Industrial Automation:

The Ultimate Buyer's Guide for Choosing Systems Integrators

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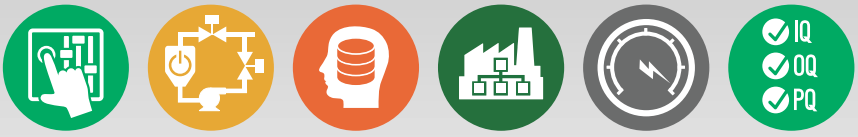

Section I
Introduction

There are a lot of good reasons why you might be interested in automating your plant or increasing it's level of automation. You might try to reduce costs by reducing labor requirements. Or you might try to reduce waste or scrap by eliminating process variations. Perhaps, you want to increase production without adding floor space, or just get better control on your processes to minimize variation in final product quality. These types of objectives often require the implementation of automated production tools and methodologies, such as machine control, continuous process control, batching systems, recipe management, and packaging systems. In other cases, they require manufacturing intelligence tools, such as downtime tracking and analysis, performance and efficiency tracking, and data historians, to capture, analyze, and report process data.

Unless you're fortunate enough to have a deep bench of automation engineers on your staff, you'll need to rely on a systems integrator to help you successfully implement these types of projects.

When to use industrial automation as an efficiency solution

Manufacturing companies, like yours, often turn to systems integrators when they decide to expand, improve, or otherwise update their production systems or processes. These expansion or improvement projects often include new process equipment, new process control, manufacturing intelligence software, or all three. The systems integrator's role in the project often includes the design or development of the equipment or software that comprises the new system, as well as testing, installation, startup and commissioning of the new system. The system integrator may also be involved in the integration (or tying together) of new or existing OEM equipment, as well as the integration (installation and configuration) of COTS (commercial, off-the-shelf software). Finally, the system integrator may assume the role of project manager and take responsibility for the overall expansion project.

The following are some more examples of the types of projects that system integrators might take on for you:

- Capacity expansion
- Automation of production processes, including machine control, batch process, continuous process, recipe management, testing, and packaging, material handling, and warehousing
- Process validation (FDA regulatory compliance)
- Performance and efficiency tracking
- Downtime tracking and analysis
- Quality assurance
- IACS network and security
- And many others specific to your production needs

With these projects in mind, it's easy to see how the success (or failure) of a critical capital expansion project can turn on the capabilities and experience of the systems integrator you select to handle your project(s). Manufacturing companies rely on systems integrators because it's assumed that they're experts in the scope of work or application that the project entails. It is assumed that the system integrator will be able to deploy a highly skilled team to minimize the risks and costs of executing the project. The goal is to complete the project faster, better, and cheaper than your in-house team could complete it.

Section II
Redefining total cost of ownership

Companies often refer to total cost of ownership (TCO) when deciding how to implement a project. Frequently, TCO calculations are used in both the project-budgeting process and the evaluation process used to select a systems integrator.

TCO calculations for technology deployment often include the following considerations:

- Computer hardware and programs
- Network hardware and software
- Server hardware and software
- Workstation hardware and software
- Installation and integration of hardware and software
- Purchasing research
- Warranties and licenses
- License tracking — compliance
- Migration expenses
- Risks: susceptibility to vulnerabilities, availability of upgrades, patches and future licensing policies, etc.
- Operation expenses
- Infrastructure (floor space)
- Electricity (for related equipment, cooling, backup power)
- Testing costs
- Downtime, outage and failure expenses
- Diminished performance (e.g. users having to wait and diminished money-making ability)
- Security (e.g. breaches, loss of reputation, recovery and prevention)
- Backup and recovery process
- Technology training

- Audit (internal and external)
- Insurance
- Information technology personnel
- Corporate management time
- Long-term expenses
- Replacement
- Future upgrade or scalability expenses
- Decommissioning

In practice, only a small subset of these costs are typically included, and those will most likely be the larger more obvious costs.

True total cost of ownership: the Opportunity Cost of Not Doing it Right

Notably absent from the above list, and from most companies' calculations, is a cost that has the potential to far exceed any of the other items listed. It's often much more than the actual capital cost of the project itself. We're referring to the opportunity cost of project failure or, better said, the Opportunity Cost of Not Doing it Right. This is the cost associated with not executing the project to specification or to schedule.

Failure doesn't necessarily have to be absolute in order to become costly. A miss on the system uptime specification by just a few percentage points can cost you huge sums of money in lost contribution margin on the production lost to unexpected downtime. The same is true for a miss on the startup date. As the old adage goes, in manufacturing, you can never recapture lost production. So, if these costs can be can be so high, why are they often not considered in the budgeting and bid evaluation process? It's because they aren't out-of-pocket costs and aren't considered real costs by traditional accounting systems. While accountants may not consider these costs as real costs, manufacturing executives certainly should. Perhaps, some examples will help drive home the point of just how large the Opportunity Costs of Not Doing it Right can be.

Section III
Understanding System Integration Opportunity Cost

Let's look at how calculating the Opportunity Cost of Not Doing it Right can help you determine what a project is worth. Here are two examples of reallife capital projects that we undertook for manufacturing companies that are probably much like yours. The first project was for a food and beverage company that wanted to improve the throughput on one of their packaging lines that was operating well below capacity. The company believed that line performance could be significantly improved by optimizing the controls system on the line. Before starting the project, we worked with the client to establish a baseline for line performance compared to capacity. This allowed us to estimate how much improvement in production we could expect to achieve. That, along with the knowledge of the incremental profit associated with each additional unit of product produced, allowed us to calculate the economic value of implementing the new control system. So, by doing a little upfront homework, developed a solid estimate of what it was worth to our client to do the project. By reversing the logic, it was also clear to the client what the opportunity cost was of not doing the project, or of not doing itright. Take a look at the numbers.

Real life example one: Controls optimization of a packaging line

The objective of this project was to update and optimize the controls system on an existing packaging line.

Here are the key product factors and performance parameters for this example:

Product

- 64 oz cans
- Sell price per can = $4.00
- Cost per can = $3.50
- Profit per can = $0.50

Production - before control optimization

- Line capacity = 140 cans per minute
- Line performance = 50 cans per minute or 38% of capacity
- Line running 16 hours per day = 48,000 cans per day

Project objective

Increase line performance to 75 cans per minute of 54% of capacity. If successful, the project would yield the following financial results:

- Increase of 24,000 cans per day at a profit of $0.50/can = $12,000/day increased profit.
- $12,000/day at 250 days/year = $3 million per year increased profit.

It's clear in the above real life example that the Opportunity Cost of Not Doing it Right in terms of a miss on the production rate, or a miss on the startup date are:

- The company will miss out on $168,000 in annual profit for every 1% miss on capacity (i.e. only achieving 74% in final capacity as opposed to the specified 75%).
- The company will miss out on $12,000 per day in profit for every day that the startup of the new system is delayed. This is profit that can't be recaptured.

Note: the above calculations are based on the company's demand exceeding their ability to produce, giving the company the ability to sell each incremental unit that could be produced — which was the case.

Project results

It turns out this project was highly successful, as the project objectives were achieved, but since the actual capital cost of the project was only $45,000, it's easy to see that the Opportunity Cost of Not Doing it Right far outweighed the apparent out-of-pocket cost of the project. It would have been a poor economic decision for the company to make the purchase decision (i.e. award the project) based solely on the project bid price. A far better decision would have been to select the systems integrator based on their track record of successfully implementing similar projects. This qualification based selection maximizes the success of the project as defined by performance to specification and schedule — even if the winning bid comes in at two or three times the price of the lowest bidder.

The second real life project is similar to the first one except that it's much larger — both in terms of the capital investment, and the Opportunity Cost of Not Doing it Right.

Real life example two: Downtime analysis and management - three multi-dose packaging lines

This project involves implementing a Downtime Analysis and Management System to reduce overall line downtime and increase production closer to the line's rate capacity.

Here are the key product factors and performance parameters for this example:

Product

- Sell price per bottle = $6.00
- Cost per bottle = $2.50
- Profit per bottle = $3.50

Production - before control optimization

- Rated line capacity = 70 bottles per minute (BPM), 4,200 bottles per hour (BPH) or 67,200 Bottles per 16-hour day
- Line performance = 42 BPM, 2,520 BPH or 60% of rated capacity
- Line running 16 hours per day = 40,320 per day

Project Objective

Increase line performance to 75 bottles per minute or 54 percent of capacity. If successful, the project would yield the following financial results:

- A 9% decrease in overall line downtime for a 7% increase in line output to 64.5% of rated line capacity
- 45 BPM, 2700 BPH = an additional 2,880 Bottles per day for an increased profit of $10,080 per day (2,880 x $3.50) per line. Incremental profit for all three lines was $30,240 per day
- $30,240 per day at 250 days/year = $7.6 million per year increased profit.

It's clear in the above real life example that the Opportunity Cost of Not Doing it Right in terms of a miss on the production rate, or a miss on the startup date are:

- The company will miss out on $560,000 in annual profit for every 1% miss on line output vs. rated capacity (i.e. every 1% of rated capacity across three production lines is worth a total of $560,000 of profit per year).
- The company will miss out on $30,240 per day in profit for every day that the startup of the new system is delayed. Again, this is profit that can't be recaptured.

Note: the above calculations are based on the company's demand exceeding their ability to produce, giving the company the ability to sell each incremental unit that could be produced — which was the case.

Project results

This project was also highly successful, and the above performance objectives were achieved. The actual capital cost of the project was $750,000. A big capital expense to be sure, but even so, the payback period was 24.8 days given the high profit margins on the product and the opportunity cost of downtime on the line. Once again, it's easy to see that the opportunity Cost of Not Doing it Right far exceeded the capital cost of the project. The company couldn't afford to make a bad decision by selecting the wrong systems integrator.

As one final example of the Opportunity Cost of Not Doing it Right, here's what one project manager (at one of our long-term clients) had to say about the results of a project that we lost to a competing systems integrator with less experience on the work scope, "The $200,000 that we saved by going to the lowest bidder was consumed in less than one day due to a late startup and reduced capacity." The project had been awarded on the basis of price alone, without regard to what happens if the project comes in late.

Section IV
The Right Fit: Picking the Integrator That's Best for You

In the previous section, we looked at the high costs of not doing a project correctly. So, how can you make sure your systems integrator does the job right, or at the very least, minimize the risk of doing it wrong? The best way to do it right is to select the right systems integrator — not the closest geographically, not the cheapest, and not necessarily the one your company has always used. Select the best one for the job. The right systems integrator is the one whose core competencies closely match the specific requirements of the project in three areas: technical fit, management fit and risk mitigation.

Technical Fit

It's critical to the success of our project that your systems integrator has the required technical skills and experience to successfully execute the project. Ideally, the systems integrator has done the exact work (i.e. installed and configured the same software in the same type of process for the same type of product) many times before. The more, the better, as this mitigates risk. The right systems integrator will be able to demonstrate a track record of Successful Execution of Similar Applications with Similar Technologies in Similar Environments.

Management Fit

Another important consideration in selecting the right systems integrator is how well they match up to your business needs from a management perspective. Does the systems integrator have a business design, organization, and standard operating procedures that closely match yours? For example, if you require a disciplined approach to project management with formal schedule updates using project management software, does the systems integrator support that?

- Do they have project managers assigned to the project?
- Do they have internal systems that help them stay on schedule?
- Do they have Standard Operating Procedures for programming so that all the code is structured in the same way?
- Do they have a well-established set of core competencies to ensure technical depth of their staff, or do they rely on a small number of experts who don't share their expertise across the organization (tribal knowledge)?
- Do they have a strong track record of performance to schedule and budget and the ability to articulate how they manage projects to perform to specification, schedule, and budget?

If these things are important to you, then they need to be important to your systems integrator too. And they should be part of their standard way of doing business.

Risk Mitigation

All automation projects entail a certain amount of risk. This risk is usually viewed from the technology perspective in terms of ensuring that something actually works. But there's also schedule risk and financial risk.

Technical risk can be summed up by two simple questions: "To what extent does the project involve scheduled invention?" and, "Are we trying to do something that hasn't been done before?" Schedule risk is the risk that the project can't be completed in the time frame required for success — this could be due to scarce project resources, too long of lead times on critical path elements, or an unrealistic project schedule at the outset. Cost, or financial risk, is the risk that the project cannot be completed within the budget — this could be due to an unrealistic budget at the outset, a poor understanding of the scope of work by the bidders, or a selection decision based too much on getting the lowest possible price for the project.

If this risk isn't managed, you'll likely have to cough up more money to satisfy change order requests to complete the project. The good news is that if you've selected your system's integrator based on a good technical and management fit, then you'll already have mitigated your technical, schedule and financial risks. Beyond that, the right systems integrator will understand the project scope of work well enough to identify those segments of the project that pose an unacceptable level of risk to either performance to specification or schedule. And they'll have a credible plan to mitigate that risk. A credible plan might include a feasibility study or proof-of-concept phase for the high-risk portions of the project. Or, it might mean partnering or teaming with another supplier that has the required expertise in a specialty area.

Why you need a requirements specification — the qualities of a good project scope of work

To determine the system integrator who best matches the criteria above, you need a detailed specification or scope of work for your project. This eliminates surprises and determines the required capabilities of your systems integrator. It allows you to match the core competencies of the systems integrator with the specific requirements of your project. It also provides the business justification for your project and establishes the criteria for project success. This information makes it easy to put a value on the system integrator's services and ensure all stakeholders understand why the project is being initiated and what it's worth to your company to do it right.

A good project specification will include (at a minimum) the following:

Justification of the project in operational terms

This specifies the operational objectives of the project in quantifiable terms: production rates, uptime or downtime percentages, defect rates and more. These may be either direct or indirect results of the project, but they should be specified nonetheless. Without these numbers, the economic justification of the project can't be calculated, and the quantitative value of the project and expected results can't be determined.

Expected results in sales, profits, or cash flow

Rarely are capital projects pursued purely for the sake of new technology. It almost always comes down to money, and almost all automation projects (despite the cool technology that might be involved) are initiated because it's believed they will have a positive impact on a company's bottom line. At the highest level, this means a positive impact on:

- Sales
- Profit
- Cash Flow

If we dig a little deeper into the manufacturing world, this means that the project will impact one or all of the following:

- Efficiency
- Production levels
- Yields
- Quality
- Material movement (and inventory).

Clearly, all of these can translate into a financial impact, so this impact can and should be calculated. As in the real-life project examples highlighted above, it is critical that your company understands why the project is being initiated, what the expected results are, and the real costs (and opportunity costs) that are associated with the project.

Technical requirements

A detailed technical specification will make it much easier to match the capabilities of a systems integrator to the specific requirements of your project. The following requirements should be specified if possible:

- Applicable technologies
- Preferred components, software, platforms
- Standards to adhere to (industry, regulatory, or safety)
- Quality
- A complete list of all required deliverables.

Delivery and schedule requirements

All major milestones on the critical path to project completion need to be specified with an emphasis on those milestones that will mitigate risk. Examples of these milestones include preliminary proof of concepts, design reviews, simulations and factory acceptance tests. Addressing schedule requirements in the specification can be particularly useful if the schedule is unusually aggressive. You can use it to differentiate between systems integrators who have a credible plan to deliver on schedule and those who don't.

Acceptance criteria
Here's where you'll establish quantifiable acceptance criteria directly related to the project's operational justification.

Management and administrative
You'll detail any reporting requirements, such as progress reporting, project schedules, or resources loading and assignments.

Again, the intent is provide enough detail in the specification to closely match the systems integrator's expertise and track record to the specific requirements of your project. You'll want a systems integrator on the project who hasn't just done it once or twice before, but over, and over, and over again — not one that's going climb the learning curve on your company's capital budget.

A Word on Geographic Proximity

Unfortunately, many companies take the same approach on high-risk, technically complex projects that they take with small, low-risk projects: they call the geographically closest systems integrator with the mistaken belief that geographic proximity is important for cost control. Close doesn't matter if the project is a bad fit for the selected systems integrator. Any cost savings related to geographic proximity will be consumed in a flash due to a miss on either specification or schedule.

Section V
The Systems Integrator Checklist

We created The Systems Integrator Checklist to help you separate the best integrators from the rest. With a fairly comprehensive specification as a basis, you can use the following checklist to evaluate competitive proposals.

Is it a good technical fit? Does the systems integrator have the following:

- A detailed and thorough proposal (Compliance with Specification)?
- Technical content — does it include a credible discussion of how the system will be architected, and how it will work?
- Does it clearly detail all of the deliverables?
- A demonstrable track record of successful execution of Similar Applications with Similar Technologies in Similar Environments (industry, regulatory, hazard level)?
- Reference projects that verify this experience?
- A credible plan for risk mitigation?
- Identification of high-risk elements of your project?
- Where is the risk and what percentage of the project is it?
- Ability to articulate the basis for the risk assessment?
- Why is it risky? Never been done before? OR, never been done before by this systems integrator?
- Plans for risk mitigation — what is the plan to manage the risk (Feasibility Studies or Proof-of-Concept Phase)?
- Customer references that verify this experience?

Is it a good management fit? Does the systems integrator have the following:

- Stable technical staff with organizational core competencies as opposed to tribal knowledge where only a few people actually know what's going on in any particular project area?
- A strong track record of performance to schedule and budget?
- The ability to articulate their project management methodology (i.e. how do they manage to schedule and budget)?
- Reference projects that demonstrate this experience?

If a systems integrator can stand up to this checklist, they're probably the right systems integrator for the job — even if they aren't the lowest bidder.

Section VI
Lower Your Total Cost of Ownership with the Right Systems Integrator

When you turn to systems integrators for help executing capital projects to expand, improve, or update your production systems or processes, don't ignore a cost that has the potential to be much higher than any of the items traditionally considered in TOC calculations. The Opportunity Cost of Not Doing it Right often far exceeds the out-of-pocket capital cost of the project itself. Selecting the wrong systems integrator could cost you a lot more than the capital cost of the project.

While this opportunity cost isn't always completely avoidable, you can significantly reduce risk by selecting the right systems integrator. By selecting a systems integrator partner who has done it before in terms of technical scope, project scale, and performance to schedule — and can prove it — you will have done almost everything you can to maximize your chances of a successful project. The key is to clearly define why your project is being initiated and what it's worth to your company — both operationally and financially. This will also help you place a fair value on your systems integrator's services and what it's worth to you to select the right systems integrator for the job.

More about Malisko Engineering

Malisko Engineering, Inc. was founded in 1994 from humble beginnings. We've grown into to a multi-disciplined team of engineers, designers, programmers, automation, network, and validation specialists. We deliver cutting-edge automation technology in rapid project timeframes at competitive pricing. We deliver our work on time and on budget. We help our clients meet their goals with well-planned system design and implementation.

Ask a Question

Have a question about this white paper or do you want more output, fewer lost batches and better reports? We can show you how to improve your production and maximize your successes through industrial automation.
Call us at 314.621.2921 or **click here to get in touch**.

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