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2016

Cloud ERP Buyer's Guide for Manufacturing

Technology Evaluation Centers

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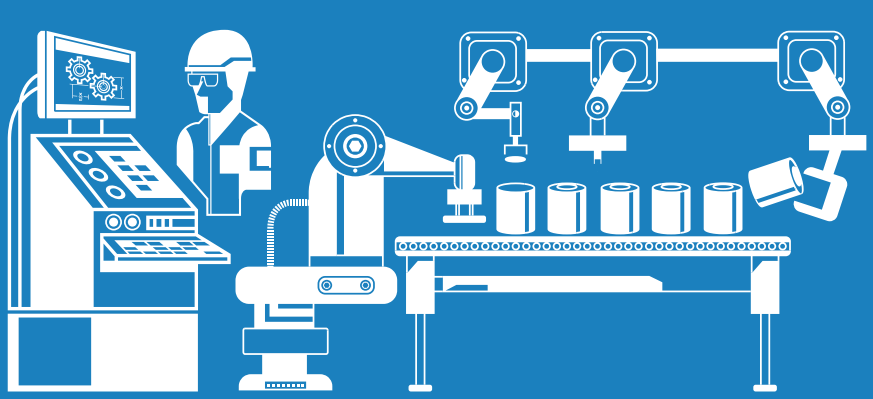

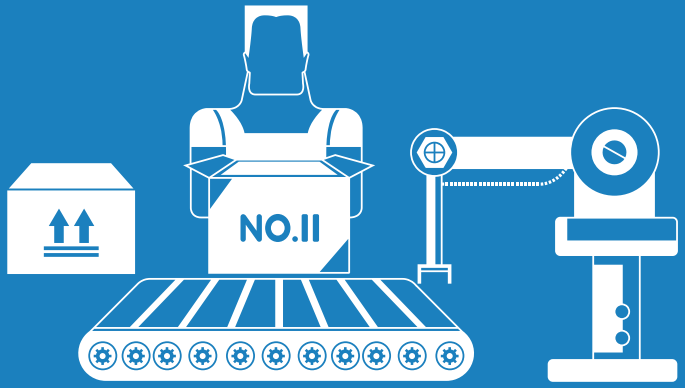

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About This Guide

The Technology Evaluation Centers (TEC) Cloud ERP Buyer's Guide for Manufacturing addresses the typical questions manufacturers have on cloud software deployment versus the on-premises and hosted alternatives, and provides a basic framework for assisting manufacturing company decision makers in their evaluation of enterprise resource planning (ERP) software solutions.

This buyer's guide is intended primarily for small and medium-sized manufacturing companies that are newcomers to the cloud ERP scene, but want to learn more about the cloud delivery option of ERP software. As the cloud entails numerous technical, functional, and financial aspects, this guide focuses on addressing basic questions regarding the initial considerations for evaluating a cloud option for ERP, a complex software system. Further considerations of cloud ERP as a viable option for your manufacturing company will require deeper investigation.

Cloud-based ERP Landscape for Manufacturing

As cloud computing is becoming the norm for organizations today, manufacturing companies are also expressing increased interest. Although most manufacturers do not see cloud-based enterprise resource planning (ERP) software systems as a viable option for their current business, they are, however, keeping an eye on the market for potential future use. Based on multiple conversations with manufacturing ERP software vendors, it appears that about 10 to 20 percent of manufacturing companies are currently deploying their ERP solutions in the cloud, or giving serious consideration to the cloud. Manufacturing businesses still express many concerns and barriers to cloud ERP, but significantly fewer than those of a few years ago, when the idea of cloud ERP was introduced. Additionally, the cloud has been developing and maturing as an industry at a high pace, offering more and more options for its customers while eliminating concerns and dispelling numerous myths about cloud computing.

Today, the vast majority of manufacturing companies have already hopped on the cloud in one way or another, and have a clearer understanding and more familiarity with cloud-based business applications, such as customer relationship management (CRM), marketing automation, human resource management (HRM), business intelligence (BI), email and office applications, and so on. And while a greater level of familiarity typically leads to fewer concerns and demystification of the cloud as a concept, still a lower percentage of manufacturing businesses, compared with businesses in other industries, wish their full-blown ERP to be delivered over the cloud.

It is particularly difficult to answer the question of how many manufacturing companies use cloud ERP. The market is highly differentiated geographically—some countries and regions have more cloud immersion than others. For instance, the U.S. market is large and probably ahead of others in terms of cloud adoption, but it is not alone. We can't directly compare cloud opportunities between some countries—e.g., China and Norway, as these markets are on opposite poles in terms of historical, cultural, and economic factors impacting cloud adoption.

Similarly, there is a big difference in the adoption of cloud software by companies of different sizes. It makes sense to talk about cloud-based ERP with small, medium, and medium-to-large businesses. But large organizations, whose own data centers are comparable in size to those

of cloud platform providers, would hardly change their on-premises approach overnight in favor of one or another cloud vendor. However, although there are exceptions, in general, large companies will eventually gravitate toward hybrid or private cloud deployment models that make sense for their particular business case.

A survey of 308 respondents from companies in all industries, including manufacturing, conducted by Technology Evaluation Centers (TEC) in December 2015 confirms the overall high interest in cloud-based ERP software. In response to the question "Has your organization considered (or is it considering) a cloud-based ERP?", 52 percent of survey participants said "Yes" (see figure 1).

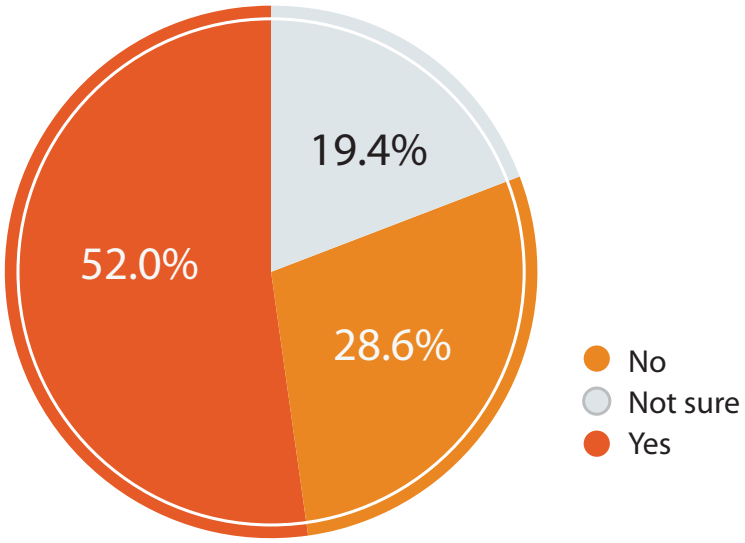

Figure 1. Percentage of organizations considering cloud-ERP software (TEC survey)

In turn, cloud-based ERP manufacturing software is increasingly becoming more advanced. While 7 to 10 years ago we could hardly place brand new cloud vendors next to their on-premises counterparts in terms of available functionality, the situation is different now. New configuration features have made it significantly easier to adjust even public cloud–based ERP software to manufacturing companies' business processes than it was before. Certainly, some packages are more flexible than others, but there is evidence for an overall trend for manufacturers to be moving toward cloud ERP arrangement and its variations. Hybrid or private cloud deployment makes it even easier for manufacturers to consider cloud ERP to run their business.

Cloud ERP 101

Like any other technology, a technology for delivering software via the Internet has greatly evolved in recent years and is rather complex. For the sake of simplicity, we will not discuss technical and other complex considerations of cloud ERP software in this guide, but will present some of the variations and options that are available for manufacturers to leverage in order to better operate their business.

There are several definitions of cloud computing, and as cloud computing continues to evolve, it is becoming increasingly difficult to define it. The basic idea of the cloud is that the technology infrastructure enables several types of computing tasks to be performed over a local area network (LAN) or a wide area network (WAN), such as the Internet.

For a formal definition, let's use the one from the National Institute of Standards and Technology (NIST): "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

Cloud as a Software Delivery Option

So, based on the definition above, NIST describes the cloud infrastructure as differing from the traditional computing model in five main characteristics:

- **Broad network access**—enables computing capabilities to be available over the network and to be accessible through a wide and common variety of client platforms (mobile phones, tablets, laptops, workstations, etc.).
- **On-demand self-service**—enables computing capabilities (storage, server time, applications, etc.) to be provided automatically from a service provider to users, without users ever having to interact with the provider.
- **Measured service**—enables both the service provider and users to monitor, control, and report resource usage.
- **Resource pooling**—serves multiple users via a multitenant model. Within this model, physical and virtual resources can be assigned and reassigned dynamically to meet consumer demand. The customer generally has no control or knowledge over the exact location and configuration of resources.

- **Rapid elasticity**—enables computing resources to be provided and released elastically and/or automatically to scale resources rapidly according to demand.

The functionality of cloud software such as ERP is technically delivered from a remote unlimited source over the network, and can be shared with other customers using the same application. Interestingly enough, the average user may not notice any difference between software that is delivered on premises and that on any type of cloud. The user is mainly interested in whether the required functionality is always available on his/her computer or other device. However, the management and information technology (IT) departments may debate the cloud versus non-cloud software delivery options from technological and financial perspectives.

Public Cloud and Hosted Solutions

The resource pooling capability of the cloud computing platform often resides in a multitenant model. Multitenancy means that a computing resource can be used or shared by more than one consumer. Resources such as storage, processing, memory, applications, and others can be shared between different consumers. These consumers can be located within the same organization, or they can be from totally different companies.

Cloud services can also be categorized based on the way they are deployed to serve the user community. A software platform infrastructure generally can be deployed in a public or private cloud, or in a hybrid mode:

- **Public cloud:** A public cloud grants general access to the same software instance to all its customers, but keeps customers' data separate. Public clouds are paid for by monthly software rental fees, enabling organizations to transfer capital expenses to operational costs. All the software maintenance tasks and upgrades are performed by the vendor. Public clouds are typically formed by organizations dedicated to selling cloud-based services only.
- **Private cloud:** This cloud infrastructure is created and deployed only within a single organization, regardless of whether it covers one or more locations. Private clouds can be managed internally by the organization, the cloud provider, or a third party. The private cloud option requires that the company assumes not only operational costs, but also capital costs.
- **Hybrid mode:** This type of deployment combines the features of both public and private clouds, and may also include elements of on-premises solutions in various combinations. Cloud platforms enable organizations to delegate tasks associated with specific security or other concerns to the private cloud or to on-site hardware and software, while allotting all public operations to the public cloud segment. In effect, this mode allows organizations to use the security and performance of their company's IT infrastructure and combine it with new functions, tools, and other opportunities available in the cloud software delivery option.

Different software delivery modes are distinguished by not only their technical characteristics but also the levels and areas of responsibility of the parties involved: the customer organization, software vendor, or third-party service provider. Table 1 provides a general scheme of how various components of software delivery can be distributed between the customer, software vendor, and/or service provider.

	On premises	Hosted	SaaS
Hardware and infrastructure	Customer	Vendor / Service provider	Vendor / Service provider
Software application	Customer	Vendor / Service provider / Customer	Vendor / Service provider
Customer data maintenance	Customer	Customer	Vendor / Service provider

Table 1. Software deployment method and areas of responsibility

This relationship is somewhat more complicated in real life. There are multiple layers of hardware, infrastructure, software, and data components involved in various different combinations of software delivery options. And for every element in the table, the assignment of responsibility really comes down to a mutual agreement between the customer, vendor, and service provider.

SaaS, PaaS, IaaS

To ensure the separation of its functional and technical components, a cloud computing platform relies on having three basic architecture layers:

- **Technology layer:** This is the first layer of the cloud platform, and it combines servers, operating systems, network devices, and so on.
- **Application layer:** This is the functional layer, and it is formed by all business applications, such as ERP, that run on the cloud computing platform.
- **Information layer:** This is the third layer, and it enables information to be available from anywhere in the cloud. It guarantees that the information will be secure, consistent, and reliable.

Each of these layers can be delivered to a customer via a cloud computing platform, providing multiple ways of consuming computing resources. These resources are delivered via three main service models. A cloud computing provider is therefore responsible for providing a wide range of computing resources included under that service umbrella. The main types of service models are as follows:

- **Infrastructure as a Service (IaaS):** Consumers are provided with computing resources such as processing, storage, and networking in order to run operating systems and applications as required. Users don't control the cloud infrastructure, but they can control the operating systems and many types of applications.
- **Platform as a Service (PaaS):** Users are provided with the ability to deploy commercial applications or applications created in-house and supported by a provider. Users have control over deployed applications but not over other infrastructure components, such as storage and processing.
- **Software as a Service (SaaS):** Users can use the software application from the provider. This application runs in a cloud computing platform over the network, and is generally available through a network interface such as a Web browser. Users don't have control of any resource other than the application itself, with control of the application consisting of a set of configuration options to personalize the application for the customer.

As every instance of a modern ERP software comprises technology, application, and information layers, such a complex software product may be delivered to customers as a single product or as a combination of layers purchased or rented depending on the requirements of the particular company. Typically, cloud ERP software as a whole product is delivered as a service on a pay-as-you-go basis. However, manufacturing businesses often use hardware from a third party via the IaaS model, and purchase their own software licences and fully control their data.

Cloud ERP Considerations by Category

A variety of cloud ERP solutions are available on the market, and manufacturers that are considering or are already in the process of selecting an ERP software system for their manufacturing business have an ample pool of solutions from which to choose. As there are dozens of software vendors that offer seemingly comparable ERP products, how do manufacturers go about choosing an ERP system that is suitable for their business? This is not an easy task, by any means.

To simplify navigating the ERP software landscape, we have classified cloud ERP software vendors according to five major factors: origin of the software, size of the customer, variety of deployment options available, vertical industry served, and technical platform used.

Software Origin

The origin of the cloud ERP software is probably the most important characteristic of the product. The software's origin reflects its range of capabilities and, often, the maturity of the product. So, here we can split cloud ERP vendors into two groups:

- Cloud ERP vendors that have emerged on the market relatively recently as cloud-only ERP products developers. Such cloud-native vendors sell strictly public cloud software; they have no history prior to their formation, although many were founded by traditional ERP companies or by previous top managers of such companies. Though they are relatively new to the market, these companies and their products have matured dramatically to become notable ERP market players. These include Plex Systems, NetSuite, Kenandy, Rootstock Software, among other vendors.
- Traditional on-premises ERP vendors that have developed newer cloud versions of their existing products or offer brand new solutions that are cloud based. This group of ERP market players is more numerous, and includes the vast majority of on-premises vendors that have recognized the cloud trend and reacted accordingly. Thus, the products in this group originate from traditional and functionally rich ERP solutions, and have accumulated a wealth of experience. Among these ERP vendors are industry leaders such as SAP, Oracle, Infor, Epicor, and many others. But while many traditional ERP solutions can now be provided over the cloud infrastructure, they are considered by cloud-only competitors and many "pure cloud" proponents to be "legacy applications."

Customer Size

The cloud delivery of massive products such as ERP blurs the classic boundaries between different types of software products and their consumers, making large systems and their functionality more affordable to smaller customers. Nevertheless, these cloud ERP products solutions can still be roughly grouped as those intended for larger organizations, those targeting medium-sized customers; and those designed primarily for smaller businesses.

Available Deployment Options

Vendors of cloud ERP solutions can be classified according to their software deployment mode, which reflects their technical capability and their readiness to accommodate the requirements of their clients. The cloud ERP companies on the market offer these three major options:

- Public cloud–only delivery and do not discuss any other options
- Public or private cloud delivery depending on the requirements of the particular customer
- Private cloud–only delivery, as these vendors are most likely traditional on-premises ERP vendors that, for some reason, cannot offer their products in the public cloud environment

Note that for many organizations, various different permutations and combinations of the above options are available—the final system configurations depend to a great extent on the mutual agreement between the parties involved.

Vertical Industry

ERP software products for manufacturing can also be classified according to the industry vertical that they serve. These products are highly specialized for specific manufacturing industries, as each industry has its own often-unique processes and compliance requirements. The vast majority of newly emerged cloud-native ERP vendors began developing their products in order to support the discrete manufacturing vertical. Other segments of manufacturing (process, engineering-to-order, etc.) were mainly occupied by software vendors that had been serving those industries for years and later developed cloud versions of their products. Thus, there are not many manufacturing cloud ERP systems that are capable of supporting multiple manufacturing industries. So companies in industries other than discrete manufacturing looking for a cloud ERP solution will most likely find that their shortlist of vertical ERP solutions coincides with that of traditional ERP vendors.

Technical Platform

The cloud platform on which the ERP application is based is another matter for consideration in the selection of cloud-based ERP software. Microsoft Azure, Salesforce.com, and Amazon Web Services are among the most popular platforms. As other packages are also developed on these platforms, companies may find it easier to integrate their ERP system with other applications on the same platform. So companies need to know which software solutions they are likely to use. This requires that companies—even small ones—develop either formal or informal IT strategies to align their vision of the future with the types of software they will use.

Recommendation

No single factor in isolation should govern your choice of ERP software. When looking to purchase an ERP solution, not only will you need to review products in depth, but it is also useful to investigate the vendors' strategies and priorities to gauge which is the best match for your company's corporate vision.

Why Is Manufacturing Behind the Cloud ERP Curve?

It is a matter of fact: manufacturing companies are slower than companies in other industries to adopt cloud-based ERP software. Practically all the manufacturing ERP software vendors and manufacturing companies TEC interacts with report this pattern of behavior. What is the rationale for their slower adoption of cloud ERP software?

A major reason for the slow cloud ERP adoption may have to do with the uniqueness and complexity of core manufacturing processes—for each and every manufacturer. Moreover, production and logistics processes are often different from one manufacturing site to another even within the same company in the same country. What's more is that similar business processes can differ across regions and countries. At the same time, public cloud software implies unified business processes and does not easily accommodate process variations and deviations. Cloud ERP vendors argue against this bias, asserting that manufacturing processes are alike overall, and can be harmonized and unified enough to be acceptable for a single-instance ERP software, which public cloud ERP essentially is. Nevertheless, the perception of the uniqueness of manufacturing business processes is still prevalent among many top managers of manufacturing companies—who ultimately make the final decision in selecting ERP software.

Another important reason why many manufacturing companies are still avoiding cloud ERP is that they have invested heavily in their own IT infrastructure, on-premises ERP, and other software—assets that cannot be easily discarded. Based on the accounting principles and standards of a specific industry or country, companies that abandon assets may have to write off non-fully depreciated assets, which negatively impacts their profit and loss (P&L) numbers. Certainly, many financial managers, company owners, and shareholders would not appreciate this.

Unlike the community of cloud proponents—which includes cloud software solution vendors, software analysts, and technical experts—the viewpoint of many manufacturing companies is that cloud delivery is just another way of deploying the same or similar massive and overwhelming software product, which ERP in fact is. The C-level management of many manufacturing companies has yet to appreciate that cloud software is a wholly different concept of computing infrastructure and software consumption that offers several benefits.

On the other hand, many manufacturing companies see cloud ERP as being very different from on-premises ERP, and they have concerns about the data ownership, privacy, and security of cloud ERP software. As a result, they are not willing to replace their on-premises ERP—even though they may not be satisfied with it. The cloud delivery model is theoretically more secure and safe for its customers, but it is not that easy for manufacturers to overcome this psychological barrier and entrust the company's entire financial, commercial, and competitive information to a third party. Additionally, there are often objective obstacles related to the ownership of sensitive information, preventing companies from handing their data over to cloud providers. For instance, manufacturers of defense and medical products are often prohibited from using software that does not reside internally. A number of countries also have legal restrictions on transferring organizations' data to other locations and legislations.

Another reason for the slow adoption of cloud ERP is that the replacement of an ERP system in manufacturing is a much more complex initiative than that in other industries. This is due to the natural complexity of the manufacturing process. Even relatively small manufacturing companies often deal with tens of thousands of production and material items, intricate internal logistics, and unique business processes, and they may generate millions of transactions on a daily basis, which require highly reliable and high-capacity Internet access. Additionally, manufacturers often operate in a low-margin environment, and have enormous pressure to reduce costs. So the management of manufacturing companies has limited room for maneuvering, and mistakes in choosing and implementing new information technologies are not well tolerated.

Although the cloud deployment model makes sense strategically for all enterprise applications, including ERP, there are always exceptions. Some businesses won't be able to adopt cloud ERP because of a variety of restrictions, such as compliance, security, etc. But even those companies might be able to employ a number of hosted and cloud technology variations.

Cloud ERP Options—Pros and Cons

While the main talking points of cloud ERP versus on-premises ERP are well known, as the cloud ERP market has matured, additional benefits have come to the forefront. Companies adopting the cloud ERP model can expect to gain benefits in terms of the following:

- cost of ownership
- data transparency and security
- system adaptability and configurability
- range of functionality features available
- up-to-date compliance with regulations
- integration with other applications

- system implementation and maintenance
- system flexibility and scalability
- Web-based system with global access
- system uptime and infrastructure

Cost of Ownership

Lower cost of ownership is still the strongest rationale of cloud-based ERP vendors. A common perception among companies is that cloud-based software is significantly less expensive in comparison with its traditional on-premises counterpart. And this is true up to certain degree but, as usual, there are nuances to consider, such as the following:

- What are the overall charges and payments?
- What are the payment schedules and exit values?
- How willing is the vendor to negotiate flexible service and payment terms?
- What promises does the vendor make with regard to service level and software availability?

In a harsh reality, the stubborn payment schedules or hidden fees of some cloud ERP vendors often negate many of the benefits of cloud delivery. These vendors may require customers to pay upfront or in large installments. They may also charge additional fees on the top of regular payments, penalize user errors or occasional data-related incidents, or have other revenue maximization measures. Although both cloud and on-premises ERP software vendors sometimes undertake such disappointing practices, large cloud ERP vendors—which have more customers with a lower average contract fee ($1,000–2,000 per year), and subsequently lower revenue share per customer—tend to be very rigid in their policies and will not accommodate unique or customized contract terms and conditions.

What public cloud ERP software really does well is that it allows diversion from capital investments to operating expenses. For some companies, this factor can be the winning argument. Fixed subscription fees (available for hosted and hybrid models and sometimes for on-premises apps), savings on ongoing upgrades, and lower licensing costs allow companies to avoid having to go through long investment approval processes, as public cloud ERP requires little to no upfront major capital investment and is associated with predictable overall spending. Cloud ERP deployment may also provide some economy on the company's own IT professionals, as it requires less IT assistance than do on-premises solutions.

However, while cloud ERP is initially less expensive, it may not be significantly less expensive over the long term. Also, the hefty price tags of many cloud vendors cause some potential customers to be less than optimistic about using their products. Additionally, the running time of the software impacts costs. Cloud ERP can be more attractive over the short term, but the

overall figures can look quite different over the long term—comparative return on investment (ROI) calculations show that, on average, a cloud ERP system becomes more expensive than its on-premises equivalent after 5 to 6 years of use.

Regardless, for both cloud and on-premises systems, the overall expenses and operating costs may be higher than originally expected. Costs are highly dependent on the practices and appetites of specific vendors. It's a good practice to investigate the total cost of ownership (TCO) and any potential hidden costs and future expenses before finalizing an ERP software selection decision.

Data Transparency and Security

Is your company really ready to outsource? It's commonplace today to see every business outsource key business functions to some degree. But how willing would your company be to committing the execution of its key business processes to other people, entrusting all its sensitive financial and commercial information to third parties, or transferring other backbone functions for the sake of reducing ERP TCO or optimizing costs? This is a fundamental question that companies considering between on-premises ERP and hybrid or public cloud–based ERP need to answer.

Companies that countenance outsourcing practices and strategies will have an easier time accepting the idea of SaaS and the cloud model of software. On the other hand, those companies that tend to safeguard all sensitive information inside their walls in order to minimize possible leakages will typically opt for on-premises ERP software.

Certainly, the presence of a third-party entity between a business and its data has the potential for creating issues that companies with on-premises ERP simply don't have. Despite written guarantees to keep data safe and restrict access to various third parties, your data nevertheless becomes accessible to people outside your company. There are no guarantees against fraud, bankruptcy of the critical software provider, or other disastrous events that may cause service termination. While on-premises ERP vendors can also fold operations for various reasons, the difference is that they don't have access to your data. In any case, on-premises ERP customers need to be more vigilant and should embrace measures for responsible data handling in order to exclude others from accessing their data—a difficult and expensive task.

On the technical side, the security concerns regarding cloud ERP solutions appear to be unfounded, as reputable cloud vendors can guarantee an even greater level of security protection than the average company can afford on its own. The anxiety that businesses

experience regarding the security of their data with cloud ERP software has more to do with a psychological discomfort with the perception that an unknown circle of people has access to the company's potentially vulnerable data. Yet there is a similar, or even greater, risk with the company's internal IT structure. However, business owners and managers of on-premises software oftentimes wrongly presume that they can control their employees better and are better able to prevent fraudulent acts or quickly mitigate their effects should they occur.

Cloud software providers can typically vouch for the security of their cloud data centers and data transferring capabilities. With the fervent development of cloud technologies, virtually no small or medium-sized manufacturing company with its own on-premises infrastructure can provide the level of data security and access control afforded by cloud ERP vendors. In reality, however, the most sensitive part of the chain resides with the end user, and is usually outside of the vendor's perpetual control. This is compounded by the fact that employees are generally allowed to use their own mobile devices for work—due to growing Bring-Your-Own-Device (BYOD) and mobile work practices—which may be infected with phishing and other malware, or somehow be tracked. Therefore, companies are forced to create and appropriately manage typically complex protection measures on their own (in fact, they have to do it regardless of their ERP software deployment choice). This need partially contradicts the statement that cloud software can easily be used with no IT staff on-site—depending on the business scale, companies using cloud ERP would still need some technical assistance from their own IT staff or a third-party service.

There are a few more points related to data ownership and access that many potential ERP buyers aren't aware of. Companies considering using public cloud software should know that the cost and time involved in fixing data errors or inevitable human mistakes can be prohibitive; there may also be fees and time delays with getting your own data back from the vendor in the case of contract termination. Additional costs may exist for data archiving, storage, and access to the archives after a certain period of time. Such expenses need to be properly identified, considered, and factored into the final price, as they may be substantial.

Adaptability and Configurability

Manufacturers of all sizes are distinct from other businesses in how they organize their internal processes, especially those related to production management. Although they share a similar company structure, they differ in many respects. In fact, no two manufacturing companies are alike, even though they may operate and compete in the same market segment. Even different facilities of the same manufacturer often conduct their internal processes in different ways. As such, the "one-ERP-software-fits-all" policy is not easily applicable to manufacturers, without companies having to make significant changes to current business processes. But ERP solutions with a vertical focus or a focus on a certain manufacturing area would work well in a cloud deployment—e.g., an ERP system specifically designed for the food and beverage industry.

Cloud ERP vendors have been increasingly developing the configuration capabilities of their software. In fact, cloud ERP software has become much more flexible over the past few years. However, there are logical and technical limitations with providing the same generic source-code application to all customers. The software fits well with some—but not all—manufacturing businesses, and with some—but not all—operations of a specific manufacturing business.

On-premises ERP solutions typically provide more adaptability in terms of system customization and modifications according to the customer's unique requirements and practices. On the flip side, there is a potentially high cost for modifications and their subsequent maintenance—for both the vendor and the customer. Again, hybrid deployment can be an appropriate option for those manufacturing companies that would like to combine the high level of modifications associated with proprietary software with the benefits of outsourced hardware.

Regardless, when undertaking a switch to new ERP software—whether it is cloud-based, hybrid, or on-premises—manufacturers should perform an in-depth evaluation of their processes and optimize all internal business processes with the new ERP system.

Functionality Range

Greater overall depth and breadth of available functionality is still a strong competitive advantage of on-premises ERP software. The larger and more complex a business, the more complicated the software requirements it demands and, therefore, the more sophisticated the ERP system it requires. Traditional on-premises software solution providers, which have been on the corporate software market for decades, have gathered unique and extensive knowledge of their customers' businesses, and have transformed their software packages into ERP solutions. On the other hand, public cloud ERP vendors are relatively new players, and many are still in the relatively early stages of functionality development.

However, the area is rapidly changing. Some large cloud-only ERP software vendors are developing their products at an aggressive pace, rapidly supplementing them with new functions and acquiring other solutions in order to include their code in the systems. So manufacturers other than hefty Tier 1 manufacturing companies will find that public cloud–based applications provide a good level of core ERP functions, such as financial management and inventory management, for their business needs. These cloud-based ERP solutions are indeed suitable for manufacturing companies with more-than-average complexity.

Traditional on-premises ERP products are also becoming increasingly available through the cloud infrastructure, at least in terms of hosting services. These options may accommodate the needs of complex businesses. Some businesses, for example, would like to retain their complex, highly customized, and unique processes, and own the data, but they do not want to have to

deal with the hardware and technical considerations of on-premises ERP systems. A number of typically smaller vendors also offer on-premises software combined with the advantages of service-like regular payments and license leasing plans. So customers have a rich choice overall—the final option of which is a matter of mutual agreement between the vendor and the customer.

Compliance

There are numerous manufacturing business verticals that fall under strict compliance rules of a specific country or region. For example, in the Unites States alone, various privacy and data security regulations stipulate that vendors must meet specific standards, rules, and practices for their software solutions. These include the Health Insurance Portability and Accountability Act (HIPAA), the Peripheral Component Interconnect (PCI), and the Sarbanes-Oxley Act of 2012 (SOX), among others. Another example of a standard is U.S. defense industry rules on citizenship data access, stipulating strict control of all data, documents, materials, and equipment on-site (on the manufacturing site).

While cloud-based ERP solutions generally comply with such standards, customers considering moving their ERP systems and data to cloud-based ERP systems should exercise an additional level of scrutiny, as the stakes are high. They should perform rigorous research of potential compliance risks and challenges prior to making such a decision. Companies that do not meet the required regulations may face significant penalties or even lose part of their business.

In fact, companies should always perform their due diligence, regardless of the deployment option sought. Specifically, they should conduct solid preliminary research and objectively evaluate and select the ERP system that best meets their business requirements, whether it's an on-premises, hybrid, or other deployment variant of ERP software.

Integration with Other Applications

The integration of sophisticated software solutions, such as ERP for manufacturing, has always been a major pain point for manufacturing businesses that have to use two or more different systems in parallel. Integration and interfacing errors and data transfer issues are the most common and critical problems for help desks to resolve. The advent of public cloud ERP had originally exacerbated the problem, as companies had a poor understanding of how to integrate the software they did not own and the data that they did not control.

The situation today has improved considerably, as the ERP industry in general and cloud vendors in particular have gained the experience and necessary know-how to provide easier application integration. In parallel, the entire software industry has developed best practices

for product integration. Moreover, the integration of cloud ERP is often less complicated than that for on-premises ERP. However, integration is still a prominent consideration point when it comes to ERP software selection. The ideal package should provide seamless integration with all the company's existing and likely future applications, whether those are installed on-premises, are located in the cloud, or are hosted. As the possibilities are endless, each individual company needs to examine the integration capabilities of all potentially suitable solutions and before making its decision.

Implementation and Maintenance Efforts

The simplicity of software implementation and maintenance is a strong selling point for cloud ERP systems. Here are a few things to keep in mind though. First, a lion's share of the preparation and implementation work involved for a typical ERP deployment at the average manufacturing company consists of business process revision and alignment with the ERP system's logic, manufacturing technology, and master data preparation and validation processes. Additionally, much time and resources are spent on user education and training. This work has to be done regardless of the ERP deployment method, and the amount of work needed remains approximately the same for cloud, on-premises, and hosted ERP software. Business process descriptions; bills of material; engineering processes; materials lists; current inventories of all the items; and the entry, migration, and conversion of other data into the system all must be correct, valid, and current. Server challenges and internal network and other hardware arrangement work are also time- and effort-consuming, but that doesn't comprise the bulk of ERP project work. An ERP implementation project should be managed similarly overall, no matter which software deployment option is preferred.

As for ongoing maintenance of ERP, cloud software definitely requires much less effort from the customer. There is no need for ERP software and server upgrades and applying fixes, which are complex and expensive processes. This responsibility is imposed upon the ERP software vendor or its authorized partner, so the customer isn't aware of any applied software upgrades unless a significant functionality chunk has been added. At the same time, and as mentioned previously, it would be a mistake to assume that cloud ERP doesn't require companies to devote any resources to supporting the technology. The ERP system for medium-sized and larger manufacturing companies is an extremely sophisticated tool that requires customers' employees to handle the data and report bugs, to track current transactions, to analyze inventory data quality, and to execute other business analysis and data analysis functions. Finally, a corporate network and Internet connections to access cloud-based ERP should be in working order at all times. All such needs require qualified technical personnel and dedicated ERP resources to be in place.

Additionally, many manufacturers want to be able to control the update processes. This is an interesting point, as all cloud ERP providers claim continuous and often unnoticeable system upgrades and updates as an absolute and unconditional benefit of public cloud software users. However, it turns out that a significant number of manufacturing companies feel uncomfortable with permanent automatic updates, and they still want to be able to fully test, prepare, schedule, and implement newly available functions. This is because those functions may interfere with core business processes and may require re-engineering and additional training for users. In such an environment, companies may opt to turn off or simply ignore much of the already available functionality.

Flexibility and Scalability

The high level of flexibility and scalability of cloud-based software appear to be strong marketing points, and hence weapons, for cloud-based ERP vendors. A high level of scalability is obviously a strong argument in favor of SaaS ERP software. Indeed, for a medium-sized company, public cloud ERP offers a virtually unlimited number of user workplaces—it can be limited only by technical restrictions, e.g., in the case where a vendor's data centers far exceed the requirements of a medium or even large customer. Another benefit of SaaS software is that it can be scaled up exponentially within a very short time frame. As customers don't need to manage their own server capacity, if they need to increase the number of users, they need only provide them with access devices and reach an agreement with the software provider about the new number of users. Similarly, cloud-based ERP customers can easily scale down the number of users, assuming the vendor agrees (and a service level agreement [SLA] should foresee this option). In contrast, for on-premises or and hardware-hosting variants, the process of scaling up or down is much more complicated—the company typically has to carry all licenses, no matter what the optimal user load is.

Flexibility, however, requires deeper investigation. The first question to ask a vendor is what exactly vendors mean when they use the term "flexibility." If they mean the ability of the software to adapt to possible future changes to internal business processes, the business environment as a whole, or other type of changes, then flexibility reflects how easy it is to make necessary changes within the software. Within this definition, the product deployment method would be irrelevant—as flexibility touches the system's internal logic, code structure, and other software architecture specifics, and has nothing to do with deployment processes. But if vendors use the term "flexibility" to describe the ease with which they can increase or decrease the number of users, and obtain access in other countries and regions, then cloud ERP software has a natural advantage over on-premises solutions.

Web-based and Global Access

Web-based manufacturing ERP software isn't something new—the vast majority of vendors have been successfully developing and offering it for many years, regardless of deployment mode. However, delivery via a Web browser is the only option technically feasible for public cloud ERP. The average user likely doesn't care whether the software is delivered via the Web; the delivery mode depends on the preference of the particular customer. But Web-based ERP typically has a smaller footprint, and requires fewer technical parameters for user access via mobile devices. And as the mobile device usage capability is organically embedded, it allows for easier access from anywhere at anytime. Considering the exponential growth of multinational activities in the manufacturing business over recent decades, easy access to a public cloud ERP system from any device and from anywhere in the world at anytime has become a critical factor in the success of many manufacturing companies. It is indeed a notable competitive advantage of cloud ERP over traditional ERP deployment models.

The cloud isn't the only delivery method that allows for mobile enablement; however, it is obviously easier with the cloud. On-premises ERP software, even though it is Web-based, does not provide the same level of freedom as cloud-based software, and assumes certain connection limitations due to its technical nature. If required, on-premise ERP can afford remote access to its users, but that would entail a more complicated and therefore more expensive process.

Uptime and Infrastructure

The availability of cloud-based ERP software 24/7 is the responsibility of the vendor. However, it is also critically dependent on the availability of a 100% reliable Internet connection channel that has sufficient bandwidth to provide the necessary transfer speed of the data transactions. As no provider can guarantee a fully functional Internet connection all the time, a good practice for companies running cloud-based ERP is to obtain a redundant Internet connection (or multiple connections) that uses an alternative communication channel, and to use it in parallel or keep it as a mandatory backup measure—in order to provide access to vital ERP information without any interruptions.

The channel's required bandwidth also critically affects the performance of the cloud ERP system. The bandwidth's capacity should be high enough to accommodate the constantly increasing needs of the system. As the volume of ERP-generated data continues to increase at an unprecedented pace, companies that use cloud ERP should be willing to continuously improve their Internet access channels. On-premises ERP solutions may also rely on the quality of the Internet connection, but this dependency is far below 100%.

In terms of the technical infrastructure necessary for ERP system functioning, the SaaS and hosted options have fewer technical requirements than the traditional on-premises model. They are more cost-effective simply because they require significantly less hardware on-site. Regardless of the deployment choice, companies need an internal secure network and Internet access. The existence of cloud variants suggests that companies can abandon the complex and cumbersome server farm. This is an important value-add for cloud-based ERP software—that many manufacturing businesses greatly appreciate.

But what are the concerns expressed by the ERP user community regarding cloud-based ERP? If we look at TEC's survey results (multiple answers allowed per respondent), we can see that the biggest concerns with cloud-based ERP software are security, expressed by 14.9% of respondents, and performance limitations, expressed by 12.7% of respondents (see figure 2). Concerns about data ownership in the SaaS model were selected by 11.4% of respondents. A total of 33.6% of respondents expressed concerns related to a third-party intermediator between a company and its data. If we break down this percentage, we can see that 14.9% of respondents had specific concerns about security, 11.4% about data ownership, and 7.3% about unclear data location. At the same time, only 3.9% of respondents noted a general mistrust of the cloud as a deployment option.

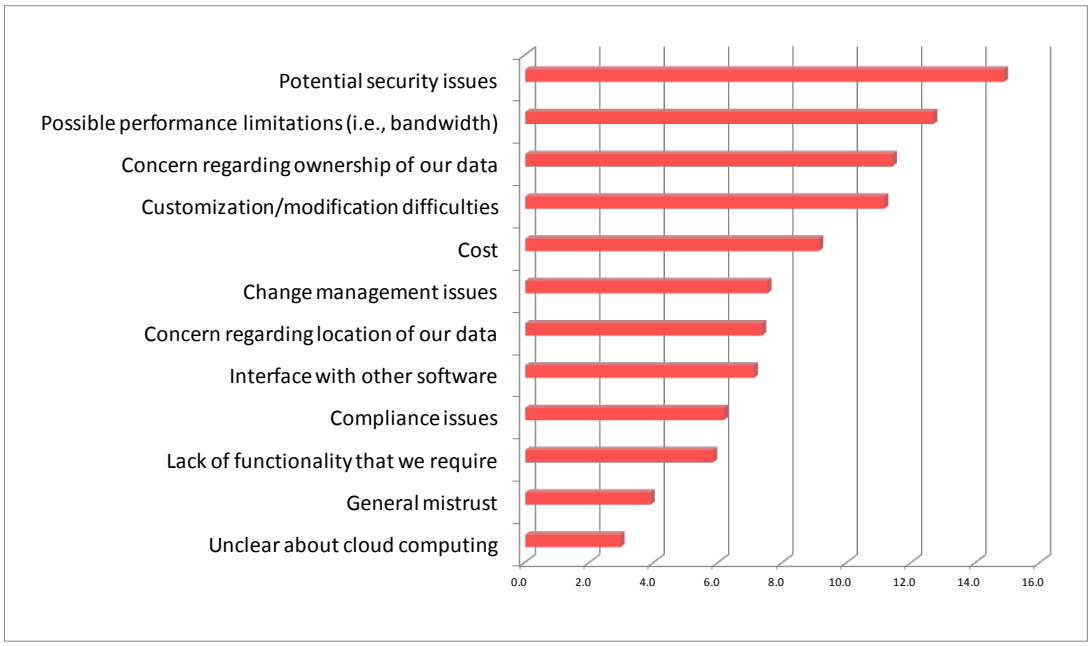

Figure 2. Percentage of respondents expressing specific concerns about cloud ERP software (TEC survey)

The most attractive qualities of cloud ERP software reside in the financial area—13.7% of respondents mentioned reduction of required IT staff, resources, and infrastructure, and 13.4% mentioned lower total cost of ownership (see figure 3). The combined percentage totals more than a quarter of all respondents (multiple answers allowed). If the "no capital investment required" reason (9.2%) is added, 36.3% of respondents believe that different aspects of the financial realm are the most important considerations in selecting cloud ERP over its on-premises competitors.

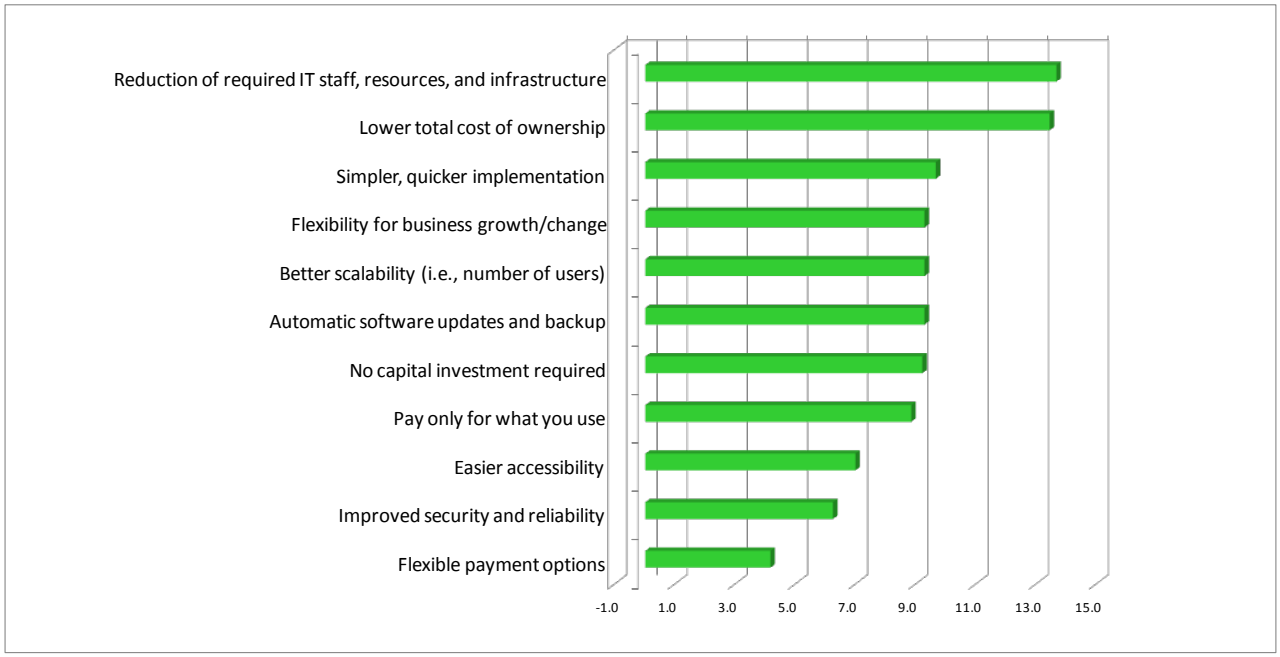

Figure 3. Percentage of respondents citing specific reasons why cloud ERP software is an attractive option (TEC survey)

When Cloud ERP Systems Appeal to Manufacturers

Manufacturing companies typically will not replace their on-premises system with a cloud-based ERP just for the sake of switching to the cloud. While there is no doubt that manufacturing companies are ultimately hopping onto the cloud, the pace of the migration differs for different types of companies and business situations. Below is a list of specific business scenarios where cloud-resided applications may be specifically recommended. In these scenarios, the embedded capabilities of cloud-based ERP systems can translate to direct benefits for manufacturers:

- Global organizations, and manufacturing companies with multiple facilities scattered across countries and regions. A two-tier ERP strategy consisting of local ERP systems combined with a global cloud-based ERP allows for easier information gathering from distant facilities and global data consolidation and analysis.
- Smaller organizations that can't afford a traditional on-premises ERP infrastructure but require a comparable level of functionality due to the complexity of their business processes.
- Businesses that prefer not to deal with the complexity of an IT infrastructure but rather need to focus on the business. This includes manufacturing companies that embrace the lean business philosophy, which considers any non-value–adding activities as a waste to be reduced and eventually eliminated.
- Newly created manufacturing businesses or new facilities that start operating from scratch, and organizations in the process of creating or reforming their manufacturing facilities and supply chains. It is significantly easier and faster to start on the cloud than it is to move there, as business processes will not be interrupted. Manufacturing companies that return their manufacturing operations from other countries (re-shoring) may also find cloud ERP to be an attractive option.
- Manufacturing companies that require enhanced mobility for their ERP users. Natively Web-based ERP software will benefit users who, for instance, may need to travel between multiple remote facilities and require ERP access from mobile or other devices.
- Manufacturing companies that use social media channels, internally or externally. Social media enablement is better and easier with cloud-based ERP software, as cloud platforms typically provide effective means for embedding social media tools.

Conclusion

Many viable deployment models may be suitable for various business situations. But there is no single answer for every company. The choice of ERP deployment option depends on dozens of unique factors specific to your company. These include strategy, industry market and vertical, type of manufactured products, geographical presence, company size, and ownership structure, among many others.

A combination of the cloud with traditional software may be an option worth serious consideration. The hybrid approach allows manufacturing companies to embrace the benefits of cloud ERP initially with non–mission-critical applications or non-transactional areas of business software. An option for those companies that prefer to keep their data inside their walls could be a private cloud deployment, which combines the scalability and flexibility of cloud ERP with the security and data ownership benefits of on-premises software.

Recommendation

Any deployment mode brings value to companies, and cloud deployment is the newest among them. Every manufacturer should conduct a thorough evaluation of the deployment model criteria based on the company's strategy, and its specific preferences and limitations—and should consider all possible ERP software arrangement options in order to select the product that best fits its business needs and future vision.

Functionality	Acumatica Acumatica Cloud ERP 5.3	Epicor Software Epicor Cloud ERP	Hatteland RamBase	IFS IFS Applications 9
Financials				
Accounting—general ledger (GL), accounts payable (AP), accounts receivable (AR), cash management	S	S	S	S
Fixed assets	S	S	S	S
Cost accounting	S	S	S	S
Budgeting	S	S	PS	S
Project accounting	S	S	PS	S
Support for lean accounting (value streams, target costing, non-standard reporting, etc.)	PS	S	PS	S
Human Resources				
Personnel management, employee self-service	PS	S	PS	S
Payroll/Benefits	S	S	A/S	A/S
Health and safety	M/C	M/C	PS	S
Training management	M/C	PS	NS	S
Discrete Manufacturing Management				
Production planning and scheduling	S	S	A/S	S
Product costing	S	S	S	S
Shop floor control	S	S	S	S
Product data management (PDM)	PS	S	S	S
Product/Item configurator	NS	S	PS	S
Project-based manufacturing	NS	S	S	S
Support for lean manufacturing (pull production, Kanban, takt time, lean planning, etc.)	PS	S	PS	S
Process Manufacturing Management				
Formulas, recipes, and routings	PS	PS	NS	S
Process batch control and tracking	S	PS	NS	S
Process manufacturing costing	S	S	NS	S
Material management	S	S	NS	S
Conformance reporting	PS	PS	NS	S
Manufacturing execution systems (MES) integration	A/S	S	NS	S
Inventory Management				
Inventory management and processing	S	S	S	S
Locations and lot control, including lot inheritance	S	S	S	S
Forecasting	A/S	S	PS	S
Reservations and allocations	S	S	S	S
Purchasing Management				
Supplier profiles and ratings	S	S	S	S
Requisitions and quotations	S	S	S	S
Purchase order management	S	S	S	S
Vendor contracts and agreements	S	S	PS	S
Quality and Regulatory Compliance				
Quality management	A/S	S	S	S
Regulatory compliance (e.g., FDA, EU, etc.)	PS	S	PS	S
Sales Management				
Sales order management, pricing	S	S	S	S
Available-to-promise (ATP)	NS	S	S	S
Customer service and returned goods handling	S	S	S	S
Customer relationship management (CRM)	S	S	S	S
Business Platform Capabilities				
Customization and configuration capabilities	S	S	S	S
Document management	S	S	S	S
Workflow, alerts, and notifications	S	S	S	S
Business process management (BPM)	PS	S	PS	S
Customizable reporting and analysis tools	S	S	S	S
Business intelligence (BI) and analytics	S	S	A/S	S
Barcoding and radio-frequency identification (RFID)	A/S	S	A/S	PS
Mobile devices support	S	S	PS	S
Social collaboration tools	S	S	A/S	S
Audit history and trails	S	S	S	S
Integration tools	S	S	PS	S
Globalization and Localization				
Multicurrency capabilities	S	S	S	S
Multicompany support	S	S	S	S
Multilanguage support	S	S	S	S
Multiple legislations support	A/S	S	PS	S
Delivery Mode				
On premise	S	S	NS	S
Hosted	S	S	NS	S
Multitenant cloud based (public cloud)	S	S	NS	NS
Single-tenant cloud based (private cloud)	S	NS	S	S

S, Fully supported out-of-the-box | NS, Not supported | PS, Partially supported out-of-the-box | A/S, Supported via a partner's add-on or solution | M/C, Supported by modification or customization.

Functionality	Infor CloudSuite Industrial 9.00.30	IQMS IQMS ERP 2015	Kenandy Kenandy Cloud ERP	Microsoft AX7 Cloud version
Financials				
Accounting—general ledger (GL), accounts payable (AP), accounts receivable (AR), cash management	S	S	S	S
Fixed assets	S	S	S	S
Cost accounting	S	S	PS	M/C
Budgeting	S	S	S	S
Project accounting	S	PS	M/C	S
Support for lean accounting (value streams, target costing, non-standard reporting, etc.)	S	M/C	NS	PS
Human Resources				
Personnel management, employee self-service	S	S	NS	PS
Payroll/Benefits	S	S	NS	A/S
Health and safety	S	S	NS	S
Training management	S	S	NS	S
Discrete Manufacturing Management				
Production planning and scheduling	S	S	NS	S
Product costing	S	S	PS	S
Shop floor control	S	S	NS	S
Product data management (PDM)	S	S	NS	S
Product/Item configurator	S	S	NS	S
Project-based manufacturing	S	S	NS	S
Support for lean manufacturing (pull production, Kanban, takt time, lean planning, etc.)	S	S	NS	PS
Process Manufacturing Management				
Formulas, recipes, and routings	S	S	NS	S
Process batch control and tracking	S	S	NS	S
Process manufacturing costing	S	S	NS	S
Material management	S	S	NS	S
Conformance reporting	S	S	NS	S
Manufacturing execution systems (MES) integration	S	S	NS	S
Inventory Management				
Inventory management and processing	S	S	S	S
Locations and lot control, including lot inheritance	S	S	PS	S
Forecasting	S	S	PS	S
Reservations and allocations	S	S	PS	S
Purchasing Management				
Supplier profiles and ratings	S	S	NS	S
Requisitions and quotations	S	S	PS	S
Purchase order management	S	S	S	S
Vendor contracts and agreements	S	S	PS	PS
Quality and Regulatory Compliance				
Quality management	S	S	NS	S
Regulatory compliance (e.g., FDA, EU, etc.)	S	S	NS	S
Sales Management				
Sales order management, pricing	S	S	S	S
Available-to-promise (ATP)	S	S	PS	S
Customer service and returned goods handling	S	S	PS	S
Customer relationship management (CRM)	S	S	A/S	S
Business Platform Capabilities				
Customization and configuration capabilities	S	S	S	S
Document management	S	S	PS	S
Workflow, alerts, and notifications	S	S	A/S	S
Business process management (BPM)	S	S	NS	S
Customizable reporting and analysis tools	S	S	A/S	S
Business intelligence (BI) and analytics	S	S	PS	S
Barcoding and radio-frequency identification (RFID)	S	S	NS	PS
Mobile devices support	S	S	S	S
Social collaboration tools	S	NS	A/S	S
Audit history and trails	S	S	S	S
Integration tools	S	S	A/S	S
Globalization and Localization				
Multicurrency capabilities	S	S	PS	S
Multicompany support	S	PS	PS	S
Multilanguage support	S	S	NS	S
Multiple legislations support	S	S	PS	S
Delivery Mode				
On premise	S	S	NS	S
Hosted	S	S	NS	S
Multitenant cloud based (public cloud)	S	S	S	S
Single-tenant cloud based (private cloud)	S	S	NS	S

S, Fully supported out-of-the-box | NS, Not supported | PS, Partially supported out-of-the-box | A/S, Supported via a partner's add-on or solution | M/C, Supported by modification or customization.

Functionality	NetSuite, Inc. NetSuite One World 15.2	Oracle Oracle Applications Cloud R11	Plex Systems The Plex Manufacturing Cloud	ProcessPro Premier On-Demand 10.5
Financials				
Accounting—general ledger (GL), accounts payable (AP), accounts receivable (AR), cash management	S	S	S	S
Fixed assets	S	S	S	A/S
Cost accounting	S	S	S	S
Budgeting	S	S	S	S
Project accounting	S	S	S	S
Support for lean accounting (value streams, target costing, non-standard reporting, etc.)	A/S	NS	S	S
Human Resources				
Personnel management, employee self-service	S	S	S	A/S
Payroll/Benefits	A/S	S	A/S	A/S
Health and safety	A/S	A/S	S	A/S
Training management	A/S	S	PS	A/S
Discrete Manufacturing Management				
Production planning and scheduling	S	PS	S	S
Product costing	S	S	S	S
Shop floor control	S	M/C	S	S
Product data management (PDM)	A/S	S	S	S
Product/Item configurator	A/S	S	S	NS
Project-based manufacturing	PS	M/C	S	NS
Support for lean manufacturing (pull production, Kanban, takt time, lean planning, etc.)	S	PS	S	PS
Process Manufacturing Management				
Formulas, recipes, and routings	S	PS	PS	S
Process batch control and tracking	S	NS	PS	S
Process manufacturing costing	S	NS	PS	S
Material management	S	PS	S	S
Conformance reporting	S	M/C	S	S
Manufacturing execution systems (MES) integration	S	PS	S	S
Inventory Management				
Inventory management and processing	S	S	S	S
Locations and lot control, including lot inheritance	S	PS	S	S
Forecasting	S	S	S	S
Reservations and allocations	S	S	PS	S
Purchasing Management				
Supplier profiles and ratings	S	S	S	S
Requisitions and quotations	S	S	S	S
Purchase order management	S	S	S	S
Vendor contracts and agreements	S	S	S	S
Quality and Regulatory Compliance				
Quality management	S	PS	S	S
Regulatory compliance (e.g., FDA, EU, etc.)	M/C	M/C	S	S
Sales Management				
Sales order management, pricing	S	S	S	S
Available-to-promise (ATP)	S	S	M/C	S
Customer service and returned goods handling	S	S	S	S
Customer relationship management (CRM)	S	S	A/S	A/S
Business Platform Capabilities				
Customization and configuration capabilities	S	S	S	S
Document management	S	S	S	S
Workflow, alerts, and notifications	S	S	S	S
Business process management (BPM)	S	S	NS	S
Customizable reporting and analysis tools	S	S	S	S
Business intelligence (BI) and analytics	S	S	S	S
Barcoding and radio-frequency identification (RFID)	PS	S	S	PS
Mobile devices support	S	S	S	S
Social collaboration tools	S	S	S	NS
Audit history and trails	S	S	S	S
Integration tools	S	S	S	S
Globalization and Localization				
Multicurrency capabilities	S	S	S	S
Multicompany support	S	S	S	S
Multilanguage support	S	S	S	NS
Multiple legislations support	S	S	S	NS
Delivery Mode				
On premise	NS	NS	NS	S
Hosted	NS	NS	NS	S
Multitenant cloud based (public cloud)	S	S	S	S
Single-tenant cloud based (private cloud)	NS	S	NS	S

S, Fully supported out-of-the-box | NS, Not supported | PS, Partially supported out-of-the-box | A/S, Supported via a partner's add-on or solution | M/C, Supported by modification or customization.

Functionality	Ramco Systems Ramco Enterprise Series 5.2	Rootstock Software Rootstock Manufacturing Apps 2.1	SAP SAP Business ByDesign 1511	SAP SAP Business One 9.1
Financials				
Accounting—general ledger (GL), accounts payable (AP), accounts receivable (AR), cash management	S	S	S	S
Fixed assets	S	A/S	S	S
Cost accounting	S	S	S	S
Budgeting	S	PS	S	S
Project accounting	S	S	S	PS
Support for lean accounting (value streams, target costing, non-standard reporting, etc.)	S	S	PS	S
Human Resources				
Personnel management, employee self-service	S	A/S	S	PS
Payroll/Benefits	S	A/S	A/S	A/S
Health and safety	PS	A/S	A/S	A/S
Training management	S	A/S	A/S	A/S
Discrete Manufacturing Management				
Production planning and scheduling	S	S	S	S
Product costing	S	S	S	S
Shop floor control	S	S	S	A/S
Product data management (PDM)	S	A/S	A/S	A/S
Product/Item configurator	A/S	S	NS	A/S
Project-based manufacturing	S	S	NS	A/S
Support for lean manufacturing (pull production, Kanban, takt time, lean planning, etc.)	S	S	PS	M/C
Process Manufacturing Management				
Formulas, recipes, and routings	S	S	NS	A/S
Process batch control and tracking	S	S	PS	A/S
Process manufacturing costing	S	S	PS	A/S
Material management	S	S	S	A/S
Conformance reporting	S	M/C	S	A/S
Manufacturing execution systems (MES) integration	A/S	M/C	A/S	A/S
Inventory Management				
Inventory management and processing	S	S	S	S
Locations and lot control, including lot inheritance	S	S	S	S
Forecasting	S	S	S	S
Reservations and allocations	S	S	S	S
Purchasing Management				
Supplier profiles and ratings	S	PS	S	S
Requisitions and quotations	S	S	S	S
Purchase order management	S	S	S	S
Vendor contracts and agreements	S	S	S	S
Quality and Regulatory Compliance				
Quality management	S	A/S	S	A/S
Regulatory compliance (e.g., FDA, EU, etc.)	A/S	A/S	PS	A/S
Sales Management				
Sales order management, pricing	S	S	PS	S
Available-to-promise (ATP)	S	S	S	S
Customer service and returned goods handling	S	S	S	S
Customer relationship management (CRM)	S	A/S	S	S
Business Platform Capabilities				
Customization and configuration capabilities	S	S	S	S
Document management	A/S	S	PS	S
Workflow, alerts, and notifications	S	S	PS	S
Business process management (BPM)	A/S	A/S	PS	M/C
Customizable reporting and analysis tools	S	S	S	S
Business intelligence (BI) and analytics	S	S	S	S
Barcoding and radio-frequency identification (RFID)	A/S	S	A/S	A/S
Mobile devices support	S	S	S	S
Social collaboration tools	A/S	S	NS	M/C
Audit history and trails	S	S	S	S
Integration tools	S	A/S	S	S
Globalization and Localization				
Multicurrency capabilities	S	S	S	S
Multicompany support	S	S	S	S
Multilanguage support	M/C	A/S	S	S
Multiple legislations support	S	M/C	S	S
Delivery Mode				
On premise	S	NS	NS	S
Hosted	S	NS	NS	S
Multitenant cloud based (public cloud)	S	S	S	S
Single-tenant cloud based (private cloud)	S	NS	S	S

S, Fully supported out-of-the-box | NS, Not supported | PS, Partially supported out-of-the-box | A/S, Supported via a partner's add-on or solution | M/C, Supported by modification or customization.

Functionality	Softland ERP 7	SYSPRO SYSPRO 7.1	VAI S2K Enterprise Management Software 5.5	xTuple xTuple ERP Enterprise Edition 4.10.x
Financials				
Accounting—general ledger (GL), accounts payable (AP), accounts receivable (AR), cash management	S	S	S	S
Fixed assets	S	S	S	S
Cost accounting	S	S	S	S
Budgeting	S	S	PS	S
Project accounting	S	PS	PS	S
Support for lean accounting (value streams, target costing, non-standard reporting, etc.)	S	S	PS	NS
Human Resources				
Personnel management, employee self-service	S	A/S	A/S	M/C
Payroll/Benefits	S	A/S	A/S	A/S
Health and safety	S	A/S	A/S	A/S
Training management	PS	A/S	A/S	NS
Discrete Manufacturing Management				
Production planning and scheduling	S	S	S	S
Product costing	S	S	S	S
Shop floor control	NS	S	S	S
Product data management (PDM)	S	A/S	S	S
Product/Item configurator	S	S	S	PS
Project-based manufacturing	S	S	S	S
Support for lean manufacturing (pull production, Kanban, takt time, lean planning, etc.)	S	S	S	S
Process Manufacturing Management				
Formulas, recipes, and routings	S	S	S	S
Process batch control and tracking	S	S	S	S
Process manufacturing costing	S	S	S	S
Material management	S	S	S	S
Conformance reporting	S	S	S	PS
Manufacturing execution systems (MES) integration	S	A/S	S	M/C
Inventory Management				
Inventory management and processing	S	S	S	S
Locations and lot control, including lot inheritance	S	S	S	S
Forecasting	S	S	S	S
Reservations and allocations	S	S	S	S
Purchasing Management				
Supplier profiles and ratings	S	S	S	S
Requisitions and quotations	S	S	S	S
Purchase order management	S	S	S	S
Vendor contracts and agreements	S	A/S	S	S
Quality and Regulatory Compliance				
Quality management	PS	S	S	PS
Regulatory compliance (e.g., FDA, EU, etc.)	PS	S	S	S
Sales Management				
Sales order management, pricing	S	S	S	S
Available-to-promise (ATP)	S	S	S	S
Customer service and returned goods handling	S	S	S	S
Customer relationship management (CRM)	S	S	S	S
Business Platform Capabilities				
Customization and configuration capabilities	S	S	S	S
Document management	PS	A/S	S	S
Workflow, alerts, and notifications	S	S	S	S
Business process management (BPM)	A/S	S	S	PS
Customizable reporting and analysis tools	S	S	S	S
Business intelligence (BI) and analytics	S	S	S	PS
Barcoding and radio-frequency identification (RFID)	S	S	S	S
Mobile devices support	PS	S	S	S
Social collaboration tools	PS	A/S	S	S
Audit history and trails	S	S	S	S
Integration tools	S	S	S	S
Globalization and Localization				
Multicurrency capabilities	S	S	S	S
Multicompany support	S	S	S	S
Multilanguage support	S	S	S	S
Multiple legislations support	S	S	S	PS
Delivery Mode				
On premise	S	S	S	S
Hosted	S	S	S	S
Multitenant cloud based (public cloud)	PS	NS	NS	S
Single-tenant cloud based (private cloud)	PS	S	S	S

S, Fully supported out-of-the-box | NS, Not supported | PS, Partially supported out-of-the-box | A/S, Supported via a partner's add-on or solution | M/C, Supported by modification or customization.

TEC Resources

Articles and Reports

- 2015 ERP Snapshot: Manufacturers' Business and Technology Challenges
- Back to Basics: Cloud Computing 101

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- Epicor's Global ERP Software to Further Company's New Customer-centric Approach
- Infor CloudSuite—No Two Clouds Should Be Alike
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Related White Papers

- Combining the Flexibility of Public Cloud Apps with the Security of Private Cloud Data
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- The SaaS ERP Applications Landscape
- The State of Manufacturing Technology
- Top 10 Reasons to Buy a New ERP Now
- Moving to the Cloud: Understanding the Total Cost of Ownership

> "While every technology deployment comes with its own unique set of challenges, the TEC process was more efficient from the perspective of both cost and time."
>
> **—Bob Lloyd, Manager, Business and Logistics Solutions, Flakeboard Ltd.**

TEC's Enterprise Software Selection Services

Technology Evaluation Centers (TEC) is the impartial advocate for the enterprise software purchaser. TEC helps companies like yours choose the enterprise software solutions that best meet their unique business requirements. Our selection services can help ensure the success of your next software selection project—quickly, impartially, and cost-effectively.

TEC's approach combines comprehensive research, industry-leading decision support technology, a proven selection methodology, and the expertise of our analysts. We can help you

- bring objectivity and transparency to the selection process,
- choose the solution that best satisfies your specific business requirements,
- reduce the cost, risk, and duration of your selection project, and
- offer rational financial justifications, and provide a clear audit trail.

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5 Guiding Principles for Success in Enterprise Software Selection

Software selection is among the most important decisions companies ever have to make. Technology is not just a framework for business processes but a tool that can be used to improve processes, increase competitive advantage, and better the bottom line.

Denis Rousseau, Director of Project Delivery, Selection Services, at Technology Evaluation Centers (TEC), has helped dozens of companies with their software selection projects in a career spanning more than 25 years. He has developed five guiding principles that he says can make or break success in enterprise software selection.

1. Examine your motives

The first step in a software selection process is to closely examine the rationale for acquiring a new software solution. "The very first question to ask—and make sure really gets answered—is 'why are we acquiring a new system?' Is it because of expansion at the manufacturing plant, getting rid of an old system because it no longer suits your needs, or because of a recent acquisition? If you can't make a real business case for it, the process later on won't work," says Rousseau.

This is a critical stage in software selection, because it allows for the most important foundations—clarity and commitment. A unified focus with clear objectives. When this decision is made well and communicated to the right people, you empower the process from the beginning and set off on the right foot.

2. Make it a business decision, not an IT decision

Upper management commonly misperceives software selection as the territory of the information technology (IT) department alone. But assigning the work chiefly to IT without involving all affected departments can mean the final selection decision is both uninformed and unsupported by the final users: the very worst scenario for what amounts to a very big decision.

To avoid strong resistance during software implementation, or even worse, having to make a "bad fit" software system mesh with your business processes, it's wise to realize from the outset that software selection needs to be a holistic business decision with high-level sponsorship. That means all C-level executives and implicated department managers need to be involved from the start, including in the initial decision to move ahead.

3. Deploy the right team

Rousseau has identified three key roles to fill when starting the enterprise software selection process in earnest: a *sponsor*, a *project manager*, and *internal subject matter experts*.

Every software selection project needs a sponsor. He or she should come from a level of management that has influence over all the areas of the organization that will be supported by the new system. This may be a C-level executive if the solution is to be used to standardize business processes in a smaller company. Or it may be the head of a specific division if the solution will involve limited operations. The sponsor will add visible support to the selection process, and can help to work out any higher issues that arise.

The software selection process also requires a dedicated *project manager* to oversee the process from start to finish. The project manager may come from within the organization or be brought in from the outside. He or she is responsible for ensuring the appropriate resources are identified and assigned to different phases of the project, tasks are coordinated in a logical manner, milestones are achieved as anticipated, and emerging issues are promptly addressed. Communicating the project plan and their role within the overall plan to all participants is key.

Lastly, Rousseau emphasizes that you must spend time identifying the people in your company who are s*ubject matter experts (SMEs)*—knowledgeable staff with a deep understanding of how the business works on a daily basis. He recommends casting a wide net when identifying these SMEs, as they may include senior staff with years of inside knowledge of the business as a whole, or junior employees with the vision to imagine how new software may create efficient change.

With their specific expertise in company processes, these stakeholders play a key role in the crucial requirements-gathering phase. "People who actually understand the business processes best need to be involved at the start, respected as opinion leaders, and conceived of as the future power users of the solution," says Rousseau.

4. Let your business requirements write the map

In the beginning stages, the only criteria appropriate to consider are the features and functions needed to support the relevant business processes. Everything else is secondary, including cost, cautions Rousseau. "There's no point purchasing a solution in your price range if it doesn't do what you need it to. Focus first on defining your business requirements to the exclusion of all else."

Rousseau emphasizes that the thoroughness of the requirements-mapping phase is crucial to success, and that this is where most companies fall short. "You have to establish a basis for comparison which includes critical deal-breaking items. It's the small details that can make a system entirely unsuitable," says Rousseau, recalling the case of a coffee producer who selected an accounting solution without realizing it could not handle their unique accounting-periods calendar.

Taking inventory of business processes and establishing subsequent requirements sounds simple but can be surprisingly difficult, especially from the inside. Experts in business process management and software selection can shorten the time it takes to elicit clarity from SMEs and other stakeholders, which brings us to the last of Rousseau's essential guidelines.

5. Match the sales proficiency of software vendors with software selection expertise

Much like commercial real estate or mergers and acquisitions, enterprise software selection should be understood as a unique area of specialization with its own experts, methodologies, and sets of tools. Software vendors are highly specialized sales professionals who should be met with equal proficiency on the buyer's side.

Would you allow someone without any experience to do your materials selection and purchasing for you? Probably not. "Just the same," says Rousseau, "don't leave software selection to someone without the necessary experience to be efficient and effective the first time around. Consider who is in charge of your next software selection initiative, and if they don't have extensive experience in this area, look to get them the help they need."

That help may come in several forms. Software industry analysts can shed light on what's available and trending in software application areas, and can tailor to specific industries and verticals. Tools like decision support systems are available to focus your selection process and define your business requirements. And selection consultants come armed with incomparable expertise in selection methodology, vendor tactics, and best practices for optimal outcomes.

As Rousseau concludes, "Software selection is a high-stakes gambit. I've seen costly disasters and fantastic successes. But you can significantly improve the risk-to-reward ratio if you think

> "Don't leave software selection to someone without the necessary experience to be efficient and effective the first time around."
>
> Denis Rousseau, Director of Project Delivery, Selection Services, Technology Evaluation Centers

carefully about your motives, involve the right staff, let your business requirements lead, and bring in some form of expertise to even the playing field."

> "Software selection is a high-stakes gambit. But you can significantly improve the risk-to-reward ratio if you think carefully about your motives, involve the right staff, let your business requirements lead, and bring in some form of expertise to even the playing field."

Denis Rousseau, Director of Project Delivery, Selection Services, Technology Evaluation Centers

Read more about TEC's approach to software selection and assessment.

To learn more about our enterprise software evaluation and selection services, visit the TEC website or email us.

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Vendor Directory

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Visibility Corporation	www.visibility.com
xTuple	www.xtuple.com

About the Author

Aleksey Osintsev, as a research analyst at TEC, focuses on the areas of ERP for manufacturing, accounting and financial software, as well as retail solutions. He has more than 18 years of experience in manufacturing and private sector IT, from both the ERP application user and the corporate software development sides.

Prior to joining TEC, Osintsev was a project manager and chief information officer (CIO) at a smart instrumentation engineering, manufacturing, and servicing company. He led the IT department and was responsible for business systems, including ERP selections, implementation projects, and business processes change management. More recently, Osintsev went through a number of successful ERP implementations, system upgrades, and business management projects as a project coordinator and consultant in the food processing, electronic manufacturing, and apparel industries.

Osintsev earned his master's degree in industrial engineering and business administration.

Technology Evaluation Centers (TEC) is the world's leading provider of software selection resources, services, and research materials, helping organizations evaluate and select the best enterprise software for their needs. With its advanced decision-making process and software selection experts, TEC reduces the time, cost, and risk associated with enterprise software selection.

Over 3.5 million subscribers leverage TEC's extensive research and detailed information on more than 1,000 leading software solutions across all major application areas. TEC is recognized as an industry-leading software selection advisory firm offering resources and services both online and onsite. For more information, please visit www.technologyevaluation.com.

Cloud ERP Buyer's Guide for Manufacturing

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March 2016

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