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Fundamentals of Business - Introduction to Information Technology

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FUNDAMENTALS OF BUSINESS

BRET J. WAGNER

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Chapter 20

INFORMATION TECHNOLOGY

Learning Objectives

1. Understand and conceptualize what information technology is and how it works
2. Know the history and evolution of ERP's and information technology
3. Analyze the different types of ERP's and compare and contrast the benefits and costs
4. Be aware of/educated about future IT developments and their impact on the workforce
5. Understand how information technology will influence your career in the long-run

20.1 Overview

THIS CHAPTER WILL DISCUSS THE RELEVANCE AND IMPORTANCE OF information technology and its integration into several business models. The term Information Technology encompasses all types of technology used to create, store, exchange, and utilize data and infor-

mation in all shapes and forms. This chapter will primarily focus on Enterprise Resource Planning (ERP) technology, which refers to a type of software that organizations use to manage day-to-day business activities such as accounting, procurement, project management, risk management, and supply chain management. Three Rivers Hot Sauce, will demonstrate the importance of ERP integration through a small case study highlighting the before and after picture of an ERP implementation.

In today's business world, the utilization of information technology is becoming more and more important in everyday business transactions, as well as big shifts in business operating strategies. Moreover, it acts as a change agent on many platforms. Later on, the chapter will go over current and future trends that embody such transitions and how they will transform tomorrow's workforce and workplace.

20.2 Three Rivers Hot Sauce - Without ERP

Before diving deeper into Information Technology and what an ERP system is and how it works, let's take a look at the fictional company of this book, Three River Hot Sauce and how it was operating before an ERP implementation. This will give a closer look into why companies decide to move forward with ERP implementations and all the benefits that come with it.

First, here is a little refresher on Three Rivers Hot Sauce as a company and all its operational bits and pieces that are relevant for this chapter. For simplicity and ease of understanding the following sections will be broken up in what business area they fall under, the necessary information, and the problems associated with that particular business process.

20.3 Background Information on the Company

Lisa Garcia founded Three Rivers Hot Sauce LLC as a limited Liability Company and performs most business functions for Three

Rivers, including most of the marketing functions. Recently Lisa hired Maggie Terrell to manage sales as this function requires close relationship management with customers. Currently, Three Rivers Hot Sauce has its traditional hot sauce that it sells nationwide through Amazon. It also develops and sells special hot sauce varieties locally at fairs and festivals as well as through local restaurants. Lisa Garcia has big plans and wants to turn her company into a national brand of high-quality, authentic Mexican foods.

Three Rivers Hot Sauce is currently using a contract manufacturer, called Brooks Bottling Company, to produce the packaged hot sauce. Not only does Brooks produce and ship Three River's products to Amazon, but they help develop the recipes from a small-scale test batch to a recipe that can be mass produced. They also provide the food analysis to produce the ingredient list and nutritional information for the labels. Recently, Lisa and Maggie have collaborated a ton with restaurants, and other small business to produce a larger assortment of spices based on customer preference. However, there is currently no established process in place on how to go about this growth in manufacturing. As the brand is expanding, the lack of communication and integration has been causing some trouble in the expansion.

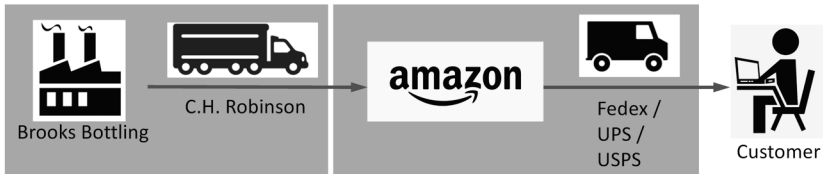
Operational Issues

- Lack of inventory control and transparency on Three Rivers behalf.
- Lack of integrated communication between Three Rivers and Brooks in the development stages.
- Manual scheduling of production executed by Lisa via email.

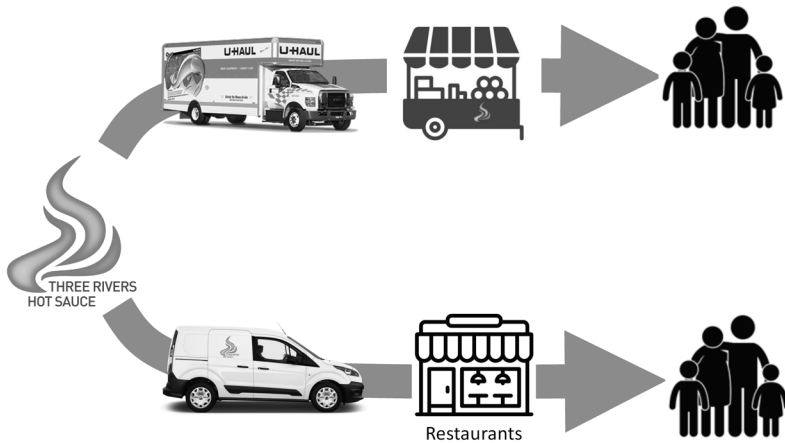
20.3.1 Supply Chain Management - Distribution Channels

As described in Chapter Three Rivers Hot Sauce company has three distribution channels for its products: Case quantities of the standard recipe sold and delivered by Amazon, direct to the customer at fairs

and festivals and retail sales through restaurants. Starting with Amazon, A total of 1,153 cases have been shipped last year, and 794 of those were sold through Amazon, proving that Amazon is a huge part of the Three Rivers Hot Sauce brand. Below is a refresher of what that distribution channel looks like.



Three River's has two other distribution channels for its products that are shown in the figure below. For sales to customers at Fairs and Festivals, Three Rivers rents a truck from U-Haul to transport all of the equipment and products directly to the customers. For sales to restaurants, Three Rivers is leasing a Ford Transit Connect commercial van that is outfitted to carry both hot sauces, displays and other promotional material to restaurants.



Operational Issues

- Lack of overview and transparency over Amazon orders (what hot sauce is the most popular? Are there any repeat customers that Three Rivers could work more closely with?).
- A lot of handoffs between transactions allow for more errors and lack of traceability back to origin in case of a recall or other quality related issues.
- Lack of shipping schedule to fairs and restaurant and potential loss in freight consolidation and cost savings.

20.3.2 Finance and Accounting

During 2019 Three Rivers increased its sales to restaurants and as Three Rivers continues to grow, it is purchasing more goods and services, many of these on credit from suppliers. The business also obtained a three-year, \$120,000 loan with an 11% interest rate at the

beginning of the year. Currently, Lisa is keeping track of all their finances on a simple spreadsheet in excel. Operating expenses including general and administrative and research and development have been low due to only two employees and one major hot sauce being sold. However, with the increasing expansion of hot sauce products and thus, a high chance of more human capital needed in the future, finances will become much more complex with increased responsibilities, such as payroll and higher expenses.

- Need to prepare a more accurate and detailed financial plan moving forward.
- Lack of centralized financial system with record keeping capabilities.
- Increased complexity with taxes and filling systems as company expands.

20.3.3 Marketing and Sales

Three Rivers is currently receiving sales orders via a few different channels: website, fax, email, and text. The bulk of the orders are being received via email or the website. However, Maggie still receives a good amount of sales orders via fax and texts, as some of their customers are smaller business, like food trucks or small mom-and-pop stores. In addition, the increasing number of customers and products is starting to become too much work for a one-person sales team.

- Need for Customer Relationship Management tool as customer base is increasing.
- Lack of centralized order management system.
- Lack of human capital or implemented systems for operational processes.

20.4 ERP Systems

As earlier discussed, Enterprise Resource Planning (pronounced “E-R-P”) technology is a type of software that organizations use to manage day-to-day business activities such as accounting, procurement, project management, risk management, and supply chain management. In more simpler terms, ERP systems tie together a variety of business operations, enabling a smooth flow of data and interconnectedness between them by using a common database and shared management reporting tools. In other words, the software takes one or multiple types of inputs and creates an output, such as a report, forecast, or sales order, that is of value to the customers, company, or suppliers. Due to the cross-functional integration, companies use their ERP systems to connect and coordinate business processes with their customers and suppliers as well.

Most companies have four main functional areas of operation: Marketing and Sales (M/S), Supply Chain Management (SCM), Accounting and Finance (A/F), and Human Resources (HR). Moreover, each of those areas can be broken down in even narrower business functions, which can be defined as activities specific to that functional business area. To better visualize how many different functional areas a company can have, take a look at the figure below:

Functional area of operation	Marketing and Sales	Supply Chain Management	Accounting and Finance	Human Resources
Business functions	Marketing a product	Purchasing goods and raw materials	Financial accounting of payments from customers and to suppliers	Recruiting and hiring
	Taking sales orders	Receiving goods and raw materials	Cost allocation and control	Training
	Customer support	Transportation and logistics	Planning and budgeting	Payroll
	Customer relationship management	Scheduling production runs	Cash-flow management	Benefits
	Sales forecasting	Manufacturing goods		Government compliance
	Advertising	Plant maintenance		

Source Line: Course Technology/Cengage Learning.

Before ERP, these functional areas have been managed individually and completely separate from each other. However, with the integration of ERP all of these departments are now interconnected, as each function requires data from the others in order to function smoothly and successfully. Communication and workflow are key to the overall success of a company due to the urgent need of information sharing in a very timely and accurate manner among functional areas. In addition, process improvement projects are mostly driven through the interdependency between the departments, as that part of the supply chain often times has lots of room for improvements. The better a company can integrate the activities of each functional area,

the more successful it will be in today's highly competitive environment.

ERP's modular software also allows businesses to integrate their unique business processes targeted to their own needs, such as, human resources, inventory management, and many more into a unified system. The only core function that all ERP systems have, regardless of their model, is for basic accounting or finance activities, including analytics, forecasting and reporting. Other modules that are relatively common across most ERPs and industries include: Human capital management (HCM), customer relationship management (CRM), procurement, inventory management, order managements. In addition, ERP systems can be more specialized depending on the industry they are in or type of company they represent. Some of these exceptions are outlines below:

Business that manufacture and distribute physical goods require two additional functionalities:

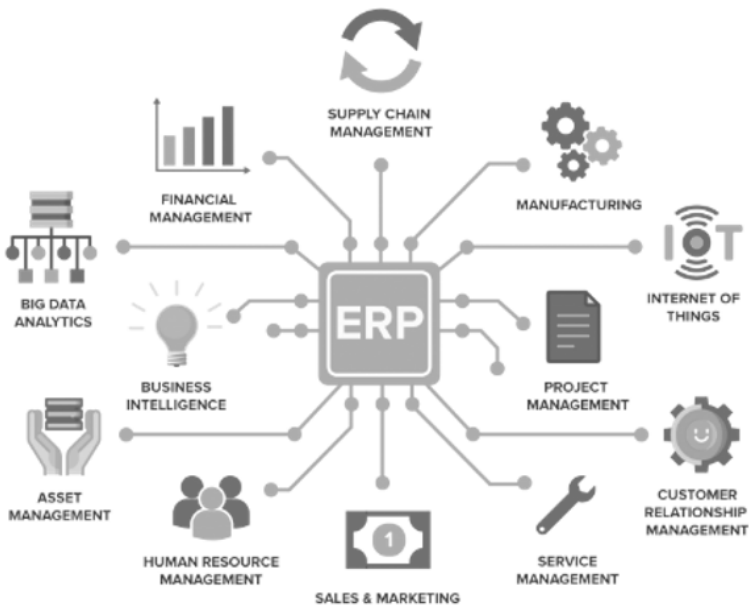
- Supply chain management: broad module that includes processes for distribution, warehousing, transportation and logistics, and demand forecasting.
- Material requirements planning (MRP): Module to plan, procure, and schedule the raw materials and components needed for production.

Larger business with more capital equipment usually has the following add-on:

- Enterprise asset management (EAM): Module that involves the maintenance of a company's physical assets throughout each asset's lifecycle. Its capabilities include planning, optimizing, executing, and tracking the needed maintenance activities with the corresponding materials, tools, and information.

Manufacturing business might also look into the following module:

- **Product lifecycle management (PLM):** Add-on that manages all the data and planning for a product going through all the process from conception to design, engineering, production, distribution, and disposal.



20.5 Benefits of ERP

- **Elimination of data duplication** – By collecting a business's shared transactional data from numerous sources, ERP allows for seamless data integration and provides a single platform for accurate and precise data outputs.
- **Easier distribution of data** – Because ERP is designed around a single, defined data structure with a common

database, it ensures that information is efficiently interconnected with easy access for cross-departmental use.

- **More financial transparency** – ERP systems track the requisition and purchase of goods and services throughout the entire procure-to-pay process in a uniform and clean data standard, allowing connected workflows, reporting's, and analytics on the financial end.
- **Data integrity** – A centralized data repository guarantees that the data is correct, up-to-date, and complete. From quarterly reports and financial statements to a single outstanding report, everyone in the company can be confident in the data they get.
- **Improved business insight** – ERP also allows real-time data flow and visibility in the form of reports to anyone with access in the company. It also eliminates information silos and allows for faster decision making through accelerated reporting performance.
- **Improved efficiency** – Through a common user experience across multiple business functions and well-regulated and defined business processes, core business processes are much more streamlined and automated. Do more with fewer resources.
- **Reduced risk** – By improving data integrity and financial controls, overall risk is greatly reduced. Maximized business visibility ensures increased control and compliance with regulatory requirements.

20.6 ERP Implementation

There are significant amount of issues and challenges when it comes to the implementation aspect of any ERP system. The implementation of ERP is an ongoing process, no a one-time task that has a very clearly defined start and end date. Therefore, most business leaders decide to limit the scope of the implementation projects to only what is absolutely necessary to operate the business at the time. Then,

after the implementation is complete and the current systems in place are running smoothly, many firms go back to seeking further improvements, such as updating or expanding their original ERP system. These follow-on implementation projects will require continued management and implementation supervision from the consultants involved in the original ERP set up stages. ERP implementation is also expensive, with cost ranging anywhere from \$10 million to \$500 million, depending on the company size. Thus, a company must first identify a significant financial benefit generated from the software. This is typically done by revising current business processes, making them more effective and efficient, refining best practices, and making sure that the ERP software can support all of those changes in order to maintain cost savings. Below is a short list of some of the ERP implementation costs that could apply:

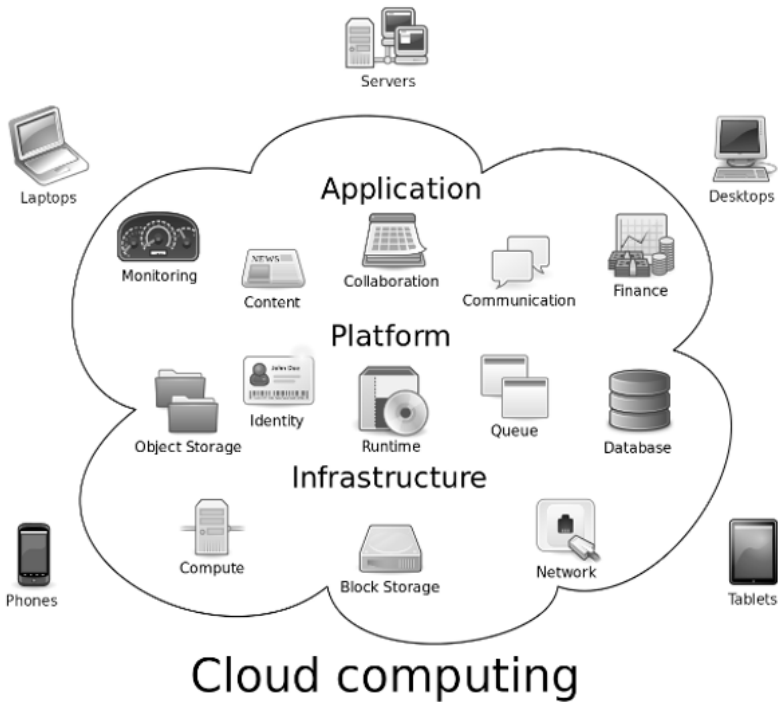
- **Software licensing fees:** Most vendors charge annual fees based on the number of users
- **Consulting fees:** Successful ERP implementations require highly skilled consultants with a lot of experience and detailed knowledge of the company's business to guide the implementation process and ensure its success.
- **Internal Employee Capital:** ERP implementations also require subject matter experts within the company to work closely alongside the consultants to make sure configuration of the software supports the company's needs. This means that some employees are frequently taken away from their daily responsibilities.
- **Employee training:** The internal subject matter experts also require ERP training before they can assist in the implementation process. Post-implementation, the rest of the employees that will use the software in every day operational activities will also require training on how to use the systems.
- **Productivity losses:** Due to the complexity of any ERP implementation, companies usually experience a loss in

productivity during the first couple weeks and sometimes even months after switching to the new ERP systems.

20.7 Types of ERP Implementations

Cloud ERP

Software service that allows users to access Enterprise Resource Planning (ERP) systems over the internet. It generally has lower upfront costs, as computing resources are typically leased or paid for by the month instead of purchased outright and maintained on premise. It is also easier to maintain, as the cloud ERP provider typically handles maintenance of hardware and software. Similar to on-premise ERP it uses a central database for storing, accessing, and sharing business data and transactions across multiple modules. However, some of the control is now lost due to the software moving off-site, which may lead to added security challenges. This type of ERP really became popularized in the late 1990s after the debut of the first cloud ERP in 1998 and continues until today, as vendors have shifted their focus and development efforts away from the on-premise version to the cloud. Even though the increasing focus on the cloud has narrowed the gap in what it can deliver compared to on-premise ERPs, cloud-based software still struggles to deliver comparable features to on-premise based systems.



On-Premise ERP




ERP Software that runs on in-house servers at the company's location. Its benefits include having the security and control of creating and using your own IT infrastructure and data center to connect your systems, processes, and people. However, it has very high start-up costs and lacks a back-up and disaster recovery system and therefore, comes with a higher total cost of ownership.

Hybrid ERP

A combination ERP system that typically includes an on-remise set up as well as some integrated cloud features. This tendency to mix and match ERP products and deployment modules has also influenced many businesses to mix and match a variety of modules from different vendors in order to meet their needs. As a result, business

applications are now often times pieced together rather than acquired in one single ERP suite from one single vendor. This allows businesses to have added flexibility, but it also creates additional significant integration challenges.


ERP DEPLOYMENT

Deployment	Typical Buyer	Benefits
 Cloud	Small to medium-sized businesses	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Low upfront costs <input checked="" type="checkbox"/> Scalable <input checked="" type="checkbox"/> Data redundancy <input checked="" type="checkbox"/> Mobile-friendly <input checked="" type="checkbox"/> Seamless updates
 On-Premise	Large and enterprise-level businesses	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Customizable features <input checked="" type="checkbox"/> Greater control <input checked="" type="checkbox"/> Data privacy <input checked="" type="checkbox"/> No internet needed <input checked="" type="checkbox"/> Integrates with incumbent manufacturing execution systems
 Hybrid	Businesses with legacy systems in transition	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Broad functionality <input checked="" type="checkbox"/> Versatility <input checked="" type="checkbox"/> Data control and access <input checked="" type="checkbox"/> Easier transition to full cloud <input checked="" type="checkbox"/> Can combine multiple best-of-breed solutions

COMPARING ERP DEPLOYMENT MODELS			
CONSIDERATIONS	ON PREMISES	CLOUD (SaaS)	HYBRID ON PREMISE & CLOUD
Data control	↑	↓	■
System control	↑	↓	■
Integration	■	↑	↑
Update Frequency	↓	↑	↑
Mobile Accessibility	■	↑	↑
Security	↑	■	■
Reliability	↑	■	■
Price Flexibility	■	↑	↑
Implementation Timeframes	↓	■	■
Initial Investment	↓	↑	↑

↑ HIGHER ■ MEDIUM ↓ LOWER

SCALE IS BASED ON GENERAL LEVEL OF ABILITY OR COST RELATED TO EACH SYSTEM BUT MAY VARY BY ORGANIZATION



20.8 Three different styles of ERP

Small Business ERP

Also known as a lightweight business management software that is designed to meet the needs of a small business, 200 employees or less. No matter how small the business is, it can always benefit from an ERP implementation. The most common benefits small businesses get from an ERP are increased transparency, real time decision-making, and increased productivity. Below are some indicators that it may be time for an ERP implementation:

- Difficulty tracking inventory in warehouse
- Sales forecast is based on guesswork
- Business cannot keep up with high volume orders
- Business relies heavily on spreadsheets for operation purposes
- Difficulty gathering solid data

In finding the right ERP for any business, not just a small business, solely depends on the business itself. In other words, there is no “one size fits all” ERP system. Each business has different needs and operating strategies, as well as business standards and goals. As a small business, it is vital to find the most cost-effective ERP that also meets your immediate and long-term needs, and fits in your industry while also being manageable. Below are some factors to consider when choosing your ERP package:

- Ease of use
- Customization
- Security Measures
- Support services
- Cloud or on-premise
- Total cost of ownership

Midsized Business ERP

This style of ERP is ideal for midmarket companies that have anywhere from 200 to 1000 employees. SAP defines their midsize ERP software to have built in analytics, rapid deployment, and best practices for 35 different business processes, such as financials, HR, supply chain management, and procurement. The key aspects of midsize business ERPs is to grow the business while still fitting your needs and budget through the following:

- Connected processes across departments
- Access to insights and analytics from anywhere
- Quick deployment for a fast ROI
- Seamless interactions with consumers and suppliers

Similar to the small business ERP, each midsize business has different needs and operating strategies, as well as business standards and goals. As a midsize business, it is vital to still find the most cost-effective ERP that primarily meets long-term needs, and fits in your

industry while also being growth focused. Factors to consider when choosing your ERP package are similar to the small business ERP factors above.

Enterprise ERP

This type of ERP is focused on large businesses that have more than 1000 employees along with large scale operations and a variety of specialized departments working cross-functionally with each other. In this category of ERP systems, all of the benefits mentioned in the previous section will apply due to the large scale of data that enterprises have on a daily basis. An example of this is Johnson & Johnson, being a Fortune 500 company and having a big international presence, this company uses an ERP system for improved internal management. From communicating with suppliers and customers, to streamlining the operational supply chain, to having one platform for all financials, J&J is using its ERP system to grow, evolve, and succeed.

FUNDAMENTAL CONCEPT: Enterprise Resource Planning (ERP) systems act as the operational backbone and data hub for any organization that has an ERP system in place. It streamlines business processes, eliminates duplicate work, and allows for one “true data story”. This means that everyone will be working with the same data and avoid any miscommunication or human error.

20.9 Three Rivers Hot Sauce Company – After ERP

Now, having a comprehensive understanding of the different types of ERP systems and their benefits, this section will apply those concepts and walk through an ERP implementation using this book’s fictional company, Three Rivers Hot Sauce. Section 20.2 outlined all the operational issues that Three Rivers was starting to experience with its

continuous growth and lack of operational support systems in place. As a result, Lisa Garcia decided to take the next step in expanding her company and move forward with an ERP implementation in order to solve all the previous issues and streamline her business processes to make them more efficient.

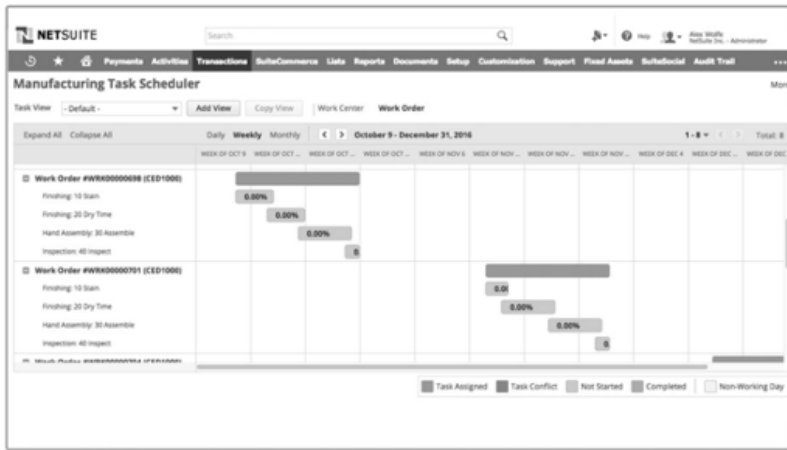
After a lot of research and comparing and contrasting of different ERP solutions, Lisa decided to go with the most popular choice for cloud-based ERP systems, Oracle NetSuite. She found that NetSuite has all the capabilities to streamline her operational needs, such as financial management, order management, production management, supply Chain Management. It also includes features, such as financial planning, warehouse and fulfillment, and procurement, which might become more and more relevant for Lisa as her business continues to grow. Therefore, NetSuite is the best solution for Three Rivers, as it is engineered to grow with the business needs and provides a lot of flexibility in terms of innovation and market opportunities, which perfectly describes Three River's current positioning.

Below is a short summary of NetSuite's small business benefits:

- Business finances streamlined through automation
- Real-time insights and control to your business operations
- Growth of new products, channels, and markets with agile features and capabilities

After choosing the right ERP fit, Lisa is getting ready for their NetSuite implementation. Let's walk through what that will look like for Three Rivers. For simplicity and ease of understanding the following features of NetSuite will be broken up in what business area they fall under, details of the application, and the ERP featured solutions associated with the previous operational issues.

Production Management

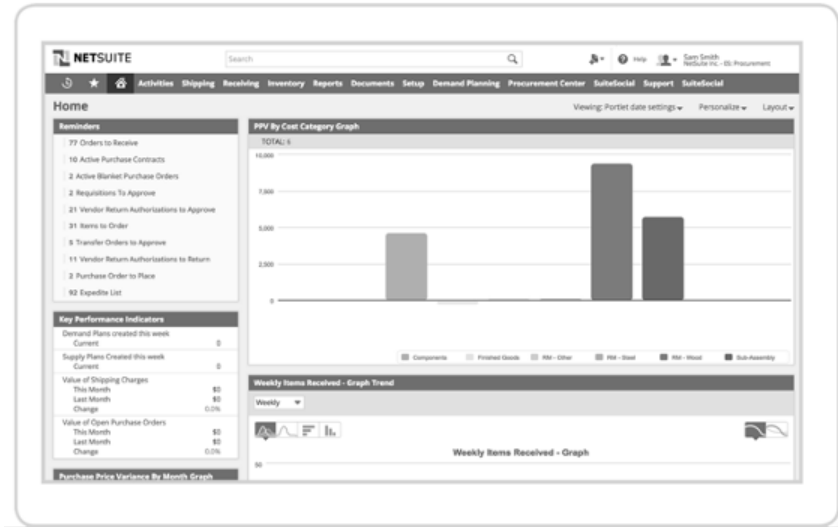


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Operational Solutions:

- Real-time insights and transparency over all the distribution channels and product movement across different suppliers and third-party logistics partners.
- Increased traceability of product at all time due to real-time tracking ability.
- System in place to schedule shipments and potential freight consolidation to meet customers' expectations and cost savings.

Supply Chain Management

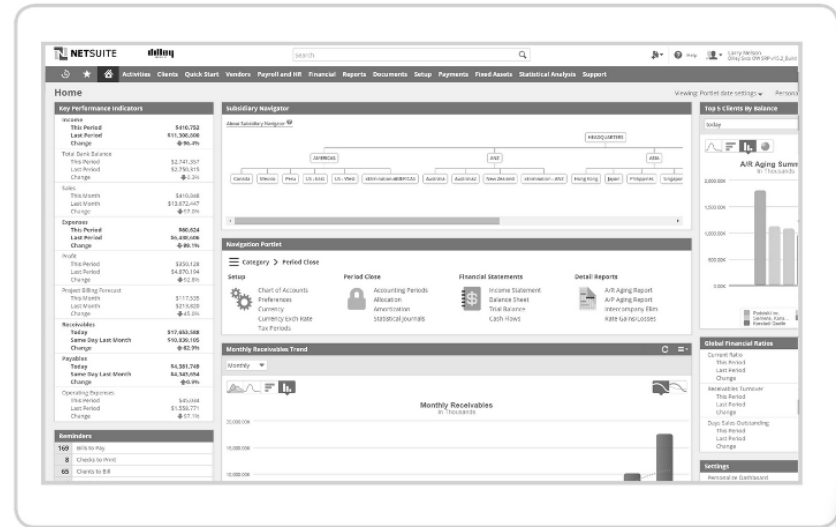


NetSuite's supply chain management solution, shown on the figure above, is capable of managing a company's manufacturing, distribution, and supply chain process. It also allows business to make critical decisions regardless of where the product is physically made or stored due to its capabilities to manage all that and lead times with ease. This module's features include planning, execution, and collaboration among suppliers and partners.

Operational Solutions:

- Real-time insights and transparency over all the distribution channels and product movement across different suppliers and third-party logistics partners.
- Increased traceability of product at all time due to real-time tracking ability.
- System in place to schedule shipments and potential freight consolidation to meet customers' expectations and cost savings.

Financial Management



NetSuite's financial management solution, shown on the figure above, is capable of expediting daily financial transactions, financial closes, and ensures full compliance overall. This cloud-based feature also ensures real-time visibility into the business's financial performance and is integrated with other NetSuite modules, such as order management, inventory, and CRM to streamline critical business decisions and processes. It also features other financial activities, such as billing, revenue recognition, financial planning/reporting, and finance and accounting.

Operational Solutions:

- Ensures financial visibility for daily operations and future financial planning.
- Provides centralized financial system with record keeping capabilities.
- Simplifies and expedites all financial transactions to lighten workload.

Order Management

NetSuite's order management solution, shown on the figure above, is capable of streamlining the order process by eliminating manual bottlenecks, errors and ensuring timely invoicing and payment. This cloud-based system also integrates sales and finance data in order to eliminate billing errors and improve fulfillment accuracy and efficiency. It also features other order management activities, including pricing and promotions, sales order and returns management.

Operational Solutions:

- Capacity to manage an increasing customer base and meet all their expectations.
- Centralized order management system to streamline all order processes.
- Requires less human capital due to automated and streamlined systems in place.

Overall, Oracle NetSuite is an extremely capable cloud-based application that will address all of Three River's operational issues mentioned in Section 20.2. It will also allow the company more room

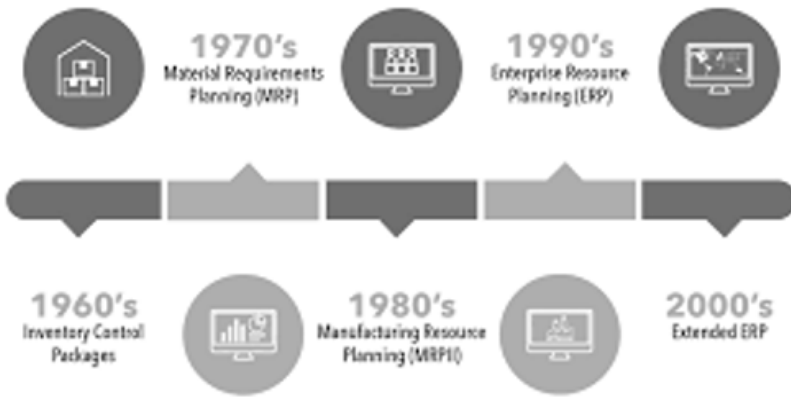
to grow with more advanced features that will adapt to the business's needs. Even though, implementations are extremely costly and are never-ending, this specific application being targeted for small businesses is less costly than bigger, more advanced SAP type ERP solutions for large multi-billion enterprises. In addition, Lisa and Maggie will now be more capable to run their business and start growing their customer base and potentially hire more employees to help out with any technical ERP advancements down the road.

FUNDAMENTAL CONCEPT: Overall, ERP's have many different capabilities depending on the company's size and needs. Put in simple terms, an ERP is like a Lego set, if the owner wants to grow his Lego world, he builds an add-on set. Similarly, if a company wants to expand and therefore requires more ERP capabilities, it can add more advanced ERP modules depending on what is needed.

20.10 The History of ERP

ERP has become such an integral part of businesses worldwide. As seen in the Three Rivers Hot Sauce example in this chapter, ERP systems have a lot of benefits and help companies to streamline their internal and external processes and operations. However, it has not always been like that. ERP systems have only been around since the 1990s but have originated from other systems long before then. Below is a quick timeline of all the different milestones in the evolution of ERP systems to give a better understanding of how ERP came about and what the driving forces were.

THE HISTORY OF ERP SYSTEMS



1960s

As computer hardware and software was rapidly developing in the 1960s, the mainframe computers became the first practical business computers. Even though these computers were a big first step in operational practices, they were not powerful or fast enough to provide integrated and real-time data for business decision making. However, they did help with managing the increased modern factory production levels and thus, the first simple *Inventory Control systems* were born, the first step of a long road to ERP systems.

1970s

As relational database software was being developed in the 1970s, it provided businesses with the ability to store, retrieve, and analyze large volumes of data. This also helped with the newest development from Inventory Control Packages to more advanced *Material Requirements Planning (MRP)* systems. MRP programs are computer-based inventory management systems designed to plan manufacturing, purchasing and delivery, as well as keep inventory levels low, which also decreased the amount of money tied up in inventory. In other words, MRP helps

answer three questions: What is needed? How much is needed? When is it needed? It then works backwards from determining a production plan for finished goods to converting that plan into a list of raw materials and components required to meet the production schedule. At that time, MRP software was only affordable and feasible for large manufacturers with very big mainframe computer capabilities. At this time, experts were also working on developing financial management software, but separate from MRP efforts.

1980s

In the 1980s, spreadsheet software became a fundamental business tool and very popular in businesses. It enables companies to perform complex business analyses without relying on custom programs developed by programmers. It also helped with the newest version of MRP, called MRP II, also known as *Manufacturing Resource Planning*. This newest development now had the ability to integrate additional data, such as employee and financial data. By bringing together more cross-functional information, the system is now able to centralize, integrate, and process information for effective scheduling, design engineering, inventory management, and cost control. MRP II is also able to create even more detailed production schedules than the original MRP system, due to using real-time data, coordination of arrival dates, and comparing those to machine and labor availability. MRP II systems are still in use by manufacturing companies today. They can be either found as stand-alone systems or integrated in ERP packages.

1990s

The acronym ERP was first used in the 1990s, as it combined MRP and MRP II capabilities together with other functionalities such as engineering, finance, accounting, HR, and project management. As mentioned, multiple times throughout this chapter, ERP is the process to manage and integrate the important parts of the business. It acts as the glue that connects the different computer systems for

large organizations. More detailed information about ERP systems can be found in section 20.4.

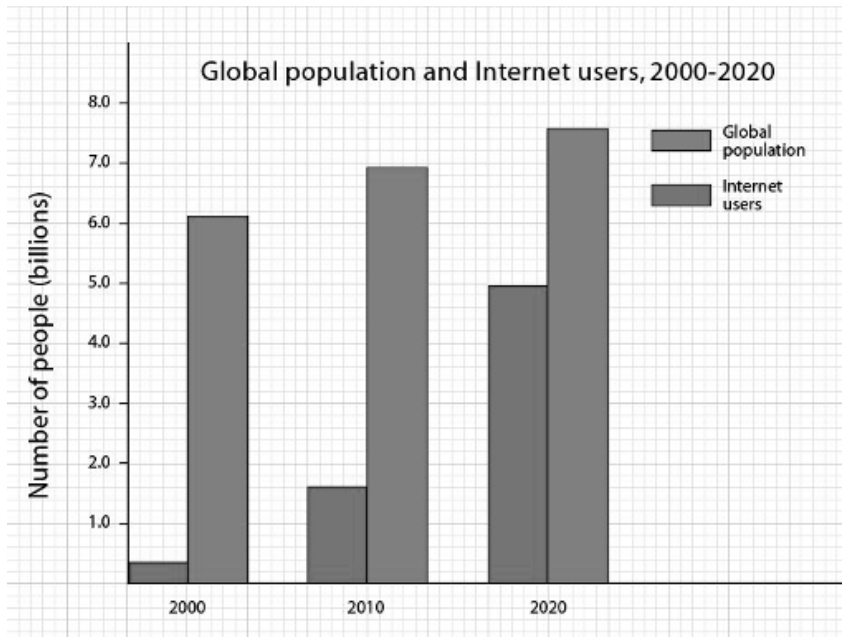
2000s & Today

In the 2000s, cloud-based ERP systems started to become popular, as it enables management to integrate systems outside of the business, such as supply chain management, and customer relationship management due to the internet-enabled software. More information about cloud-based ERP can be found in section 20.3. The ERP vendors that really emerged in the 2000s and have been dominating the market ever since include, Microsoft, Oracle, SAP, Infor, Sage, and NetSuite.

20.11 Future IT Trends

We are currently amidst the 4th Industrial Revolution and technology is everywhere and evolving faster than ever. Leading companies are putting a lot more emphasis on “future systems”, which are defined as technology innovations that constantly change the way companies operate internally, externally, and conduct business. A recent Accenture report, indicates that the majority of business leaders are currently investing in innovation and the so called, future systems, more than ever. As a result, they tend to adopt new technologies earlier, develop higher levels of expertise faster, and prioritize the optimization of those implementations before other projects. In addition, Accenture found that business leaders believe that humans and machines can bring out the best in each other and that innovations within and outside of the organization can be scaled. As seen in the figure below, this does not just apply to the companies, but also to the individual based population. The number of people with access to the internet has been increasing exponentially. Dramatic shifts in population behavior like this only further drive worldwide interconnectedness and therefore, global innovation on a scale that has never been seen before. Therefore, any companies and individuals that choose not to keep up with

major trends, are at an extremely high risk of being left behind for good.



20.11.1 Artificial Intelligence

AI has lots of definition and can be used by companies in many different ways. Forbes describes it as the process of every aspect of learning or any feature of human intelligence being so precisely describes that a machine can stimulate it. Thus, often times AI causes a certain amount of unease and fear of the unknown in the industry due to its broad scope of possibilities and untapped potential that has yet to be discovered. Leaders, like Stephen Hawking and Elon Musk have also warned of AI and its high capacity to quickly evolve from benefiting human society to taking over and becoming a threat. However, that is just one definition of AI, another, more modern definition, by Forbes describes it as a sub-field of computer science and machines imitating human intelligence, rather than becoming human. The English Oxford Living dictionary gives yet another defi-

nition: The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages. For the purpose of this book, we will move forward with that last definition.

Overall, all of these definitions show that AI is still such a new innovation on the technology market and is continuing to evolve depending on the goals that are trying to be achieved by the company using the systems. The most common use of AI in today's business world is to use human reasoning as a model and not necessarily the end goal. Thus, most companies invest in AI to provide better products or service and improve the customer experience to streamline business operations. However, while more and more companies are now starting to rely on AIs, designing and implementing an entire AI-based system for just one company is an extremely expensive undertaking. Therefore, most of the current AI applications are being delivered through providers based on a service platform, which allows companies to buy the algorithms and computer resources from those established AI companies and plug in their own data for a much smaller price. A few examples of AI established companies are, Amazon, Google, and Microsoft. In addition, in 2016 all of those companies and Apple, DeepMind, and IBM joined together to create "Partnership on AI to Benefit People and Society". This collaboration studies and formulates best practices on AI technologies together and advances the public's understanding of AI by sharing those insights on a public platform open for discussion and engagement on all things AI.

In the future, the development of AI will only grow with a wider adaption and bigger pool of providers, offering more tailored applications and services specific to companies' needs. As a result, even smaller companies will have access to such services and the use of AI services will become more and more common in everyday business transactions and decision making. Finally, while still keeping the potential threats, mentioned earlier, in mind, the primary focus

of those using AI will be to use its highly technological capabilities to benefit the greater good of society and enhance the world.

Now, since AI does pose a threat to the human workforce and nobody really knows how big that potential threat might be, it is important to educate yourself on what you can do to get ahead of it. As mentioned above, AI will only grow and most businesses no matter how big or small will start to integrate it more and more in their daily activities. Therefore, that will affect the dynamic of human workers and their business activities and responsibilities. Below is a list of all the preparations you can take to ensure a career that can leverage AI, instead of being replaced by AI. Even though these are specifically tailored towards AI, these tips can be applied to all the major IT trends in this chapter touched on later.

6 Helpful Tips to Protect Your Job:

1. Stay relevant and innovate – AI threatens jobs that tend to be repetitive. Get involved and contribute to your team by becoming part of the conversation and participate in more strategic processes. Your goal is to become the subject matter expert!
2. Become an AI expert – Since AI is not going anywhere, learn as much as you can about it and how you can leverage it in your own organization. You will become not only an asset, but are also increasing your credibility and securing your job.
3. Adapt – Figure out what areas of your work could be automated and adapt to new skills, like analytics, in order to prepare yourself for the switch and make sure you are still a valuable asset to the company.
4. Build relationships – Stay connected with influential people and build a network by making a name for yourself within the organization. Get involved in project outside of your job scope and show your problem-solving skills to higher level management. As a result, if AI does take over, your chances

to be reassigned to another role instead of being replaced are much higher.

5. **Develop your EQ** – Even though AI can replace once IQ on some level, its emotional intelligence capabilities are limited. Grow your emotional intelligence and soft skills and become indispensable with a value proposition that is very difficult to replicate.
6. **Be flexible and helpful** – Expand your job scope by offering to help your co-workers. Ask if they need someone to fill in for them at lunchtime or when they need to go to an appointment or conference. Become a continuous learner by being able to work in multiple positions and make yourself invaluable at the same time.

20.11.2 Blockchain Technology

Blockchain, also known as the record-keeping technology behind Bitcoin, is a new technology that is fairly difficult to understand and only experts can truly comprehend its entire concept. To make it simple, think of blockchain as a “chain” of “blocks”, blocks meaning digital information and chain meaning a public database. More specifically, these digital information blocks have three parts to them:

- **Date, Time, and Dollar** – Blocks store information about transactions, such as date and time, and the dollar amount.
- **Participants** – Blocks store information about who was participating in transactions. Instead of using the actual name of the person, blockchain creates a unique digital signature, like a username, without any identifying information.
- **Unique identifier** – Blocks store information that distinguishes them from other blocks. These unique codes are called “hash” and created by special algorithms.

One block can hold a few thousand different transactions and a

single block on the Bitcoin blockchain can store up to 1MB of data. Then, when a new block stores more information, it automatically gets added to the blockchain, creating a “chain” of information. That piece of information is then available to the public and for anyone to view, which makes blockchain a public system that is not private. In fact, if a user opts to connect their computer to the blockchain network, they receive a copy of every single new block that has been added to that blockchain, similar to any sort of social media news feed that gives you status updates. As a result, each user/computer in the blockchain network has its own copy of the blockchain, which means that there are millions of copies of the exact same blockchain, making it extremely hard for anyone to manipulate that information. If a hacker tried to change anything in the data of one specific blockchain, it would be simply impossible due to there being so many copies out there spread around the entire world at times. The fact that there are so many copies that get distributed, blockchain is also sometimes called a “distributed ledger”.

Back to the security issue that can be associated with blockchain, since it is 100% public. Since every new block is always added to the last block in the chain, it creates a really long, linear chain that is connected. Therefore, if a hacker wanted to change a transaction in the past, he would not only have to alter that hash but also every other hash after that until he finally arrived at the newest one, making it near impossible to recalculate all those hashes. In addition, before a user wants to join a blockchain, it has to pass a computer test called a consensus model. In this screening process, the computer must solve extremely complex math problem before deemed eligible to join the blockchain. In summary, the blockchain model consists of five major elements: a distributed ledger, a traceable ledger, encryption, tokenization, and a public consensus mechanism.

Even though blockchain is extremely complex, its decentralized model of record-keeping comes with lots of benefits, such as:

- Increased accuracy through removal of human verification

- Cost reduction by eliminating third-party verification
- Decentralization reduces chance of hackers
- Transactions are securely and efficiently stored with privacy (no identifying information)
- Transparent technology (ability to trace back transactions all the way to its origin)

A few disadvantages of blockchain include:

- High technology cost on the front end
- Low transactions per second (takes a few minutes to add a block)
- Tendency to be used in illicit activities
- Increasing risk of being hacked due to technology advancements

At the moment, blockchain remains in its testing and small-scope stages due to a range of technical problems, like scalability. However, Gartner experts predict that blockchain will be fully scalable by 2023. Currently, big companies like FedEx, IBM, Walmart, and Mastercard are continuously investing in blockchain to make that happen. Facebook is also currently working on launching its blockchain-based cryptocurrency, called Libra. In the future, the completed blockchain model will have the potential to transform business markets and alongside, AI and Internet of Things, blockchain is most likely to revolutionize the entire economy.

20.11.3 Internet of Things

The Internet of Things, also known as IoT, can be defined as a large network made up of connected devices to the internet. These devices include other gadgets besides a computer or smartphone, such as cars, kitchen appliances, security systems, and even medical devices such as heart monitors. The most commonly used IoT devices at the moment include remote car starting apps and at-home lighting and

temperature control via smartphones. Even though this list is just a small sample of all the devices that are currently already a part of the IoT, the scope of IoT will only grow in the next few years and with it the number of devices that share that quality. In order to be considered an IoT device, it has to be a stand-alone device that can connect to the internet and controlled or monitored from a remote location. As technology is progressing and chips are becoming smaller and more powerful, experts are saying that almost all products can be turned into IoT devices.

In order for IoT to work, there is a whole ecosystem on the backend, such as gateways, analytics, and security. Other key parts of the IoT ecosystem are outlined below:

- **Physical layer** – The hardware of an IoT device that has all the networking gear and sensors.
- **Network layer** – The part of the device that is responsible for transmitting the collected data to different IoT devices via the internet.
- **Remotes** – Enables users of the IoT device to control the device using a mobile application for example.
- **Dashboard** – Displays the share the information about the IoT ecosystem to the user and gives them control over it. This is usually included on a remote.
- **Data Storage** – The place where the data from the IoT devices is stored.
- **Networks** – This is the internet component of an ecosystem that enables users to communicate with their devices and vice versa.
- **Analytics** – Software systems that take all the data from the IoT devices and analyzes it. This can often times be used for predictive maintenance.
- **Platforms** – While one device transmits information to another using the internet, the data has to go through a platform, which serves as a connector between the device's

sensors and the data networks. Amazon, Microsoft, IBM, Cisco, Salesforce, and Oracle are currently some of the top IoT platforms on the market.

Overall, IoT devices have the power to not only bridge the divide between the physical and digital world, but also be the driving force behind the developing data-based economy of the future. Business experts are estimating that more than 64 billion IoT devices will be installed worldwide and the market will grow to over \$3 trillion annually by 2026. They also predict a total spend of almost \$15 trillion amongst consumers and companies to be spent on IoT related products and systems between 2018 and 2026. Companies that have stood out the most in IoT and invest heavily are Intel, Microsoft, Amazon, IBM, Google, and Cisco to name a few. Industries that will benefit the most from IoT include, manufacturing, transportation, defense, agriculture, infrastructure, retail, banks, insurance, food services, and healthcare. In addition, IoT will also benefit the consumer and the environment. For example, having a smart home with smart lighting has the potential to reduce your overall energy consumption and electric bill. Smart city infrastructures have the ability to create an entirely different ecosystem with more efficient routing and less traffic on the roads. Finally, the healthcare industry could benefit hugely from IoT, giving people a deeper and more in depth look at their own health than before.

However, there are also a lot of privacy and security issues associated with the growth of IoT. For example, in 2019 a group of hackers took down an entire power grid in western Ukraine, causing the first blackout from a cyber-attack. This is likely to only continue, as the whole nature of IoT relies on the ecosystem of the internet, making it extremely vulnerable to hackers. Consumers are also at risk, as their privacy is no longer guaranteed and a big part of their lives is now connected on the internet. Below is a short list of some of the major security and privacy issues associated with IoT.

- **Public perception** – The majority of consumers are worried about the possibility of their private information being stolen from their smart home. With that kind of concern, consumers have proven to show doubt and hesitation when purchasing IoT devices. Thus, the industry needs to take that very seriously and prioritize security issues in order to guarantee a successful future for IoT.
- **Vulnerability to hacking** – Hackers have proven that they can hack into devices without much effort, which means that there is a lot of room for hackers to replicate that type of manipulation. A research project lead by Microsoft at the University of Michigan, discovered multiple “holes” in the security of Samsung’s SmartThings IoT platform by using not very complex methods.
- **Companies are not ready** – AT&T’s Cybersecurity Insights Report showed that 85% of companies intend to deploy IoT networks, however, only 10% feel they have the systems in place to keep those networks secure.
- **Data overload** – The amount of data that IoT devices can gather is unimaginably high. A Federal Trade Commission report showed that less than 10,000 households can accumulate more than 150 million unique data points every single day. With that much vulnerable data being exposed, it leaves too many opportunities for hackers to retrieve sensitive information.
- **Unwanted use of data** – Companies could easily use that type of data being generated by IoT devices to make decisions consumers are not even aware of due to their agreement to terms that they might not even have understood in the first place. For example, health or care insurance companies can use such information to build a profile around their customer with all the sensitive and private information found from IoT devices such as smart cars, smart health devices, etc. in order to calculate the customer’s insurance rate.

FUNDAMENTAL CONCEPT: Information Technology is an ever-changing field that will only continue to advance and keep accomplishing the impossible. It will drastically change the future workforce and affect everyone's jobs one day. Be prepared as much as you can and embrace the change by being on the forefront of it!

20.12 Key Terms

Information Technology

Database

Enterprise Resource Planning (ERP)

Accounting

Procurement

Project Management

Risk Management

Supply Chain Management

Contract Manufacturer

ERP Implementation

New Product Development

Distribution Channel

Transportation

Freight Consolidation

Finance

Marketing and Sales

Customer Relationship Management (CRM)

Modular software

Analytics

Material requirements planning (MRP)

Enterprise asset management (EAM)

Product lifecycle management (PLM)

Cloud-based ERP

On-premise ERP

Hybrid ERP

Production Management

Financial Management

Order Management

Inventory Control System

Material Requirements Planning (MRP I)

Manufacturing Resource Planning (MRP II)

Artificial Intelligence

Machine Learning

Blockchain Technology

Digital Security

Internet of Things

Network

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