Managing uncertainty and preparing for disruptive changes in the financial services industry

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Introduction

- The presentation discusses advanced optimization solutions for strategic **financial decision-making and enterprise-wide risk management** in financial institutions
- **Detech Optimizer** is a decision support tool for integrated management of investment and funding strategies over long time horizons under uncertainty
- It provides a **holististic view of the long-term financial standing** of the institutions and allows the analysis of the effects of scenario developments in economic and financial market environments
- The sofware is an **integrated platform** for banking, insurance, pension funds, wealth management and multinational financial groups
- The solutions are based on the **multiple goal stochastic programming** approach to financial planning

Common challenges in financial institutions (1)

Why managing financial institutions under uncertainty is an important issue?

1) The importance of managing financial institutions efficiently has been demonstrated by **financial crises** around the world
2) The **losses** to the economies, institutions, individuals and the societies as a whole have been immense
3) In my country the banking crisis created a **recession that lasted for years**
4) Furthermore, the crises tend to recur **at regular intervals**
5) The present day **political and economic developments** and **failing banks** underline the importance of the issue

In short, we are dealing with a problem of major significance

Common challenges in financial institutions (2)

How do financial institutions differ from other companies?

1) **Balance sheet vs. production process**
   Banks`balance sheet coincides with the **production process** contrary to other industries where the balance sheet is a **by-product**
2) **A bank**, for instance, takes in funding in various forms, processes the funds and produces new financial products such as loans to its customers
3) The **volumes of balance sheets** as well as related funding and investment activities are **very large** but the **capitalization levels** are relatively **low**
4) This means the **capital adequacy** positions are **vulnerable** under uncertainty and when disruptive changes take place in the operation environment
5) This can lead to the **failure** of the institution
6) Furthermore, the **interdependence** of international financial markets may lead to **contamination** in other institutions and countries, i.e. to a **financial crisis**

Common challenges in financial institutions (3)

Important issues in the strategic financial management of institutions include the following

A. Treatment of economic and financial market scenarios

1) There are multiple **political and economic developments** which may start evolving in different directions over time
2) You have to be prepared for **multiple scenarios simultaneously**, not just one scenario at a time
3) You also have to be in a position to **take advantage of good scenarios** when they occur and at the same time to **prepare for stress scenarios** in the case of **disruptive events**
4) You have to be prepared to take dynamic **corrective actions** over time to deal with remaining risks during the planning horizon

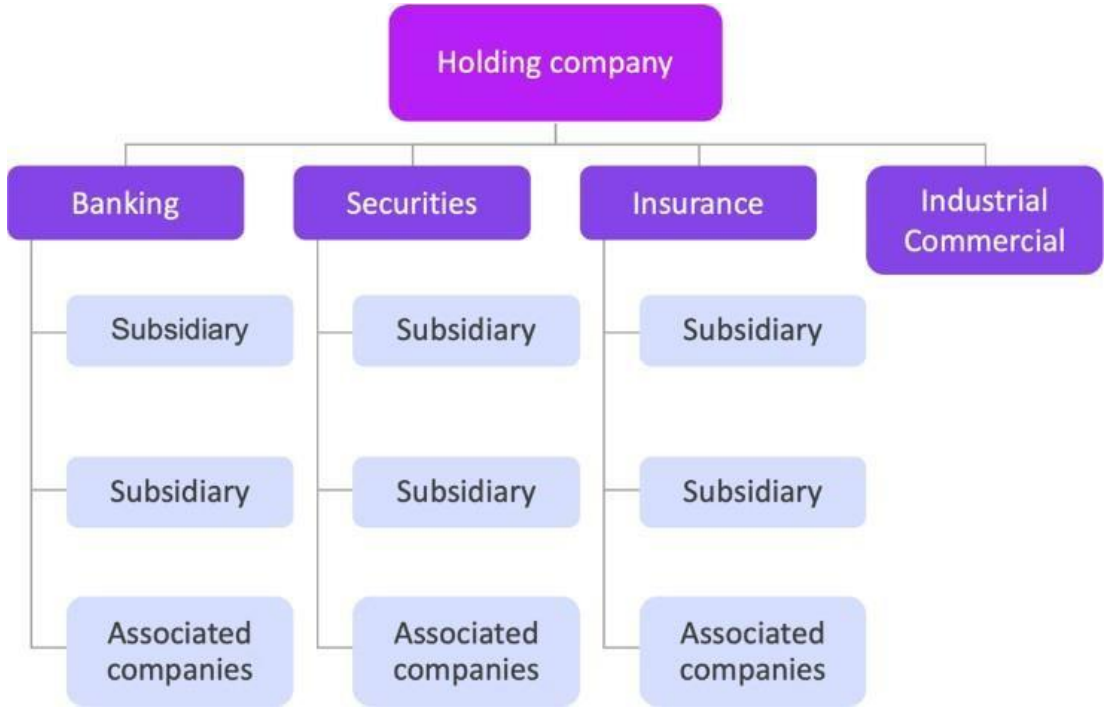
Common challenges in financial institutions (4)

B. Business decision-making issues

1) You have to be able to compute recommendations for **optimal actions** to take
2) You have to **combine long-term** strategic decisions with **short-term** operative actions
3) You have to have a **holistic view** of a **multicompany group** where risks may move from one company to another
4) Strategic **management goals** are conflicting and changing over time, and **trade-offs** have to be determined to make the right decisions about the goals to be achieved
5) An extensive number of **different types of risks** have to be covered simultanously
6) Financial institutions are **heavily regulated** and the contents of future regulations may be uncertain
7) The **number of potential strategies** to consider is **infinite** – the non-optimal strategies have to be eliminated

Common challenges in financial institutions (5)

Complex multinational and multi-level groups with varying structures and intra-group relationships



In short, we are dealing with a complex problem

Multi-stage stochastic programming approach to strategic financial management

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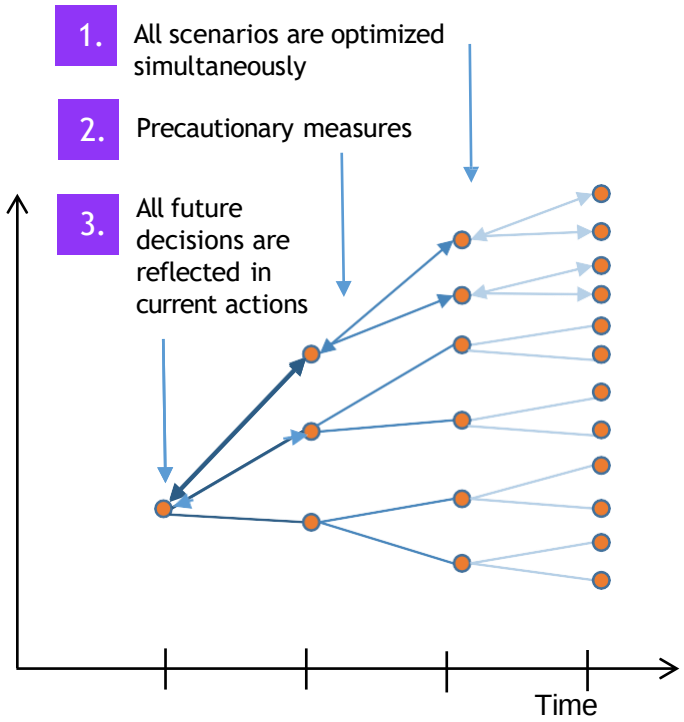
Scenario-based stochastic programming vs. simulation

1. Optimized dynamic strategies cover multiple scenarios simultaneously

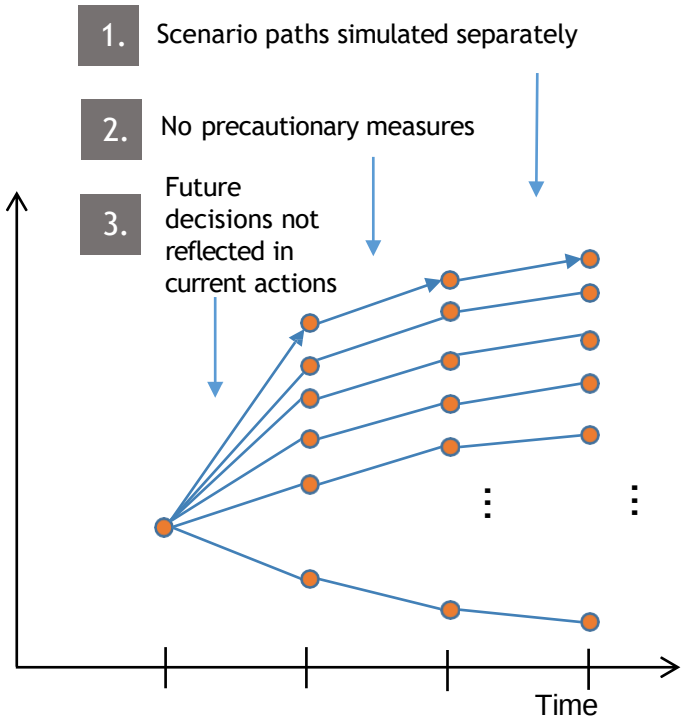
2. Simultaneous consideration of multiple scenarios requires precautionary measures that would not be needed if only the requirements of one scenario development had to be fulfilled.
The decision points (nodes) take into account the **remaining uncertainties** after the nodes

3. Availability of optimal decisions in all subsequent periods is taken into account in making current decisions

Scenario-based stochastic programming



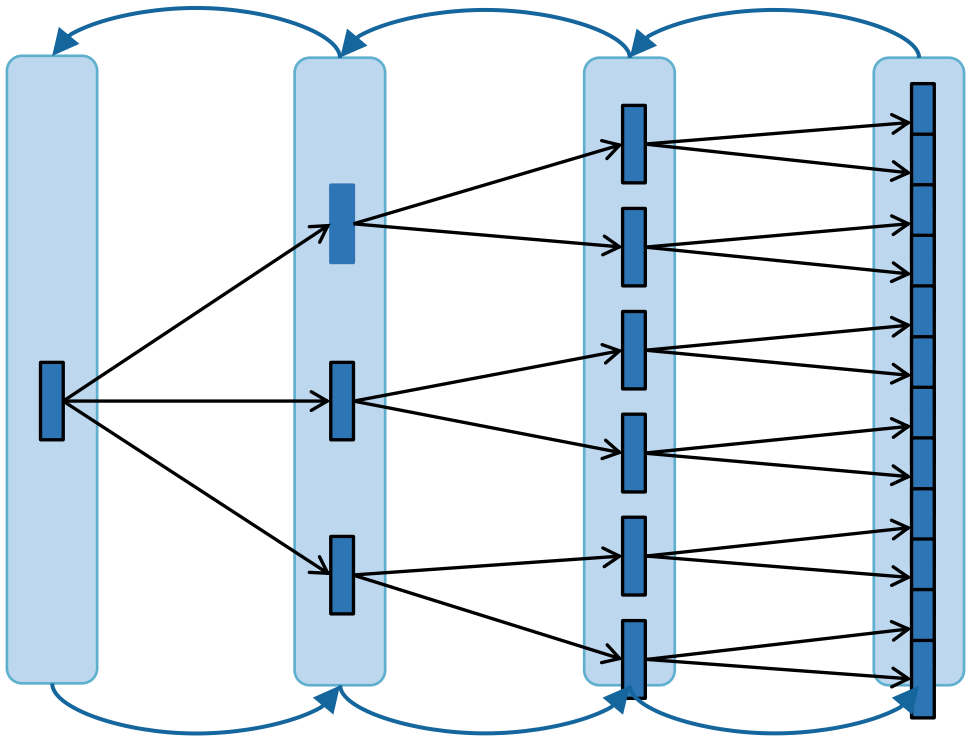
Monte Carlo with decision rules



Managing uncertainty

Scenario-based stochastic programming

Future scenarios affect current decisions



Current decisions affect future portfolios

- Determines **dynamic multi-period strategies**
- Takes into account future uncertainty and **readjustments** to initial policies
- Gives **scenario-specific** strategies
- Allows detailed analysis of **optimal actions** to take

Detech solutions overview

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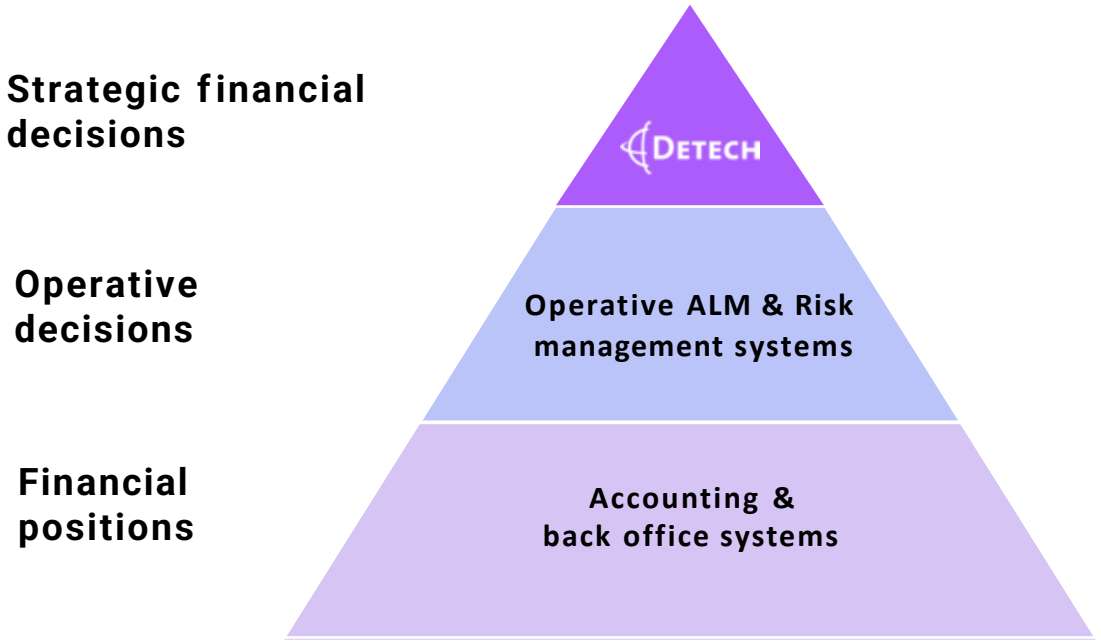
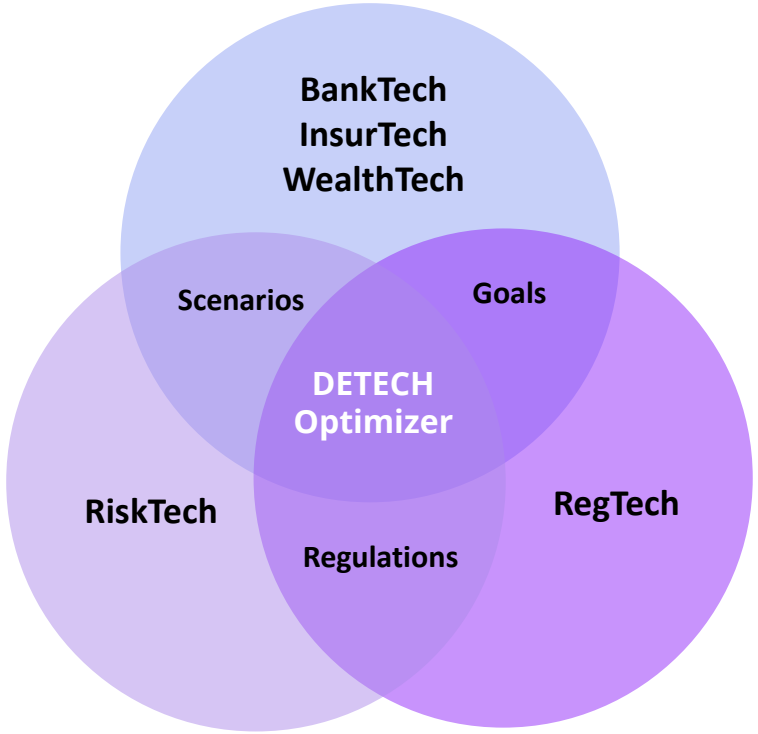
Detech solutions overview

- Detech Optimizer is a ready-made sophisticated desicion support tool for **securing stability and success of financial institutions** in volatile operating environments
- **Optimizes assets, liabilities and capital** of the institutions so that they may respond to economic and financial market uncertainty in an optimal way
- Solutions are offered **as a SaaS service on a unified platform** allowing an **integrated treatment of diverse companies and business areas**
- The flexible **modular structure** of Detech Optimizer makes it possible to provide solutions tailored to needs of **different financial institutions**
- Standard and advanced versions cover the following customer specific solutions
  - Detech Banking Solution
  - Detech Insurance Solution
  - Detech Pension Fund Solution
  - Detech Wealth Management Solution
  - Detech Financial Group Solution

Detech Optimizer – Integrated platform for Strategic Balance Sheet Management



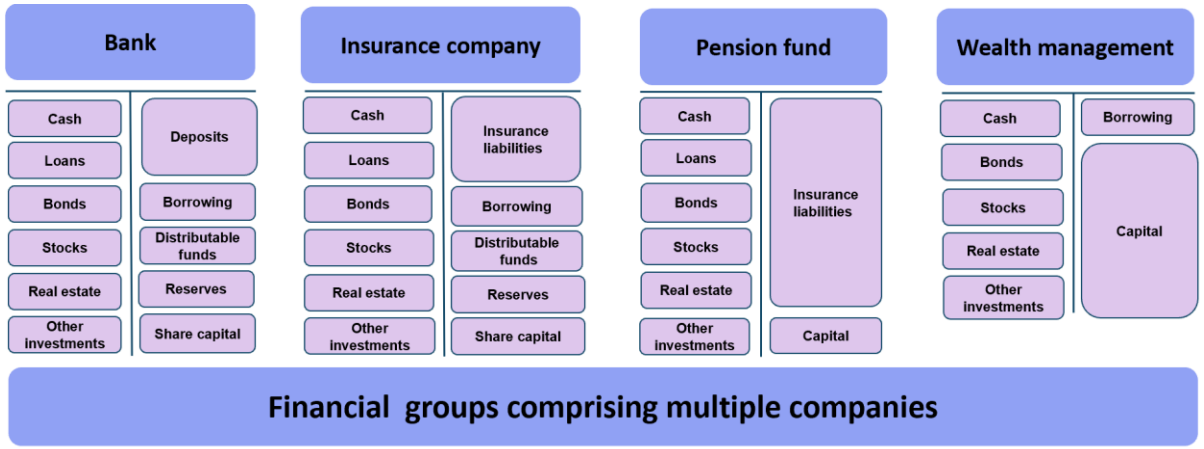
The tool provides a link between strategic and operative decision-making



An integrated platform provides a holistic view of strategic financial management

Detech Optimizer – Solutions overview

Financial institutions have a lot in common



Flexible modular structure allows creating different types of institutions

Solutions allow an analysis of trade-offs between conflicting management goals

Bank	Insurance company	Pension fund	Wealth management
Profitability	Profitability	Profitability	Profitability
Solvency	Solvency	Solvency	Risks
Liquidity	Liquidity	Liquidity	
Risks	Risks	Risks	
Dividends	Dividends	Benefits	
Market share	Market share	Contributions	
Customer demand	Customer demand		
	Policy dividends		
	Benefits		
	Contributions		

Detech solutions overview

- **Strategies cover multiple scenarios simultanously**

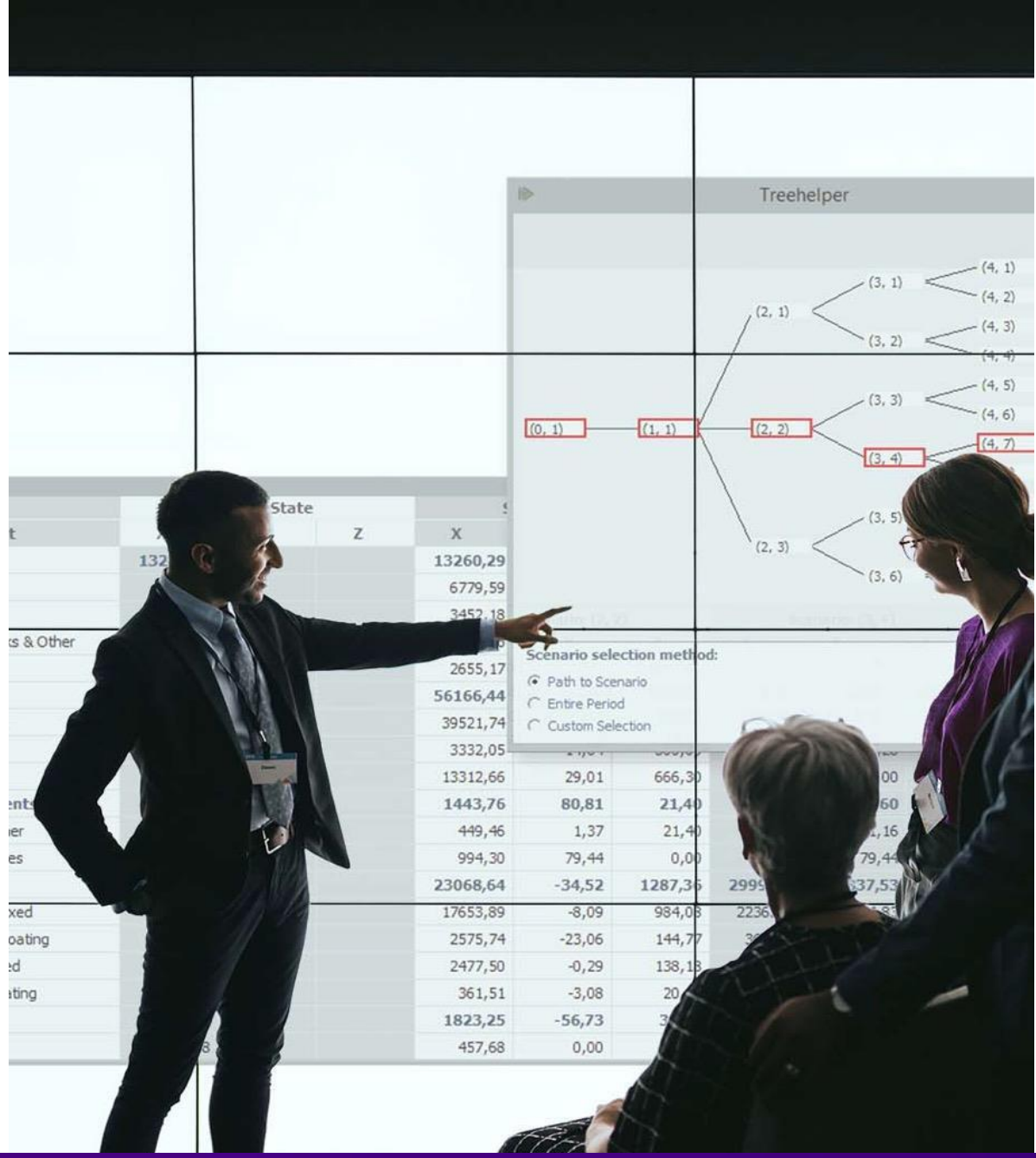
  Software analyses macroeconomic scenarios and financial market developments and computes concrete long-term strategies that prepare the institutions for numerous **future economic scenarios simultaneously**

- **Scenario specific strategies and actions**

  Computes optimal actions and balance sheets for all periods and scenarios during the planning horizon

- **Long-term and short-term decision-making**

  Provides a link between **long-term** strategic and **short-term** operative decision-making



Detech solutions overview

- **Management goals and trade-off analysis**

  Solutions allow a simultaneous treatment of multiple management goals dealing with profitability, solvency, liquidity, risks, growth, market share, customer relationships, distribution issues and other management goals

- **Integrated risk management**

  Solutions allow an integrated treatment of credit risk, interest rate risk, currency risk, equity risk, real estate risk, other investment risks, insurance risks and solvency risks

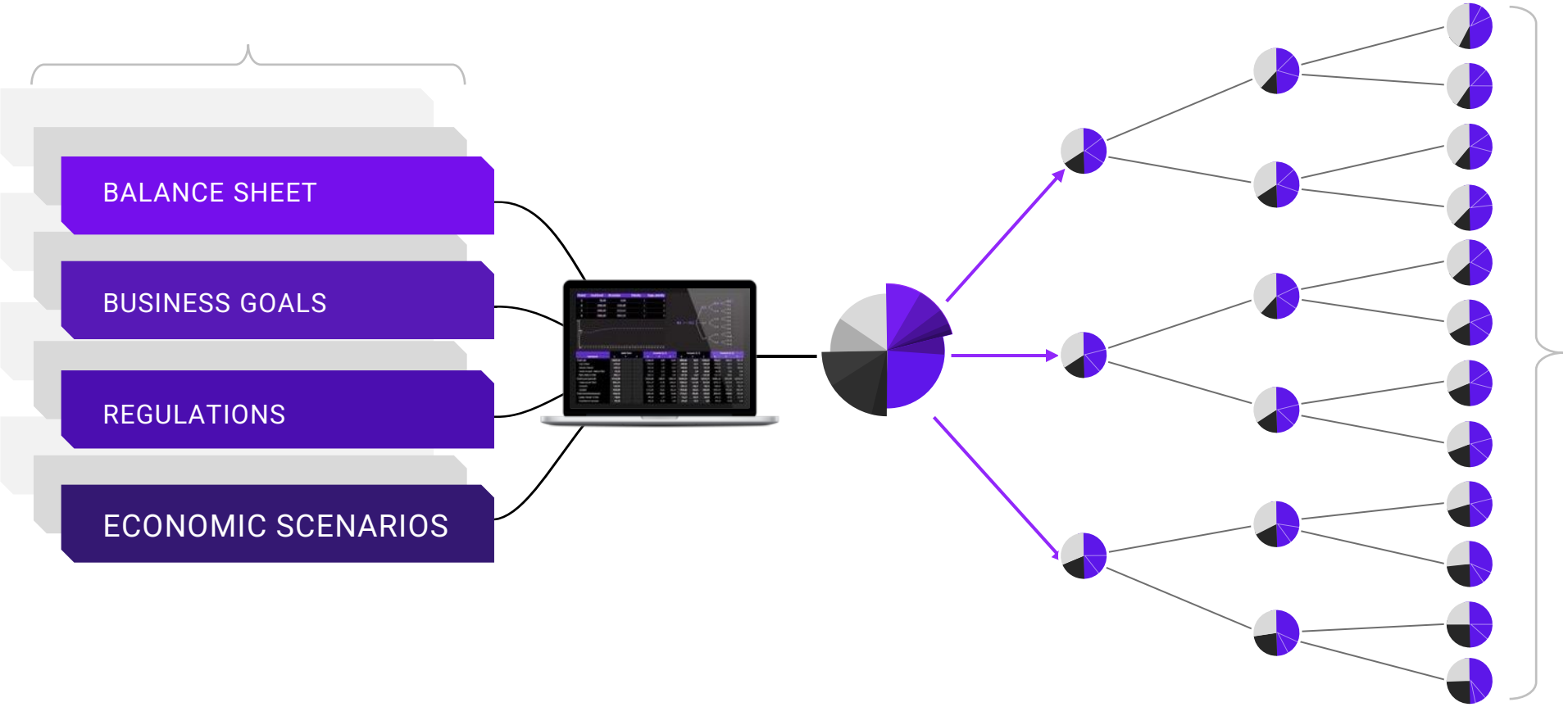
- **Regulatory and other issues**

  Solutions cover a broad range of institutional and regulatory issues, explicit modelling of **intra-group transactions and relationships**, structures to deal with distressed assets and covering of losses, as well as the treatment of extreme stress scenarios

Detech Optimizer workflow

1. Create a model by importing data and define **objectives** and **constraints**

2. Compute **optimal actions** to adjust **current balance sheet** and prepare for future strategies



3. Get optimal **scenario-specific strategies** over selected time horizon

Outputs from Optimization

Examples in a banking case

Optimized management goals and performance metrics

Optimized management actions by periods and scenarios

Optimized management goals and performance metrics

- Expected market valued profits and risk
- Expected accounting earnings and risk
- ROE
- Expected capital ratio and risk:
- Total Capital Ratio, Tier1, CET1
- Leverage ratio
- MREL
- Liquidity coverage ratio
- Liquidity ratio
- Net stable funding ratio
- Cash reserve deposit
- Dividend policy
- Growth rate of loans
- Satisfaction of loan demand by customer types
- Flexible investment limits by instrument types

Optimized management actions by periods and scenarios

- All asset portfolio restructuring decisions by currency, market or instrument type at the desired level of aggregation
- Increases or decreases of cash or cash equivalents
- Granting new loans or transfers of loans, purchases and sales of bonds
- Purchases and sales of stocks and real estate
- Investments in fixed assets
- New deposits acquired
- Optimal values for short-term and long-term borrowing and prepayments
- New capital issues, dividend policies and the use of derivatives
- Intra-group investment and funding transactions

Outputs from Optimization

Examples in a banking case

The dynamic strategies provide the best solutions in the presence of conflicting management goals, future uncertainties, regulatory constraints and policy constraints

Outputs from Optimization

1. Optimized period specific goals over time
   Optimal solutions compared to the target levels
2. Optimized scenario specific goals over time
   Optimal solutions compared to the targets levels
3. Optimized values of instruments over time by periods and scenarios
4. Optimal initial actions to take at the present time
5. Optimal dynamic strategies over time by periods and scenarios
6. Optimal balance sheets over time by periods and scenarios
7. Summaries of the solutions in the periods

Detech solutions overview

Notes on technology

- Detech Optimizer combines **stochastic programming** with **goal programming** techniques.
  In this approach the decision maker's taste may easily be represented and analysed by setting goal levels and attaching priorities to the goals. It also allows the management to include **non-financial** and **qualitative considerations** in the analysis
- Applications also include **mixed-integer programming (MIP)** and **non-convex quadratically constrained** programming features
- The regulatory requirements that involve non-convex quadratic constraints are solved using a FICO solver, which is capable of solving non-linear optimization problems, including non-convex quadratically constrained optimization problems
- **Solvency 2 regulations in insurance** provide an example of a problem involving non-convex features
- **Mixed-integer programming (MIP),** on the other hand, is relevant in investment decision-making where large **investment projects** may have to be dealt with **as one entity**
-

Case study

CASE STUDY: FINANCIAL GROUP SOLUTION APPLIED TO PENSION INSURANCE (1/3)

Improved results under adverse market conditions

- Detech has provided Finnish pension insurance companies analysis services which are unique in that they take into account the **interactions between competing companies**. The reason is that the national **regulatory framework** includes **feedback features** that make the **solvency position** of a single company depend on the actions taken by other companies
- Detech applied its **multi-company financial group model** to cover **all the major pension institutions** and to **optimize their actions** given their financial positions, management goals and company policies
- Detech has developed an advanced solution to include the solvency requirements also in this regulatory framework within the optimization model

Exceptionally adverse market conditions

- The optimized strategy produced excellent results under exceptionally adverse market conditions which resulted in 1.2 billion loss in the Finnish pension industry

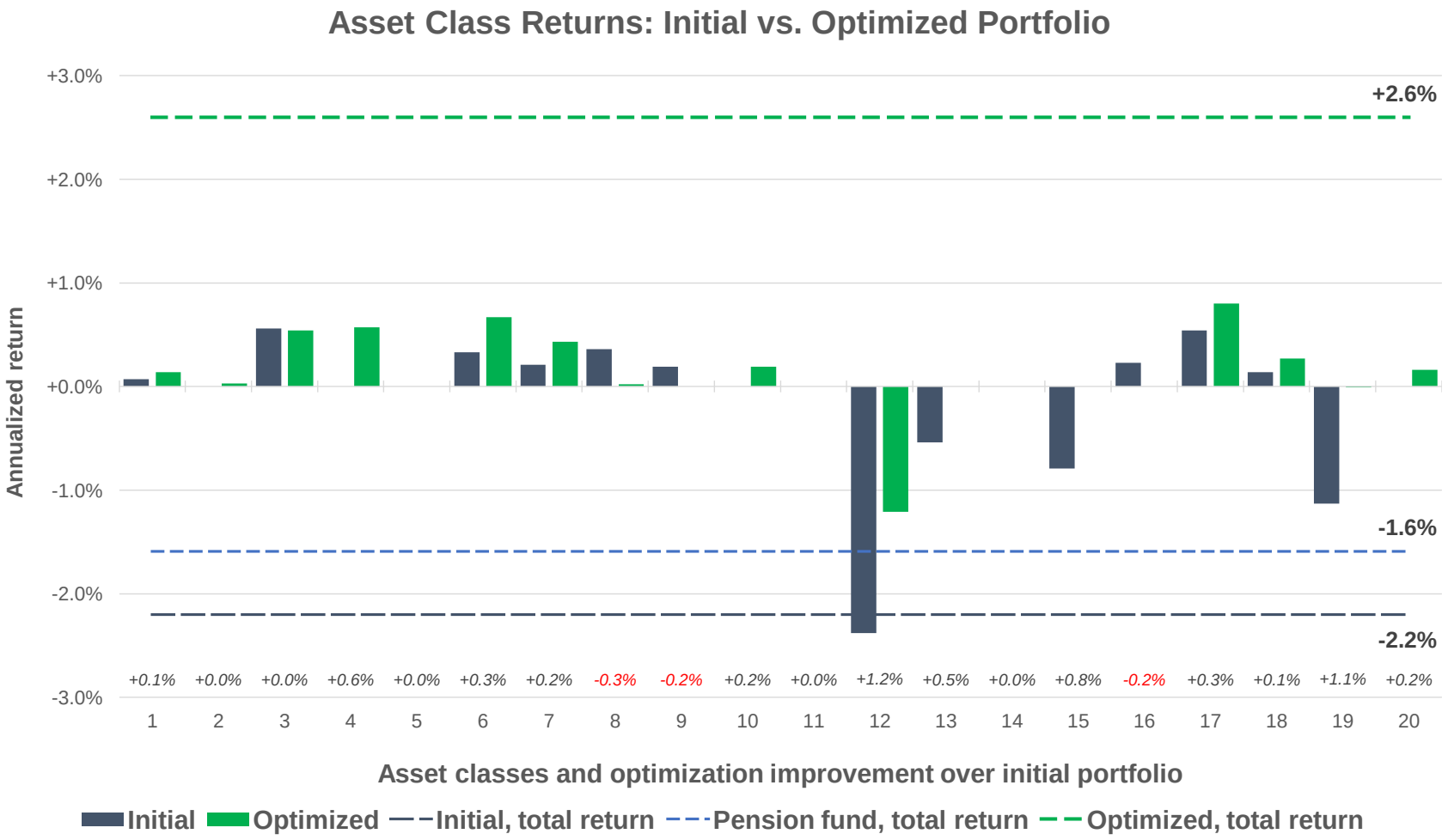
CASE STUDY: FINANCIAL GROUP SOLUTION APPLIED TO PENSION INSURANCE (2/3)

The annualized return for the period was +2.6 percent, or 4.8 percentage points higher than the initial allocation. At the same time, the portfolio's annual volatility was reduced to 2.9 percent, 2.1 percentage points lower than that of the initial portfolio.

In addition to the impressive improvements in risk and return statistics, 75% of all individual asset weight recommendations shown by the optimized model were an improvement over the pension institution's strategy. Finally, the solvency ratios of the institution and the entire industry at the end of the period were predicted accurately within 0.5 percent of their realized values.

	Static Initial Portfolio	Pension Institution Strategy	Optimized Strategy
Return (annualized)	- 2.2 %	- 1.6 %	+ 2.6 %
Improvement over static portfolio		0.6 pp	4.8 pp
Volatility (annualized)	5.0 %	4.5 %	2.9 %
Improvement over static portfolio		0.5 pp	2.1 pp

CASE STUDY: FINANCIAL GROUP SOLUTION APPLIED TO PENSION INSURANCE (3/3)



Summary

- The presentation discusses optimization solutions for strategic financial decision-making and enterprise-wide risk management in financial institutions.
- The software is a sophisticated prescriptive analytics solution based on a **stochastic dynamic optimization** approach and solves highly complex real-world financial planning problems under uncertainty.
- The **application is an integrated platform** for banking, insurance, pension funds, wealth management and multinational financial groups.
- The software computes dynamic, **multi-period financial** strategies with concrete **action plans** that fulfill diverse **management goals, priorities** and **regulatory** requirements.
- The strategies help institutions to prepare **simultaneously for multiple economic** and financial market scenarios in uncertain operating environments.
- The computed **forward-looking** strategies lead to considerable **improvements in performance** when compared with more traditional approaches. This improvement in performance becomes particularly **noticeable in exceptionally difficult** and turbulent operating environments

Detech Optimizer workflow

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Detech Optimizer workflow

Creating a new model and steps in using the software

(1) Define institutions

(2) Create scenario tree

(3) Select currency areas

(4) Create instruments and instrument parameter values

(5) Select regulations to be applied

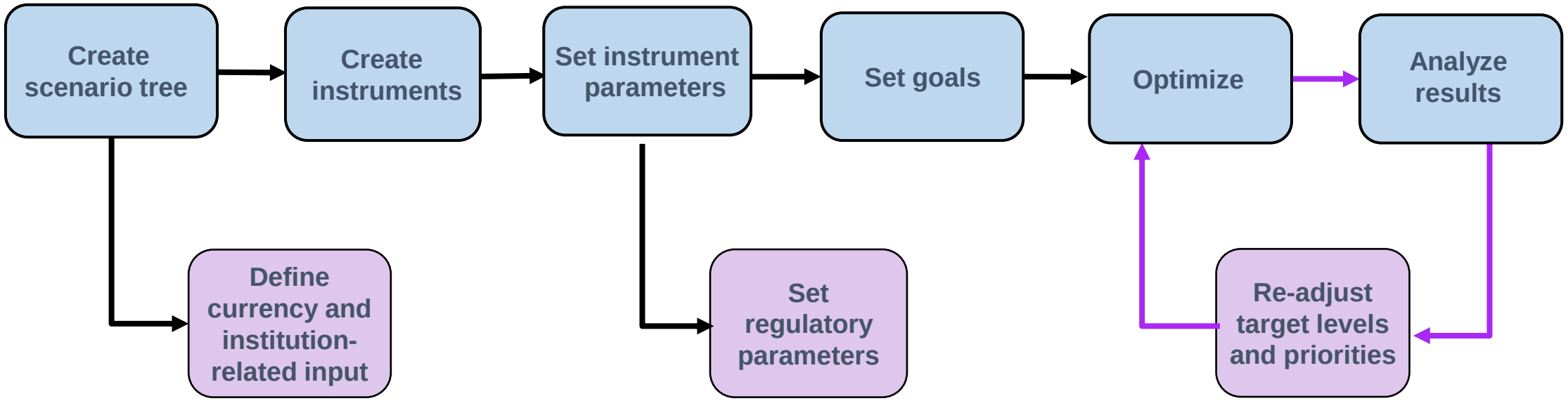
(6) Define management goals

(7) Solve the model – illustrations of optimal solutions

(8) Comparison of solutions and choosing the strategy

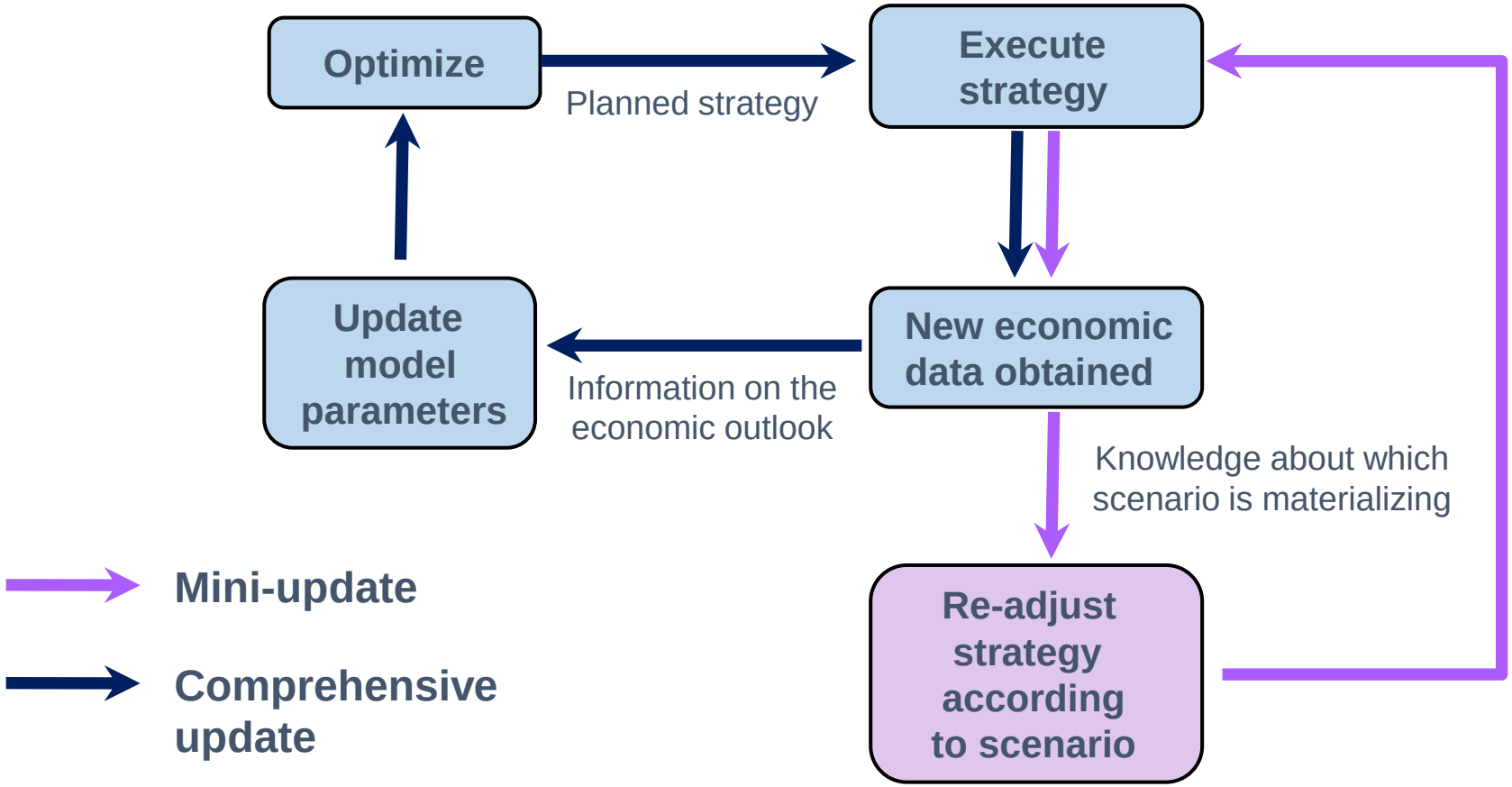
(9) Updating strategies

Steps in using the software for the first time



Updating strategies

Mini and comprehensive updates



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