

## **I-ERP: New Age Management Tool-Opportunities and Challenges**

**Nidhi Jain**

Research Ph.D. Scholar, Amity Business School, Amity University, Uttar Pradesh  
Noida, India, [nidhijn24@gmail.com](mailto:nidhijn24@gmail.com)

**Abstract**—Enterprise resource planning (ERP) is the most revolutionary software development and maintenance an organization is holding these days. ERP applications in any organization consist of significant processes and platforms incurring huge investments and resources. ERP systems espouse different business processes from all areas of operations in Business. I-ERP is an intelligent way of operating ERP systems in a business eco shell. I-ERP introduces a smart way of connecting business processes and operations to the outer internet and more outreach world and leveraging the benefits disruption of smart technologies which is taking the world to a new era of digital transformation. Business is now reaching endless limits of new technology as compared to Classic ERP where the company was working in silos and within limited integration options within the organization environment. I-ERP is a kind of archetypal cloud model where the distribution of computing facilities like servers, technical development, databanks, network, software, etc. transpires over the “The Cloud”. I-ERP is a model on Cloud and is not just a catchphrase rather an uprising model of the modern world which offers rapid modernization, flexible resources at much lower costs as compared to Classic ERP. Intelligent ERP provides several opportunities and benefits despite many threats and challenges. Moving Classic ERP to the I-ERP can accelerate the digital upheaval and expose numerous commercial benefits like faster time to market for new technologies, disrupts IT infrastructure costs, rapidly identifying new business prospects and revenue streams. This paper intends to identify and explore I-ERP and its benefits, challenges, and opportunities. This paper will be useful to potential intelligent ERP adopters as well as service providers.

**Keywords**---ERP, I-ERP, Cloud Computing, ERP on Cloud, SaaS, I-ERP Architecture, Digital Transformation, I-ERP opportunities, I-ERP Challenges.

### **INTRODUCTION**

“The term Enterprise Resource Planning (ERP) was first popularized by the Gartner Group in the 1990s to define software that integrates every business process starting from manufacturing to Payroll of a company” [1]. In the 1990s, ERP was mostly implemented on the client’s servers and data centers. With the upheaval of internet and cloud technologies, different software facilities are increasingly delivered over the cloud. Organizations mainly see the right cloud and smart architecture for leveraging the benefits of the digital revolution by turning ERP implementation and Upgrade to I-ERP into a business prospect. Today, every enterprise likes to see real-time insights into their business in shorter timeframes. “I-ERP system is an ERP system that is rendered stacked with cloud architecture” [2]. Intelligent and smart ERP is equipped with improved automated business processes and the ability for acclimatization and business with suppliers, partners, and customer gateways. ERP modernization with The Cloud can eventually sustenance companies better guard themselves against adversaries and variations in the marketplace and become disruptors themselves by leveraging virtualization. Nevertheless, there is more to study while adopting I-ERP which outlines and compares opportunities with challenges it has to offer.

## ENTERPRISE RESOURCE PLANNING

“ERP is undoubtedly one of the most noteworthy and most widespread information systems for business enterprises, that was first used in the 1990s” [3]. “Enterprise resource planning (ERP) is the integrated management of core business processes, often in real-time and interceded by software and technology” [4]. “The ERP system is used to integrate the functions of departments in all departments of the organization and to keep in contact with all branches of the organization, regardless of geographical location” [5] [2] [6] [7]. “The integrative characteristics of this system and its ability to exchange information across operational areas using databases have made this solution the most popular among all other information systems” [8] [9] [10]. “ERP integrates database including management of (material, sales and distribution, production, quality management, project management, planning management, service feedback and control, human resource, accounting, and finance with industry best business practices defined by capability maturity model (CMM))” [11] [12]. Thus, ERP is an inclusive software package that goals to integrate the core business functions and processes of an organization as shown in Fig. 1. Each ERP module typically emphasizes one business area like sales, productions, finance, etc. There are also industry-specific solutions provided and available in ERP. With time passing ERP systems eyewitness a lot of variations and alterations, thus leading to upgrading ERP release to enhance its functionalities and capabilities. Different ERP vendors like SAP, Oracle, People Soft, Microsoft, etc. supports enhanced packages and new releases for the current ERP customers. “Classic ERP systems can be classified into two categories – On-premises ERP and Hosted ERP” [13]. In On-Premises ERP, ERP software is maintained at the client level on their servers and physical locations. This deployment model offers complete data protection and control of using its company’s IT infrastructure to connect with people, processes, and systems according to purchased software license systems. However, such benefits come at a huge investment and incremental costs to an enterprise. All kinds of costs including software care, operational management, licensing as well as disaster recovery costs are borne by the enterprise, thus, it is considered a costly ERP deployment model. “Hosted ERP can be defined as a service offered to an individual or an organization by a provider that hosts the physical servers and runs that service somewhere else. The service is most of the time offered through a direct network connection that may or may not run via the internet” [14] [15].



Fig. 1: ERP system and Its Modules [16]

## CLOUD COMPUTING

“Cloud computing technology is the model that is used to enable convenient, on-demand access to the network to any shared pool of the configurable resources of computing that could be rapidly provisioned as well as released with the minimum effort of management or the interaction of any service provider” [17]. It brings different benefits to the company with its access to reach, on-the-fly models, cost-effectiveness, and disruption of IT infrastructure costs. Cloud computing is the popular term used for providing any services over the internet on-demand. Different services like data centers, networks, service centers, BPOs, software implementation, operational maintenance, etc. can be made available to companies over the cloud. All resources and services are pooled over the internet with the Cloud option. Companies have the option to pay for the services till the time they are used. This way expenditure of companies is always in control and IT budgets can be effectively utilized and managed for future enhancements and vision. Enterprises looking for digital transformation find the cloud very innovative as it helps in the growth of the company alongside keeping low operational costs. With the evolution of Cloud Computing, ERP has also changed its way of working. Earlier ERP exists in its internal cohort and integrates within the company environment only. It has no reach to the outside world through the internet and other services. Companies now feel the need to communicate with vendors and customers over a common portal on the internet which can only be possible if their ERP becomes smart enough to operate externally as well. Hence, with the advancement of technology, it is a universal need of every business to move their business over the cloud and make them more tech-savvy and modern. ERP on the cloud gives them that opportunity. Moreover, every ERP vendor now promoting cloud options on their ERP systems to be in this competitive environment. If we talk about SAP, this company has declared that classic ERP companies must mandatorily migrate and upgrade their ERP system to new cloud and smarter versions. Different cloud computing versions are available in the market for the companies to choose from depending upon their business need and requirement.

## CLOUD SERVICE AND DEPLOYMENT MODELS

**Cloud Service Models:** Cloud Service Models are various service offerings or facilities provided by cloud vendors. These are also popularly called Cloud Computing Stack as these models are formulated on top of each other. These models can be further classified into different names based on the services they rendered. **IaaS** (Infrastructure-as-a-Service) is the infrastructure cloud service provided by vendors. The company would pay for only the type of service they utilize to the cloud provider. These services include data servers or virtual machines. AWS (Amazon web services) and Microsoft Azure are some of IaaS examples. **PaaS** (Platform-as-a-Service) is the development and enhancement system service to the customers. The company is given a development environment where they can perform Unit testing, development, and coding of their existing functionalities. This helps companies in managing their system and software operations. Beanstalk and Cloud foundry are some of the types of PaaS models. **SaaS** (Software-as-a-Service) is a widespread archetypal where customers’ application or software needs are met over the internet by cloud providers. This service is mostly on a subscription basis. There are regular security patches and upgrade requirements to software and applications if the company chooses this service. Gmail, Salesforce are some examples of SaaS models. **FaaS** (Function-as-a-Service) is another cloud service on top of PaaS. Coders can run their codes in a smaller environment without disturbing productive systems and servers. This gives flexibility to developers and companies to error and correct codes. FaaS applications

do not require servers until an event occurs and need to transport to a productive environment. “AWS (Lambda), Google Cloud Function are some examples of FaaS” [18].

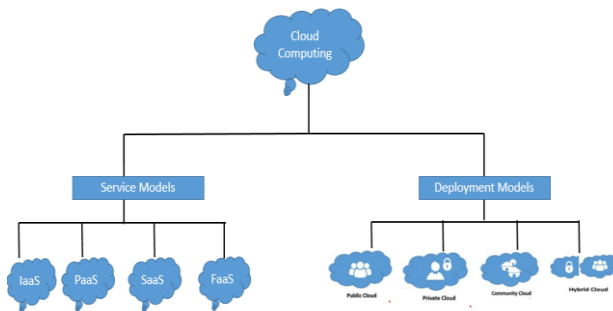


Fig. 2: Cloud Models Classification

**Cloud Deployment Models:** Based on how a company wants to move and deploy their cloud models, it can be further classified as **Public Cloud** – It is a shared pool model where different companies use services of Cloud providers. For example- the server is jointly shared between different companies and is not specific to one- enterprise. **Private Cloud** – This deployment option gives the option to companies to use their private servers or applications under a private cloud and not to share with other enterprises. This ensures the highest security and control to companies where there is no sharing with other companies. **Hybrid Cloud** – This cloud model is a mix of public and private options wherein some services are under the private cloud offer more security while a few services are still under the public cloud model. **Community Cloud** – This model is useful for a similar type of industry that uses the same cloud service and share. The companies can be from different geographical locations with common industry types.

## WHAT IS I-ERP

I-ERP term is first invented by IDC to describe ERP which is smart and intelligently designed to automate and optimize business processes in today’s digital transformation world. I-ERP can be called the backbone of the digital age and cover ERP systems that utilize new technologies and enablers like cloud computing, mobile technologies, big data, analytics, internet of things (IoT), Machine learning, Artificial intelligence, Blockchain technology, and any new technology for enhancing and powering business operations. “I-ERP is an enterprise resource planning (ERP) system deployed based on a SaaS model where services are delivered on an ERP vendor’s cloud platform as opposed to an on-premises network, allowing organizations to access over the internet” [19]. ERP on Cloud is a revolutionary approach of any business towards digital transformation. ERP deployment on the cloud is a pioneering solution that is more adaptive, quick, robotic, scalable, and cost-effective. There are major benefits companies are realizing after migrating to I-ERP. Real-time reporting of profit and loss is such a feature that no finance person can deny because of I-ERP. Instead of On-Premises and physical servers, I-ERP can be deployed on the cloud that allows companies to get servers hosted by renowned cloud providers and additional expensive IT infrastructure costs can be avoided. I-ERP since on a subscription basis doesn’t need additional time for implementation and business downtime requirements. “Cloud can be implemented quickly because no need for hardware

and no need to install special software in a customer location, accessed through the Internet, the data and application are under the control service provider” [20] [21]. With COVID-19 Pandemic spread across the world over the last 2 years, there is a significant need for digital technologies for the business to survive in competitive age and operate with agile growth and pioneer business operations, hence, its adoption rate is increasing day by day. I-ERP has different architecture layers. From the infrastructure layer to the software application layer, every layer of the pyramid can be on a subscription basis. After the Hardware layer, the IaaS platform can be provided by a cloud service provider powering enterprises with cloud computing power. After IaaS, the PaaS layer is provided to give power to the developers to enhance and regulate business operations without disturbing the production environment along with middleware integration applications integration. On top of PaaS, the Software application layer SaaS comes which provides application support to the business users and gives them analytical reports real-time over the internet anytime anywhere, thus, execution of finance reports anytime by CEO now becomes reality without actually going into complex systems and different resources and people. Lastly, the GUI layer is the first top layer where admin users work and see all the applications in a layman language and operate effectively. Diagram 1 below depicts different architectural layers of I- ERP.

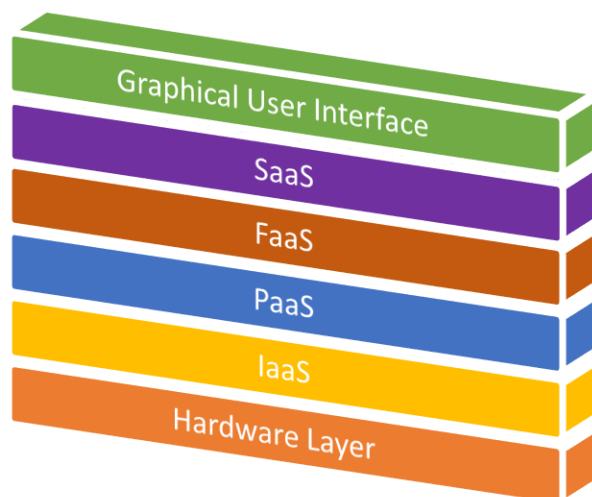


Diagram 1- Architecture Layer-I- ERP

### **PAYBACKS AND OPPORTUNITIES: I-ERP**

I-ERP solutions are deployed to reap its varied benefits for business growth and empowerment. It is a popular integrated solution and has become the first choice for companies targeting optimal business operations. The benefits of deploying I-ERP are listed below:

- **Reduced IT Infrastructure Costs**-“Low running and operational costs are one of the biggest advantages of Cloud ERP. Since the cloud ERP vendor hosts and manages the software on its servers, businesses avoid upfront infrastructure costs as well as additional costs for IT staff, maintenance, and security” [19].



- **Mobile Business-** With Cloud ERP working over the internet, the business has become more mobile and accessible through any smart device over the internet from any geographical location.
- **Automatic Latest release upgrades-** Cloud vendors give latest patches and upgrades to existing software applications and products with no business downtime; thus companies enjoy newer latest application versions with the same subscription costs
- **Quicker access to new functions-** “Since updates are faster, more features are implemented with every update, therefore enhancing the system frequently and increasing the ERP systems functionality” [22].
- **Rapid Implementation-** Deploying I-ERP is much cheaper and hassle-free than classic ERP. Classic ERP has a long process of implementing core modules that involve different resources from people, systems to management. Whereas I-ERP does all of these without involving too many resources over the cloud.
- **Increased Business Efficiency-** ERP on cloud offers less implementation time with fewer resources allowing business users to focus on operations and daily business pain points. Thus, increase business productivity
- **Elastic Cloud Model-** Applications, servers, resources all can be amplified and degraded as per business needs. This gives companies a more flexible approach to handle current business operations and future technology system needs.
- **Development and Coding-** With FaaS coming into the picture, developers are given more discretion to deploy their codes in a smaller ecosystem rather than deploying in the real production environment. This gives developers and coding a flexible approach.
- **Instantaneous Analytics-** I-ERP main USP is its real-time analytics. Businesses can get reporting on the fly anytime anywhere over the cloud. This is such a feature that has won many hearts of bigger companies and the adoption rate of I-ERP is getting larger day by day.
- **Imminent technologies for Future growth-** Cloud service providers come up with the latest technologies and have different deployment options. This gives a growth path for companies on the way for their technology development in this sustainable environment.
- **Improved Business Profits-** Transforming and Migrating Classic towards I-ERP can be a low-cost affair with Cloud options rather than a toll on business budgets and profits. This helps the business improve on profits and their simultaneous utilization in other bigger business operations.
- **No obstacles for newer companies** – Since Cloud options give subscription and low cost on implementing ERP solutions. There are no entry-level blockers for businesses. They can invest fewer gain profits and make their technology journey more rewarding.
- **Agile decision-making process-** Businesses can opt for cloud at less cost and resources, thus giving a better opportunity for leaders to choose and adopt technologies and be swifter in the business decision-making process.

- **Swift updates and performance** – I-ERP can add new functionalities easily and integrate with existing business services and networks. It upgrades systems and performance at a high speed as compared to Classic ERP systems.
- **Optimization of System Recovery Process**- All manual efforts in back-up of data and servers as disaster recovery can be redundant and avoided with I-ERP. This subscription-based cloud service provider option has automatic data recovery periodically, thus, giving better options for disaster recovery.
- **Any enterprise GO Model**- With lesser resources and cost, any small or medium enterprise can go for Cloud Model and opt for its technological growth without being need of huge investments required for the digital transformation path. This allows each enterprise to grow and compete in today's digital age world.

### **INTIMIDATIONS AND CHALLENGES: I-ERP**

Despite many advantages, I-ERP has its challenges and threats. Companies should keep in mind these challenges before opting for any kind of cloud computing model on their existing ERPs. Below are the challenges of the Cloud ERP model:

- **Cloud resistance for bigger Enterprise Size**- Bigger companies always want to have more data security with their physical servers and infrastructure although it involves more costs. Thus, the I-ERP model has some organization size restrictions and variations that need to be considered while its adoption.
- **Data servers Rights**- With I-ERP and cloud models, cloud service providers have rights and ownership on servers that may be shared with other companies. Challenges of continuity and ease of operations if system updates happen automatically and if there is some already existing functionality running on an older version, that may not be reusable in newer versions.
- **Server safety Issues**: “Biggest concern of Cloud ERP is data security. Information is shared over the web and that too hosted by someone else leads to possibilities of violation of data. Breaching of the ERP system can lead to system failure and prevent or completely halt production until a solution is implemented” [22]
- **Unforeseen Supplementary Costs**- There are more costs involved in I-ERP and cloud computing models over time which are unexpected and cannot be avoided as well. This increases its total cost of operations substantially over time.
- **Higher Subscription fees**- Cloud computing models offer new technologies with more advanced features that made businesses go live with such functionalities and urge for cloud options. This renders older Classic ERP investments at risk and non-reusable.
- **Forgo Standard ERP operations**- With I-ERP offers enhancements and customizations to every business need, that makes business systems and execution more complex. People comfortable with Classic ERP sometimes hesitate to use new customized ERP cloud solutions.
- **Expensive Migration costs**- Migration to I-ERP can be costlier with existing IT staff to train on newer functionalities and more system subscription costs to maintain classic ERP licenses.

- **Data theft threats-** Major shortcoming of Cloud computing models is its availability and accessibility to all over the internet. This leads to the risk of data vulnerability and theft by hackers. Some organization divisions like defense and other confidential department cannot opt for cloud options so easily because of data theft risk.
- **Hesitance with the change** – Business users generally don't want to give up their comfort zone with classic ERP and have a lot of resistance in adopting I-ERP. “Moving the ERP software offsite results in administrators losing some control over processes that become automated, and with the vendor managing all maintenance and infrastructure, IT teams lose control over certain operational processes” [19].
- **Data security requirements-** “Companies with especially strict cyber security policies, restrictions around hosting customer information in the cloud, and regulatory compliance issues may not experience the full benefits of a cloud-based ERP solution” [19] [23].
- **Old ERP investment wastage risk-** With I-ERP implementation, huge investment on classic ERP gets wasted and companies rethink their decision on moving to I-ERP. There is a risk involved and that has to be estimated and calculated before migration.
- **No Data Back-ups-** There is no standard cloud server backup available unless and until opt for more subscription and services of Data loss. Hence, needs more investment to keep companies' data safe.
- **Web and Cloud issues-** Cloud computing operates heavily on internet connectivity. Hence, if any issues happen with internet and web service connections, that needs to be pre-estimated and arranged for.
- **Inadequate Computing Acquaintance-** Insufficient knowledge of business users on Cloud and its computing ways comes as a hindrance to understanding the new cloud technologies and reaping its benefits.

## COMPARISON: CLASSIC Vs. I-ERP

There are a lot of open questions from each department in an enterprise if a company moves from Classic ERP to I-ERP. It is difficult to address different departments about the need for and importance of moving to smart technologies. This is the general tendency of people to resist any new change especially when comes to changing software and applications. Cloud changes the basic infrastructure of companies from hosting the servers at a physical location to moving on Cloud with private or public space. Both ERPs Classic and I-ERP have their benefits and challenges like two sides of a coin. There are always a set of people who are in favor of intelligent platforms, and some will be against their implementation. However, to survive in such a sustainable competitive business environment, it is a necessity nowadays to go digital way and unlock new business tech-savvy enablers. However, the recent inclination of businesses towards I-ERP especially during the COVID-19 situations is just unbelievable. Its adoption rate is increasing every day with not only bigger companies but small and medium companies opting for Cloud computing features and options for their businesses. Nonetheless, there are still many enterprises that think data security and servers ownership should be with the company rather than external cloud service providers. They are of opinion that making investments in servers will help in safeguarding their data and processes and thus prefers Classic ERP software over intelligent ERP cloud solutions.



This paper highlights the benefits and challenges of Cloud and intelligent ERP on cloud computing stack. It further tries to give observation on the comparative view of both kinds of ERP solutions. This paper has collaborated different old and new literature reviews on I-ERP solutions to formulate a distinguished view of Classic and Intelligent ERP for decision-makers to take rapid business choices. Table 1 describes differences between both ERP solutions based on the above collated and mentioned benefits and challenges.

Determinative Factors	Classic ERP	Cloud ERP
<b>Costs and Pricing</b>		
Low Upfront Infrastructure (Hardware, Network, servers, storage)		✓
Low Operating Costs (maintenance, upgrades, Staff)		✓
Subscription Fees		✓
User License Costs	✓	
Unexpected Costs		✓
Price Contemplation		✓
<b>Data Security and Control</b>		
Data Confidentiality and Security	✓	
Data and Security Compliance	✓	
Data Vulnerability and Hacking		✓
Improved System Disaster recovery	✓	✓
Central Database		✓
Data Redundancy	✓	
<b>Distinctive Features</b>		
Flexibility and Scalability		✓
Adaptability and Responsiveness		✓
Reliability	✓	✓
Accessibility and Ease of Use		✓
Single User Interface		✓
Speed and Performance		✓
<b>Implementation and Customization</b>		
Rapid Implementation		✓
Suitability for SME		✓
Suitability for Large Enterprises	✓	
Quick customization and enhancements		✓
Easy and Timely Software Upgrades and latest releases		✓
Integration with other systems and applications		✓
<b>Advanced Features</b>		
Future ready and embedded intelligence		✓
Real time analytics		✓
Accessibility of new features		✓
<b>Management and Overheads</b>		
Software and Systems Ownership	✓	
Quick Decision Making		✓
Additional Overheads		✓

Table 1- Classic Vs. Cloud ERP Differential Factors

## CONCLUSION

This paper has attempted to present and collate secondary literature available on Cloud and Intelligent ERP and tried to explain its relevance and need as compared to Classic ERP. The major identified paybacks of I- ERP in comparison with Classic ERP includes Reduced IT infrastructure costs, Mobile Business, automatic latest release upgrades, access to newer functions, Rapid implementation, Increased business efficiency, elastic cloud model, development and coding, instantaneous analytics, imminent technologies for future growth, improved business profits, no obstacles for newer companies, Agile decision-making process, swift updates and performances, Optimization of the system recovery process, Any enterprise GO model.

The major drawbacks with I-ERP are Cloud resistance for bigger enterprise size, higher subscription fees, server safety issues, expensive migration costs, data theft threats, unforeseen supplementary costs, forgo standard ERP operations, hesitation with the change, data security requirements, old investment wastage risk, web and cloud issues, No data back-ups and inadequate computing acquaintance. As described in Table format of comparative review of both Classic and I-ERP solutions, Intelligent ERP has lots of benefits and future growth options which is why the companies are inclining towards smart ERP systems. Its low

cost and maintenance yet giving all Tech-savvy newer technologies to run business operations is one of the foremost reasons why companies are choosing such cloud options. However, in categories of data security, ownership, server vulnerability, classic ERP outpace cloud solutions unless and until they are secured on private clouds. This paper tries to give exploratory view on both paybacks and downsides of I-ERP which is a roadmap for decision-makers to start talking about migration and upgrade to I-ERP. Classic ERP is the first choice where there is confidential data as companies want to have full control and security over their data. Whereas if data security can be compromised, cloud ERP offers many benefits with regards to lower operational costs, newer technology and functions lead to rapid business growth. For future research directions in this area, we highly encourage exploring the impetus of organization type and size on I-ERP adoption decision making with the likely I-ERP deployment models.

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