

# Consulting Projects

## Lecture 10 - Management Science

Dr. Tobias Vlček

### Introduction

#### Your Final Challenge

Three major clients need your expertise:

- QuickBite: Food delivery routing crisis
- NurseNext: Healthcare scheduling nightmare
- TechMart: Inventory allocation disaster
- Each group picks ONE client to work with
- This is 40% of your final grade

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#### Note

You're not just students anymore - you're consultants.

### Today's Learning Objectives

By the end of this session, you will:

1. Understand three realistic optimization problems
2. Select a client project aligned with your team's strengths
3. Begin data exploration and initial solution development
4. Plan your approach using techniques from the course
5. Prepare for professional consulting presentations

### The Expectation

What makes a successful consulting project?

- Clear recommendations backed by data
- Business impact quantified in €€€
- Confidence in your approach and results
- Actionable insights clients can implement

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Tip

“Reasonable and well-explained beats perfect and incomprehensible”

## Meet Your Clients

### Client Briefing: QuickBite

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CEO's Morning Crisis:

“We're bleeding money on delivery costs while customers complain about cold food! Our 4 drivers just ‘wing it’ every day. Result? 75% late deliveries, angry customers, and investors getting nervous.”

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### QuickBite: The Delivery Chaos

QuickBite's daily logistics nightmare:

- 120 meal deliveries across Hamburg every day
- 4 drivers starting from one central depot
- Current approach: Drivers choose routes by “intuition”
- The damage: Monthly waste in fuel + penalties
- Customer complaints: Up 40% this quarter

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! Important

The Stakes: Cut costs AND improve on-time delivery before investors pull funding!

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### QuickBite: Your Mission

What you need to solve:

- Vehicle Routing Problem with time windows
- 120 delivery locations across Hamburg
- 4 drivers with capacity constraints
- Time windows for each delivery (violations = penalty)
- Trade-offs: Distance vs. punctuality vs. driver workload balance

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! Important

Any questions?

## Client Briefing: NurseNext Hospital

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COO's Scheduling Crisis:

"I spend 8 hours every week manually scheduling nurses, and they're still terrible! Massive monthly overtime, 25% sick leave from burnout, nurses quitting citing 'unfair scheduling.'"

### NurseNext: The Burnout Problem

NurseNext's staffing crisis:

- 20 nurses across 3 departments (ED, Med-Surg, ICU)
- Current system: Manual scheduling by exhausted COO
- The damage: Overtime, 25% sick leave rate
- Fairness issues: Unequal weekend distribution
- Turnover: Losing 3-4 experienced nurses annually

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#### ! Important

The Stakes: Reduce overtime massively AND improve nurse satisfaction or face staffing collapse!

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## NurseNext: Your Mission

What you need to solve:

- Employee Scheduling with complex constraints
- Multiple skill levels (Junior, Senior, Specialist) and departments
- Shift patterns: Morning (7-15), Evening (15-23), Night (23-7)
- Labor law: Max consecutive shifts, rest periods, weekly hours
- Fairness: Weekend equity, workload balance, distribution
- Robustness: What happens when nurses call in sick?

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#### ! Important

Any questions?

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## Client Briefing: TechMart Electronics

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COO's Inventory Paradox:

“We have €10M stuck in inventory, yet we’re constantly out of stock on bestsellers! 20% stockout rate on popular items while slow-movers occupy our fast warehouse. Black Friday is in 3 weeks!”

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## TechMart: The Allocation Disaster

TechMart’s warehouse crisis:

- 30 electronics SKUs: Smartphones, laptops, ...
- Two warehouses: Fast (Hamburg) and large (Poland)
- Current problem: Wrong products in wrong warehouses
- Last Black Friday: Ran out of top items in Hamburg on Day 1

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### ! Important

The Stakes: Optimize inventory allocation before Black Friday or repeat last year’s disaster!

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## TechMart: Your Mission

What you need to solve:

- Demand Forecasting from 3 years of sales history
- Identify: Patterns seasonality , trends, and Black Friday spike
- Inventory Optimization: Which SKUs go in the fast warehouse?
- Monte Carlo Simulation: Test allocation under uncertainty
- Trade-offs: Shipping speed vs. warehouse capacity

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### ! Important

Any questions?

## Project Details

### Timeline

Your three-session consulting engagement:

| Session    | Focus   | What Happens                              |
|------------|---------|---|
| Lecture 10 | Kickoff | Choose client, explore data, start coding |

| Session    | Focus       | What Happens                           |
|------------|-------------|--|
| Lecture 11 | Development | Presentation training + intensive work |
| Lecture 12 | Final       | Presentations + Q&A                    |

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#### Tip

You will likely need 6-10 hours to complete this project. If you start today in class and also use Monday in two weeks, everything should be manageable.

## Grading (40% of Final Grade)

How your consulting project will be evaluated:

Solution (20%)

- Correctness (8%)
- Technical Implementation (7%)
- Analysis & Insights (5%)

Presentation (20%)

- Clarity (8%)
- Visualization (7%)
- Business Communication (5%)

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#### Important

Any questions here?

## Deliverables

All groups must submit by lecture 12:

1. Jupyter notebook with complete solution
  - Results and visualizations embedded
2. Presentation slides (8 minutes maximum)
  - Problem understanding & Solution approach
  - Results, Visualization and validation
  - Business impact

## Bonus Points Opportunity

Student Voting (After Presentations)

After all presentations, you'll vote for:

- Best Solution for each client (3 winners)
- Winners receive 5 bonus points per group member

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#### Tip

Last chance on bonus points!

## Tips for Success

### Strategic Advice

How to approach your project:

1. Choose your client wisely
  - Pick based on your team's strengths
2. Start with data exploration
  - Understand the data BEFORE coding
3. Build incrementally
  - Simple solution first (greedy)
  - Then improve (local search, metaheuristics)

### Common Pitfalls to Avoid

Watch out for these:

- Scope creep: Trying to solve everything perfectly
- Poor time management: Coding until the last minute
- Ignoring business context: Technical solution without impact
- Bad visualizations: Unreadable charts or no visuals

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#### Important

Don't build a solution that you can't explain to the client!

## Let's Get Started!

### Next Steps

Your roadmap for today's session:

1. Hour 1-2: Choose your client
2. Hour 3-4:
  - Open the project notebook
  - Explore the data
  - Start coding initial solution

- Ask clarifying questions

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#### Tip

We only see each other again in 2 weeks, use the time!

## Final Thoughts

You have all the tools you need:

- Monte Carlo simulation
- Forecasting techniques
- Greedy heuristics
- Local search optimization
- Multi-objective trade-offs
- Metaheuristics concepts

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#### Important

You have ALL the tools you need to succeed.

## Break!

Take 20 minutes, then we start choosing

Next up: You'll choose a project and group and start working on it.

## Bibliography