on the full turnkey services provided by a systems integrator. Although they may possess the automation know-how, many manufacturers simply do not have the resources to complete an automation project in the required timeframe. The continuously shrinking time-to-market factor drives the need for resources that are only available from [an outside source].”

With most engineering staffs pared down to the bare bones, top management is often reluctant to approve internal machine building projects. “There is less tendency to want to build your own equipment these days,” says the Lean Learning Center’s Flinchbaugh. “If you do, the CFO will probably start asking a lot of questions, because

it’s hard to build something for less than you can buy it,” notes Flinchbaugh. “But, sometimes, ego gets in the way.

“Most engineers who like to build their own equipment argue that systems integrators and machine builders design in more than is needed,” says Flinchbaugh. “They like to make equipment that is ‘the biggest’ or ‘the fastest.’ Traditionally, there’s a tendency to build in more than the customer needs, which adds cost and lead time.” And, of course, that generates more waste, which counteracts the lean manufacturing philosophy.

Internal Benefits

There are several advantages to building equipment in-house. Manufacturing engineers typically consider do-it-yourself projects to maintain the confidentiality of a new product or a proprietary assembly process. They argue that a competitive edge can be gained from proprietary systems.

Companies that feel that they have trade secrets are usually more prone to creating their own equipment. Those manufacturers believe they cannot reveal



Complex assembly cells that include robots, conveyors and other automated equipment are often best left to automation specialists, such as system integrators. Photo courtesy Bosch Rexroth Corp.

their highly proprietary processes to outside resources. Consumer product manufacturers and medical device companies are a good example.

If you possess specific expertise, there are advantages to building in-house, especially if you are developing a new product or manufacturing process. Do-it-yourself automation allows companies to keep information regarding proprietary processes within the organization. By internally developing those processes, manufacturers can gain an advantage over their competitors by achieving a knowledge level which cannot be easily or quickly duplicated.

Another benefit of in-house building is greater control over the design and specification of components. Decisions are not left in the hands of a machine builder or systems integrator. Engineers are able to redesign or modify equipment immediately.

“One trend which we are seeing is customers—especially those with advanced automation or motion requirements for their projects—maintaining a tight control on the overall design, whether it be a machine or process, but

relying on experts to optimize the performance of [the supplier’s] portion of the system based on their application parameters,” says Aerotech’s Botos.

According to PHD’s Hessler, many engineers have pride of authorship. “They know their products and processes better than anyone else,” he points out. “They know all the idiosyncrasies. But, if they go to an outside source, they have to explain that to them, so there’s always the risk of something getting lost in translation.”

Many engineers also see in-house projects as an opportunity to learn new things and hone their technical skills. “Internal employees who integrate automation develop a much greater knowledge of the system,” says

Bosch Rexroth’s Dinges. “This expertise will allow them to better support the system in terms of system service and maintenance.”

With an in-house project, engineers can also set their own priorities and timetables, which avoids potential delivery delays. “As business conditions pick up, machine builders or systems integrators may become tied up with other projects,” notes Hessler. “You may have to wait in line as other customers take priority.”

Engineers traditionally believe the do-it-yourself approach to machine building is less expensive than buying turnkey solutions. But, some experts claim that it costs twice as much to build in-house. They argue that actual costs always end up getting lost in overhead rates.

Manufacturing engineers are often overly optimistic as to their availability to work on in-house projects; their ability to stay committed to the project; and costs of materials such as plating, fitting, wiring, hoses and other components that are not obvious, but which can comprise a major portion of the functionality of the equipment.



Many manufacturers no longer have the expertise needed to build equipment in-house, so they are forced to buy off-the-shelf systems. Photo courtesy Remmele Engineering Inc.

Insufficient budgets and cost overruns hamper many in-house machine building projects. There's a tendency to overestimate internal capability and underestimate the time needed to get the job done. Engineers tend to overlook the hidden costs. Many well-intentioned projects suffer from artificially low in-house costing estimates.

Sometimes, engineers focus on materials and parts cost, but overlook the cost of ownership. They don't consider start-up costs, warranties or applications support. Those are big costs that are often hidden when equipment is built in-house. For instance, debugging time often is understated or unaccounted for.

Nevertheless, there is a tendency to always think, "We can build it better ourselves." Depending on how manufacturers crunch the numbers, in-house projects may truly be a less expensive alternative. "If you have a staff, in theory you're already paying for them," notes Hessler. "The cost on paper [to build in-house] may be less, depending on how

you allocate overhead."

Staff Shortage

Even if they wanted to, many manufacturers no longer have the expertise needed to build equipment in-house. They are forced to buy off-the-shelf systems because of staff cutbacks. And, most downsized engineering departments no longer have enough excess capacity to handle internal projects.

According to Don Ewaldz, director of the Bourton Group (Carmel, IN), manufacturers may be better off having their engineers focus on developing new products and improving existing production processes. He says do-it-yourself projects tend to tie up personnel, facilities and development time. For instance, they can take time away from other initiatives that are more critical to strategic business objectives.

"The major disadvantage in [building] production equipment in-house is straying from core competencies and

using valuable resources that could be channeled toward producing innovative product designs," warns Richard Ligus, president of Rockford Consulting Group (Rockford, IL). "Equipment suppliers will likely have a time-cost advantage, since they do [automation] as a core competency and have the resources needed."

One disadvantage of building automation systems in-house is not being able to tap into the expertise of machine builders and systems integrators that have many years of experience in automation applications. "Our customers are very good engineers, but their expertise is usually in areas specific to their businesses and not necessarily in automation or motion control," says Botos. "Engineering time is a finite resource. Opportunity costs are real costs that are sometimes not taken into consideration. [Manufacturers] must ask themselves how they want to allocate their time and resources."

Another disadvantage of do-it-yourself automation is the large number of employees who are required short-term to complete the project. "As product life cycles continue to contract, it becomes critical to minimize time to market," warns Dinges. "Since integrators work on a project-by-project basis, they have the flexibility to dedicate more or fewer resources to a specific project in order to hit a required delivery date. In order to achieve these same dates, most manufacturers would have to divert resources from other departments or initiatives."

In addition, Dinges says there is no check and balance system with in-house projects to ensure that the most optimum automation solution or technology has been chosen for the project. "There may be a more viable and economical off-the-shelf solution that an in-house engineer may not be aware of or has simply overlooked," he points out.

"If you are buying 'garden variety' components for your [in-house] product or process, you will get a commensurate garden variety performance out of your system," warns Botos.

It's very important for manufacturing engineers to carefully evaluate all internal capabilities and external



The benefits of buying turnkey systems often outweigh any do-it-yourself arguments.

Photo courtesy ATS Automation Tooling Systems Inc.

resources before deciding to build or buy assembly equipment. No decision should be made without a thorough cost analysis.

“Size, complexity and timing are three of the primary factors in determining whether to tackle an automation project in-house or not,” says Dinges. “An extension to an existing assembly system or a small assembly system with minimal process controls may be a good candidate for an in-house automation project. In particular, the availability of pre-engineered modular components, such as non-synchronous conveyors and aluminum structural framing, have simplified and shortened the design process, thereby allowing in-house engineers to take on some small projects that they may have outsourced otherwise.”

Turnkey Pros and Cons

Buying an off-the-shelf system offers numerous advantages. In fact, many observers wonder why anyone would even consider building equipment in-house.

“Today’s business climate has limited the engineer’s ability to build most systems themselves, especially the larger and more complex systems,” says Dinges. “In particular, staffing cutbacks, expanding product variations and increasing system complexity—when coupled with shrinking implementation dates—have made manufacturers more reliant on the full turnkey services offered by an integrator.”

Turnkey systems are usually advantageous for highly specialized

equipment designs. “If a company does not have the specialized expertise in-house, it makes a lot of sense to go turnkey,” notes Rockford Consulting’s Ligus. “But, fewer headaches previously caused by in-house designs are often offset by new headaches in closely monitoring the [outside supplier’s] quality of work. In other words, you still must keep a bottle of extra-strength aspirin handy.”

However, the benefits of buying turnkey systems often outweigh any internal arguments. By tapping outside expertise or purchasing equipment from one source, manufacturers can:

- Maximize productivity. If correctly specified, responsibility is clear and the buyer’s employees can concentrate on their core business. The systems integrator or machine builder assumes day-to-day project management responsibilities.

- Provide for single-source accountability to assure that interaction between devices, components and machinery is one party’s responsibility.

- Assure continuity in controls and mechanical design that provides for a smoother operating system.

- Minimize the risk requirements and management requirements for in-house engineering to bring the equipment online.

- Inject new ideas and concepts. In-house projects run the risk of using old ideas and old technology. For instance, designs tend to follow similar automation themes that are part of the culture of the company. By using outside services, technological advances as well as

alternative automation approaches can be explored.

- Ensure that warranty and maintenance issues are handled at a single source. The buyer can say, “My product isn’t being assembled correctly. Please fix it.”

- Spread expense and depreciation over time. By buying turnkey systems, lead times can be shortened and overall total cost of ownership can be reduced.

“As time to market continues to shrink, minimizing development time can increase profits by introducing new products to the market faster,” says Dinges. “Building a long-term relationship with the systems integrator is important in terms of trouble-shooting and warranty support. By ‘shopping’ an automation project to a group of competing integrators, a company can compare various automation solutions and also ensure they are paying an equitable price.

“Any disadvantages to buying an off-the-shelf system are not inherent to the actual system,” adds Dinges. “The primary disadvantage of buying an off-the-shelf system is that customer expectations may not be met. It is critical that all system expectations be clearly defined and communicated to the system builder. It is also important to ensure that the customer has the necessary in-house technical expertise to support the equipment on a daily basis.”

Most observers believe there will always be a need for some type of in-house automation projects. For instance, many manufacturers continue to build or modify jigs and fixtures. Jamie Flinchbaugh predicts that more and more companies will buy off-the-shelf equipment and then adapt it to fit their unique needs rather than developing systems from scratch.

For instance, process modularization and built-in flexibility allows engineers to reconfigure independent subsystems in order to respond to changes in product mix while maximizing asset utilization and minimizing cost. “We’ll continue to see more and more master adapters rather than innovators,” says Flinchbaugh. “There will always be new ways to fixture parts, new ways to feed parts and new ways to transfer parts.” **A**