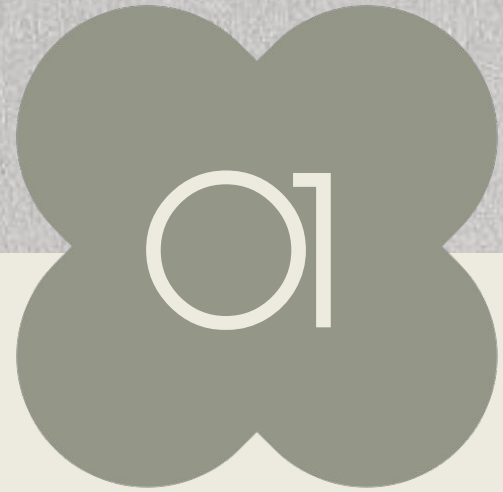# Balancing the Clock: Smarter Overtime Allocation for Cost Efficient Productivity
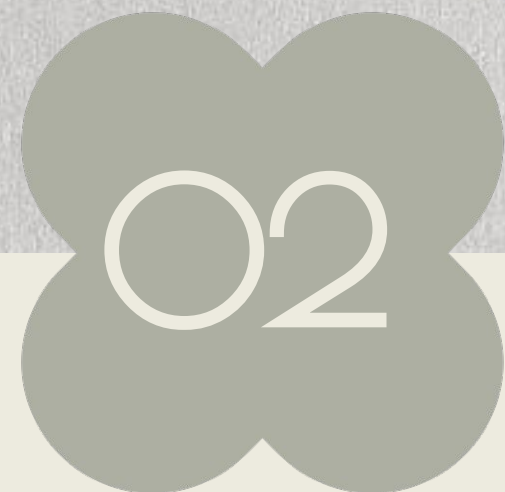
Ambika Burramukku

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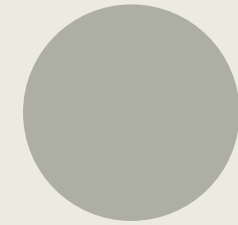**Key Takeaways**

01

Problem Overview

Background

- Balancing production targets with labor costs is a critical challenge in workforce management

- Over-scheduling overtime increases costs, while under-scheduling risks unmet productivity goals

Objective

- Develop an optimization model to allocate overtime hours efficiently across employees to minimize costs while meeting productivity targets

4RCE (Force) Company Story
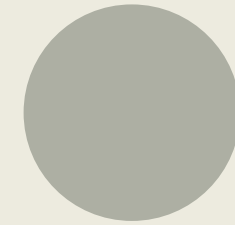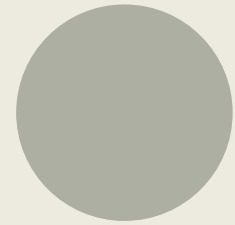
- 4RCE Industries is a mid-sized manufacturing Wisconsin company that produces a variety of consumer electronic gadgets. The company prides itself on delivering high-quality products while maintaining a productive workforce. In order to meet growing demand, the company decides to optimize its workforce by utilizing overtime hours strategically.

- 4RCE Industries production team has 10 employees who do various tasks in the production department, from manufacturing, packaging, and R&D. Each employee is assigned a productivity target, which represents the minimum number of tasks they need to complete each week. However, with a surge in demand, some employees will need to work overtime to meet production goals. The company wants to ensure that overtime is allocated efficiently to minimize costs while still achieving the required output.

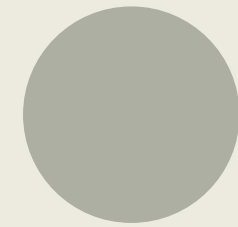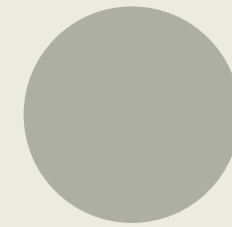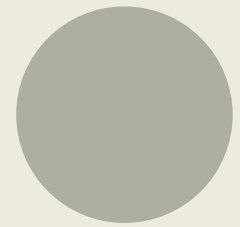# Model Design

Mixed-Integer Programming

Model Components

- **Decision Variables:** Overtime (OT) hours worked by each employee
- **Inputs:** Base salaries (hourly pay rate for each employee), OT wages (1.5x the base salary), productivity targets for each employee, assumption of 40 hour work weeks
- **Objective:** Minimize total OT cost = Sum of (Overtime hours × Overtime wage)
- **Constraints:** Total overtime cannot exceed 20 hours per employee, OT budget of $5000, meeting productivity targets for each employee, respecting each employee's OT max limits, total OT cap of 200 (20 hours x 10 employees)

Results

Results

- *Model effectively reduces costs while meeting productivity demands*
- Incorporating preferences might enhance employee satisfaction as some employees (7 and 10) requested working 0 hours of OT
- Total overtime cost was $3,690.52
- Total production achieved was 1,226 tasks
- Option to conduct a sensitivity analysis for further analysis of different budgets, targets, etc...
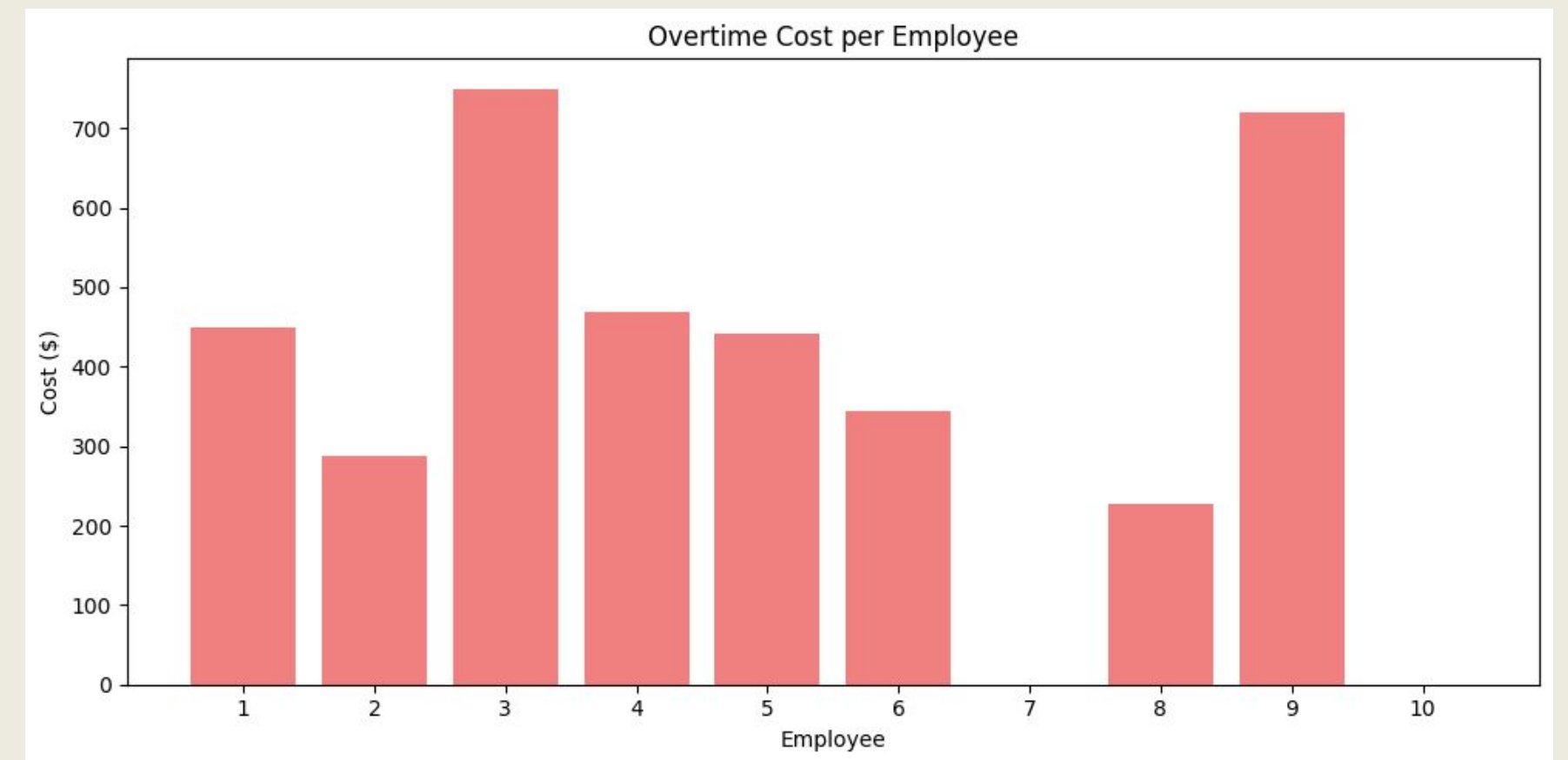
Output

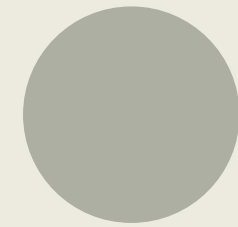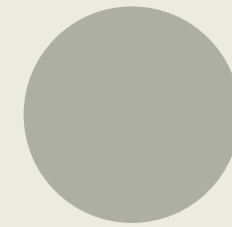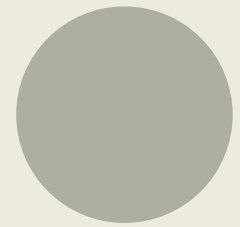| Employee	OT Hours	OT wages (hourly)	OT Cost ($)	Base wages (hourly)	Total Hours Worked	OT Productivity (tasks)
1	15	30	450	20	55	150
2	8.70	33	286.96	22	48.7	69.57
3	20	37.5	750	25	60	240
4	17.39	27	469.57	18	57.39	156.52
5	14	31.5	441	21	54	154
6	10	34.5	345	23	50	140
7	0	30	0	20	40	0
8	8	28.5	228	19	48	56
9	20	36	720	24	60	260
10	0	39	0	26	40	0

Results
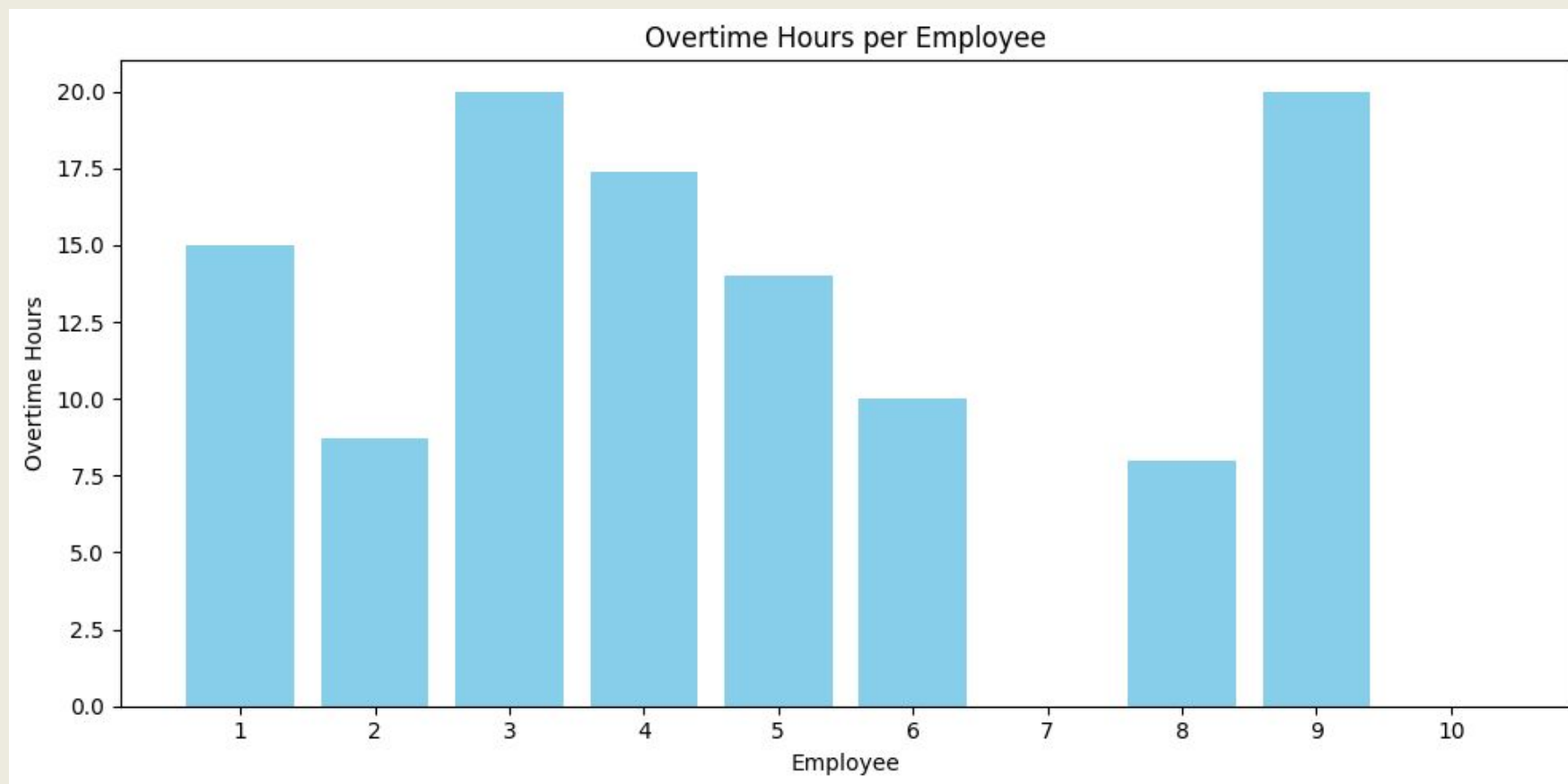
- **6 employees reached their max OT limit for the week**

- **Cost is proportional to OT hours worked**
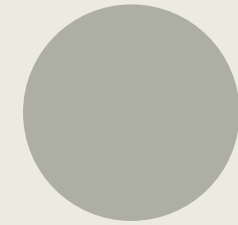
Key Takeaways

Key Takeaways

- Assigning OT based on remaining productivity gaps ensures that employees contribute to meet the overall productivity targets
- Model can be adapted to different team sizes, budgets, and production environments, making it versatile for use in various industries
- Is more cost efficient compared to manual methods which may result in higher overtime costs
- HR can create an interactive dashboard for real-time updates and can quickly adjust inputs and constraints as needed

Limitations
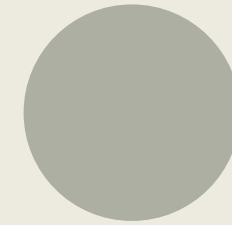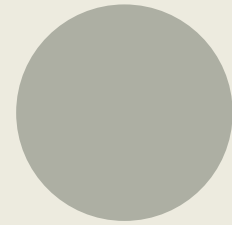
- Model assumes that productivity scales linearly with overtime hours, which might not always be realistic. To solve this, we can incorporate a diminishing returns function
- Assumes that the overtime budget is a hard constraint, meaning if the budget is exceeded, the solution becomes infeasible. In reality, there may be more flexibility in the budget. To solve, we can add penalty costs as a real-world solution

Thank You

Any Questions?