



Managing Supply Chain Risk

Learning Outcomes

By the end of this unit the learner will be able to:

- ✓ Identify risks that may affect a supply chain
- ✓ Discuss how to minimize risks and reduce the impact of these events.

Managing Supply Chain Risk

Supply Chain Risks

Here are some of the top risks that can negatively affect supply chains.

Severe Weather Events

There is no doubt that weather events such as hurricanes and tornadoes are increasing in frequency and severity. Similar events can have a major impact on the flow of a business' supply chain and its profits. For example, after the 2011 earthquake and tsunami in Japan (as well as the flooding in Thailand), Toyota's profits fell by \$18.6 million due to severe disruption in their supply chain, particularly with their manufacturing facilities.

Political Unrest and Terrorism

Unrest caused by disruptions in the political system of a country or terrorist activity can wreak havoc in a supply chain. Shipments can be delayed or intercepted, factories may shut down, and workers may be unavailable.

Terrorism can also impact how supply chain management activities are performed. For example, after the September 2001 terrorist attacks in the United States, customs and security procedures changed dramatically, altering the way millions of companies did business.

Loss of Control through Outsourcing and Globalization

Many organizations outsource key processes (including product sourcing, manufacturing, and distribution). This can result in a loss of control over processes, quality, and the end product itself.

For example, in 2012 and 2013, European food safety agencies discovered that ground beef being sold in supermarkets actually contained undeclared horse and pork meats. The errors were traced back to slaughterhouses in Romania and Poland. The supply chains that were responsible involved multiple re-distributors, requiring lengthy and extensive investigation by several different food safety agencies.

Increased Specialization

In an effort to reduce costs, many companies manufacture products at only one or two facilities. If those facilities are damaged, the supply chain may not be able to complete manufacturing activities.

For example, the potato chip snack Pringles™ used to be made in only two factories: one in Jackson, Tennessee and the other in Mechelen, Belgium. When severe tornadoes struck the Jackson, Tennessee facility in 2003, production (and subsequent revenues) was so severely impacted that parent company Procter & Gamble suspended North American distribution for several weeks.

Mitigation Strategies

No matter what type of risk exists, the result is the same: possible disruption to the supply chain. Here are some strategies that you can use to minimize risks and reduce the impact of these events.

Consider the Big Picture When Making Decisions

Sometimes the best way to mitigate a risk is not to place the supply chain in a vulnerable position. For example, let's say that your organization can save a million dollars a year by moving all manufacturing facilities to a region that is highly vulnerable to flooding for eight months of the year. You must also consider the possible impact to the supply chain and business revenues if manufacturing is disrupted for a significant period. Are the savings worth it?

Transfer Responsibilities to Other Partners in the Supply Chain

Transferring responsibility to the partners performing the actual activities can motivate them to reduce risks and improve the resiliency of the supply chain. For example, some organizations have a profit sharing program with their logistics provider. If the supply chain is disrupted, so are profits, and the logistics provider sees a direct reduction in their profits as well.

Extend Visibility through the Supply Chain

Give all the members of the supply chain as much information as possible about what's happening in the supply chain. As well, make sure that your organization knows what's happening every step of the way. This can be achieved through information management systems and supply chain teams that have members from all partners involved.

Identify Your Priorities and Create a Backup Plan

Your organization should have a clear picture of the critical steps in its supply chain. Then, those critical items should each have a backup plan. Here are a few examples.

Critical Path Step	Risk	Backup Plan
Product crosses border from country A to country B to complete manufacturing	Significant political unrest between countries A and B often leads to border closures	Increase transport time by three hours and use border crossing between countries C and D instead
All products require a widget to complete production	Widget is only manufactured in one plant	Create agreement with one manufacturing facility near each production plant to create widgets if primary widget plant is disrupted

Information is shared with suppliers through a single system (SupplyNet)	SupplyNet operates from a single office and goes down if power is lost	Create backup servers so that service is not disrupted
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Stay on Top of Inventory Planning

Ensure that your inventory planning reflects the risks facing your supply chain. This could include reducing the time it takes for products to get from the manufacturing facility to the end user, simplifying the supply chain so that products have fewer steps to take (and thereby face fewer risks), or building up safety stock during times of potential crisis.

Tracking and Evaluating Supply Chain Data

Ratios and Formulas

Introduction

Gathering, tracking, and measuring data is an important part of measuring the success of your supply chain. Here are some common ratios and metrics that can provide you with insight into the efficiency and responsiveness of your supply chain.

Business Metrics

First, let's look at some basic metrics that can help you evaluate the overall health of the business.

Net and Gross Profit Margin

These two ratios measure the amount of money that the business earns as a percentage of overall revenue.

Gross profit margin takes into account only the cost of making the product or service. Therefore, its equation looks like this:

$$\frac{\text{Gross Profit}}{\text{Gross Sales}}$$

The net profit margin shows what the business has earned after selling its products and paying all expenses – the true bottom line. Its equation is:

$$\frac{\text{Net Profit (After Interest and Taxes)}}{\text{Gross Sales}}$$

The results of both equations are expressed as a percentage.

Collection Ratio

This ratio shows the number of days it takes for your business to get paid for sales where you are providing credit. Here is the formula:

$$\frac{\text{Accounts Receivable} \times 365}{\text{Gross Sales}}$$

Investment Turnover

This ratio shows the ability of your business to use its assets to generate sales income. Calculate it with this formula:

$$\frac{\text{Gross Sales}}{\text{Fixed Assets}}$$

A good indicator of the strength of the business is its ability to generate more and more sales from a stable asset base. If the ratio is declining, it can indicate that the growth of the business is not being met with a matching growth in sales proportionate to your investment in assets. In general, the higher the ratio, the stronger the business.

Return on Investment

This analysis provides a clear indication of business profitability. It shows how much profit a business is able to generate in proportion to its net worth. The formula is:

$$\frac{\text{Net Profit}}{\text{Net Worth}}$$

This figure shows what level of actual return you are getting on the money which you have invested in your company. Unless you are actively working toward a healthy return on your business investment, your business has little chance to grow and thrive. A respectable goal is to aim for a 12% return in order to remain healthy and viable.

Revenue per Employee

This ratio shows how much money is generated per employee. A high ratio typically indicates high productivity.

$$\frac{\text{Revenue}}{\text{Number of Employees}}$$

Inventory and Delivery Metrics

Cash to Cash Cycle

This formula calculates how long cash is tied up in the inventory process (including accounts receivable, accounts payable, and current stock). It is calculated using the following formula.

$$\text{Receivable Days} + \text{Inventory Days} - \text{Payable Days}$$

Inventory Turnover

This formula calculates how often inventory sells out and is replaced over a given period. It is most often calculated using this formula:

$$\frac{\text{Sales}}{\text{Inventory}}$$

It can also be calculated using this formula:

$$\frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$$

Order Fill Rates

A variety of data can be gathered on how orders are filled, shipped, and delivered, including:

- Average time for order to be filled
- Percentage of early, on time, and late orders
- Percentage of perfect orders
- Percentage of incomplete orders
- Percentage of damaged orders
- Accuracy percentage

These metrics can be tracked by order and/or by order line (each item in the order).

Backorder Information

Backorder information is another important set of data that should be tracked. Information to gather should include:

- How many backorders occurred in a given period
- When the backorders were placed
- What the value of the orders was
- How long it took for the orders to be filled

Sales Metrics

Return on Sales Ratio

This ratio allows a business to determine how much net profit was derived from its gross sales. It is very similar to the Net Profit Margin but it factors in all expenses, including interest.

$$\frac{\text{Net Income (Before Interest and Taxes)}}{\text{Gross Sales}}$$

This ratio tells us whether expenses are under control and whether the business is actually generating enough revenue to pay for its costs. The higher the Return on Sales Ratio, the better it is for the business.

Forecast Accuracy

This metric is very important for supply chain management. It compares sales projections to actual sales (typically by product units) for any given period.

The most common formula used to evaluate forecast accuracy is Mean Forecast Error:

$$\frac{\text{Actual Sales} - \text{Forecast Sales}}{\text{Actual Sales}}$$

Multiply the results by 100 to calculate the error rate as a percentage.

Return Rate

This metric calculates what percentage of products were returned. Here is the formula:

$$\frac{\text{Products Returned}}{\text{Products Sold}}$$

Multiply the results by 100 to calculate the return rate as a percentage.

What is Benchmarking?

Defining Benchmarking

Benchmarking allows an organization to track specific metrics in the areas that matter most to them. These metrics are typically called key performance indicators (KPI's). Benchmarking with KPI's allows a company to objectively, accurately compare data against themselves at past points. It also allows for equivalent comparison against competitors, industry leaders, and best practices.

What Benchmarks Should Be Measured?

In order to get a holistic view of the health of your supply chain, it is important to measure products, processes, and services. Here are the four key categories that will need to be evaluated in order to determine how well the supply chain is performing, as well as some sample KPI's in each area.

Category	Sample KPI's
Customer Service	- Product is available when required - Product is of the desired/expected quality - Product is delivered in expected timeframe
Business Processes	- Profit margins meet or exceed targets - Inventory meets targets such as cycle time, turnover time, etc.
Development and Manufacturing	- Processes are designed to optimize capacity and flexibility - Manufacturing times meet targets for quantity and quality
Supply and Demand	- Processes can handle a level of uncertainty and disruption - Manufacturing can be adapted to handle upswings and downturns - Product scope is clearly set (e.g. level of customization, requirements for special orders)

(Please note that we have kept each KPI quite generic in order to maximize its applicability. Each KPI will need to be customized for the specific supply chain to include objective targets, such as a maximum defect rate of 0.01% or minimum production rate of 100 units per day.)

Ultimately, it's the customer's perception that counts the most. They are at the end of the supply chain and represent the culmination of all the steps within the chain. Examining their level of satisfaction is an important part of benchmarking.

The SCOR Model

The Four Categories

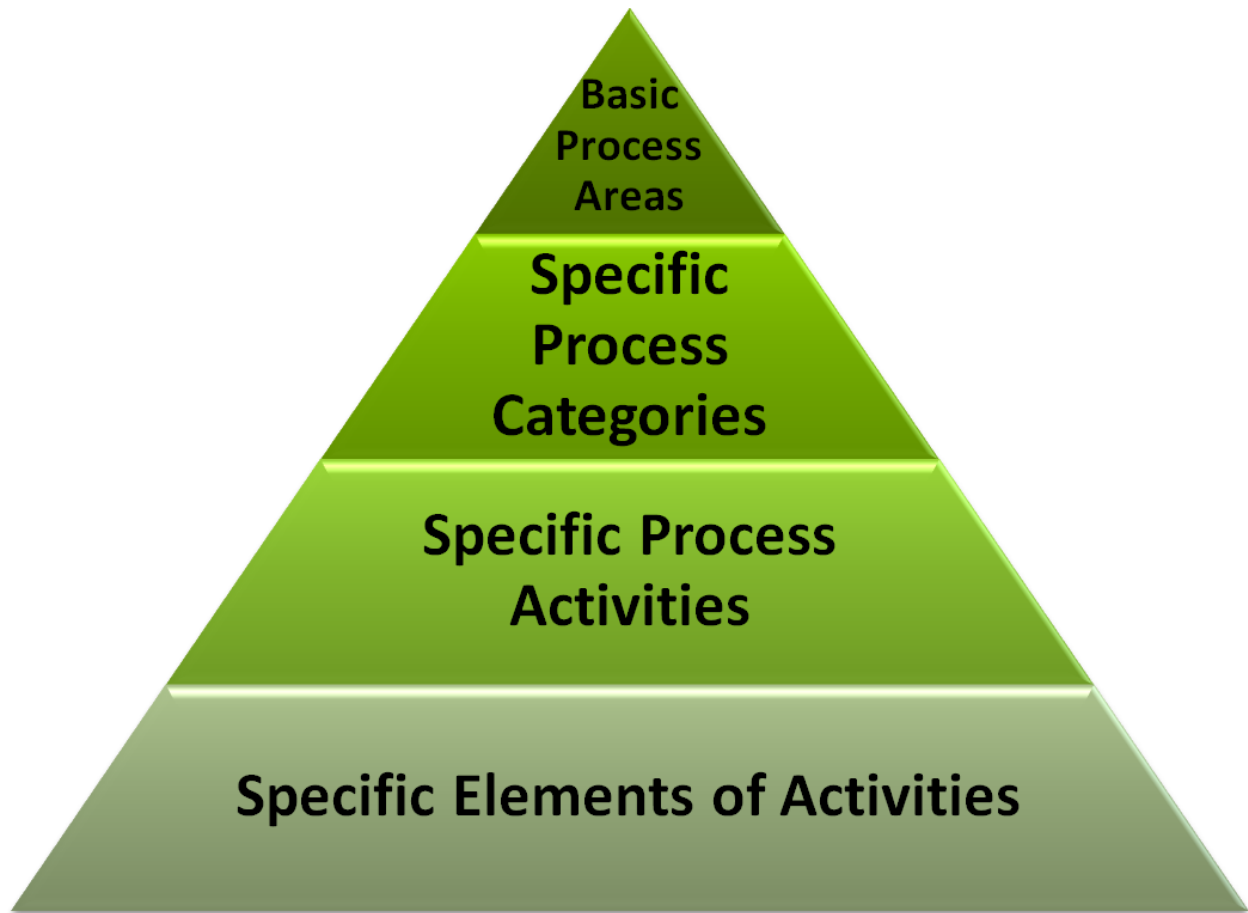
One of the most comprehensive models for supply chain benchmarking is the SCOR model developed by the Supply Chain Council. Although the details of the framework itself are copyrighted by the Supply Chain Council, we can share the basic structure.

The framework is based around the core process areas (plan, source, make, deliver, and return) that were covered in Session Four. For each process area, there are four levels of metrics:

- The first level sets basic performance targets that should remain the same no matter what type of supply chain is being evaluated. It focuses on the attributes that we have been discussing so far: reliability, responsiveness, agility (flexibility), cost, and assets.
- The second level sets out various process categories that can be customized depending on the supply chain. This also lets an organization customize the complexity of the model.
- The third level breaks out the various processes in more detail and allows organizations to fine-tune the processes, metrics, and best practices for each area.
- The top level focuses on taking excellence a step further with supply chain management best practices specific to the industry. The goal of this area is to give the organization a competitive advantage through their supply chain and to build flexibility even further.

SCOR as a Pyramid

The basic framework of SCOR is represented as a pyramid, with each level delving deeper into the supply chain processes.

**References**

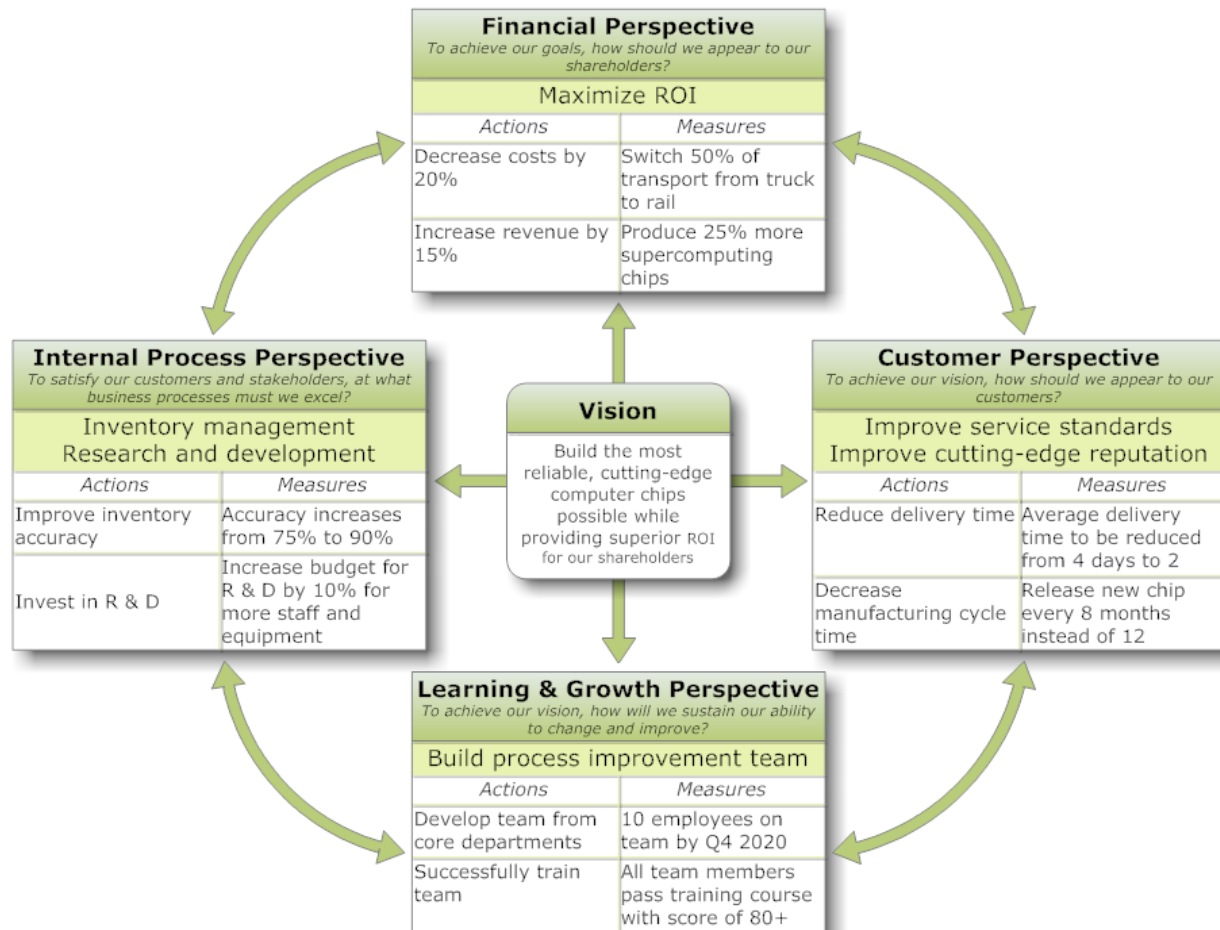
More information on the latest version of the SCOR model can be found at <https://supply-chain.org/scor>.

The Balanced Scorecard**What is the Balanced Scorecard?**

The balanced scorecard is used to communicate, measure, and execute any type of strategic plan. It provides a balanced way of synthesizing the critical actions required to achieve the goals of your supply chain. It can also help you identify the supply chain's strengths and weaknesses, provide a balanced overview of all elements, manage risks, and much more. It is particularly useful for supply chain management because of its holistic approach; it looks beyond basic financial results through to the underlying processes and non-tangible activities, and to the real drivers of the supply chain.

Sample Balanced Scorecard

In the balanced scorecard below, you can see the four perspectives and their objectives in the yellow boxes. Then, each perspective contains specific actions and measures. We have included a few supply chain-oriented actions and measures, just to give you an idea of what it's all about.



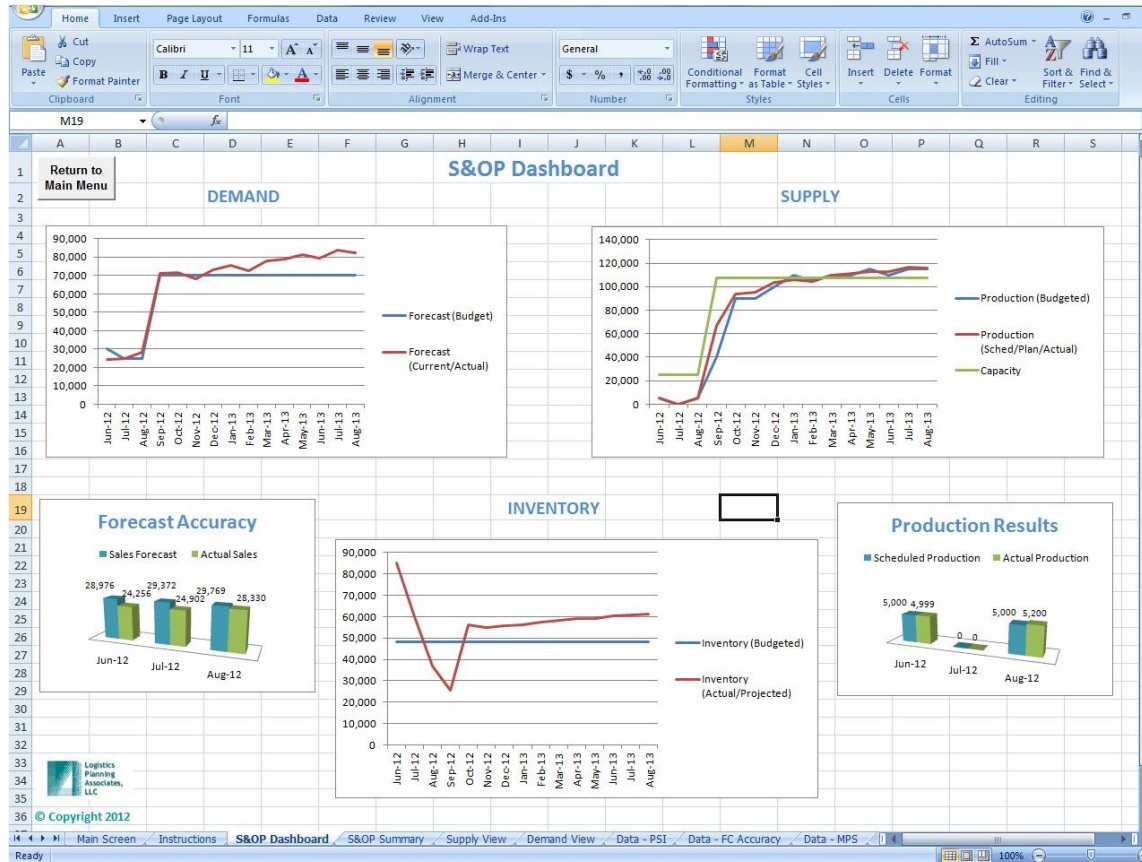
Adapted from the Balanced Scorecard by Robert S. Kaplan and Dave P. Norton. Harvard Business School Press. 1996.

Supply Chain Management Dashboards

About Dashboards

Dashboards are an extremely useful supply chain management tool. Ideally, they should give you an at-a-glance image of how a particular aspect of how your supply chain is performing. Dashboards should also enable you to quickly gather data on key performance indicators, evaluate it against your targets, and compare it with past data.

Here is a simple dashboard created using Microsoft Excel and a set of add-ins. You can quickly see visual information and specific details about key aspects of the supply chain, including current and forecasted data. You can also see additional views and business areas accessible through the worksheet tabs at the bottom of the screen.



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Creating a Supply Chain Dashboard System

To choose the right dashboard system for your supply chain, follow these steps.

Step One: Gather the Team

The first step is to create a cross-functional team with members from all supply chain functions. This should include representatives from the manufacturing, inventory management, logistics, and transportation teams, as well as members from supporting functions like information technology, finance, and human resources. Board-level members should also be on the team so that it has the authority to make and implement decisions.

Creating this type of team will ensure that all the necessary information is gathered so that a holistic solution can be created that will benefit the entire supply chain. It will also help the team create a solution that fits within the constraints of the organization (budget, resources, etc.).

Step Two: Identify the Problems

As a team, identify the problems that you're trying to solve with the dashboard. This might include:

- No easy access to real-time data
- Multiple spreadsheets are being maintained in multiple locations by different people
- Difficult to obtain data in a timely manner from different departments
- Difficult to efficiently share correct data with outside partners (such as transport carrier, suppliers, etc.)
- Difficult to consolidate data into reports
- Difficult to track key performance indicators and their impact on benchmarks

Step Three: Develop a Problem Statement

Now, create one or more statements about the problems that the dashboard will solve. Make sure that each statement is specific and objective.

Here are some sample problem statements.

- We are currently unable to quickly access real-time data across the various areas of our supply chain system (particularly inventory, manufacturing, and distribution).
- On average, there is a two-day delay in delivering information to our suppliers. This information should be provided automatically in real-time via a secure supplier portal.
- It currently takes business analysts one week to compile data on key performance indicators and benchmarks. This data should be accessible real-time to the executive team.

Step Four: Develop a Goal Statement

Finally, bring the problem statements together to identify the goal for the dashboard system. Your goal statement should be specific, have measurable targets, and be reasonable. You may also want to include a target date for implementation.

In our working example, we might build a goal statement that looks like this: "Our ideal dashboard will give us access to real-time data across the inventory, manufacturing, and distribution areas of our supply chain system in order to easily build KPI reports and share data with our suppliers."

Step Five: Determine What Data to Display

Now you can identify what data you want the dashboard to display. Here are a few ideas for our sample goal statement.

Inventory

- Number of units of each product in stock at each location
- Inventory value
- Order accuracy percentage

Manufacturing

- Number of units waiting to be processed
- Number of units being processed
- Number of units processed and waiting for packaging
- Number of units packaged and ready for shipment
- Average wait time before unit is processed
- Average wait time after unit is complete and before it is shipped

Distribution

- Number of units out for delivery
- Average delivery time
- Map with GPS location of each truck with specific load and driver information

Once your list is created, mark each item as “nice to have” and “need to have.” Then, prioritize each list. This will help guide you when choosing a software package.

Step Six: Look at the Options

The final step is to look at a variety of systems and choose one that meets the supply chain’s needs and the organization’s. If the supply chain is small, then a simple Excel dashboard may suffice. For larger supply chains, a more comprehensive system may be required.

Here are some questions that you should ask about each system to help guide your decision.

- Will the dashboard reflect our goals and key performance indicators?
- Can the dashboard plug into our current systems to provide real-time data? Having a dashboard that relies on manually entered data will not usually be efficient or reliable.
- Will the dashboard system meet our needs for the foreseeable future? Can modules easily be added and removed?
- Can the dashboard be customized on the fly to reflect the areas that we need information on? For example, users should be able to easily access an overview of the entire dashboard and drill into specific data areas.
- Is dashboard security adequate? You may want to limit access to particular areas of information. However, be sure not to lock down the dashboard to the point where it reduces usability and functionality.
- Do we need to share information with people outside the company (such as transportation carriers and suppliers)? Does the dashboard provide an easy way to do that (such as through an online portal)?
- Is the dashboard accessible using all elements of our infrastructure, including desktop PC’s, tablets, and smartphones?

Test Your Knowledge

Using the case study below, choose either to create a balanced scorecard or dashboard. If you are using a balanced scorecard, you will identify some goals, actions, and measures for each area. If you have selected a dashboard, identify some data areas and metrics that would be useful for the company described in the case study.

Case Study

ZoomFood prepares and distributes pre-packaged, frozen meals that are sold in grocery stores. Consumers can then purchase the meals and reheat them at home. Their business vision is, “To be the world leader in healthy, high-quality, prepackaged meal solutions.”

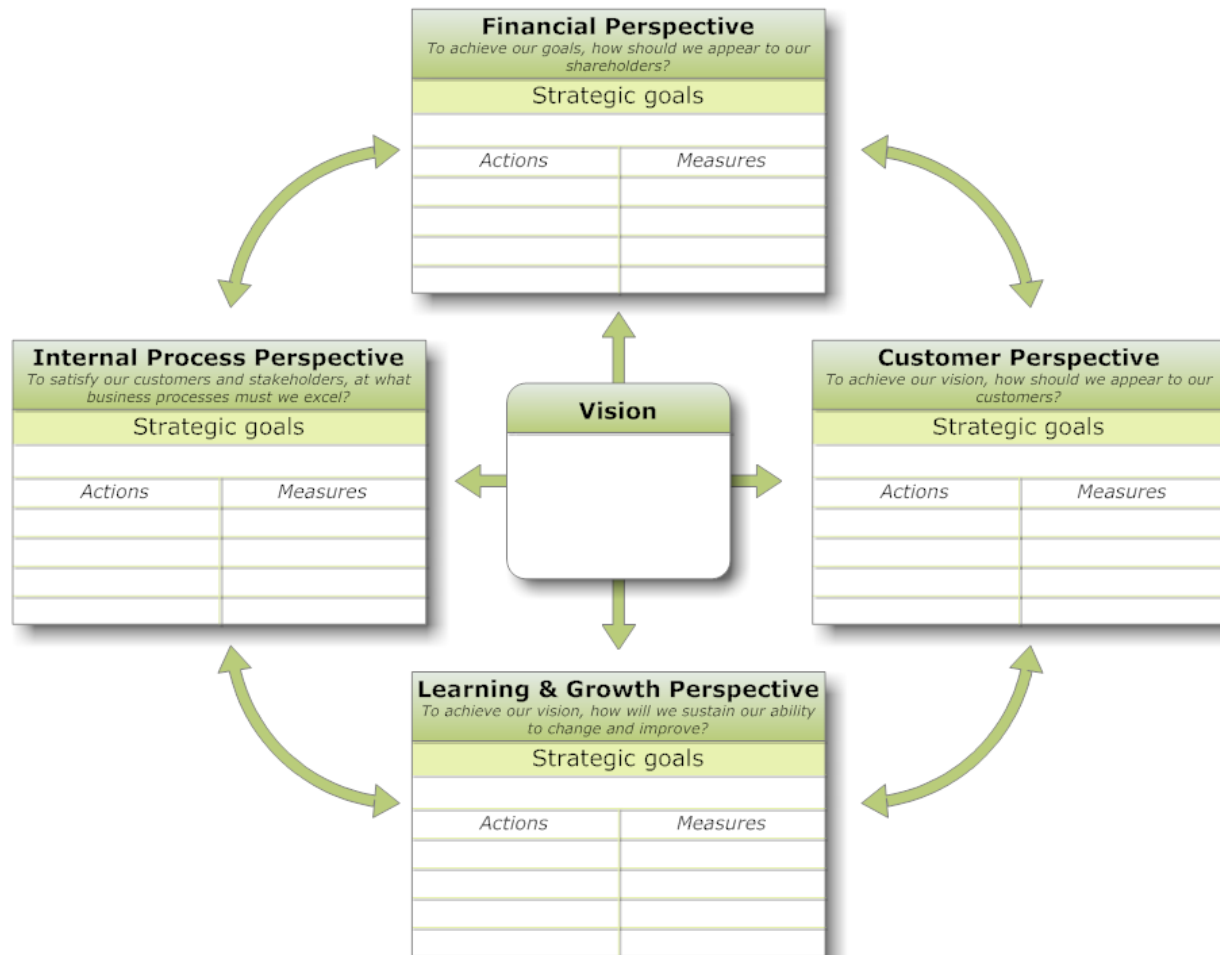
Their business includes the following areas:

- Incoming Inventory: Raw ingredients (such as meat and vegetables) are received and stored until they are ready to be manufactured.
- Manufacturing: Raw ingredients are turned into prepackaged meals, placed into containers, labeled, and flash frozen.
- Outgoing Inventory: Meal packages are boxed, placed on pallets, and stored in a warehouse freezer. When a grocery store places orders, boxes are picked from the appropriate pallets, re-palletted, and stored in a staging area inside the freezer.
- Distribution: Pallets are taken from the freezer, placed in freezer trucks, and taken to the appropriate stores.

Human resource and financial functions are also performed in-house.

Option One: Balanced Scorecard

Identify some goals, actions, and measures for each scorecard area.



Adapted from the Balanced Scorecard by Robert S. Kaplan and Dave P. Norton. Harvard Business School Press. 1996.

Option Two: Dashboard

Identify some data areas and metrics that would be useful for the company described in the case study.

Data Area	Useful Metrics

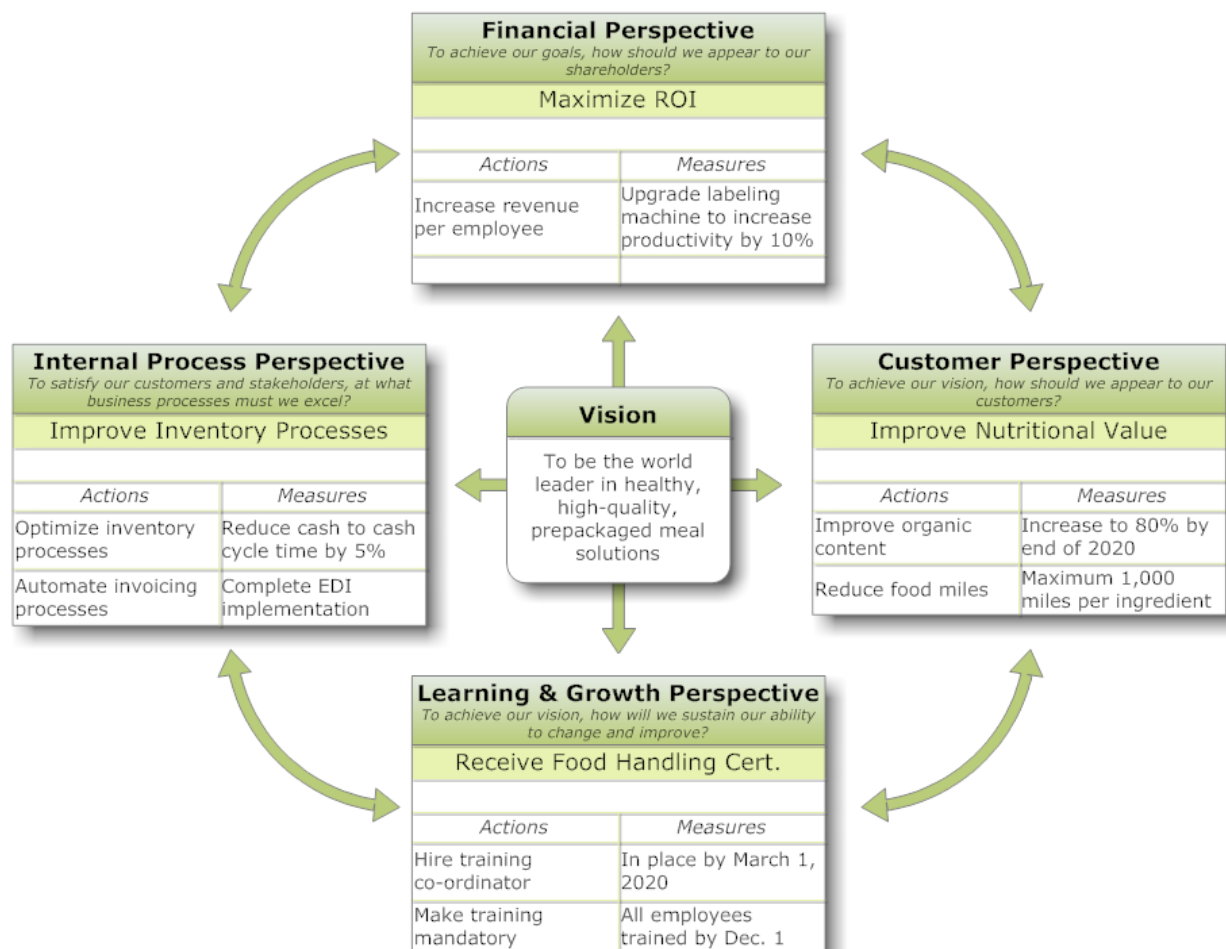
Sketch out a draft dashboard layout in the space below.

Debrief

Compare your answers to the sample ones shown here.

Option One: Balanced Scorecard

Identify some goals, actions, and measures for each scorecard area.



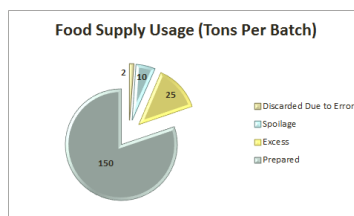
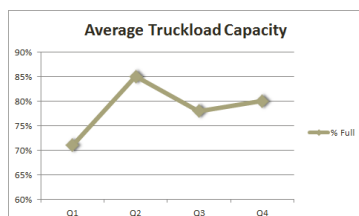
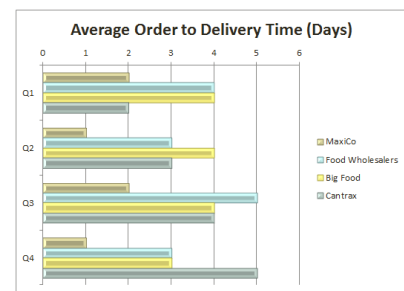
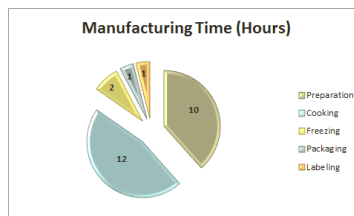
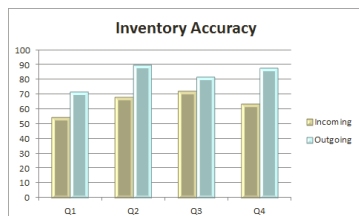
Adapted from the Balanced Scorecard by Robert S. Kaplan and Dave P. Norton. Harvard Business School Press. 1996.

Option Two: Dashboard

Identify some data areas and metrics that would be useful for the company described in the case study.

Data Area	Useful Metrics
Incoming Inventory	- Incoming order accuracy - Waste in tons, broken down by cause - Average time to receive raw materials - Average time that materials are stored
Outgoing Inventory	- Outgoing order accuracy - Waste in tons, broken down by cause - Average time to prepare products for distribution
Manufacturing	- Time for each step of manufacturing (cooking, packaging, labeling, and freezing) - Waste in tons, broken down by cause and type
Distribution	- Percent of truckload capacity being utilized - Time that each delivery takes - Number of orders per day, week, and month

Sketch out a draft dashboard layout in the space below.



Troubleshooting Supply Chain Problems

Signs of Trouble in Your Supply Chain

As you work through this material, think of additional solutions to each problem.

Once you start looking at your supply chain's key performance indicators, you will probably discover some areas that aren't performing as they should (whether in terms of processes or final output). Here are some signs of trouble that you should watch for and address.

Decision makers can't find the data that they need when they need it.

If the supply chain management team is constantly getting requests for data that should be easily accessible, you may need to re-evaluate the information management system. Make sure that the data is accurate, complete, and easy to access. Dashboards and summary sheets may need to be re-configured to display the right information in the right context. Or, staff members may need more training on how to use the software.

No one can tell you how forecasts were developed.

Some organizations still use subjective rules to forecast manufacturing and inventory demands (like, "We always order a bit less in July because business seems to be slower then."). Forecasts should be developed based on calculations, metrics, and relevant data rather than rules of thumb.

Inventory is never present in the right amounts; either too much is being stored or customers are waiting too long for orders.

Does it feel like you can't get on top of inventory management? That's a clear sign that you need to evaluate your processes, gather KPI data, establish benchmarks, and optimize the system. You may also want to evaluate outsourcing options, which we will discuss in the next session.

Vital cycle times (such as transfer time between facilities, inventory storage time, and delivery times) are not consistent.

If cycle times are not consistent, then you will never be able to optimize the flow of goods in the supply chain. Reducing variables is the key to developing a reliable, efficient supply chain.

The supply chain lacks visibility.

Does this discussion sound familiar?

- "Where's that shipment of widgets?"
- "The one coming from the Elm Street facility? I think it's on a truck going to Smithville."
- "I thought that was coming from Smithville and going to the Acme Company?"
- "I'm not really sure. I think our supplier MixCo was handling that whole delivery."

The supply chain management team needs to know where all products are at all times. This can be achieved through supplier partnerships, information management systems, and clear responsibilities for all activities.

Test Your Knowledge

What other problems have you seen in your supply chain and what solutions were used to resolve the problem (if any)?

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.