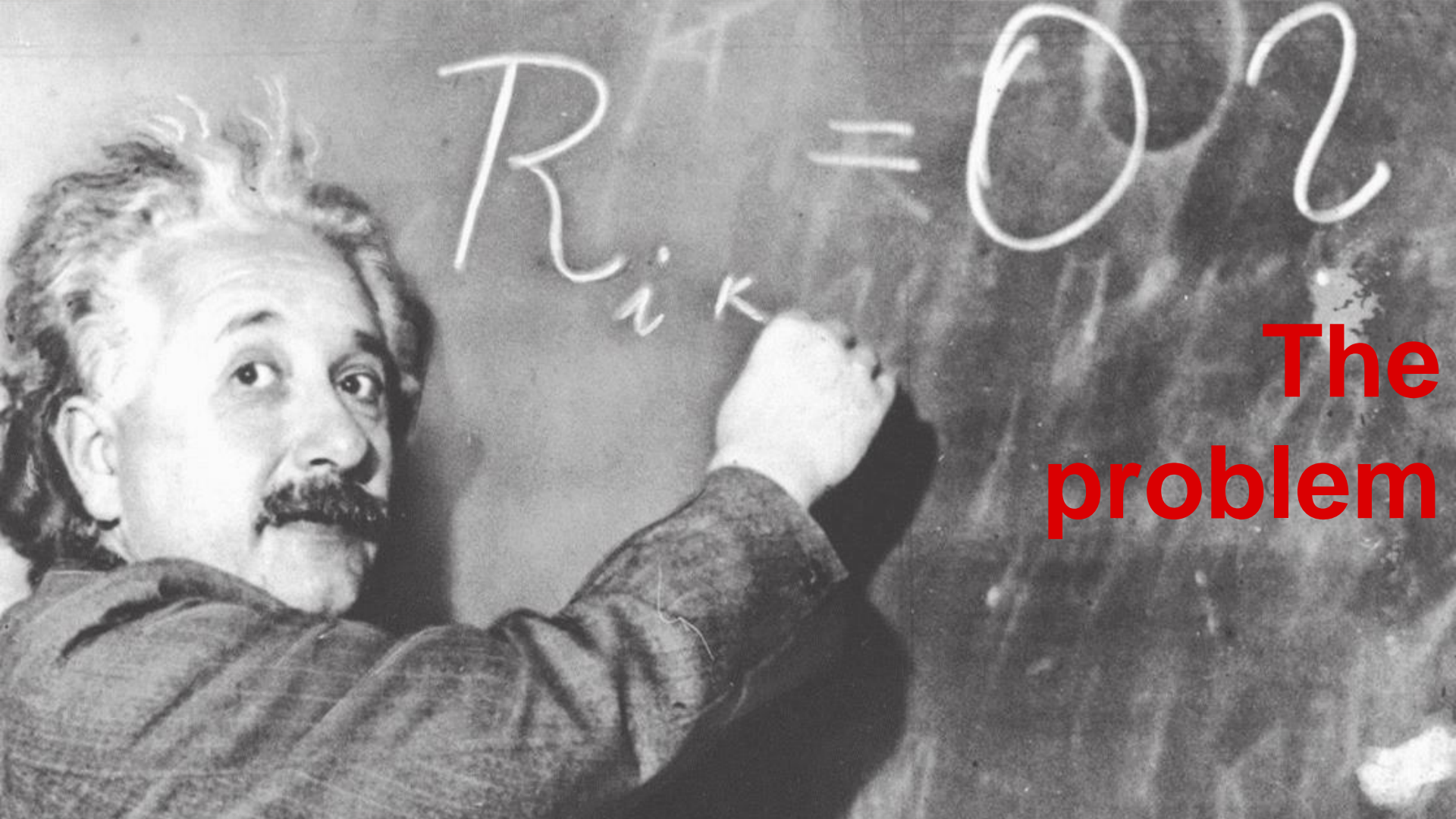


DEUTSCHES HOLZPROBLEM



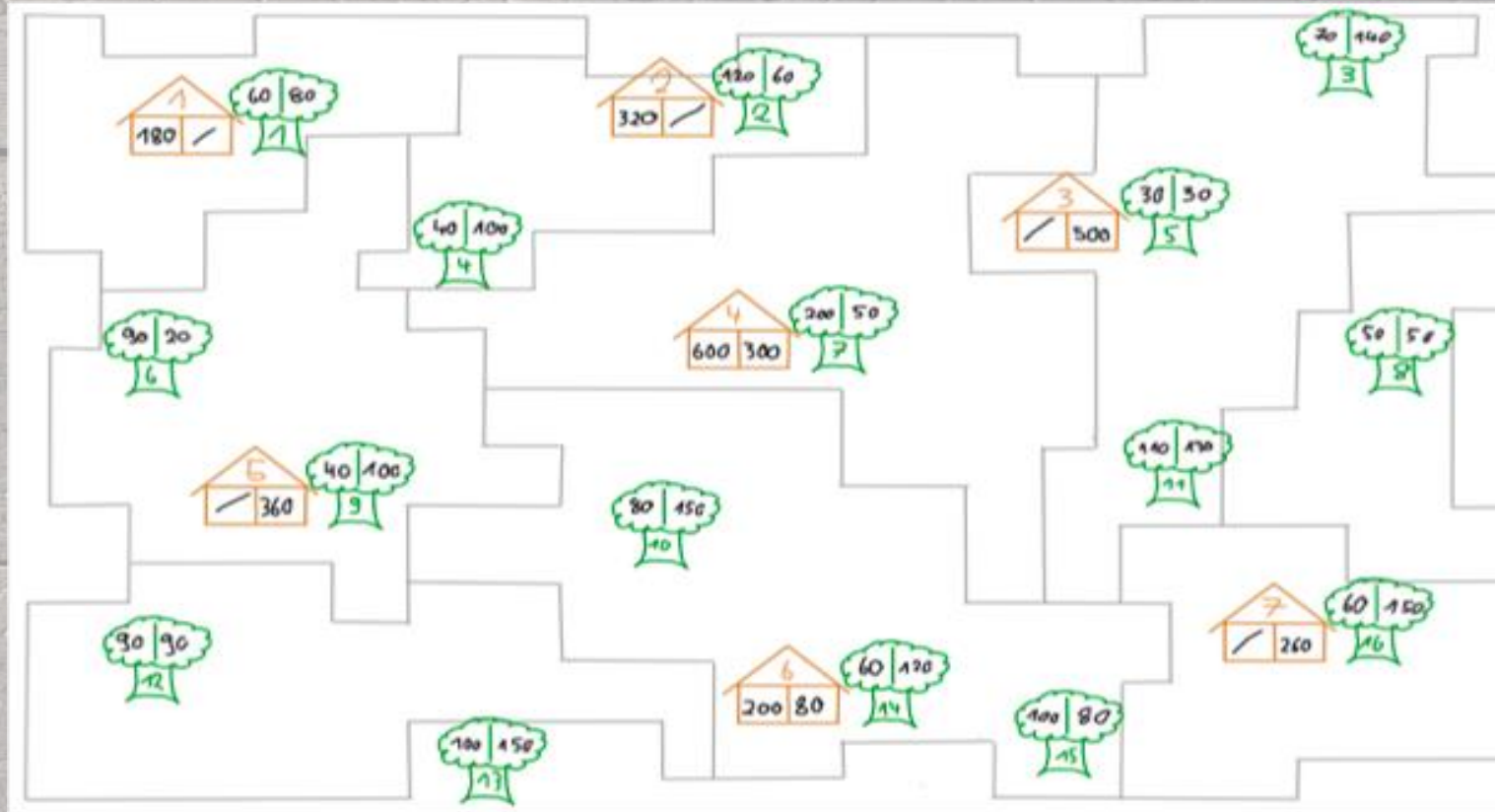
Agenda

- The problem
- The model
- The results
- The real world application



**The
problem**

Supply and demand in German logging



Essentially, a 2-tiered problem

In class terms...

**beer transportation &
traveling salesman**

Step 1. Trees = Beer

TYPE 1:

High Density



TYPE 2:

Low Density



Sawmills can only process one type



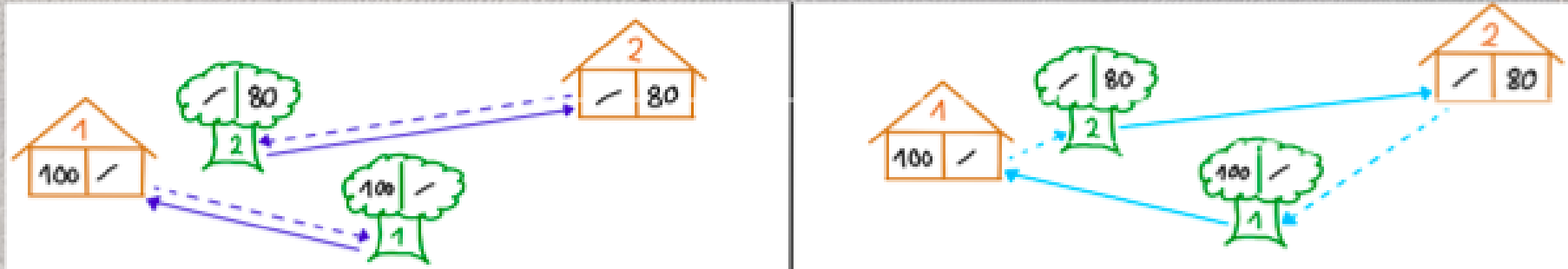
OR



NOT



Step 2. Traveling salesman = German trucker



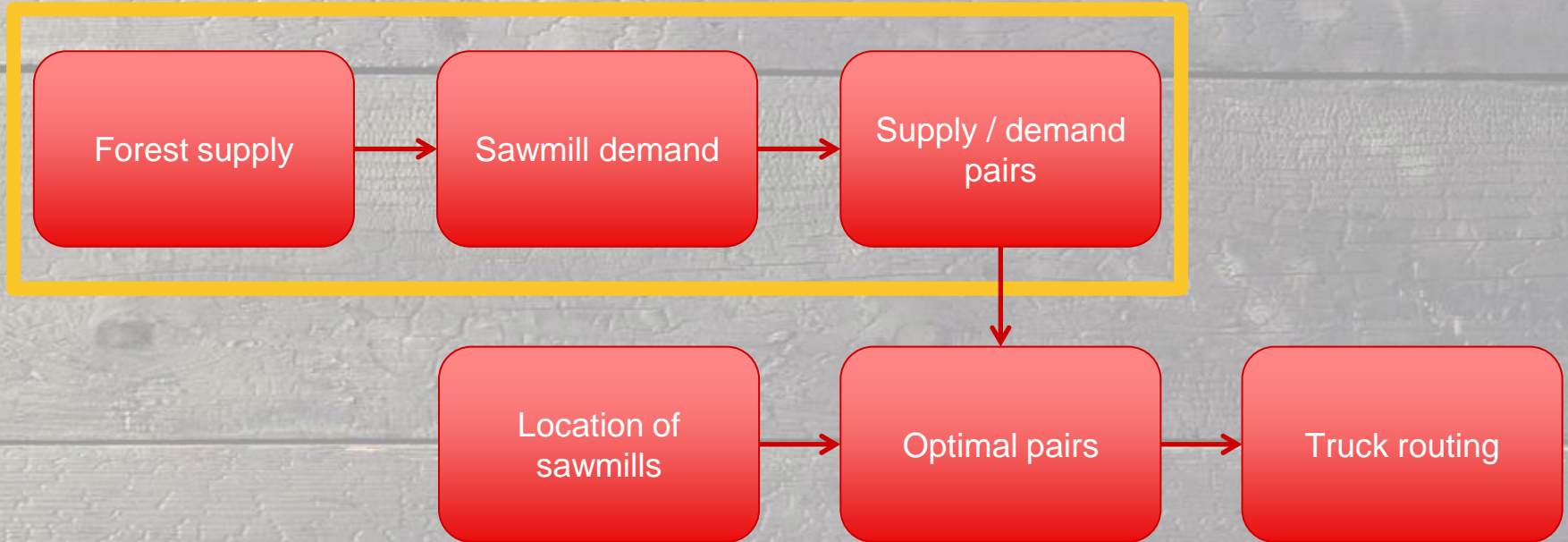
Without

With

**The
model**



Simultaneous problem solving



Initial setup, the six-node map

	1	2	3
1	<div>3040</div>	<div>3040</div>	
2	<div>60</div>	<div>60</div>	<div>100</div>

Legend

Type 1 Type 2

Supply 1 Supply 2

Demand 1 Demand 2

Initial setup, the Excel allocation

Type 1 Timber related

Density

1

Timber Allocation

		1	1	1	2	2	2	Supply
		1	2	3	1	2	3	
1	1				30	0		30 <= 30
1	2				30	0		30 <= 30
1	3							
2	1							
2	2							
2	3				0	60		60 <= 60
Demand					60	60		
					>=	>=		
					60	60		

Type 2 Timber related

Density

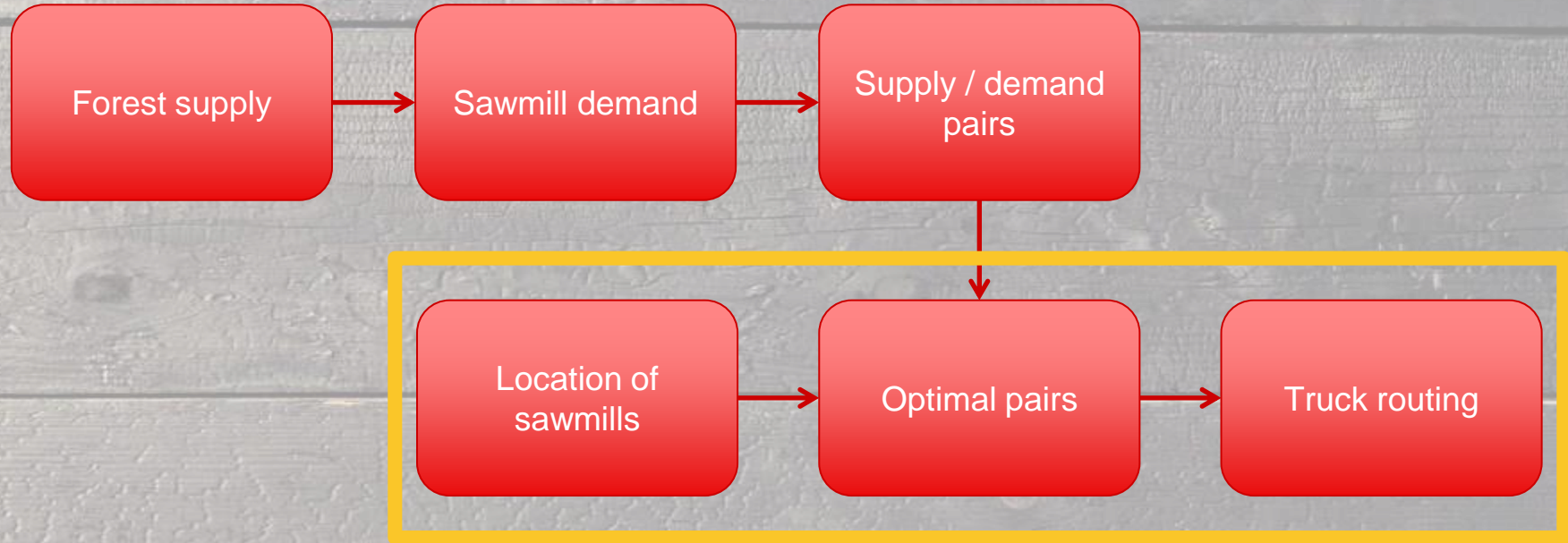
2

		1	1	1	2	2	2	Supply
		1	2	3	1	2	3	
1	1			40				40 <= 40
1	2			40				40 <= 40
1	3							
2	1							
2	2							
2	3			20				20 <= 20
Demand				100				
				>=				
				100				

Constraints for timber allocation

- **Trees:** Finite supply
- **Mills:** All have minimum demand >0
- **Trucks:** Finite capacity
Homogeneous
Limited driving hours

Simultaneous problem solving



Truck routing setup

	1	2	3
1	30 40	30 40	100
2	60	60	20

Diagram illustrating the truck routing setup. The grid shows distances between locations 1 and 2, and 2 and 3. Red arrows indicate the routing path: from location 1 to 2 (up), then from 2 to 3 (right), and finally from 3 to 2 (down). The distances are: 30 (1 to 2), 40 (2 to 3), and 60 (3 to 2). The total distance is 100.

Truck #1 Routing (located at Mill [1,3])

		General Routing								
		1	1	1	2	2	2	1	>=	1
		1	2	3	1	2	3			
1	1			0	0	0		0	=	0
1	2			1	0	0		1	=	1
1	3	0	0				1	1	=	1
2	1	0	0				0	0	=	0
2	2	0	1				0	1	=	1
2	3			0	0	1		1	=	1
		0	1	1	0	1	1			

Constraints for truck routing

- **Valid routes:**
times arrive = # times leave each mill
- **No subtours**
- **Come home:**
Trucks must return to home depotTM

**The
results**



**With cooperation, trucks
drive 417 miles ... as
compared to 845 miles if
they had not cooperated**

A grayscale photograph of a forest with tall, slender trees and a misty atmosphere. Sunlight filters through the canopy, creating a soft, ethereal glow. The ground is covered in grass and fallen leaves, with a path leading into the distance.

**The
real world application**