Mine Automation and Data Analytics

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Week-3

Lecture-12

Enterprise Resource Planning (ERP) System

Welcome back to my course, Mine, Automation, and Data Analytics. In the last lesson, we discussed the computerized maintenance management system, and in this lecture, we are going to discuss enterprise resource planning for managing the business from all aspects. In this lesson, the following concepts will be covered: We are going to introduce the ERP system and why ERP is important. Then we will compare the different features of CMMS versus ERP. We will discuss the benefits of ERP and the types of ERP deployment, the fundamental features of an enterprise resource management system, ERP software, ERP integration, the drawbacks of the ERP system, different modules of ERP, ERP operations, and the effects of the industry 4.0 on ERP systems, what is the ERP for the mining industry, the features of ERP for the mining industry, and the benefits of using ERP for the mining industry? So let us focus on the enterprise resource planning system, the ERP system.

So, ERP is all about an application or software that manages the business in totality and integrates everything in the business organization. It also manages the operations; it integrates all operations into its module, and the purpose is to achieve higher efficiency in the process.
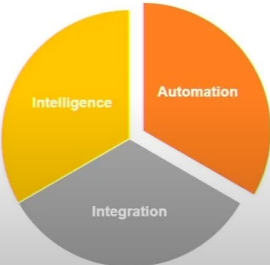
So, this is basically the different schematics, the modules that ERP can take into account. ERP takes into account finance, R&D engineering, asset management, company and organization sales, supply chain inventory of the organization, manufacturing, sourcing, and procurement services. So, these are the aspects, and there are some other aspects as well, because there is some positive sign you can see. So, it can add more modules to its system to improve business performance. So, these sets usually include a set of mature business applications and tools for financial and cost accounting, sales and distribution, material management, human resources, production planning and computer-integrated manufacturing, supply chain and customer information. So, these packages have the ability to facilitate the flow of information between all supply chain processes, internal and external, in an organization. ERP packages touch on many aspects of a company's internal and external operations. Consequently, successful deployment and use of ERP systems are critical to organizational performance and survival. The most important attributes of ERP are its abilities to automate and integrate business processes across organizational functions and locations, enable the implementation of all variations of best business practices with a view to enhancing productivity, share common data and practices across the entire enterprise in order to reduce errors. produce and access information in a real-time environment to facilitate rapid and better decisions and cost reductions.

So why is ERP important? ERP is the central nervous system of an enterprise, and the ERP software system provides the automation, integration, and intelligence that are essential to efficiently running all day-to-day business operations. So, these are the three key features of an ERP module, and because of that, nowadays in industry 4.0. All mining and manufacturing sectors use ERP to improve business process efficiency. So in

the last lesson, we discussed many aspects of CMMS, and in this lesson, we have started with ERP. So let us see what the differences are between these two modules. The computerized maintenance management system CMMS and the ERP enterprise resource planning system are both software solutions that play a crucial role in the management of business operations. However, they serve different purposes and focus on distinct aspects of an organization. The primary purpose of CMMS is to manage maintenance activities and assets. It helps in scheduling preventive maintenance, tracking equipment, managing work orders, and ensuring the overall efficiency of maintenance processes. The primary focus of ERP is that it is a comprehensive system that integrates various business processes, including finance, human resources, procurement, manufacturing, and more. ERP aims to provide a unified platform for managing and optimizing overall business operations. The scope of CMMS is that it focuses especially on maintenance-related tasks such as equipment upkeep, work order management, and inventory control. Whereas the scope of ERP encompasses a broader range of business functions beyond maintenance, including finance, supply chain management, customer relationship management, and human resources, There are modules, it typically includes, particularly in CMMS, preventive maintenance, work order management, asset tracking, inventory management, and sometimes health and safety compliance. For ERP, the modules that are included in ERP are finance, procurement, production planning, inventory management, human resources, CRM, and more, depending on the specific ERP system, and these modules can be more and more depending on the specific needs of the business. Integration-the CMMS often operates as a standalone system, although it may integrate with other software solutions like ERP for data exchange. ERP is designed to be an integrated solution where various modules share a common database, providing real-time data visibility across different departments.

There are six key benefits of ERP. Accelerated reporting-From time to time, in a business, we require the preparation of reports and performance. So, in ERP, all the data is available on the dashboard, which makes reporting much easier. Improve agility-On the demand, something has to be done. The data is there, so based on the data, it can act promptly based on the necessity. Deeper insight-again, the key feature is that you have a lot of data, and based on the analysis, you can have a deeper understanding of what is going on, what the situation is, and what the health of the business is. Then it is simpler IT required for this system for management at the enterprise level. Higher productivity-The principle and purpose of using the ERP are to achieve higher productivity in the system and lower risk because the ERP often and quickly identifies waste in the process, and by that and also from time to time, it basically helps improve efficiency. So, ERP in total helps achieve lower risk in the operation.

Higher productivity- Streamline and automate your core business processes to help everyone in your organization do more with fewer resources.

Deeper insight- Eliminate information silos gain a single source of truth and get the first answer to mission-critical business questions.

Accelerated reporting-Fast-track business and financial reporting and easily share results. Acts on insight and improves performance in real time.

Lower risk-It maximizes business visibility and control, ensures compliance with regulatory requirements, and predicts and prevents risk.

Simpler IT-By using integrated ERP applications that share a database, you can simplify IT and give everyone an easier way to work.

Improve agility-With efficient operation and ready access to real-time data, you can quickly identify and react to new opportunities.

Types of ERP deployment-It is primarily cloud ERP that is the most popular one. There are also on-premise ERP systems available, and there are hybrid ERP systems as well. So, the cloud ERP is the data; everything is on the cloud. The software is managed by the provider company, and on-premise ERP. The software is installed at a suitable business location, and the hybrid is a combination of both cloud and on-premise ERP.

Cloud ERP-With cloud ERP, the software is hosted in the cloud and delivered over the internet as a service that you subscribe to. The software provider generally takes care of regular maintenance updates and security on your behalf. Today, cloud ERP is the most popular deployment method for many reasons, including lower upfront costs, greater scalability and agility, easier integration, and much more. Provided that in the business sector, all across different units in the business, you have good access to the internet and computer so that everything can be accessed through the internet.

So, this is the schematic diagram showing that wherever you operate the business, you should have connectivity to the internet, and you are using the ERP as a SaaS. So, it is basically provided through the internet on the cloud.

Cloud ERP

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Let us discuss a question.

Question l.

Why is cloud ERP considered a popular deployment method? It requires a high upfront cost, It lacks scalability and agility, It is challenging to integrate with other systems, lower upfront cost, greater scalability, and agility, and It involves complex installation procedures.

The right answer is, Lower upfront cost, greater scalability, and agility.

On-premise ERP-This is a traditional model for deploying software where you control everything. The ERP software is typically installed in your data center at the location of your choice, and the installation and maintenance of the software and hardware are the responsibility of your staff. So many companies are modernizing and upgrading their on-premise ERP systems for cloud deployment. This requires careful planning of your ERP upgrade as well as a thoughtful process of evaluating ERP software and deployment options.

Hybrid ERP-For companies that want a mixture of both to meet their business requirements, there is a hybrid cloud ERP model. This is where some of your ERP applications and data will be in the cloud and some on-premise. Sometimes this is referred to as a two-tier ERP system.

Fundamental features of an enterprise resource management system-It has a common database, it has embedded analytics, It has very good data visualization tools, It helps to achieve automation in the system, It has a consistent user interface, It is very easy to integrate with other modules in the industrial 4.0 ERP system, and it is very adaptable to new technologies, There are different technology platforms as well, Multinational support, and choice of deployment. So, these are basically the features of an enterprise resource management system.
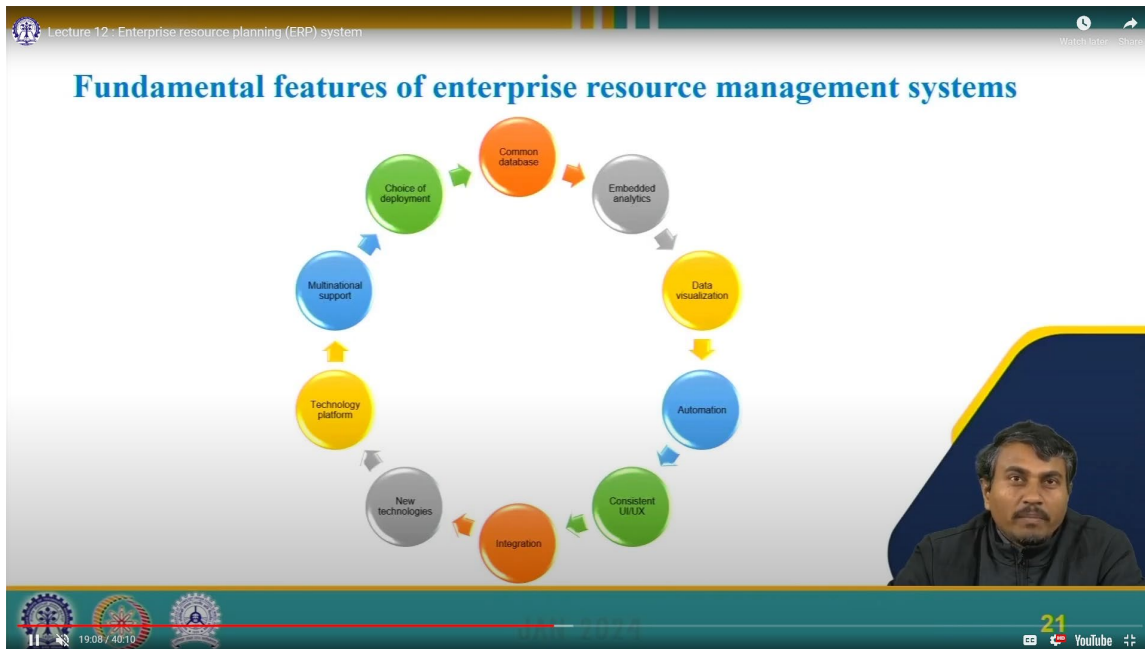
Common database*Centralized information and a single version of the truth provide consistent shared data and a cross-functional view of the company. Embedded analytics-built-in analytics, self-service business intelligence, reporting and compliance tools that can deliver intelligent insight for any area of the business. Data visualization-Visual representation of key information with dashboards, KPIs, and point-and-click analytics to assist in quick and informed decision-making. Automation-Automation of repetitive tasks as well as advanced robotic process automation are RPAs powered by AI and machine learning.

Consistent UI and UX-The same look and feel across modules as well as easy-to-use configuration and personalization tools for processes and users, including customers and suppliers, business units, locations, and product lines.

Integration-Seamless integration of business processes and workflows, as well as open and easy integration with other software solutions and data sources, including those from the third parties.

New technologies-Support for AI and machine learning, digital assistance, the IoT, RPA security, privacy, and mobile.

Technology platform-A fast-proven stable technology stack for this long-term investment includes a low-code/no-code platform, an integration platform such as a service (IPaaS), data management, and more.

Multinational support-including language, currencies, and local business practices and regulations, as well as technical support for cloud services, training, help desk, and implementations.

Types of deployment-Cloud, on-premise, or hybrid.
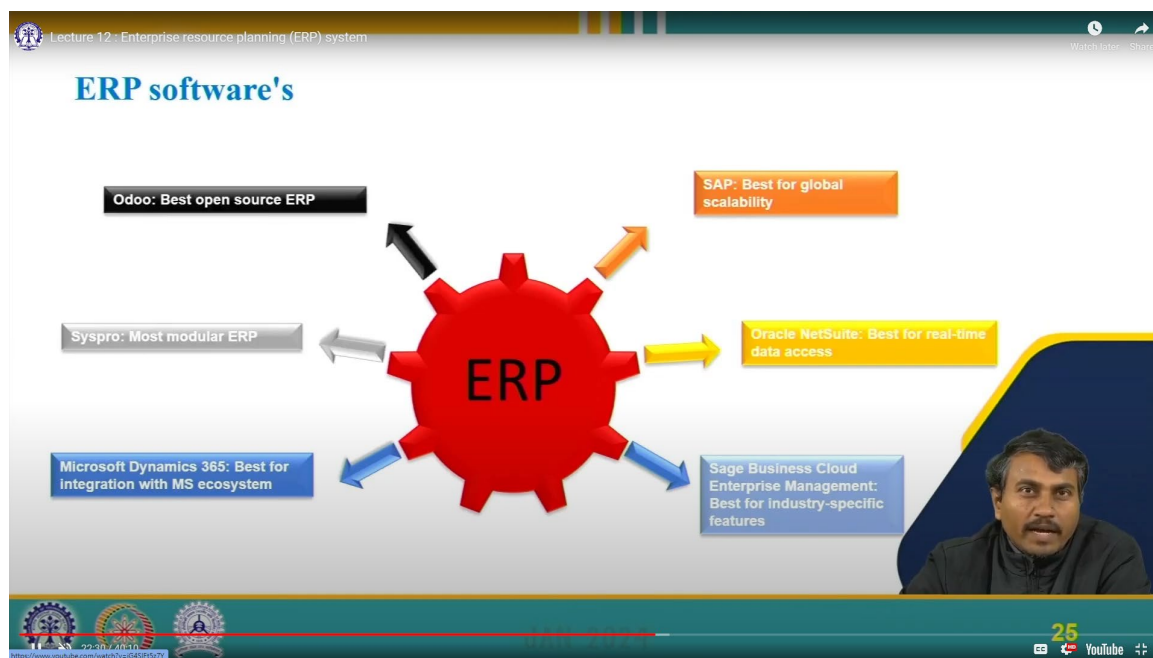
ERP software-SAP-based for global scalability; oracle NetSuite is built for real-time data access. Sage Business Cloud Enterprise Management is based for industry-specific features. Microsoft Dynamics 365 is based for integration with MS ecosystems. Syspro is the is the most modular ERP and Odoo-based open-source ERP.

ERP integration- Modern ERP systems are open and flexible and can easily integrate with a wide range of software products using connectors or customized adapters, such as application programming interfaces. Other modules for ERP integration include ESB Enterprise Service Bus and IPaaS, which offer a cloud-based approach and are very popular options for modern businesses. The IPaaS platform can rapidly synchronize on-premise or cloud-based ERP with SAS applications from the same vendor or third parties. They typically require little to no coding. They are flexible and relatively inexpensive, and they offer a whole host of other uses such as automatic API generation, machine

learning, data integration, Internet of Things (IoT) network integration, pre-built content, and more.

Drawbacks of the ERP system-Although ERP systems have certain advantages, such as low operating costs and improved customer service, they also have some disadvantages due to the tight integration of application modules and data. Huge storage is necessary and the networking requirement is also required, and training over it is frequently mentioned as an ERP problem. So, there are four categories of challenges in the ERP system. One is the cost and implementation, In the long run, it might be very costly, and only big organizations or big companies can afford to have the ERP system. There are some functional-specific issues in that some of the operations and some of the functions might not match with the ERP system. There are some technical challenges as well with the integration with the existing system, and there are other fronts of the challenge, including usability. Many new technicians or users have problems using this system, which means a large amount of training is required to understand and use it.
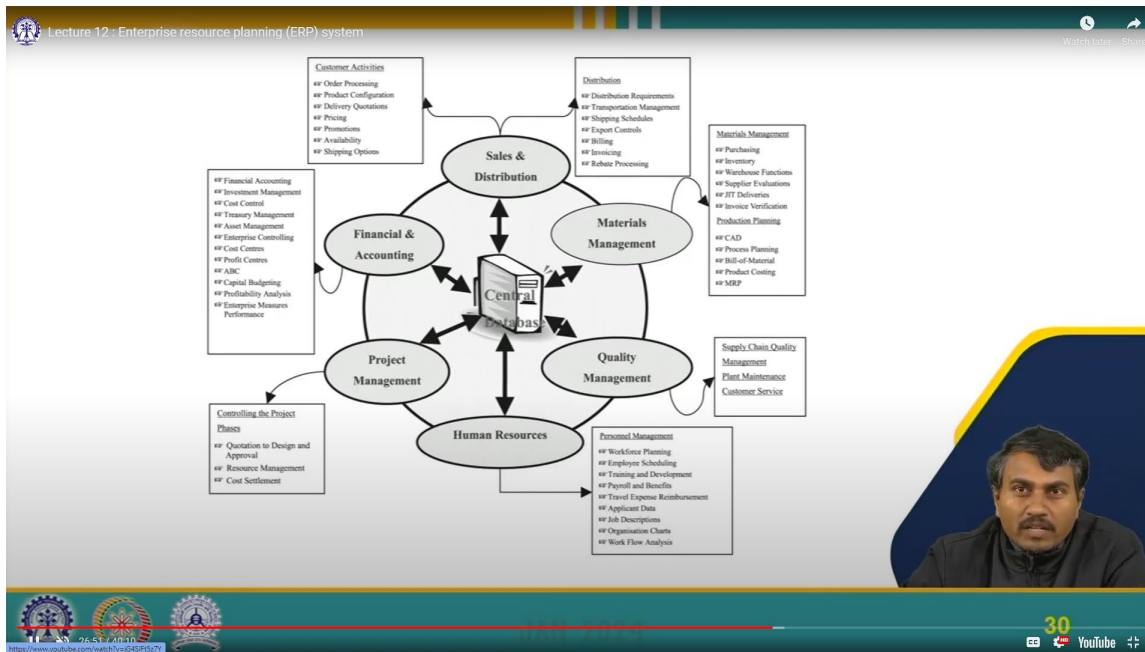
Modules of ERP- The various modules of ERP include engineering data control, bill of material, process plan, work center data, sales, purchase and inventory, sales and distribution inventory and purchase, material requirement planning, resource flow management, production scheduling, finance and human resources management, work documentation, work order, shop order release, material issue release and root card for parts and assemblies, shop floor control and management, and others like costing, maintenance, management, logistic management, and MIS.

So here we have six modules: sales and distribution, which takes care of the customer activities of order processing and pricing, as well as the distribution requirements, billing,

invoicing, shipping schedule, and everything else in sales and distribution. Materials and management include purchasing, inventory, warehousing, etcetera. For planning CAD, process planning, bill of material, MRP, and product costing, Quality management-supply chain quality management, plant maintenance, and customer service. Human resource management includes workforce planning, employee scheduling, payroll, application data, and so on. Project management, includes controlling the project phases, quotation to design and approval, resource management, and cost settlement. Financial and accounting involves financial accounting, cost control, cost centers, profit centers, capital budgeting, etc. So, all these modules are together in the ERP for achieving better efficiency in the business organization and higher productivity. Finance, includes financial accounting, treasury management, enterprise control, and asset management. Logistics, includes production planning, material management, plant maintenance, quality management, project systems, sales, and distribution. Human resources, includes personnel management, training and development, and skill inventory. Workflow-integrate the entire enterprise with flexible assignment of tasks and responsibilities to locate positions, jobs, groups, and individuals.
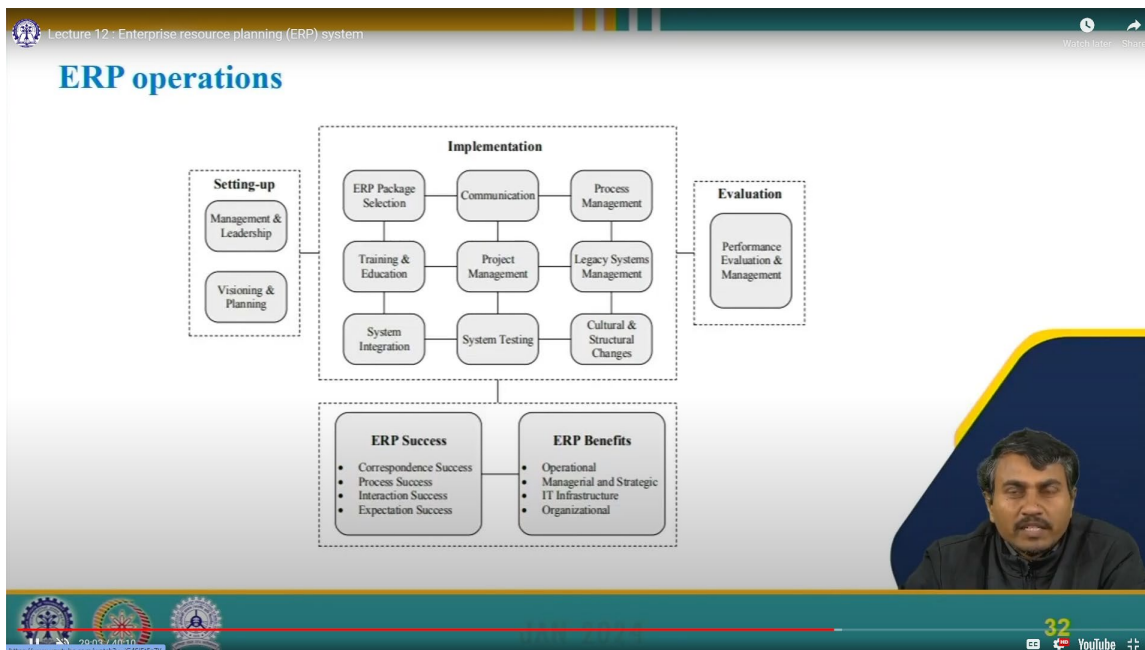
ERP Operations: So here, setting up the system management and leadership and visioning and planning, and in the implementation stage, we have the ERP package selection, specific ERP, which kind of ERP is needed, then its communication and its process management, legacy system management with the integration of that, project management, training and education with the existing manpower for greater usability of the system, system integration with the available system it should integrate, then system testing, how it is performing and the cultural and structural changes, and in a new assignment, new roles of different systems to be integrated together. So, this is the

implementation stage, and here ERP has the correspondence success, process success, interaction success, and expectation success. We have to measure in terms of operational benefits, managerial and strategic benefits, IT infrastructure benefits, and organizational benefits and evaluation. We have to evaluate its performance and its management efficiency in the long run.

Effects of the industry 4.0 on ERP systems: ERP systems have a complex software environment that includes different layers. ERP software includes a database design and database layer in order to keep different numbers of data from the system. The database can only be accessed by core business logic such as security applications and firewalls that are provided at the server level. The business functions such as finance, marketing, production, etc. are modeled as applications at the business application layer. Finally, end users are accessed by the system by using user interfaces at the end user layer. So, from the SCADA there is a business application server to the core business logic and from there the database. In the classical approach, the corporate data stored in the SCADA system, which is used as a data acquisition system, is analyzed in order to achieve manufacturing, tracking, or a better decision-making system. Finally, at the knowledge level, ERP systems are implemented to increase integration between processes and data.

So here, the standard architecture of the SCADA system is fitted with different devices. The SCADA system is fitted with different devices and acquired data, and at the manufacturing execution system, they have been transformed, and finally, it is transformed into the enterprise resource planning ERP. So that was the standard architecture and connection with the device. In the age of Industry 4.0 and the industrial internet of things, devices and apps are all connected together, and communication

Effect of the Industry 4.0 on ERP Systems

infrastructure is much easier. So, applications have ready connections with the devices to get the data, and it is very quick and accurate so that in real time it can analyze what the status of the devices of various devices is.

What is ERP in the mining industry? For mining organizations searching for ERP software, maximizing investment benefits is critical. The volatility and risk associated with fluctuating prices of natural resources mean expenditure must have a deep positive impact on operations. Investing in mining enterprise resource planning software provides payback through streamlining operations and increasing control of critical processes. Selection of a proven mining management ERP solution, even at the exploration stage, therefore becomes key to driving mining success.

ERP for the mining industry is sophisticated business management software that streamlines essential benefits involved in the mining industry and facilitates seamless coordination between the human workforce, organizational assets, and resources. It encompasses diverse modules for managing mining operations and provides tools and functionalities specifically tailored to mining businesses. Integration-ERP solutions for the mining industry integrate data from all business aspects. It saves employees the hassle of entering the same data over and over, eliminating duplicate records and errors. Decision-makers can access key business data to get a better understanding of business operations and find areas for improvement. The best business management software brings operational efficiency and improves various aspects of the mining business, such as project management, asset management, supply chain management, financial management, and compliance. Data analysis-Data analysis involves collecting, storing, and analyzing data to find historical trends and patterns and accurately forecast future

sales, revenues, and expenditures. Mining ERP software has business intelligence tools and data analytical capabilities that provide useful insight into business data and make actionable decisions that reduce risk, reduce cost, minimize cost, improve profitability, and benefit the business in the long run.

Question 2:

What is the primary purpose of an ERP solution in the mining industry? Mining resource extraction, generating geological surveys, integrating data from all business aspects, managing equipment and maintenance, Conducting an environment and impact assessment.

The right answer is, integrating data from all business aspects.

Reporting and dashboard-The best ERP for the mining industry provides business intelligence tools. These tools play a vital role in data consolidation and analysis to identify trends and patterns. They use various key performance indicators (KPIs) to make a visual representation of the data and predict future events more accurately. Optimal resource allocation-Resource allocation and utilization are some of the critical aspects of mining firms, much like other firms. The asset management module in mining ERP software enables the company to effectively manage organizational assets, assign human resources, capital resources, machinery, and materials to appropriate work sites, and track them for their performance efficiency and defects. ERP implementation provides a deep understanding of how resources are used and helps flag underutilized resources to take timely corrective measures. Enhanced supply chain management-In order for a mining firm to become profitable, it needs to efficiently handle supply chain management and have an equally efficient inventory management system. One of the benefits of an ERP system is their ability to do route planning, cargo capacity management, transport reservations, driver management, and maintenance scheduling. The supply chain management tools help reduce transportation and operating costs, minimize waste, and improve efficiency in mining operations. Improved compliance-Mining companies have to strictly adhere to several environmental, health, safety, labor, and financial regulations set by the government. Mining ERP solutions and software brings end-to-end traceability into business operations and allows it to track emissions and waste, accurately generate financial reports, and reduce human errors. Ultimately, the company can avoid fines, penalties, litigation, and damage to its reputation.

So, these are the references. So let us conclude in a few sentences. We have provided an overview of enterprise resource planning. We have explored the significance of ERP in streamlining business processes. We have discussed the comparison between CMSs and ERP systems. We have examined the advantages, including enhanced efficiency and resource management. We have classified ERP deployment options for businesses. We

have explored key features essential to an enterprise resource management system. We have discussed the software applications facilitating ERP implementations. We have highlighted the importance of seamless integration within the ERP system for optimal functionality. We have examined the limitations and challenges associated with ERP implementations. We have explored the diverse functional modules within the ERP system, illustrating their role in comprehensive business management. We have explored the functional functioning and processes involved in an enterprise resource planning system. We have examined the influence of industry 4.0 on the evolution and capabilities of ERP systems. We have defined ERP in the mining industry, emphasizing its relevance. We have explored the specific feature tailored for ERP systems in the mining sector. We have examined the advantages of implementing an ERP system in mining operations for enhanced efficiency and management. Thank you.