

Network Design For Mid-day Meal Program

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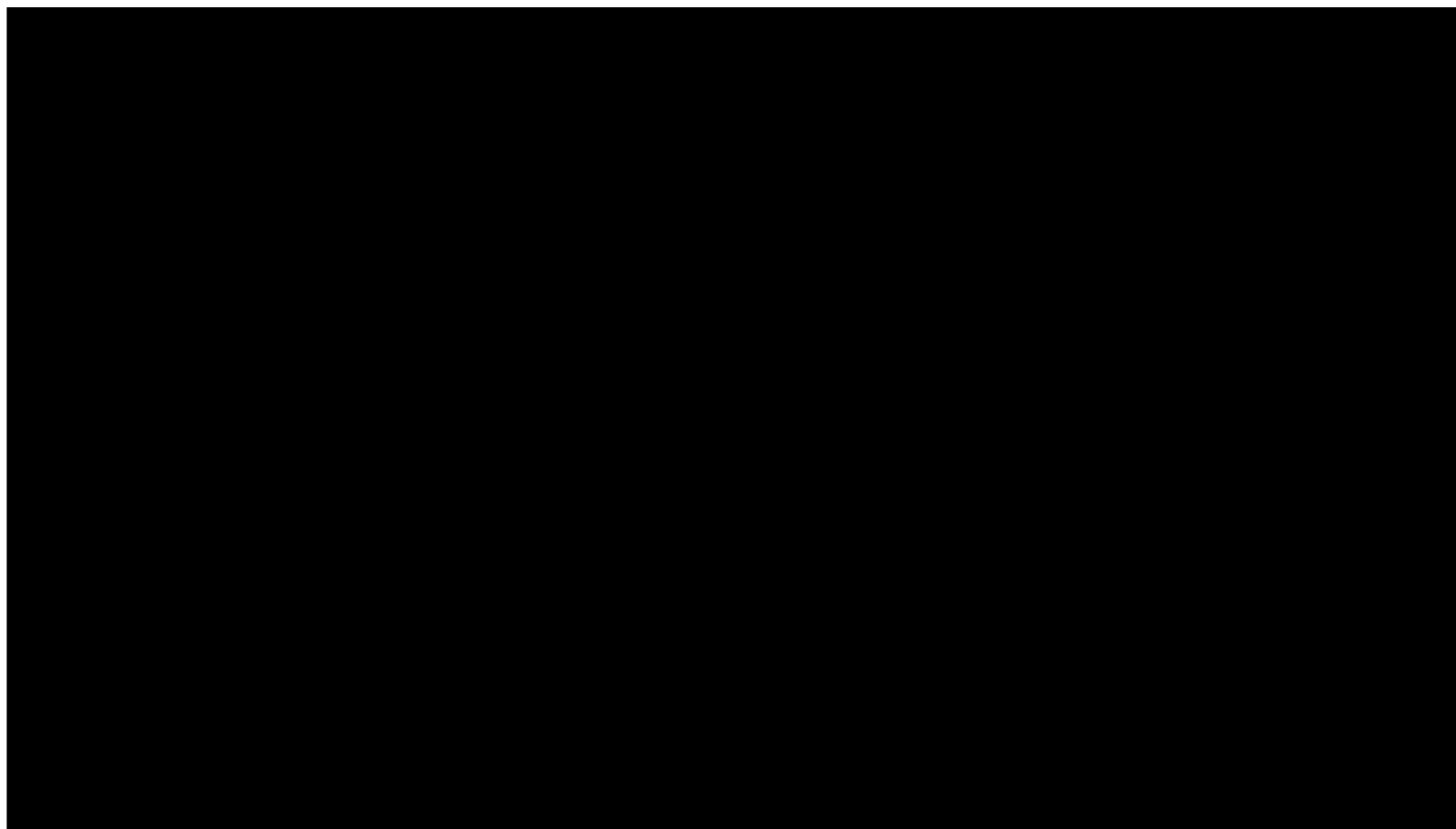
Overview of Akshaya Patra



The World's Largest NGO-Run Mid-Day Meal Program
Serving Wholesome School Lunch to Over 1.7 Million
Children in 14,173 Schools Across 12 States in India.



Akshaya Patra Video

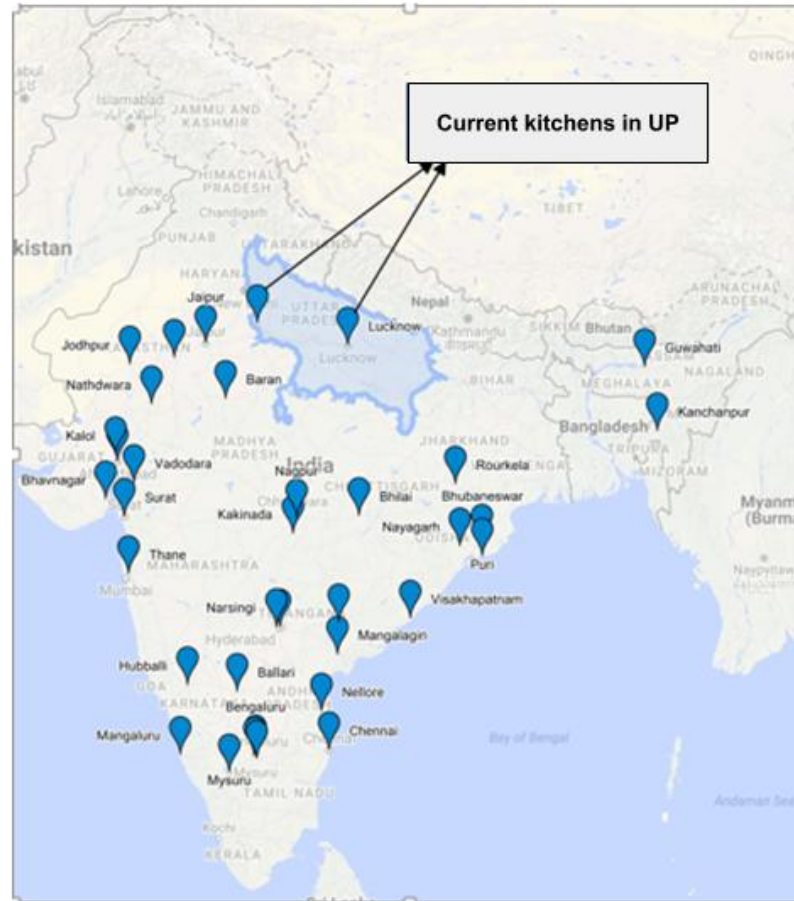


Problem Statement

What would be the optimal centralized kitchens network design for Akshaya Patra to serve all the public schools of UP?



Geographic Scope

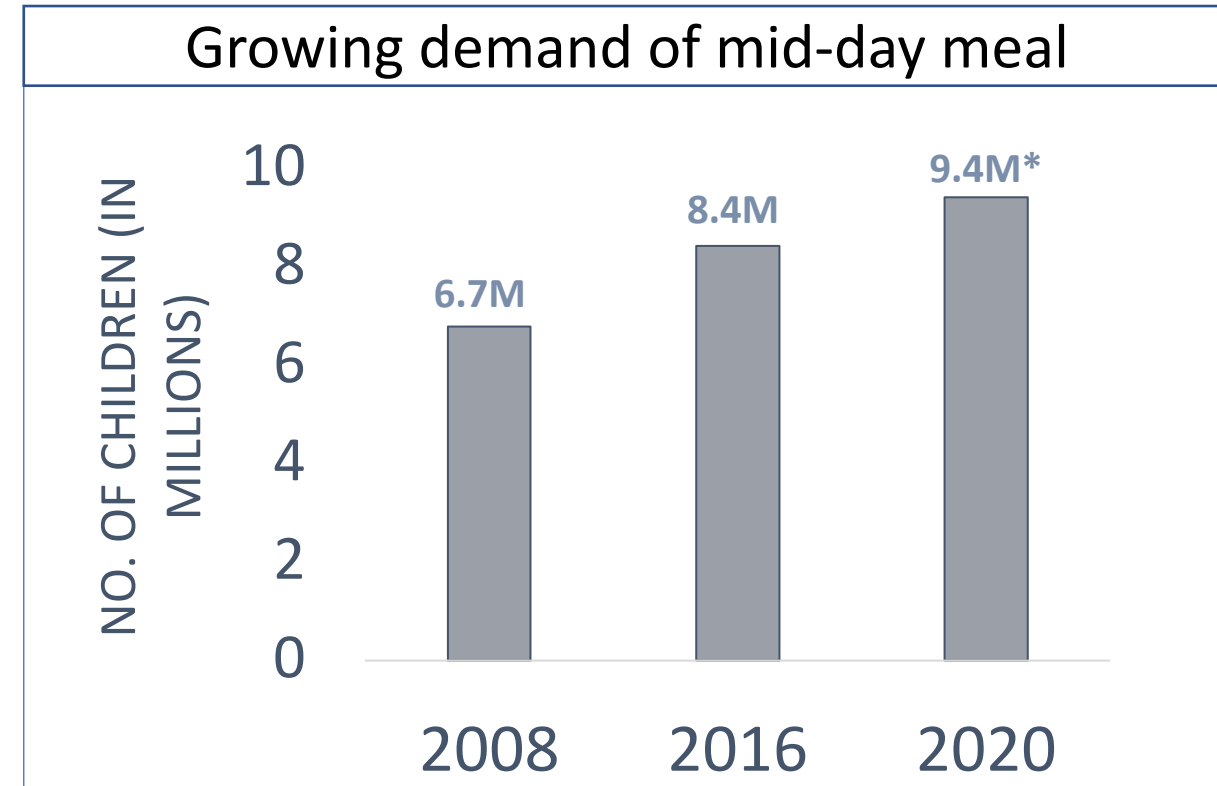


Why the project is significant

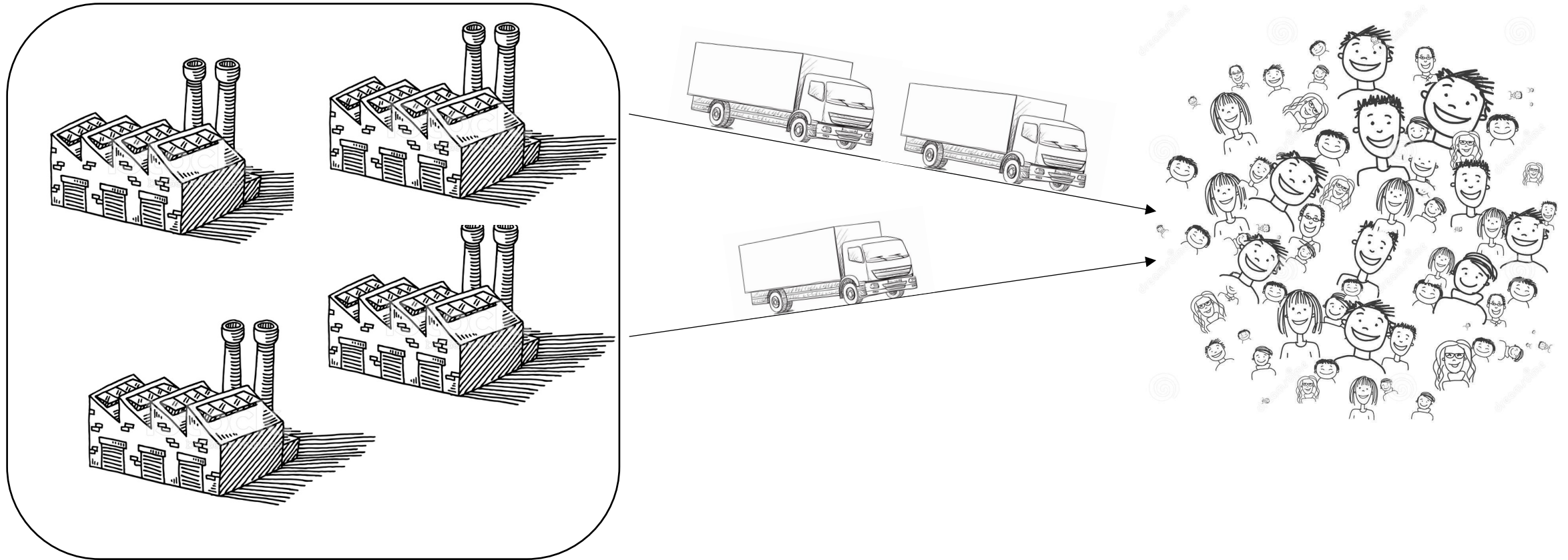
Number of children served in UP state = 0.21M

Minimum cost to open one centralized kitchen is 10M INR.

Capacity of centralized kitchen is 250,000 meals



Current Supply chain process



Kitchens

Centralized kitchens



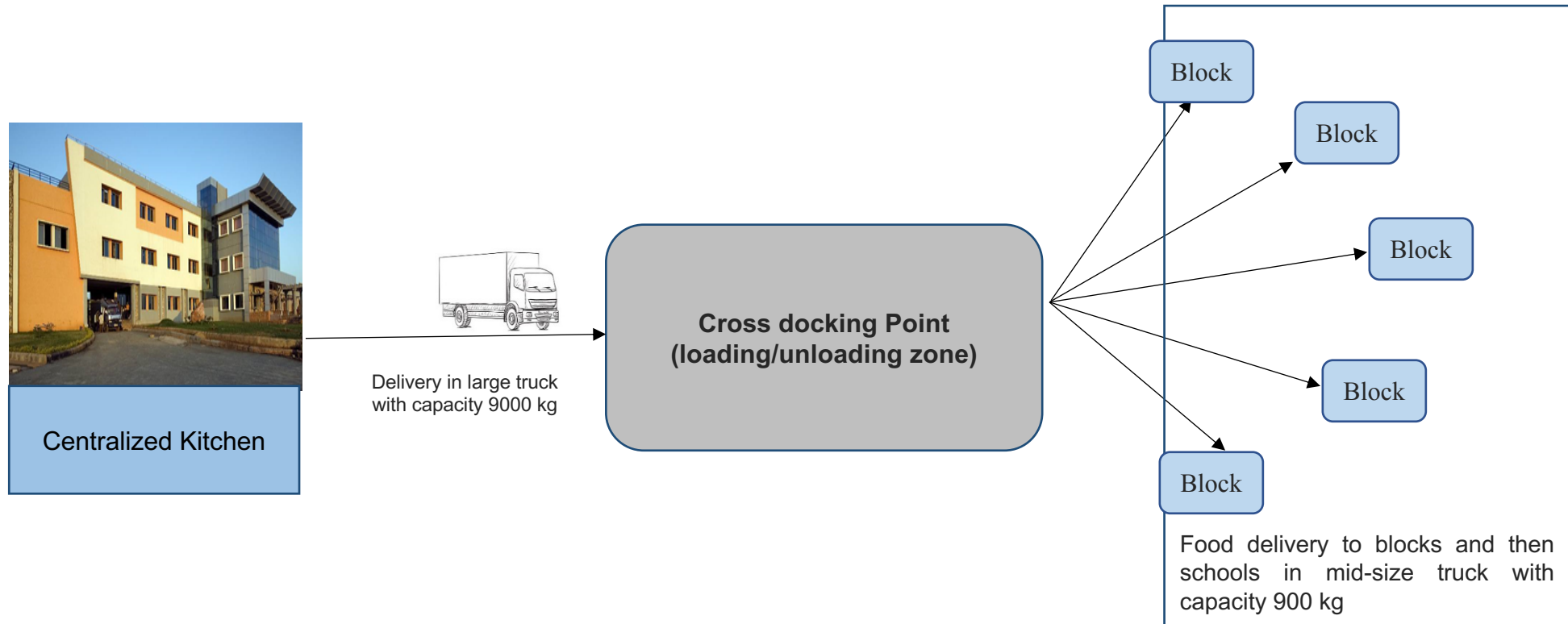
Decentralized kitchens



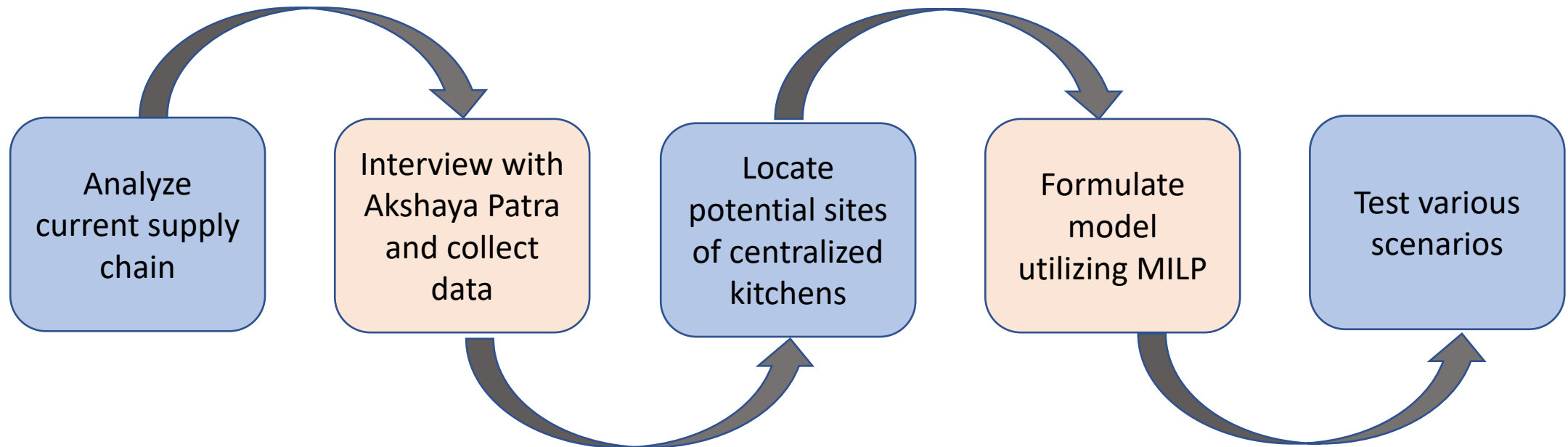
Literature Review

- Perishability challenge
- Harvard case study
- Optimization
- Food delivery
- Cross docking

Cross docking



Methodology



Problem Formulation

- Candidate locations for kitchens and cross docking facilities
66 cities within Uttar Pradesh
- Customers
1076 blocks (157 schools on average with 50 kids in each school)
- Data
66 by 1076 matrix each for distance and time (each city to each block)

Goal:

MINIMIZE Kitchen set up cost + Delivery cost

Subject to Constraints- Demand, Supply, Time, Co-location, Flow conservation

Methodology....

Various Scenarios For Network design

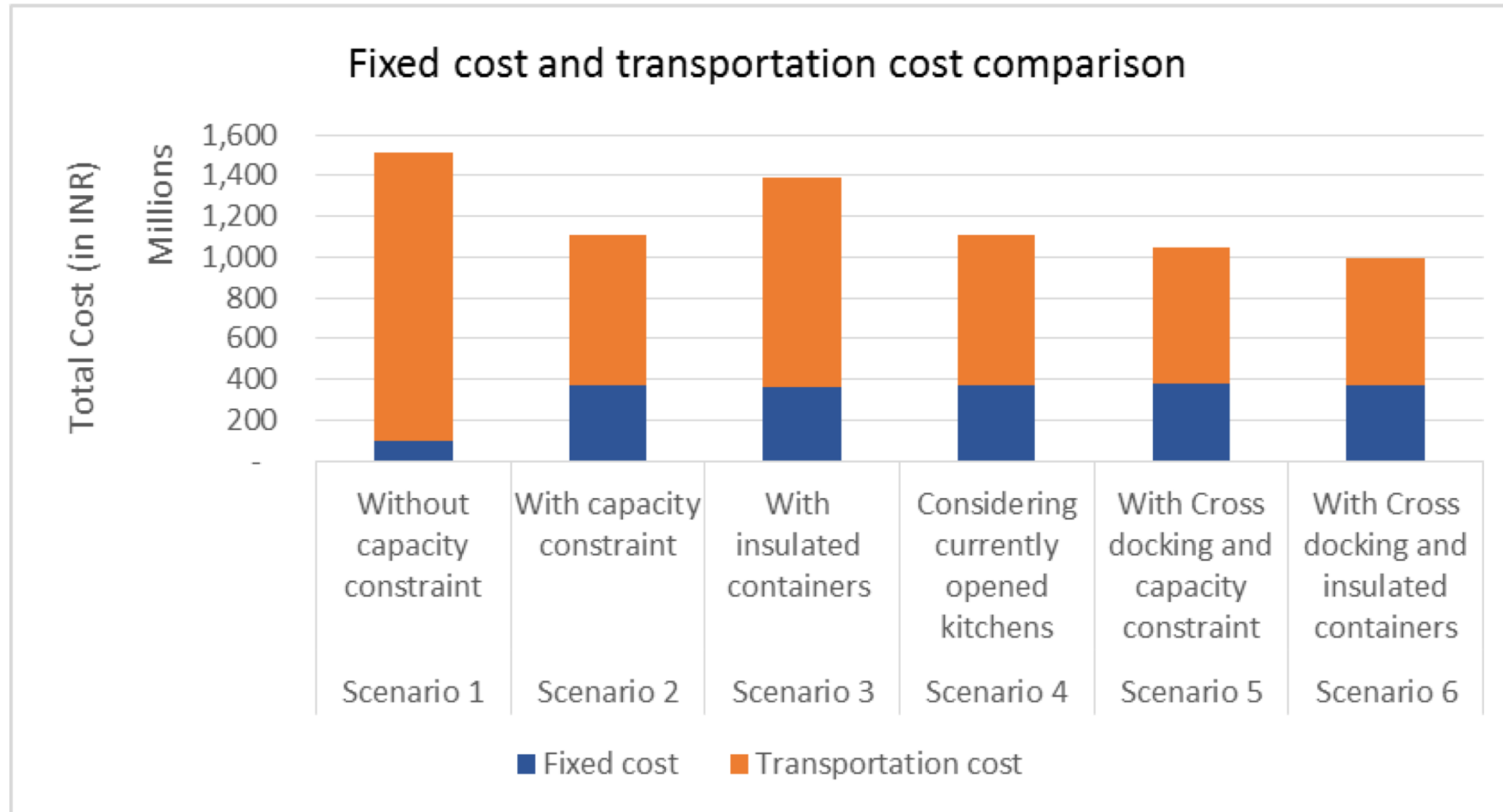
1. Network design without capacity constraint
2. Network design with capacity constraint
3. Network design with insulated containers
4. Network design considering currently opened kitchens
5. Network design with cross docking and capacity constraint
6. Network design with cross docking and insulated containers



Cost analysis for one year (all scenarios)

Scenarios	Network Designs	Fixed cost (up front)-a (INR)	Transportation cost (1 day)-b (INR)	One year total cost-a + b*225 (INR)
Scenario 1	Without capacity constraint	100,000,000	6,296,264	1,516,659,400
Scenario 2	With capacity constraint	370,000,000	3,280,810	1,108,182,250
Scenario 3	With insulated containers	360,000,000	4,590,560	1,392,876,000
Scenario 4	Considering currently opened kitchens	370,000,000	3,297,892	1,112,025,700
Scenario 5	With Cross docking and capacity constraint	380,000,000	2,969,716	1,048,186,100
Scenario 6	With Cross docking and insulated containers	370,000,000	2,763,304	991,743,400

Cost analysis for one year (Graph)



Cost analysis for one year (all scenarios)

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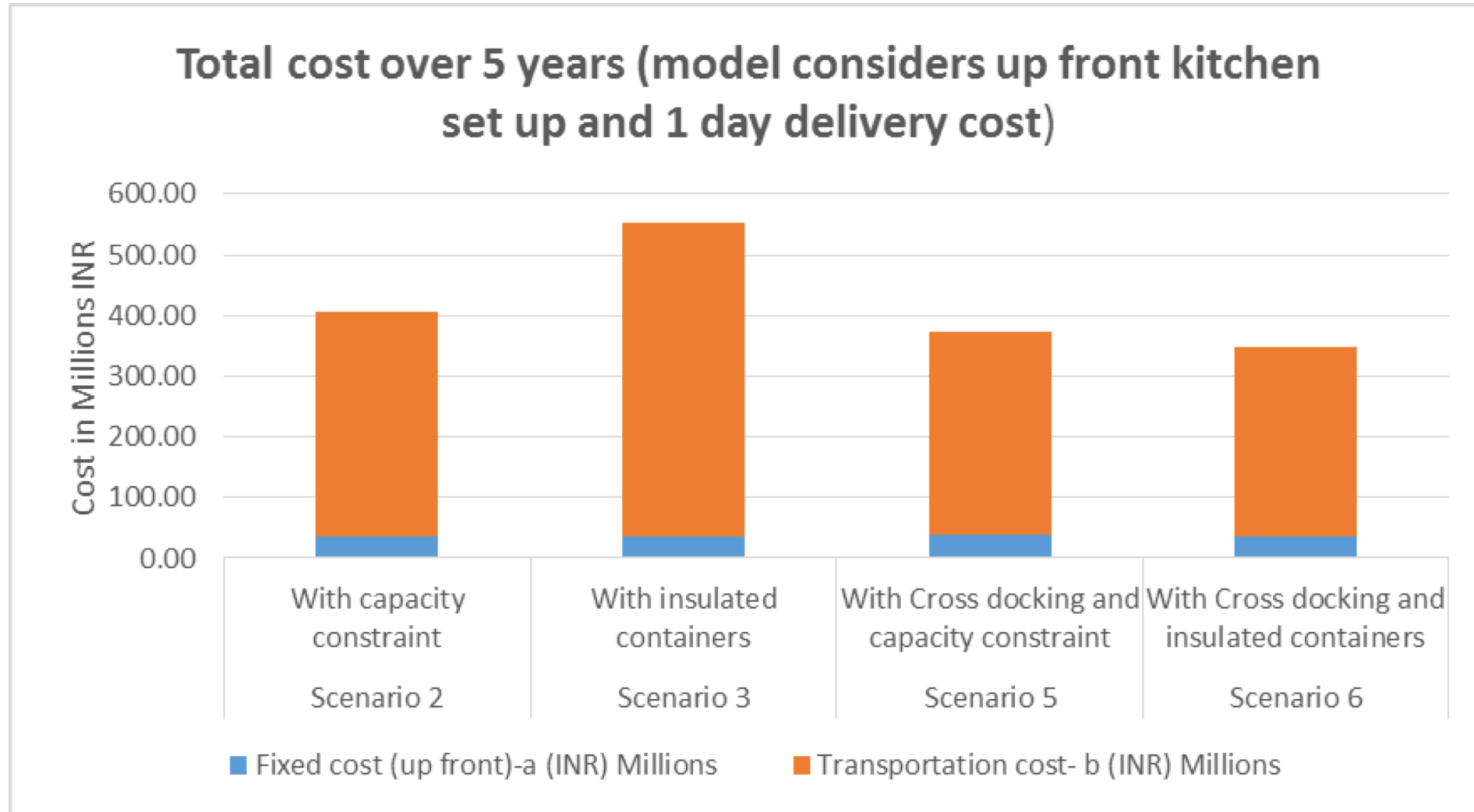
Cost analysis for five years

(Model considers upfront cost and 1 day delivery cost)

Scenarios	Network Designs	Fixed cost (up front)-a (INR)	Transportation cost (1 day)-b (INR)	Five year total cost-a+b*225*5 (INR)
Scenario 2	With capacity constraint	370,000,000	3,280,810	4,060,911,250
Scenario 3	With insulated containers	360,000,000	4,590,560	5,524,380,000
Scenario 5	With Cross docking and capacity constraint	380,000,000	2,969,716	3,720,930,500
Scenario 6	With Cross docking and insulated containers	370,000,000	2,763,304	3,478,717,000

Cost analysis for five years

(Model considers upfront cost and 1 day delivery cost)



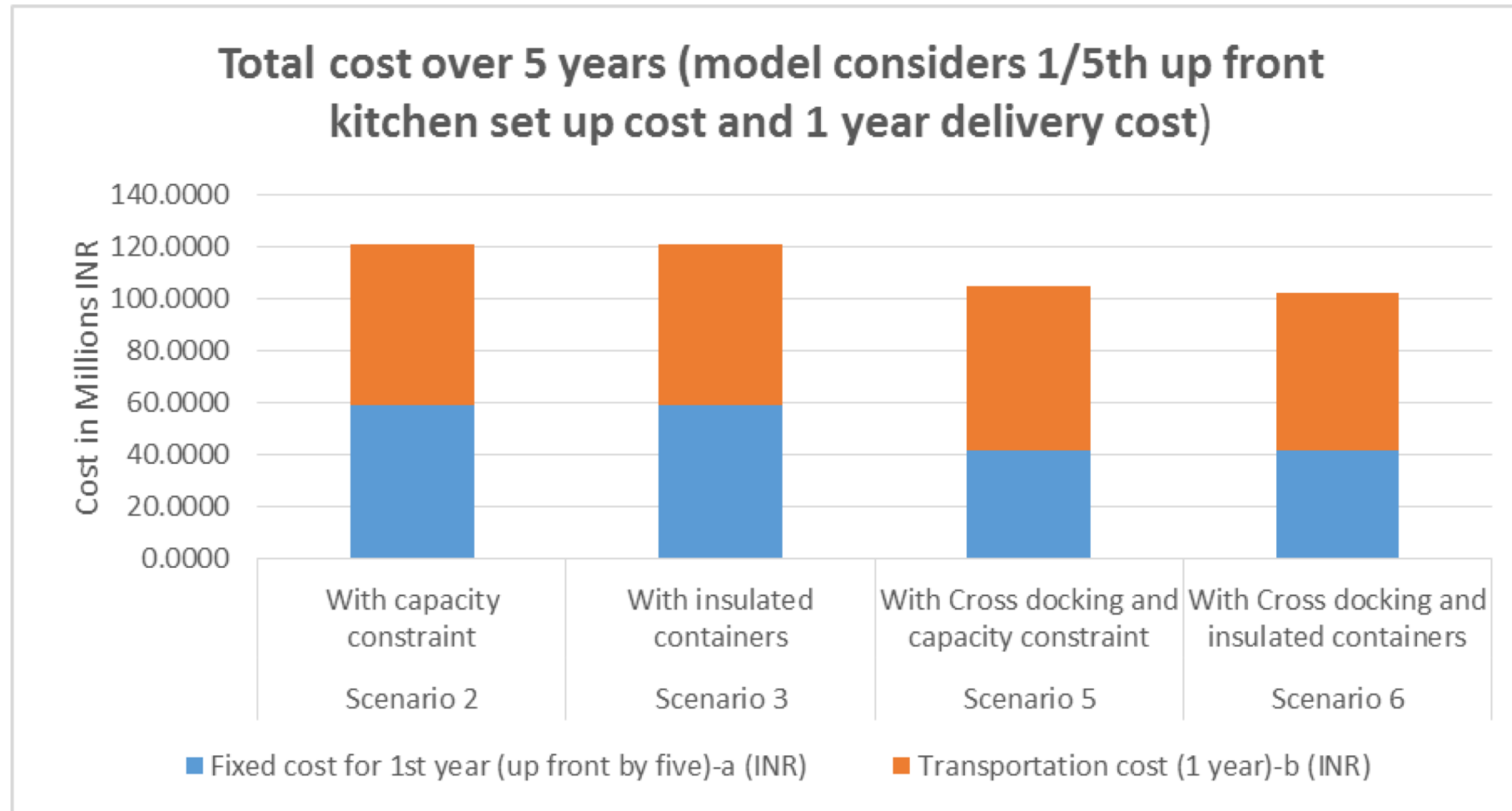
Cost analysis for five years

(Model considers upfront cost divided by 5 and 1 year delivery cost)

Scenarios	Network Designs	Fixed cost for 1 st year (up front by five)- a (INR)	Transportation cost (1 year)- b (INR)	Five year total cost- a+b*5 (INR)
Scenario 2	With capacity constraint	590,000,000	619,006,050	3,685,030,250
Scenario 3	With insulated containers	590,000,000	618,988,500	3,684,942,500
Scenario 5	With Cross docking and capacity constraint	420,000,000	632,166,602	3,580,833,010
Scenario 6	With Cross docking and insulated containers	420,000,000	604,595,507	3,442,977,535

Cost analysis for five years

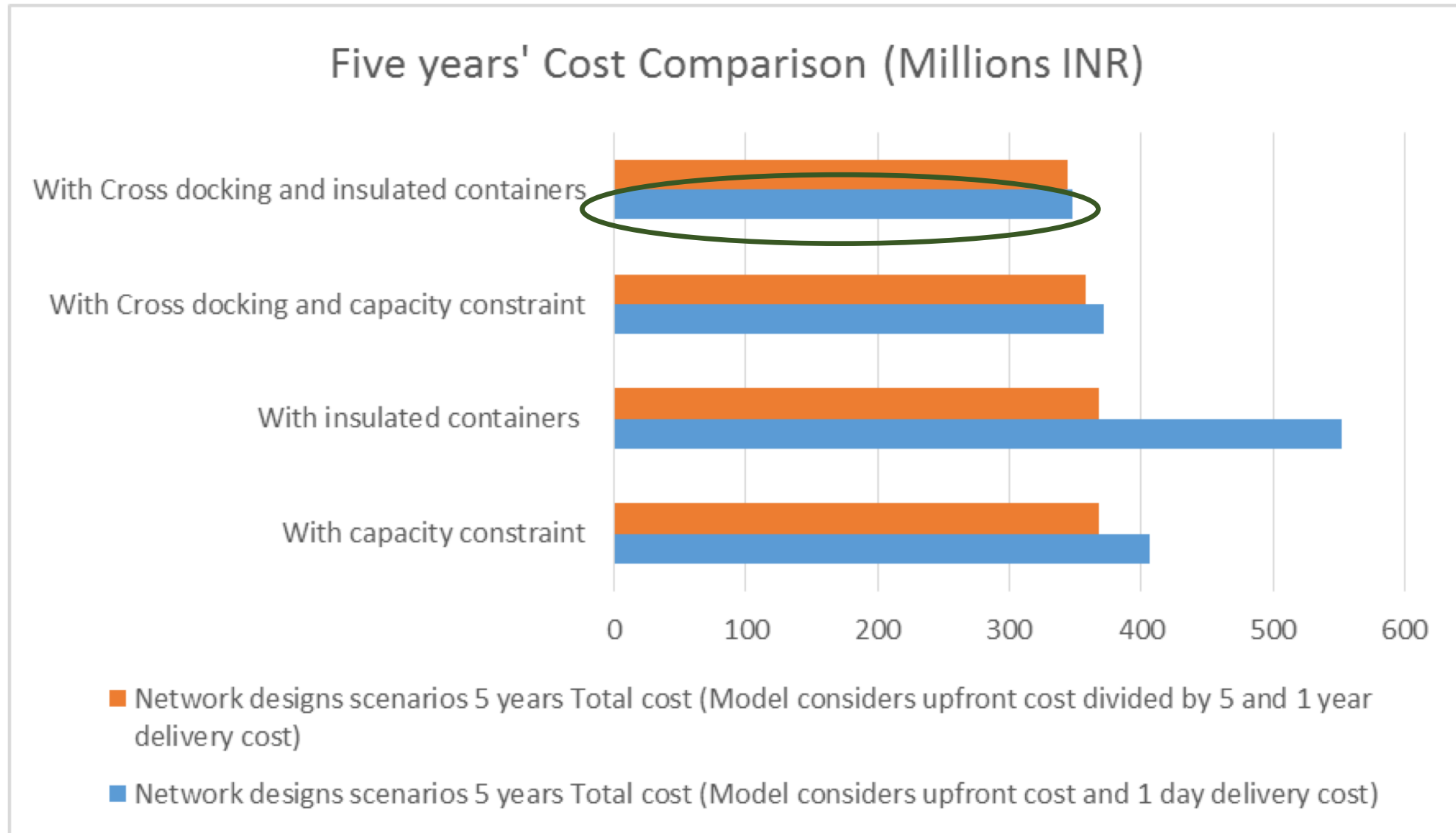
(Model considers upfront cost divided by 5 and 1 year delivery cost)



Five years' cost comparison

Network designs scenarios	Five year cost analysis (in INR)			
	5 years Total cost (Model considers upfront cost and 1 day delivery cost)	No. of Kitchens opened	5 years Total cost (Model considers upfront cost divided by 5 and 1 year delivery cost)	No. of Kitchens opened
With capacity constraint	4,060,911,250	37	3,685,030,250	59
With insulated containers	5,524,380,000	36	3,684,942,500	59
With Cross docking and capacity constraint	3,720,930,500	38	3,580,833,010	42
With Cross docking and insulated containers	3,478,717,000	37	3,442,977,535	42

Five years' cost comparison



Limitations

- Truck Size
- Truck Utilization (36% are under utilized)
- Decentralized kitchen
- Cross docking cost
- Cost of insulated containers
- Cost of inbound transportation
- Cost of setting up kitchens in different locations



Conclusion

From our analysis

- insulated container (with a lead time from four to six hours) along

- consolidated delivery routes provides the most

* Remember the mo



unit from four

livery cost

