M8L1a. Scenario Analysis (Simulation Method)

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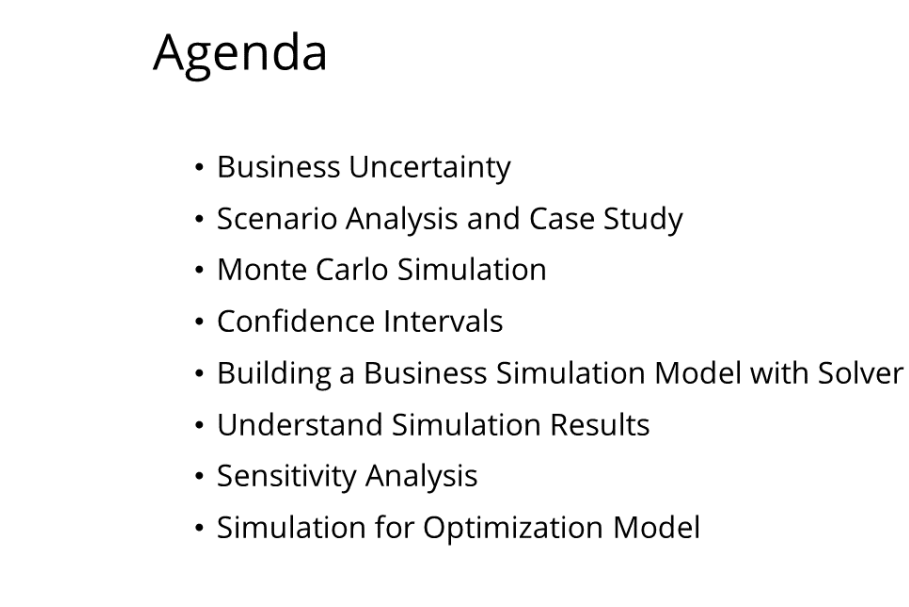
Slide #2



The simulation module includes the following topics:

Business Uncertainty,

Scenario Analysis and Case Study,

Monte Carlo Simulation and Confidence Intervals,

Building a Business Simulation Model with Solver,

Understand Simulation Results,

Sensitivity Analysis,

Simulation for Optimization Model.

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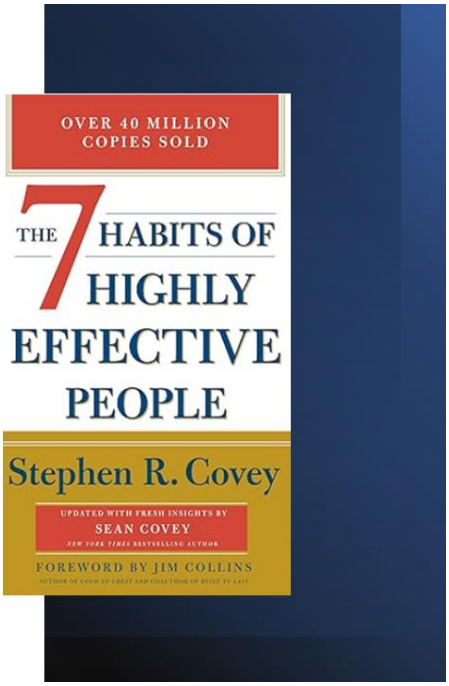

Stephen Covey, the author of The Seven Habits of Highly Effective People, once said, if there's one thing that's certain in business, it's uncertainty.

Indeed, running a business is about dealing with uncertainty, just as it is by the constant of change.

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Factors Contributing to Uncertainty

- Market fluctuations
- Shifts in regulations
- Technology breakthroughs

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Market fluctuations, shifts in regulations, and breakthroughs in technology are all factors that contribute to a climate of uncertainties facing decision-makers.

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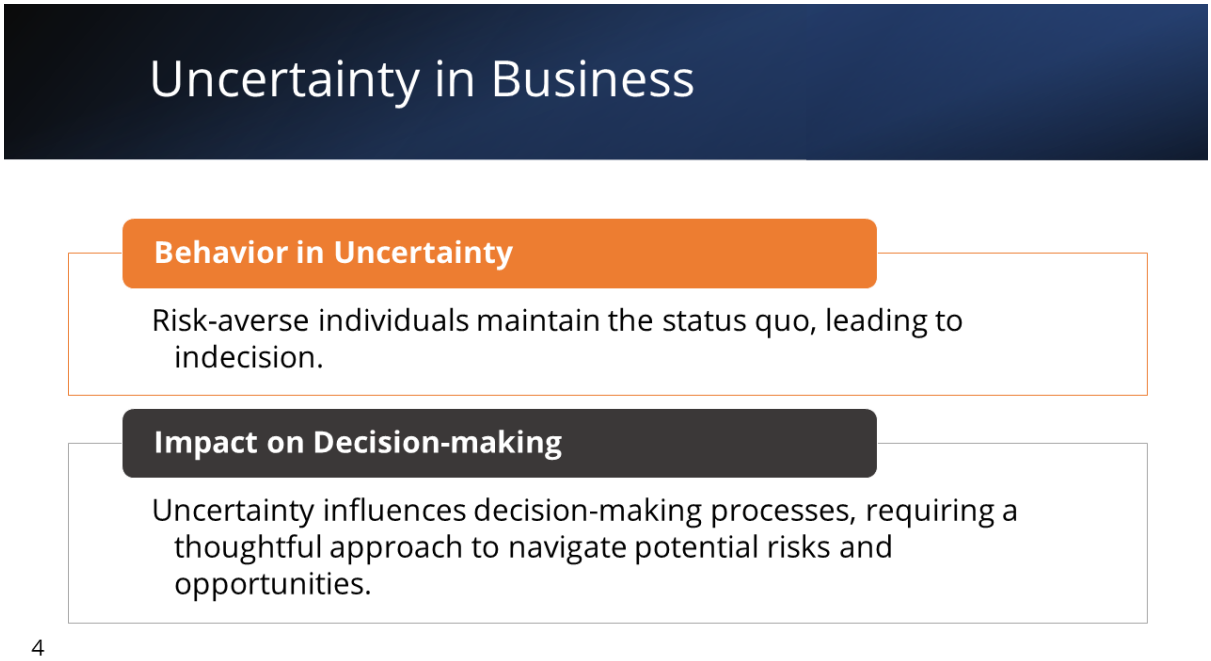

Early in this course, we discussed how individuals who are risk-averse tend to prefer maintaining the status quo when faced with uncertain circumstances.

However, for managers, mastering the art of navigating through uncertain waters is not just an essential skill; it demands adopting a perspective that does not see uncertainty solely as an element of risk, but as a source of opportunities.

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Navigating the unknown in business is akin to exploring uncharted waters.

While the immediate reaction might be to evade potential dangers, consider the possibility of discovering untapped territories.

Embracing uncertainty transcends mere risk avoidance. It involves recognizing and leveraging the vast potential embedded in the unforeseen.

This requires a pivotal shift in the decision-making mindset, viewing uncertainty not as a barrier but as an entrance to new prospects.

Achieving these calls for a systematic approach that offers both insight and foresight, empowering managers to make informed decisions even in the face of uncertainty.

Navigating uncertainty combines the visionary ability to identify opportunities within unpredictable circumstances with the practicality of making informed choices, guided by a deep comprehension of how these uncertain situations could unfold. Business simulation is a powerful tool for businesses to examine, evaluate, and understand the potential outcomes of uncertain situations.

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Scenario Analysis Definition

What if analysis is a method used by organizations to anticipate the impact of different situations or changes on their operations.

Process: create and evaluate hypothetical situations

Benefits:

- identifying risks and opportunities,
- evaluating the viability of strategies, and
- enhancing decision making clarity.

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Business scenario analysis, or what if analysis, is a strategic tool that enables organizations to explore the effects of different market conditions on their operations and to evaluate their decisions.

This method involves constructing and evaluating forecasted scenarios to examine potential outcomes and prepare businesses for a variety of future possibilities.

It is an invaluable resource for identifying risks and opportunities, evaluating the viability of strategies, and enhancing decision-making clarity.

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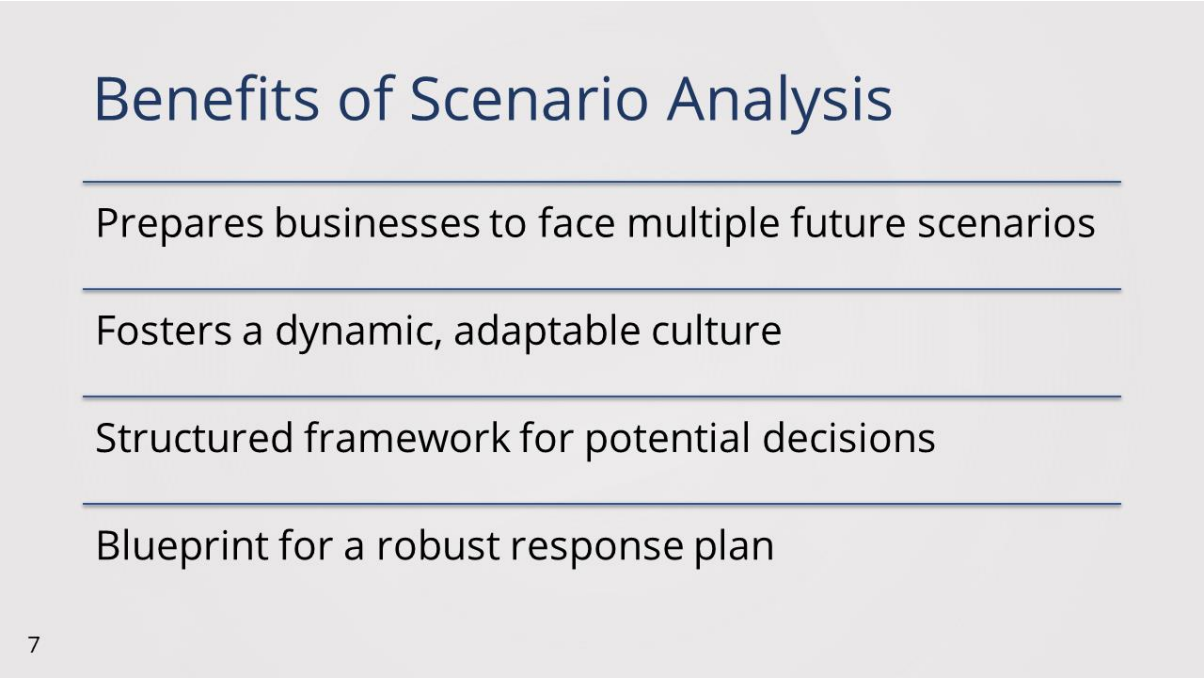

Understanding the goals of scenario analysis is essential before diving into its methodologies.

This ensures a tailored, effective approach, maximizing the utility of the tool for strategic advantage.

The key benefits of employing scenario analysis are as follows: Scenario analysis prepares businesses to face multiple future scenarios, reducing the element of surprise and uncertainty and positioning them to capitalize on opportunities.

This proactive stance solidifies a company's competitive edge in a fluctuating market landscape.

Through scenario analysis, companies foster a dynamic, adaptable culture.

This enterprising spirit enhances resilience and encourages a forward-looking approach to uncertainties, empowering businesses to navigate change with confidence and optimism.

It provides a structured framework for evaluating potential decisions, ensuring choices are made with a comprehensive understanding of their impacts.

This process aids in communicating decisions across the organization and motivating teams by setting clear, achievable goals.

By identifying key success factors and risk elements, scenario analysis offers a blueprint for a robust strategic response plan.

This methodical approach guides businesses through uncertainty, enabling them to seize opportunities and advance confidently.

Scenario analysis is more than just a planning tool.

It acts as a proactive guide for businesses to steer through market complexities with agility and informed readiness, ensuring they are well positioned to excel amidst uncertainty.

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In scenario analysis, we explore potential futures by outlining three key forecasts.

The best case, worst case, and most likely scenarios.

The best-case scenario imagines an optimal outcome signaling the highest potential rewards.

The worst-case scenario, on the other hand, prepares us for significant challenges, promoting resilience.

The most likely scenario provides a grounded view, shaped by current trends and data.

This approach allows businesses to develop strategies that are both ambitious and pragmatic, boosting confidence as they plan.

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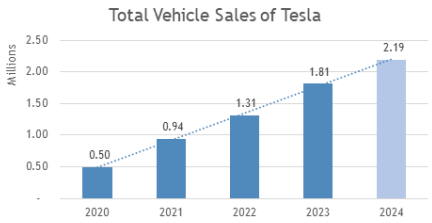
Scenario Analysis Example

Business Case : Tesla Market Expansion

Tesla expects that the market expansion of its global electric vehicles business continues to grow because of strong worldwide demand of EVs.

Year	Total Annual Sales (Model S, X, 3 and Y)
2020	499,648
2021	936,081
2022	1,313,851
2023	1,810,000



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Take Tesla, for example.

The company anticipates continued growth in its global electric vehicle business, driven by robust demand worldwide.

Tesla's extensive supply chain and advanced manufacturing capabilities are expected to uphold its leadership and competitive edge in the industry across its range of models, including the eagerly anticipated Cybertruck, set for exclusive release in the U.S. Canada and Mexico.

Drawing on Tesla's sales data from 2020 to 2023, we can project its 2024 vehicle sales.

The consistent annual increase suggests a pattern of growth which, when analyzed with a linear regression model, forecasts combined sales of 2.19 million vehicles in 2024.

This projection represents the most likely scenario continuing the trend observed over the past four years.

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Scenario Analysis: Best-case/Worst-case

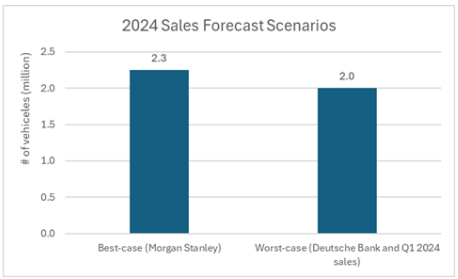
Global market competition and AI technological advancements introduce **uncertainty** in the global EV business and the company's market expansion.

Best-Case Scenarios:

- Strong demand in the US
- Possible opportunities in Europe

Worst-Case Scenarios:

- Market growth of EVs continues to decelerate in the developed markets, such as U.S and Europe.
- Slow sales of Tesla models in the emerging ASPAC markets due to strong competition of low-price EV models from China.



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However, the EV market is experiencing a shift with China emerging as a leader thanks to strong government support and rapid technological innovation, challenging Tesla and its competitors.

To maintain a competitive edge, Tesla must focus on innovation, market expansion, partnership development, and navigating global regulations.

The evolving landscape, highlighted by China's rise, injects uncertainty, urging automotive stalwarts to adapt quickly to remain competitive.

This environment drives the market introduction of more sustainable and advanced vehicles, benefiting consumers and the planet.

In the U.S., Tesla's demand remains high, buoyed by tax incentives for EV buyers.

Europe also presents opportunities, especially if the European Commission's investigations into Chinese EV subsidies result in measures that curb competition.

Morgan Stanley's optimistic forecast of 2.25 million Tesla sales in 2024 underscores confidence in Tesla's brand and the global EV demand surge.

The growth of electric vehicles in the United States and Europe is slowing, and automakers including Ford Motor, General Motors, and Mercedes Benz are recalibrating investment plans after finding consumers to be less enthusiastic about going electric than the companies had expected.

Growth is under threat in emerging markets by the influx of lower priced Chinese EVs, impacting its sales.

These challenges could affect Tesla's performance and highlight the need for strategic adaptation to navigate the shifting automotive landscape.

Deutsche Bank's conservative forecast of 2.05 million Tesla sales in 2024 reflects these market dynamics potential impact.

The 2004 outlook could be even worse than the conservative view as Tesla posted a 15% decline in vehicle deliveries in the first quarter of 2024 from the same period in the previous year.

Although Tesla attributes the performance to temporary factors, such as Red Sea shipment, the worst-case scenario for 2024 sales could be less than 2 million dollars if the company cannot rapidly make strategic adjustments to navigate the evolving automotive landscape.

The comprehensive scenarios serve as a guide for business managers to understand the varied possible futures Tesla faces.

It underscores the importance of strategic planning and adaptability in navigating the complex and evolving global market.

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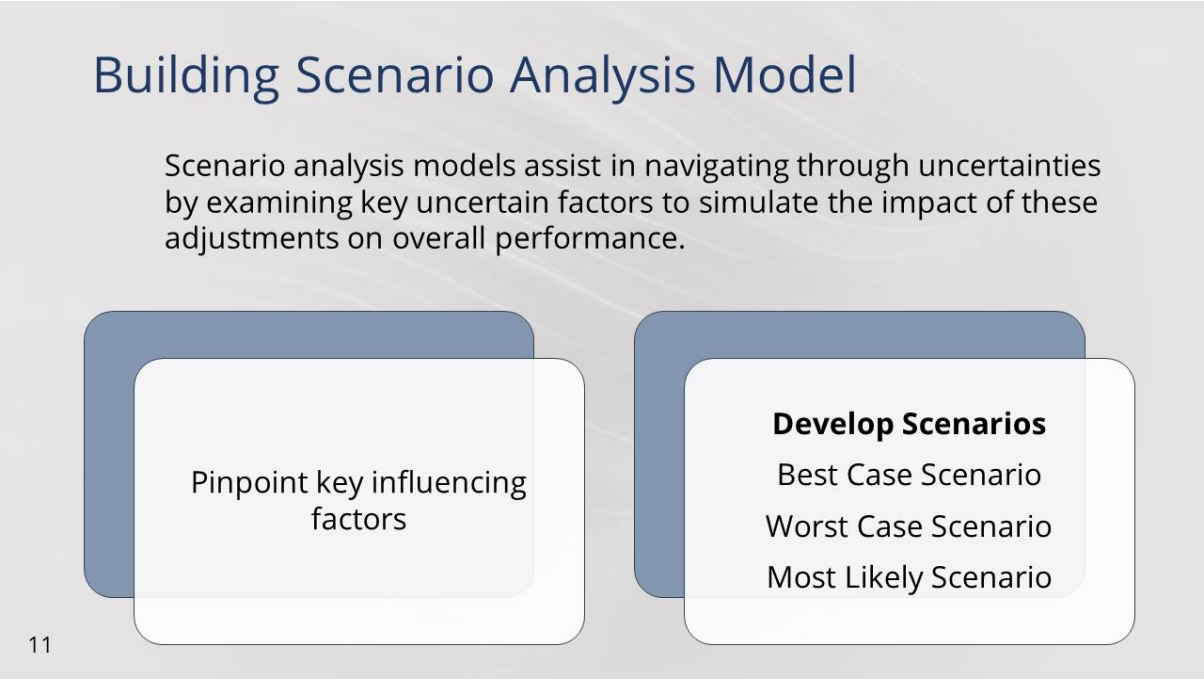

Scenario analysis models offer businesses the ability to navigate through uncertainties by examining key uncertain factors such as sales, costs, and market trends to simulate how these adjustments could influence overall performance.

Building a scenario analysis model begins with pinpointing your business's key influencing factors.

Then, develop scenarios, a best-case where everything goes right, a worst-case to safeguard against challenges, and a most likely scenario that reflects ongoing trends.

This method provides clear, actionable insights, empowering businesses to make decisions confidently and strategically.

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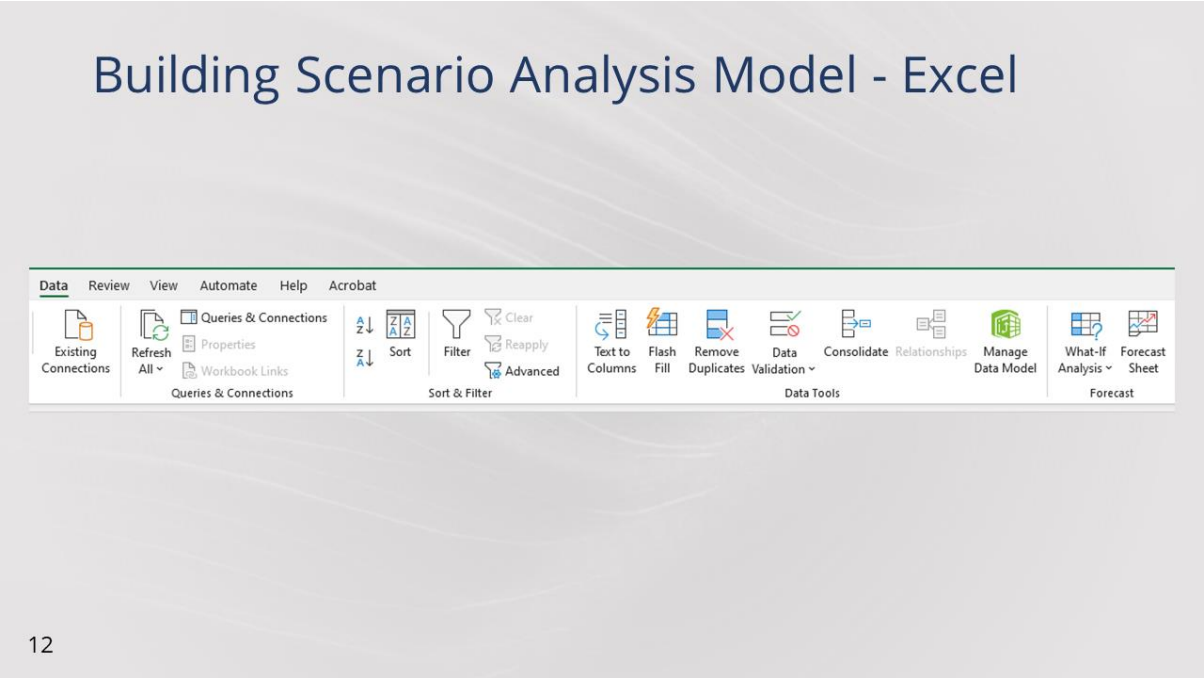

While numerous tools are available for scenario analysis, we have selected Microsoft Excel's what If function as our demonstration tool due to its simplicity and intuitive design.

This choice aims to explain the process in a manner that is both accessible and straightforward for business managers.

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Scenario Analysis Model Example

Capital Investment Scenario Analysis Case

Scenario: Decide on the capital investment on additional machines and associated labor for the next year to meet growing market demand.

Available Information:

- Forecast of sales demand and price for the next year
- Guidance on materials price and labor cost forecast. Their forecast includes three possible scenarios which represent economic and market uncertainty.

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This business case for capital investment draws from an actual situation faced by a company in Texas.

In your role as the Chief Operating Officer of a manufacturing firm, you are tasked with making critical decisions about capital investments in new machinery and additional labor for the upcoming year in response to an anticipated increase in market demand.

The Sales and Marketing Division has provided forecasts for sales demand and pricing for the next year.

While insights on projected material costs and labor expenses were provided by your procurement and HR divisions respectively.

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Business Economic Model

Forecast	Likely case	Recession	Strong economy
Sales demand growth	6%	2%	8%
Unit price growth	2%	1%	4%
Material price growth	2%	1%	4%
Fixed cost price growth	2%	1%	4%

Demand, delivery and revenue	Current year	Next year (additional machine)	Next year (status quo)
Annual sales demand	700,000	742,000	742,000
Annual delivery	700,000	740,000	700,000
Unit price	$ 250.00	$ 255	$ 255
Annual revenue	**175,000,000**	**188,700,000**	**178,500,000**
Production capacity			
# of machines	70	74	70
Capacity per machine	10,000	10,000	10,000
Total capacity	700,000	740,000	700,000
Total production	700,000	740,000	700,000
Variable cost			
Variable cost per unit	$ 150.00	$ 153	$ 153
Total variable cost	**$ 105,000,000.00**	**$ 113,220,000**	**$ 107,100,000**
Fixed cost			
Machine and operating labor (per machine	$ 720,000.00	$ 734,400	$ 734,400
Total machine and operating labor cost	$ 50,400,000.00	$ 54,345,600	$ 51,408,000
Others	$ 4,000,000.00	$ 4,080,000	$ 4,161,600
Total fixed cost	**$ 54,400,000.00**	**$ 58,425,600**	**$ 55,569,600**
Total cost	159,400,000.00	$ 171,645,600	$ 162,669,600
Total profit	**15,600,000.00**	**17,054,400**	**15,830,400**

Decision and Impact		Additional machine #	Additional machine #
		4	0
	Likely-case summary	4 additional machines	
	Investment (machine and operating labor)	$ 2,937,600	
	Profit change	$ 1,224,000	
	ROI	42%	

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These projections are framed within three potential scenarios, likely case, best-case, and worst-case, to account for the economic and market uncertainties that could influence your business decisions.

The business variables under three scenarios are shown in the left table.

A basic business model is first constructed within a clear framework of assumptions and economic evaluation methodology.

The business assumptions delineated are as follows.

The annual delivery volume is less than the demand to ensure no surplus.

Production volume matches delivery volume exactly, eliminating the need for inventory storage.

All additional machinery required for production will be operational from the start of the next fiscal year.

Production capacity, directly influenced by the number of machines, sets the limit for production volume.

Variable costs are solely comprised of the material's cost for parts.

Fixed costs include expenses related to machinery, operating labor, and other operational costs, including management, sales, and marketing.

The business model utilizes likely cases data to compute key financial metrics, revenue, production costs, and total profit.

The pivotal decision variable in this model is the determination of the number of additional machines needed for the forthcoming year.

Performance metrics are the incremental profit derived from the investment in additional machinery contrasted against a scenario with no additional machine investment for the next year.

The return on investment, ROI, for the additional machines.

The model calculations are laid out across three columns.

The first column calculates the profit from the current year.

The second forecasts the performance for the next year, assuming additional machinery investment.

And the third outlines the expected performance for the next year without any investment in new machines.

This structured approach provides a clear, quantifiable basis for planning decision making regarding capital investment in machinery aimed to enhance production capacity and financial performance.

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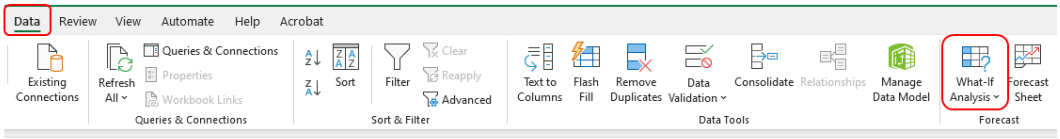
Scenario Analysis



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Enhancing your financial model with a scenario analysis capability is straightforward using the Microsoft Excel what if function as demonstrated in our tutorial video.

This feature allows you to explore the financial implications of various scenarios, worst-case, best-case, and likely case, by assigning corresponding data to the key on certain variables demand, price, material costs, and fixed costs,

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Scenario Analysis for Decision-Making

Scenario Summary (4 additional machines)			
Uncertain variables	Likely case	Worst	Best
Sales demand growth	6%	2%	8%
Unit price growth	2%	1%	4%
Material price growth	2%	1%	4%
Fixed cost price growth	2%	1%	4%
Incremental profit	$1,224,000	$(1,454,400)	$1,331,200
Return of Investment	42%	-50%	44%

What is your decision given the opportunity and risk?

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Utilizing Excel's Scenario Manager function, you can generate a scenario summary report.

This report illustrates how different uncertain business situations will impact important outcome metrics like incremental profit or return on investment.

For instance, consider the decision to invest in four additional machines along with the necessary operating personnel.

By applying the scenario manager analysis, you can compare the projected incremental profits and ROI figures across the three predefined scenarios.

These comparisons are presented in a polished scenario summary table, enabling informed decision making by forecasting potential outcomes of business decisions.

If the business environment continues to evolve in line with historical trends, investing in four additional machines is projected to yield an additional profit of 1.22 million dollars and a 42% return on investment, positioning it as a promising opportunity for the company.

However, this investment is not without its risks.

In a worst-case scenario, where market demand grows by only 2% and prices increase by 1%, the company could face a net loss of 1 45 million dollars.

Conversely, under optimal conditions, the expected profit could rise to 1.3 million dollars.

Given the potential for both opportunity and risk, how do you decide on proceeding with the investment?

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Scenario Analysis for Decision-Making (2)

Scenario Summary (2 additional machines)			
Uncertain variables	Likely case	Worst	Best
Sales demand growth	6%	2%	8%
Unit price growth	2%	1%	4%
Material price growth	2%	1%	4%
Fixed cost price growth	2%	1%	4%
Incremental profit	$ 652,800	$ 0	$748,800
Return of Investment	44%	0%	50%

By applying the model, we can easily evaluate different investment decisions.

For example, choosing to install two additional machines under the scenario is expected to secure an incremental profit of 0.65 million dollars, half of what could be achieved with four machines.

This gradual approach to capacity expansion minimizes investment risk.

In a scenario where market demand only increases by 2% and prices by 1%, opting for just two machines could avert any net losses.

This cautious decision may resonate well with companies prioritizing risk aversion.

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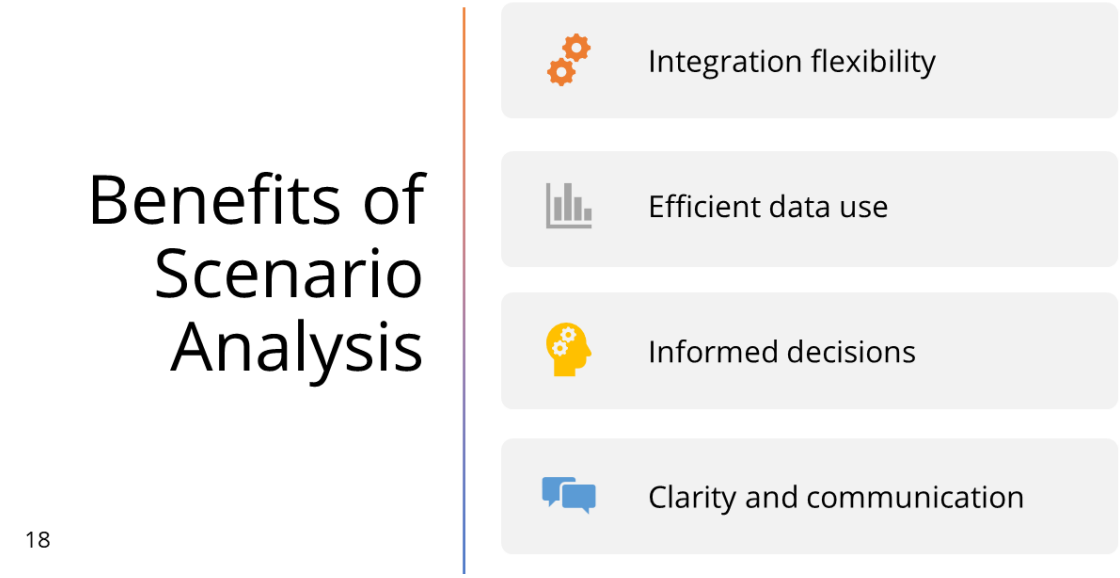

The Capital Investment Case Study highlights the practical application of scenario analysis in strategic decision making and sheds light on its advantages and limitations.

Integration flexibility scenario analysis can be easily integrated into business economic models, making it an intuitive tool for planning.

Efficient data use, it requires a modest amount of valuable input, which can often be collected in a semi quantitative way, making the process practical and manageable.

Informed decisions. By providing essential data on potential opportunities and risks, scenario analysis supports the foundation of well-informed business decisions.

Clarity and communication. The results and consequent decisions from scenario analysis are straightforward, facilitating easy sharing and understanding among stakeholders.

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Limitations of Scenario Analysis

Low probability: Best and worst-case scenarios represent extreme situations.

Critical Question: To what extent can these extreme scenarios really help managers make more informed decisions than just showing the boundaries of risks and opportunities?

Goal: Informed decision-making

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Scenario analysis often involves exploring best-case and worst-case scenarios, which, while crucial, represent extremes with low probabilities of occurrence.

This raises a critical question for business managers.

How much do these outlier scenarios truly assist in making more informed decisions, beyond merely sketching the outer limits of potential risks and opportunities?

In deploying scenario analysis for decision making and communication, it is important to acknowledge this boundary.

The goal is to treat scenario analysis as a dynamic tool for informed decision making, rather than as a mere procedural task.

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Summary

- Scenario analysis highlights the potential of simulation techniques in empowering businesses to make informed decisions with greater confidence.
- This is achieved through a comprehensive understanding of the impacts of business uncertainties, both as opportunities and risks.

Next

More sophisticated simulation models, tools, and case studies.

Scenario analysis highlights the potential of simulation techniques to improve decision making in empowering businesses to make informed decisions with greater confidence.

This is achieved through a comprehensive understanding of the impacts of business uncertainties, both as opportunities and risks.

As we continue, we will discuss more sophisticated simulation methods, tools, and case studies, offering a firsthand guide for business managers eager to leverage these insights for better decision making.