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Network Design

Review – July ’15

Agenda

- Introduction
- Problem definition (Network Design - review)
- Scenarios Comparison
  - Service Level
  - Logistics Costs
  - Total Costs (transportation + FCs + taxes)
- Final Recommendations

Introduction

- Network Design – Walmart.com (3YP): Academic purposes;

- Motivations:
  - Supply Chain Strategies Review (Jul´15)
  - Business Plan (3YP review – volume and sales)
  - Service Level – under pressure
  - Supply Chain Cost reduction (% Net Sales)
  - Assets utilization level

Problem Definition

- There was no connection between Supply Chain and Business Strategy;
- Service Level and Supply Chain Cost (% Net Sales) – under pressure;
- Sales ($ and volume) were decreasing year by year;
- Idle Assets – fixed costs dilution: the distribution network was designed for a diferente volume level (almost 3 times);

Network Design (Review) – 3YP: based on some assumptions, we decided to review the distribution network (Service Level, SC Costs, Sales, Taxes, and others)

Problem Definition

- **Network Design (Review):**
  - # FCs and its locations
  - FCs coverage (markets achievement)
  - Categories Allocation based on taxes
  - Capacities review for each FC

- Optimization Model – Supply Chain Guru® (**LLama**soft ®)

- Scenarios Comparison:
  - Service Level Improvement
  - Logistics Costs
  - Total Costs (Logistics and Taxes)

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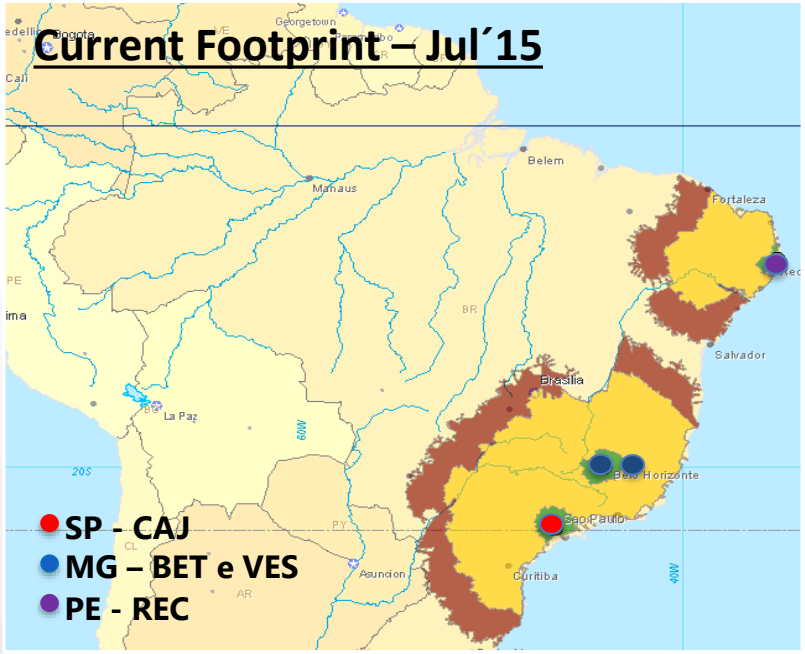
Presentation Purpose and Methodology

Define Service Scenario

Define Min. Logistics Cost Scenario

Define Min. Total Cost (incl. taxes) Scenario



Compare Service, Cost and Capacities → **Define which option implement**

- **Network Design (Review):**
  - *# FCs and its locations*
  - *FCs coverage (markets achievement)*
  - *Capacities review*

- **Objective Function:** *maximizing SL or minimizing LC or TTC*

- **Constraints:** *# Max.FCs, FCs capacities, service level and transporation lead times*

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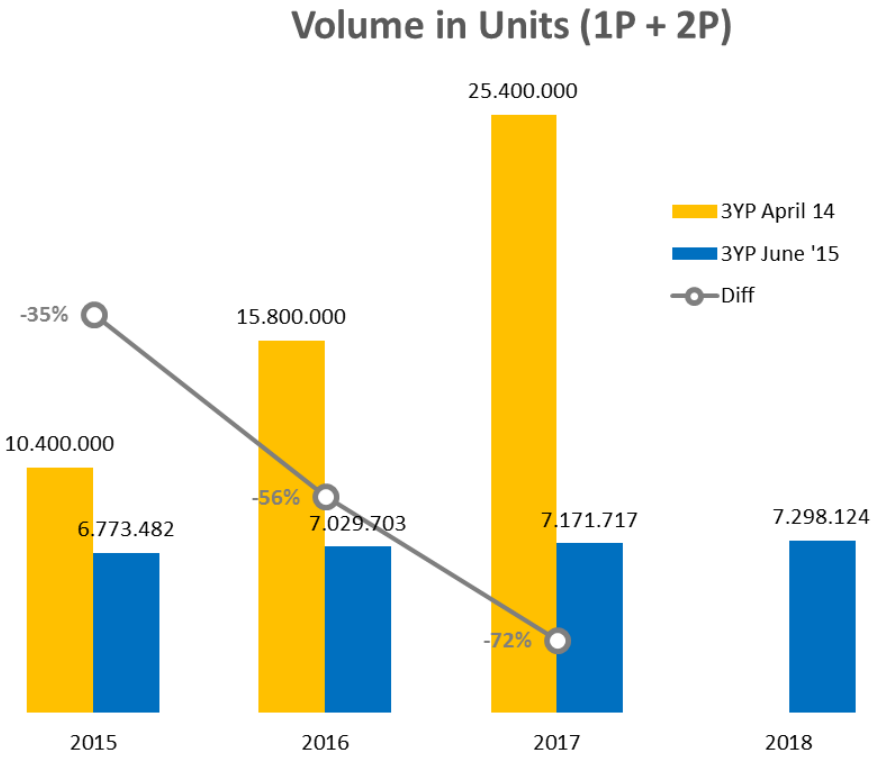
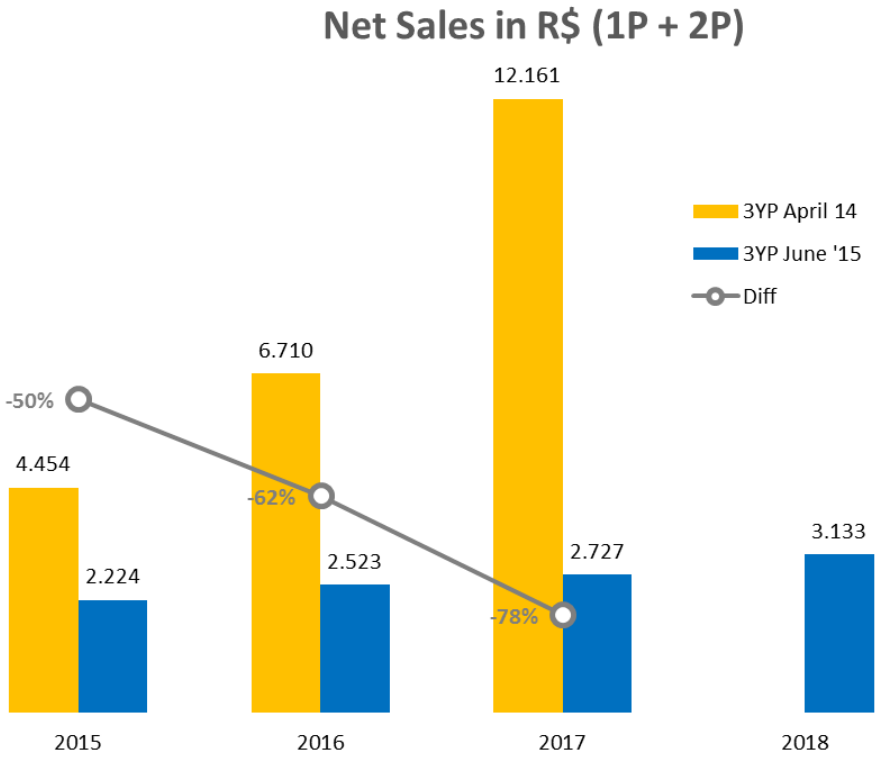
Assumptions

NETWORK DESIGN REVIEW – JULY 15

Sales Review (3YP)





- Significant sales change from last year 3YP.
- Volume in 2016 is less than half and in 2017 less than a third

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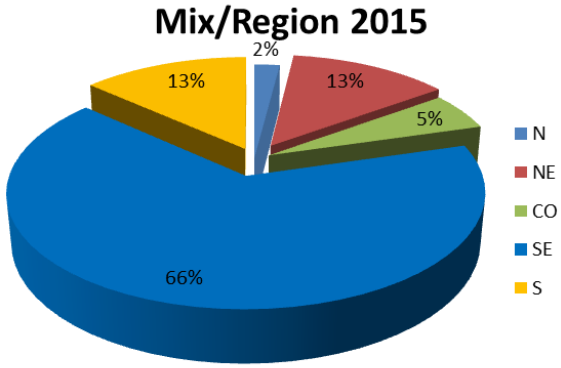
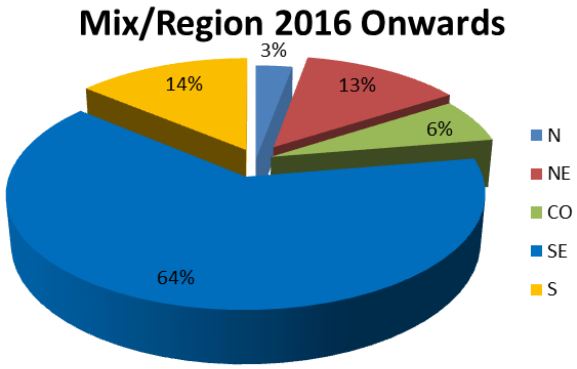
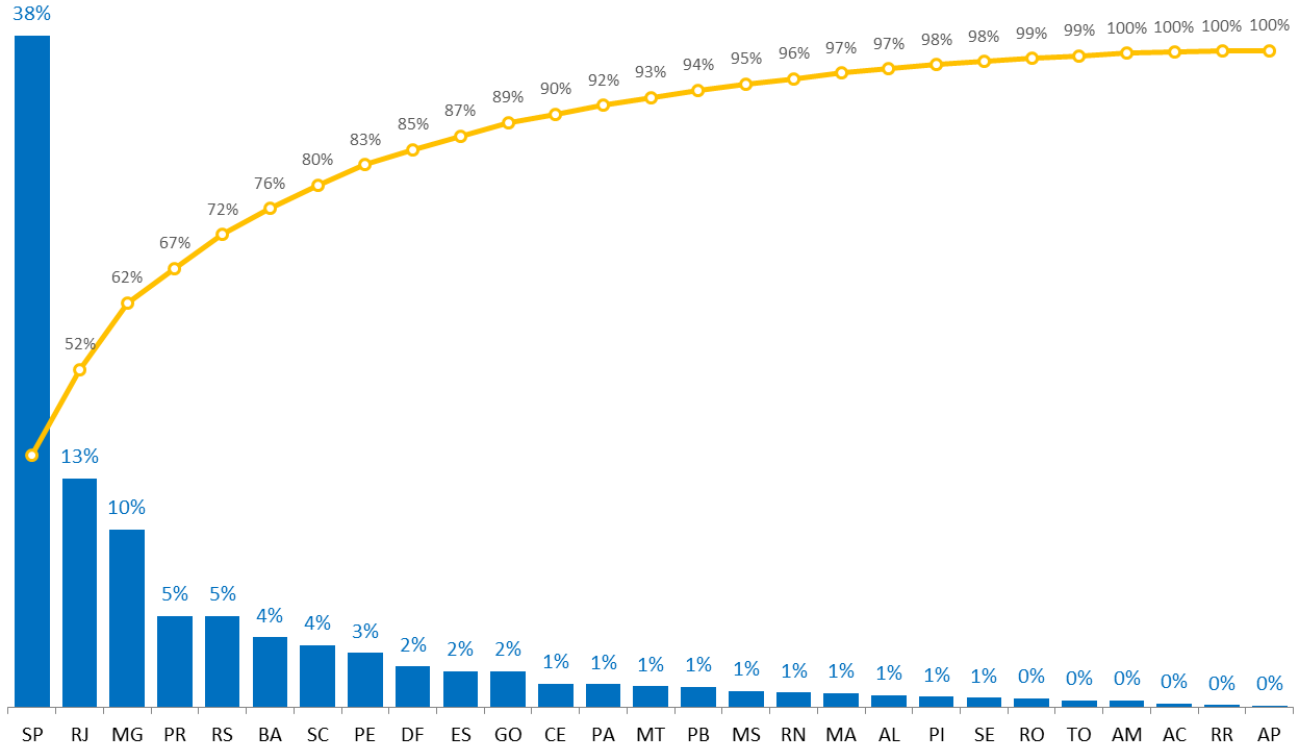
Mix Assumptions and States Representativeness







- Almost no change in split among regions and states

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Service Level Scenario

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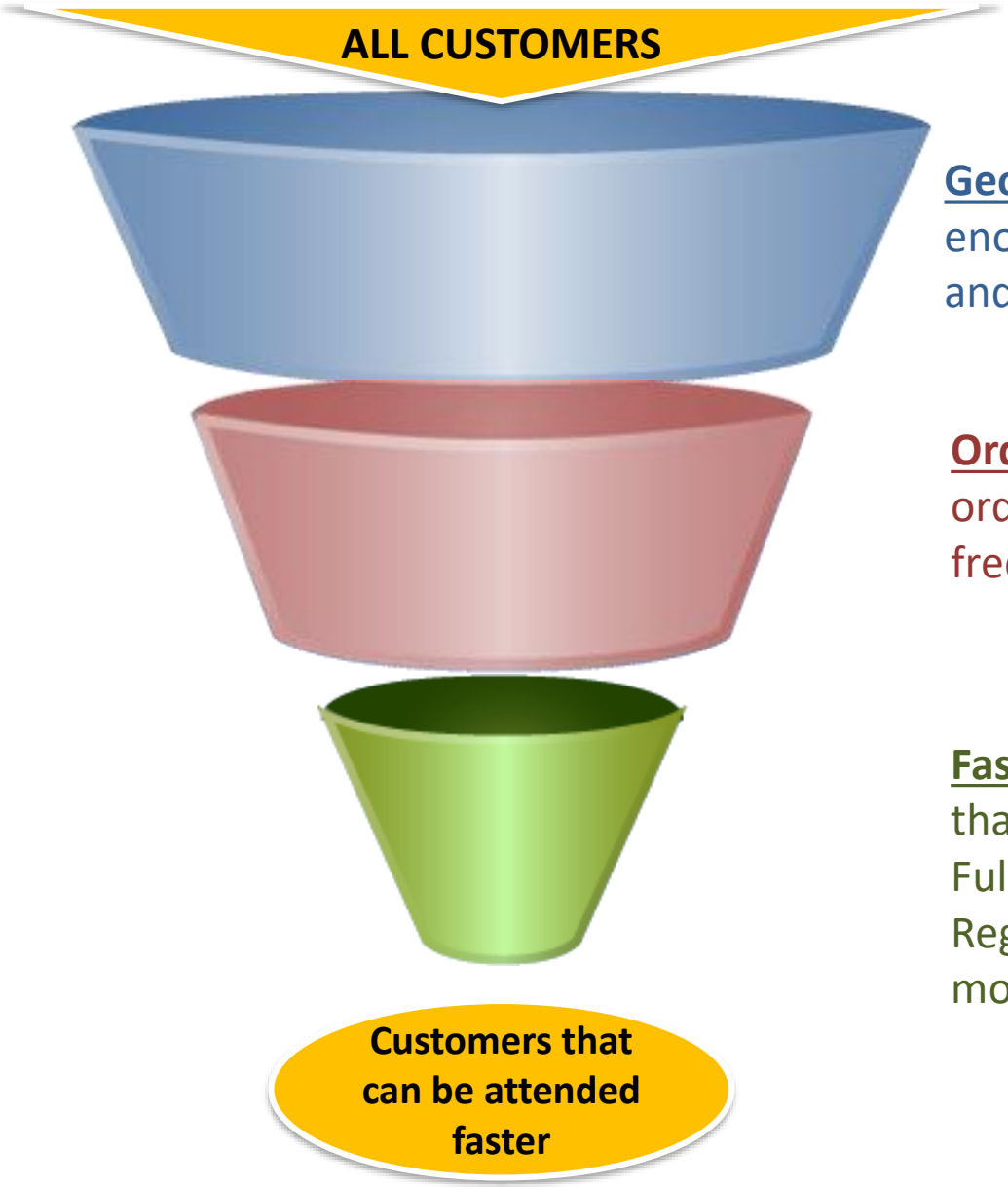
Service Level Assumptions

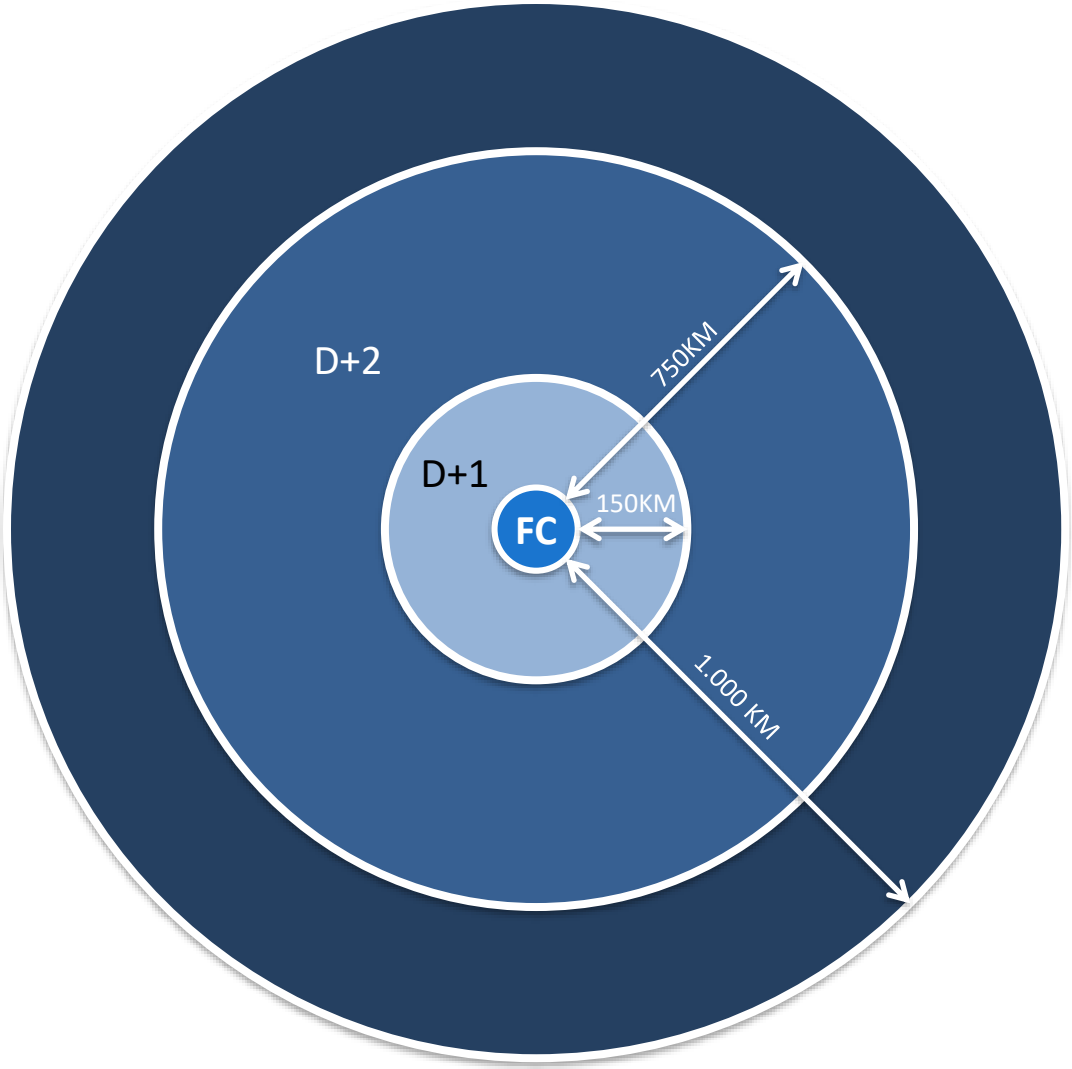


Geographic Radius: Cities that are close enough from a FC to be attend in D+1 and D+2

Orders Density: Cities that have enough orders to justify faster and more frequent deliveries

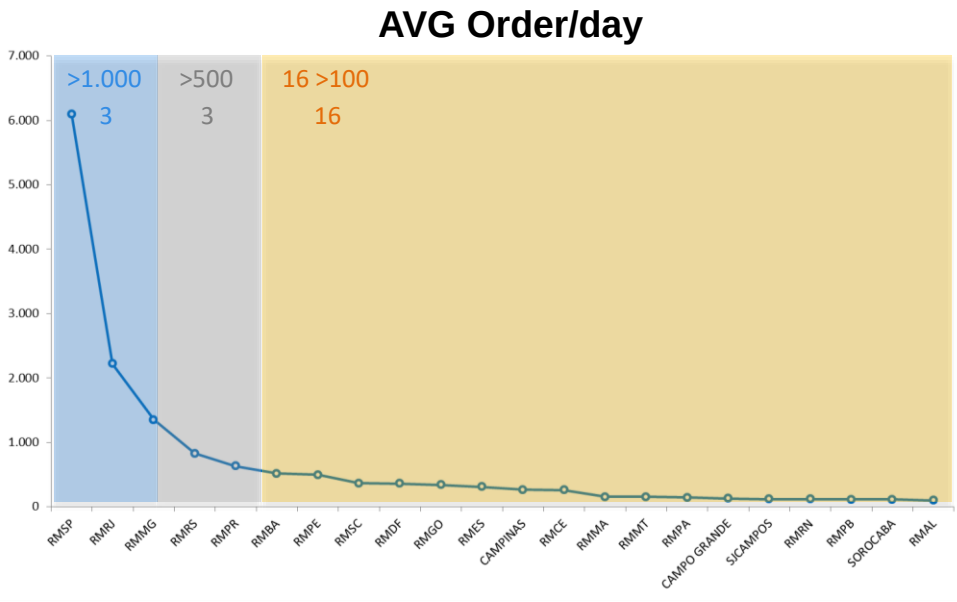
Fast Movers and Slow Movers: Cities that can be attend from the National Fulfillment Center (all items) and from Regional Fulfillment Centers (just fast moving items)

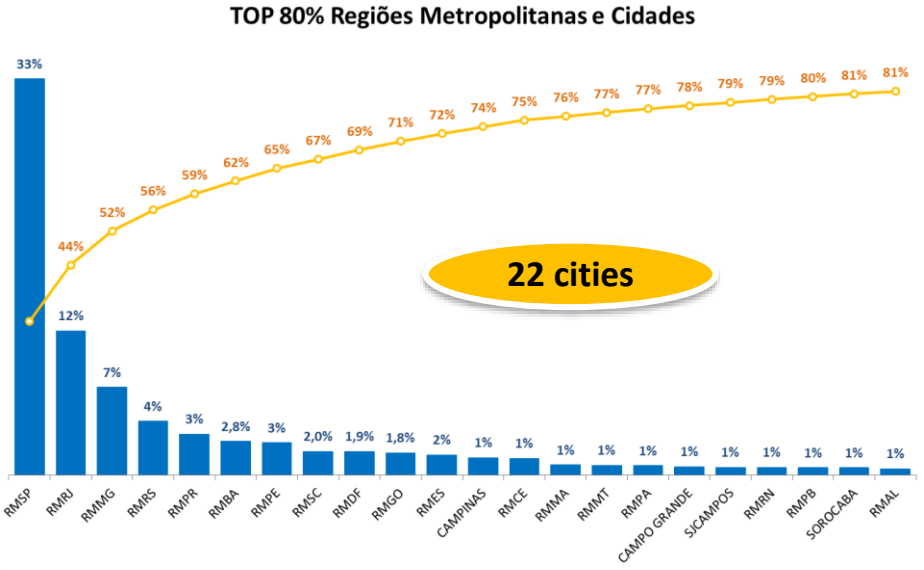
Geographic Radius

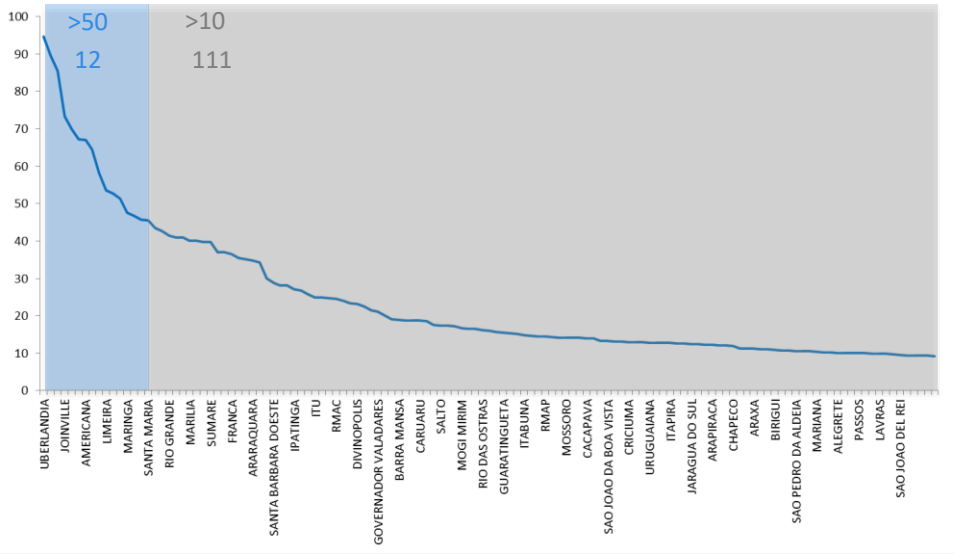


- 3 service radius considered:150Km (D+1), 750Km (D+2) and 1.000Km (> D+2) respectively;
- This filter **only considers** the FC geographic location to provide faster shipment alternatives

Order Density







- Only 6 Metropolitan Regions (MR) with more than 500 orders/day (average)
- Need 20 MR or cities to cope with 80% of total demand
- 65 order/day was the threshold considered to order density (based on Smart Delivery assessment)

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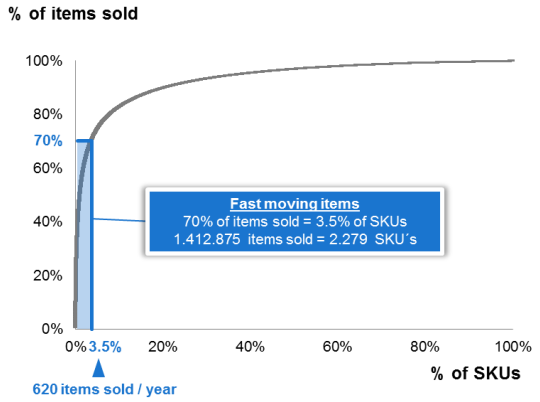
Fast Movers and Slow Movers

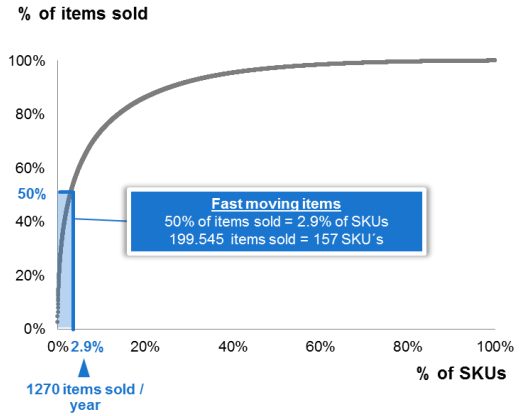
Fast and Slow Movers Definition

Business Approach

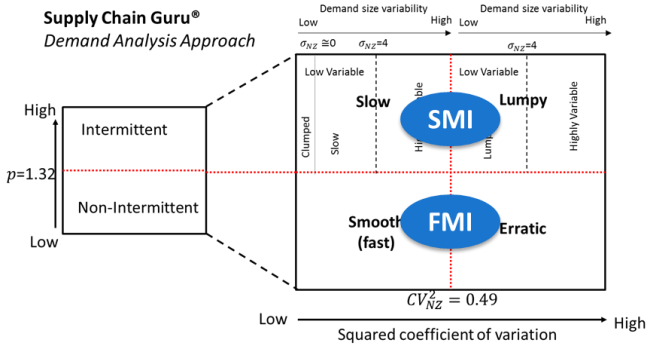
Conveyable items



Non-conveyable items



Demand Behavior Approach



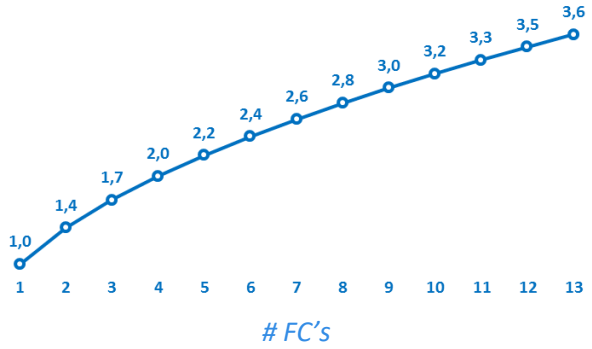
FAST MOVING ITEMS

VOLUME	#SKUs
74.13%	13.08%
% of NET Sales	
73%	

SLOW MOVING ITEMS

VOLUME	#SKUs
25.87%	86.92%
% of NET Sales	
27%	

Stock Need vs. Number of FCs



- From business and from demand behavior perspective, Fast Movers cope with approx. 70% of the demand
- Each new FC in the network will demand more inventory to deliver the same product availability. Ex.: 2 FCs will require 41% more inventory. 3 FCs 72%.

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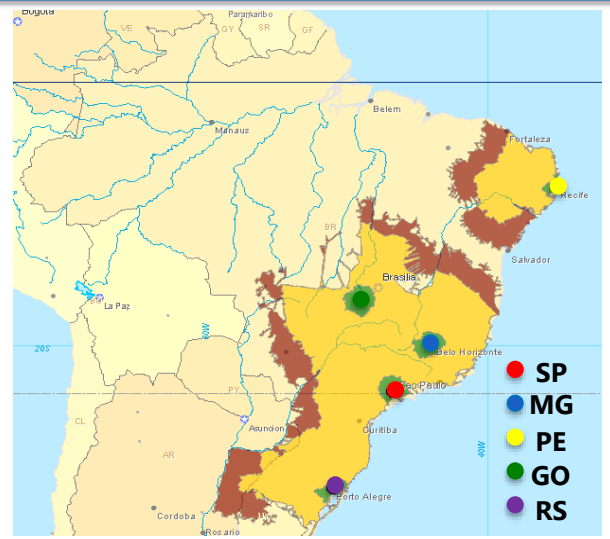
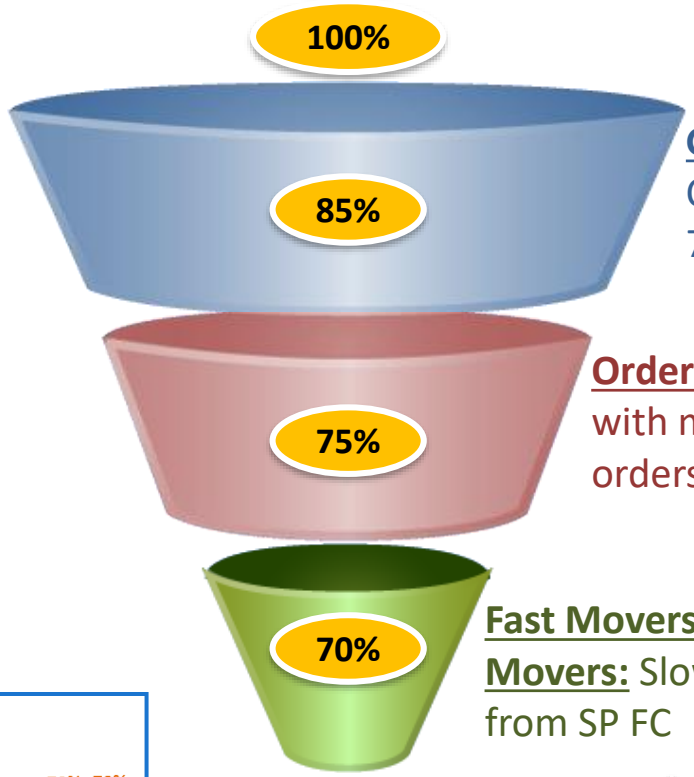
Service Assumptions – 5 FCs and D+2

5 FC's – Service Scenario

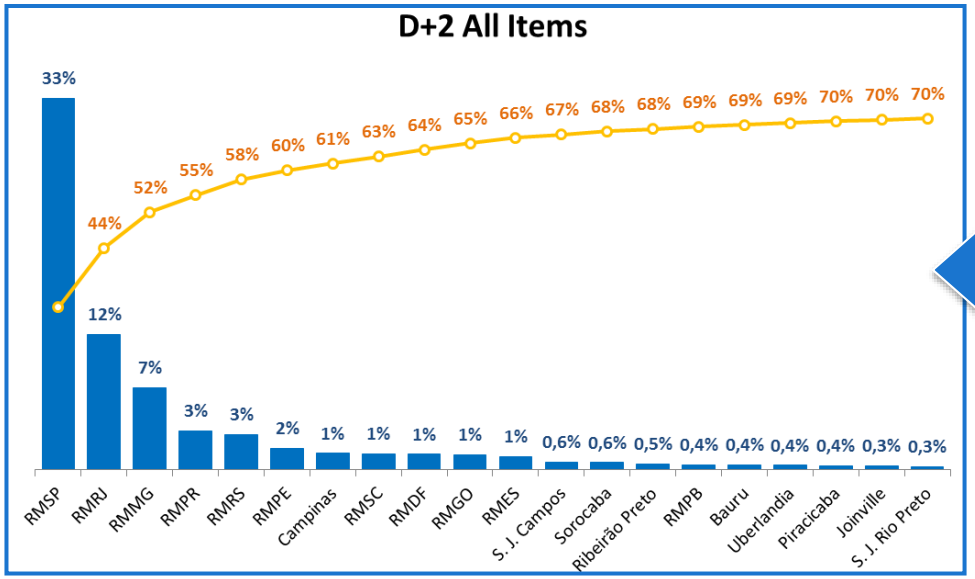




Geographic Radius: Cities closer than 750KM

Orders Density: Cities with more than 65 orders/day

Fast Movers and Slow Movers: Slow Movers only from SP FC



Recommended Service Scenario: 5 FCs. To deliver **80% in D+2** we will need **11 FCs** (SP, PE, MG, RS, GO, BA, CE, MA, MT, PA, and TO) disregarding order density

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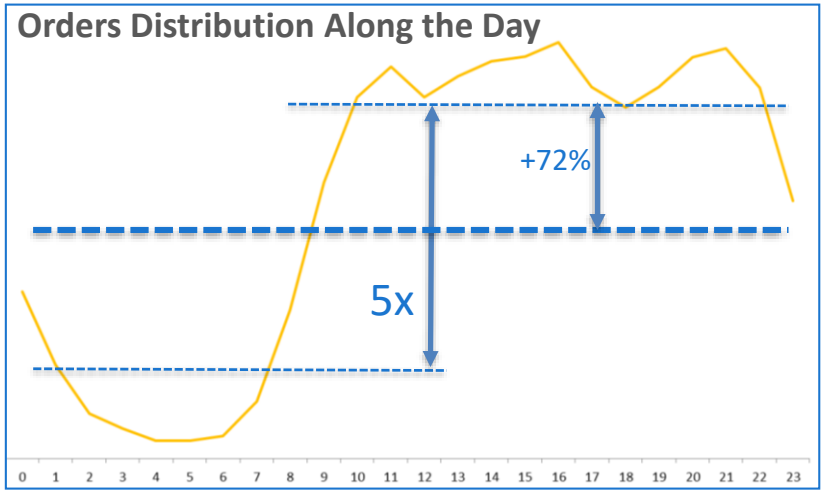
Service Assumptions – Fulfillment Cost and Capabilities

Capacity and Cost Assumptions



- To reduces APD to 8h for 100% of the volume, the FC capacity must be 72% higher than the day average
- To improve FCs capacity to cope with this requirement there is a need to increase people related expenses, depreciation and maintenance in 78%
- This means a 52% increase in variable cost and 13% increase in fixed cost

Operational Requirements

- Carrier's truck 24h available at docks for non-conveyable and pick-up 3 times/day for conveyable
- More resources from carriers to monitor pick ups and reduce load time
- Buy 250 barcoding scanning gun
- Buy fork-lifts, clamps and
- Buy 50 printers

Others Capabilities Required

- WMS time bucket in hours (instead of days)
- Order tracking within the FC
- Improvement management and control tools

Service Assumptions – Transportation Cost and Capabilities

Capacity and Cost Assumptions

Origin - Destination	On Cost (%)
GO-Capital	48%
MG-Capital	34%
PE-Capital	22%
SP-Capital	43%
SP-Interior	16%

- Volume transported per lane will decrease (more frequent dispatches) therefore the cost per unit will increase due to the loose of scale/consolidation.
- To guarantee 3 pick ups x day, the freight cost increases due to the number of trips x day and carrier´s team availability
- To guarantee the transportation management, it´s needed the increment of 3 HC at transportation team

Operational Requirements

- Carrier's truck 24h available at docks for non-conveyable and pick-up 3 times/day for conveyable
- More resources from carriers to monitor pick ups and reduce load time

Others Capabilities Required

- 1 HC at the corporative transportation team (Database management)
- 2 HC at the DC transportation team, one in each new site (Dock scheduling & Tendering)

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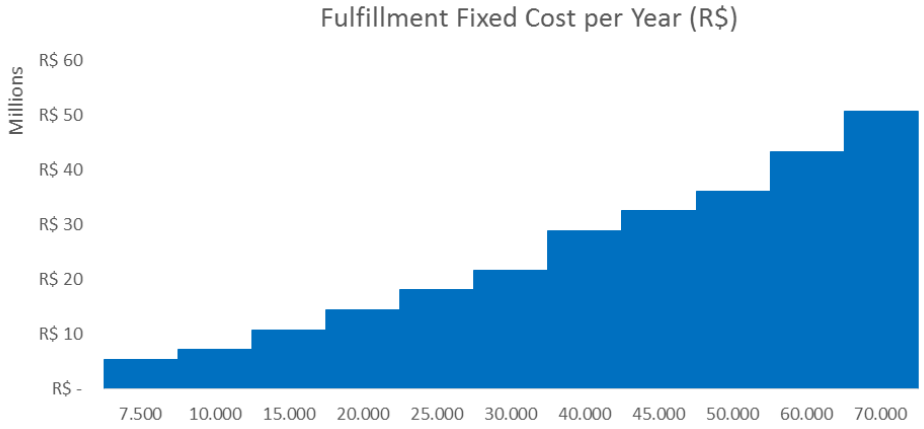
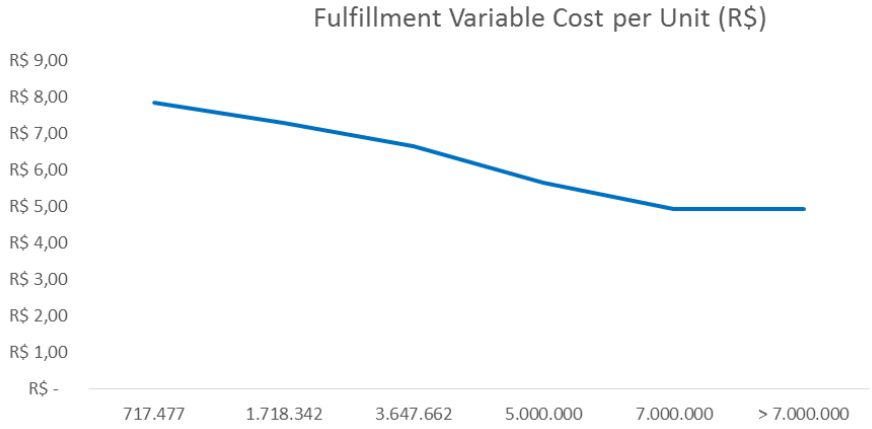
Minimum Cost Scenarios

NETWORK DESIGN REVIEW – JULY 15

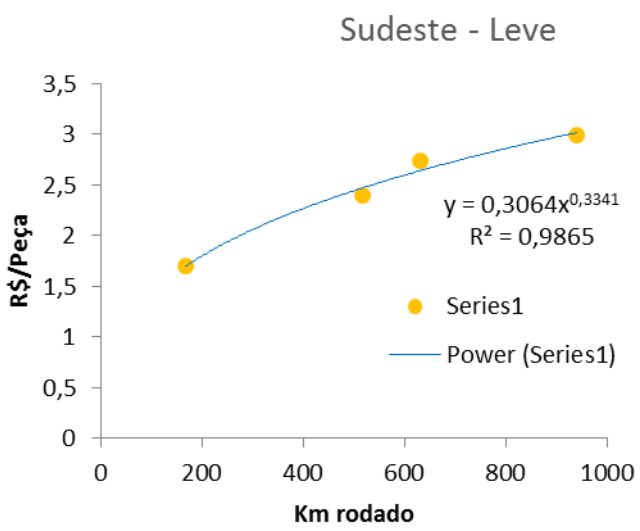
Cost Assumptions

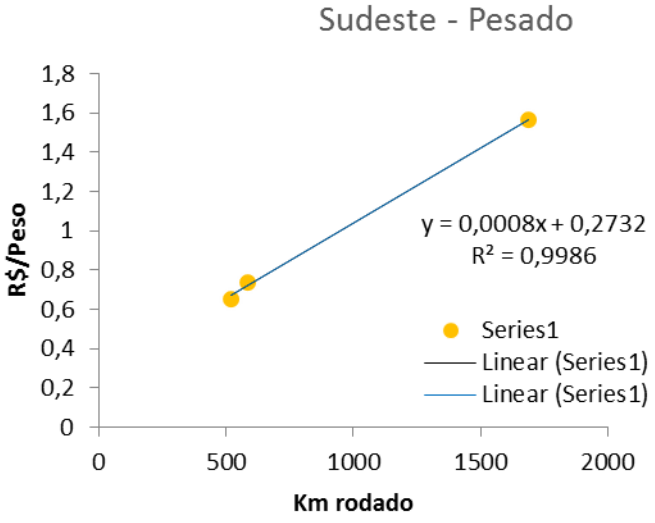
Fulfillment





Freigth





Freight

- By Cluster: Leves / Pesados
- By Region: N, S, NE, CO, SE
- By Weight
- To all BR Zip Codes (origin or Destination)

Taxes Assumptions (Examples)

	Origem	Destino	Carga 2015	Carga 2016	Carga 2017	Carga 2018
Eletrodomésticos	SP	MG	18,6%	18,6%	18,6%	18,6%
	SP	RJ	18,6%	18,6%	18,6%	18,6%
	SP	RS	18,6%	18,6%	18,6%	18,6%
	SP	SP	18,6%	18,6%	18,6%	18,6%
	MG	MG	10,8%	10,8%	10,8%	10,8%
	MG	RJ	10,8%	13,4%	14,7%	16,0%
	MG	RS	10,8%	13,4%	14,7%	16,0%
	MG	SP	10,8%	13,4%	14,7%	16,0%

	Origem	Destino	Carga 2015	Carga 2016	Carga 2017	Carga 2018
Eletrônicos	SP	MG	26,0%	26,0%	26,0%	26,0%
	SP	RJ	26,0%	26,0%	26,0%	26,0%
	SP	RS	26,0%	26,0%	26,0%	26,0%
	SP	SP	26,0%	26,0%	26,0%	26,0%
	MG	MG	11,2%	11,2%	11,2%	11,2%
	MG	RJ	11,2%	16,8%	19,6%	22,4%
	MG	RS	11,2%	16,8%	19,6%	22,4%
	MG	SP	11,2%	16,8%	19,6%	22,4%

	Origem	Destino	Carga 2015	Carga 2016	Carga 2017	Carga 2018
Telefonia	SP	MG	14,5%	14,5%	14,5%	14,5%
	SP	RJ	14,5%	14,5%	14,5%	14,5%
	SP	RS	14,5%	14,5%	14,5%	14,5%
	SP	SP	14,5%	14,5%	14,5%	14,5%
	MG	MG	11,6%	11,6%	11,6%	11,6%
	MG	RJ	11,6%	12,6%	13,1%	13,6%
	MG	RS	11,6%	12,6%	13,1%	13,6%
	MG	SP	11,6%	12,6%	13,1%	13,6%

- No change in SP rates along the year
- Increase on MG rates along the years
- Despite the tax rate increase in MG, this state continue to be better than SP (from tax perspective) for the main categories that are currently there

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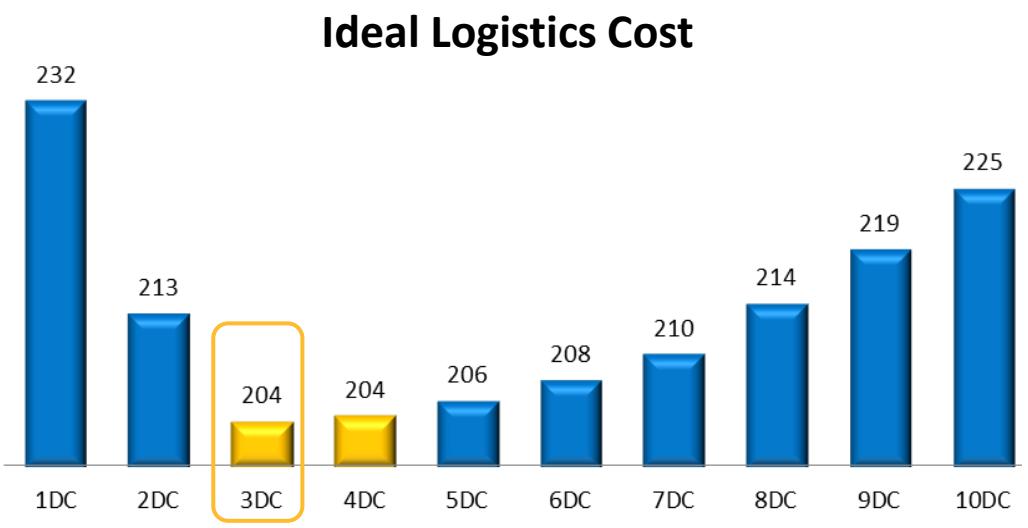
Minimum Cost Scenarios

NETWORK DESIGN REVIEW – JULY 15

2015 Results – Minimizing Logistics Cost



# FCs									
1	2	3	4	5	6	7	8	9	10
SP	SP	SP	SP	SP	SP	SP	SP	SP	SP
	PE	PE	PE	PE	PE	PE	PE	PE	PE
		MG	MG	MG	MG	MG	MG	MG	MG
			RJ	RJ	RJ	RJ	RJ	RJ	RJ
				RS	RS	RS	RS	RS	RS
					GO	GO	GO	GO	GO
						BA	BA	BA	BA
							ES	ES	ES
								SC	SC
									PR

	Ideal Log. Cost	Fixed FF	Variable FF	Freight Cost	⍉ 150KM	⍉ 750KM	⍉ 1000KM
1DC	232.340.141	43.403.844	38.737.424	150.198.873	38%	71%	72%
2DC	213.494.772	48.829.324	40.323.048	124.342.400	41%	76%	81%
3DC	203.874.189	48.829.324	42.000.448	113.044.417	51%	74%	83%
4DC	204.394.277	54.254.804	42.866.450	107.273.023	60%	74%	82%
5DC	205.676.843	59.680.284	42.866.450	103.130.109	62%	77%	83%
6DC	207.508.999	65.105.764	42.866.450	99.536.785	63%	78%	85%
7DC	209.805.711	70.531.244	42.866.450	96.408.018	64%	80%	86%
8DC	214.337.280	75.956.724	42.866.450	95.514.106	64%	81%	87%
9DC	219.156.468	81.382.204	42.866.450	94.907.815	64%	82%	86%
10DC	224.581.948	86.807.684	42.866.450	94.907.815	59%	84%	86%

Best configuration: 3 FCs - SP, PE and MG

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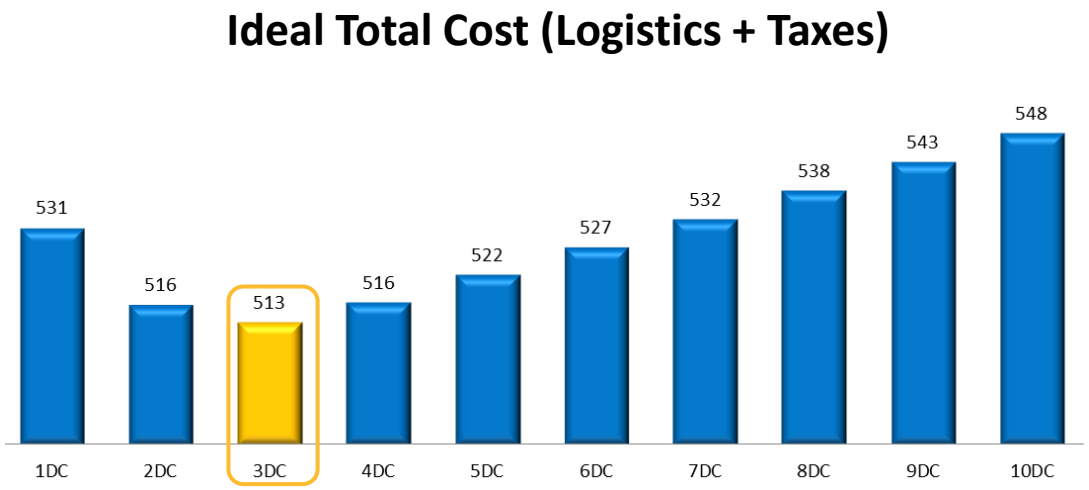
2015 Results – Minimizing Total Cost (Including Taxes)



 # FCs

1	2	3	4	5	6	7	8	9	10
MG	MG	MG	MG	MG	MG	MG	MG	MG	MG
	PE	PE	PE	PE	PE	PE	PE	PE	PE
		SP	SP	SP	SP	SP	SP	SP	SP
			RS	RS	RS	RS	RS	RS	RS
				GO	GO	GO	GO	GO	GO
					BA	BA	BA	BA	BA
						SC	SC	SC	SC
							RJ	RJ	RJ
								ES	ES
									PR

	Ideal Total Cost	Logistics Cost	Duty
1DC	530.569.573	235.620.864	294.948.709
2DC	516.045.825	233.862.322	282.183.503
3DC	512.734.986	229.309.578	283.425.407
4DC	516.436.037	229.542.657	286.893.380
5DC	521.639.997	234.608.306	287.031.691
6DC	526.884.606	239.482.620	287.401.986
7DC	532.169.166	244.363.340	287.805.825
8DC	537.524.670	249.791.435	287.733.236
9DC	542.927.728	255.186.297	287.741.431
10DC	548.353.208	260.611.777	287.741.431

⊘ 150KM	⊘ 750KM	⊘ 1000KM
8%	67%	74%
9%	62%	72%
11%	62%	72%
12%	64%	74%
12%	64%	73%
14%	64%	74%
15%	62%	74%
15%	62%	73%
15%	62%	73%
13%	65%	73%

Best configuration: 3 FCs - MG, PE and SP

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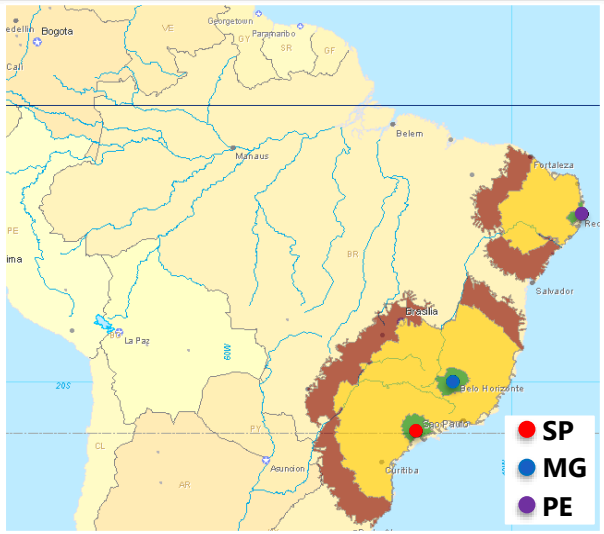
Scenarios Comparisons - 2015

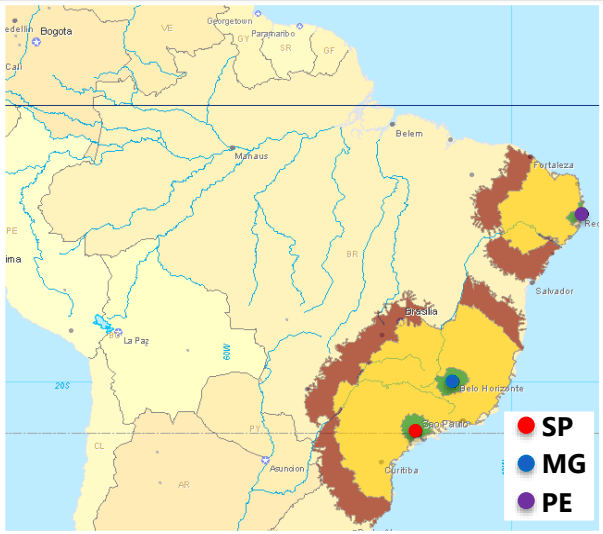
3FCs – Optimized by Logistics Cost



24h 48h 72h

150KM	51%
750KM	74%
1.000KM	83%

3FCs – Optimized by Total Cost



24h 48h 72h

150KM	14%
750KM	63%
1.000KM	70%

Other Comparisons

Storage Need @ Peak (in pp)

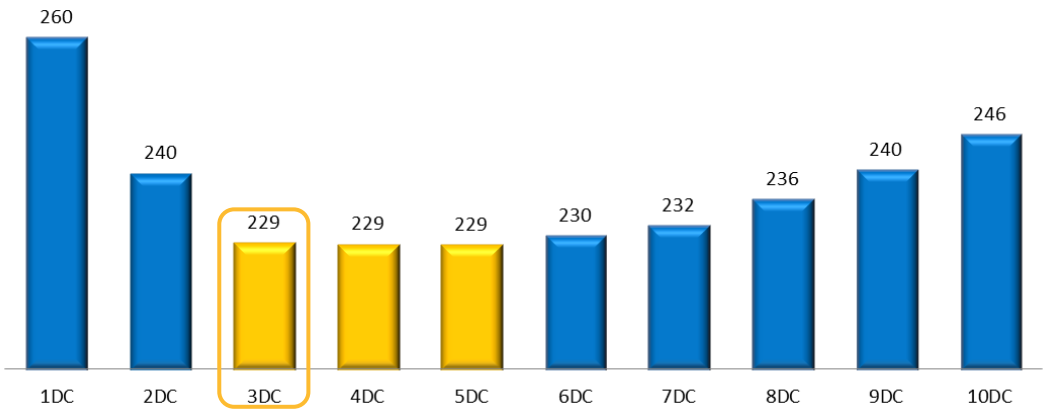
	SP	PE	MG	TOTAL
Logistics	62.857	13.856	26.015	102.729
	61%	*13%*	*25%*	
Tax	3.034	14.799	84.897	102.729
	3%	*14%*	*83%*	

Throughput (in units)

	SP	PE	MG	TOTAL
Logistics	5.391.856	712.405	764.077	6.868.338
	79%	*10%*	*11%*	
Tax	137.930	1.624.603	5.105.804	6.868.338
	2%	*24%*	*74%*	

2018 Results – Minimizing Logistics Cost

Ideal Logistics Cost



# FCs									
1	2	3	4	5	6	7	8	9	10
SP	SP	SP	SP	SP	SP	SP	SP	SP	SP
	PE	PE	PE	PE	PE	PE	PE	PE	PE
		MG	MG	MG	MG	MG	MG	MG	MG
			GO	GO	GO	GO	GO	GO	GO
				RJ	RJ	RJ	RJ	RJ	RJ
					RS	RS	RS	RS	RS
						BA	BA	BA	BA
							ES	ES	ES
								SC	SC
									PR

	Logistics Cost	Fixed FF	Variable FF	Freight Cost	⊘ 150KM	⊘ 750KM	⊘ 1000KM
1DC	260.267.234	50.637.817	36.956.375	172.673.041	35%	69%	70%
2DC	239.583.923	56.063.297	38.454.948	145.065.678	41%	70%	77%
3DC	229.030.211	52.446.311	46.097.121	130.486.779	48%	73%	82%
4DC	228.833.864	57.871.791	46.696.219	124.265.853	52%	76%	86%
5DC	228.791.860	63.297.271	47.914.948	117.579.641	61%	76%	85%
6DC	230.128.908	68.722.774	47.914.941	113.491.193	64%	79%	87%
7DC	231.649.479	74.148.231	47.914.948	109.586.300	66%	81%	87%
8DC	235.652.903	79.573.711	47.914.948	108.164.244	66%	82%	88%
9DC	240.086.171	84.999.191	47.914.948	107.172.032	67%	82%	87%
10DC	245.511.651	90.424.671	47.914.948	107.172.032	61%	84%	87%

Best configuration: 3 FCs - SP, PE and MG

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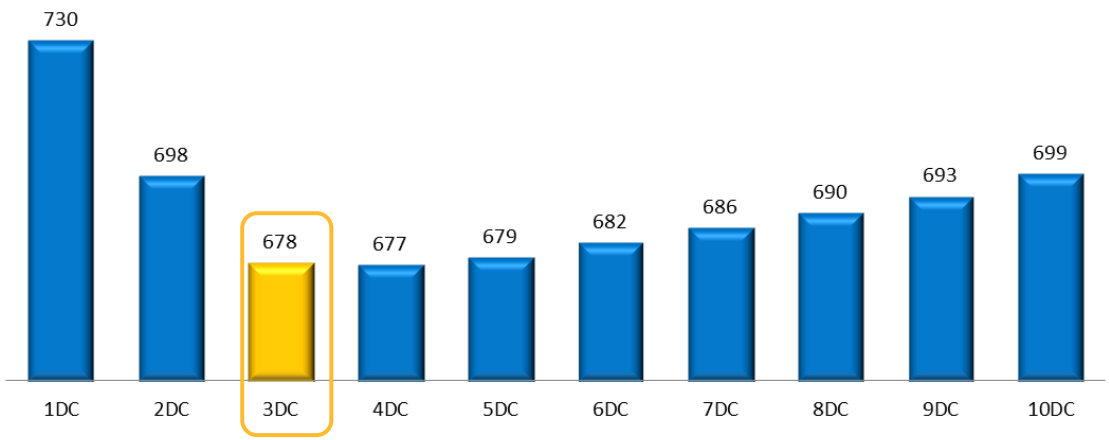
2018 Results – Minimizing Total Cost (Including Taxes)

Ideal Total Cost (Logistics + Taxes)



# FCs	1	2	3	4	5	6	7	8	9	10
	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG
		PE	PE	PE	PE	PE	PE	PE	PE	PE
			SP	SP	SP	SP	SP	SP	SP	SP
				GO	GO	GO	GO	GO	GO	GO
					RS	RS	RS	RS	RS	RS
						RJ	RJ	RJ	RJ	RJ
							ES	ES	ES	ES
								BA	BA	BA
									SC	SC
										PR

	Total Cost	Logistics Cost	Duty	⊘ 150KM	⊘ 750KM	⊘ 1000KM
1DC	730.484.454	261.660.881	468.823.573	8%	65%	73%
2DC	698.318.432	262.976.464	435.341.969	11%	66%	77%
3DC	677.623.290	233.433.078	444.190.211	38%	69%	74%
4DC	677.229.810	232.670.496	444.559.314	41%	72%	78%
5DC	678.858.391	233.937.158	444.921.233	44%	75%	80%
6DC	682.487.624	237.731.786	444.755.839	49%	75%	83%
7DC	685.859.660	241.385.907	444.473.753	56%	73%	83%
8DC	689.537.615	244.165.425	445.372.191	60%	75%	83%
9DC	693.396.171	247.791.681	445.604.490	62%	77%	83%
10DC	698.821.651	253.217.161	445.604.490	62%	77%	83%

Best configuration: 3 FCs - MG, PE and SP

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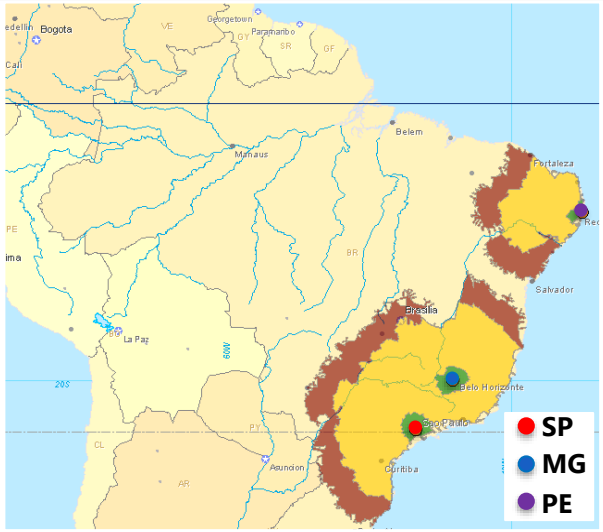
Scenarios Comparisons - 2018

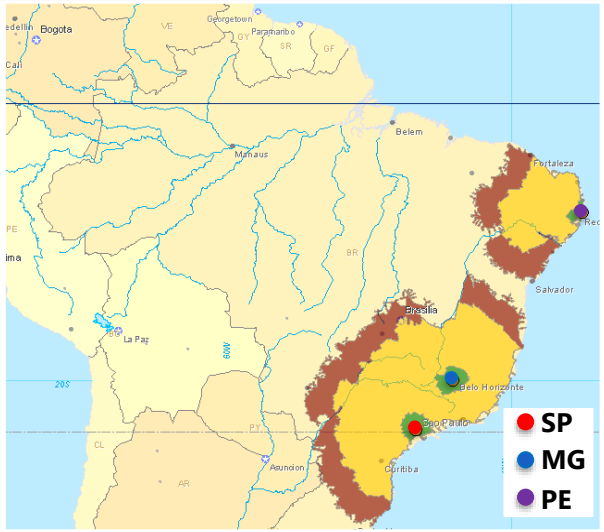
3FCs – Optimized by Logistics Cost



24h 48h 72h

150KM	48%
750KM	73%
1.000KM	82%

3FCs– Optimized by Total Cost



24h 48h 72h

150KM	28%
750KM	67%
1.000KM	78%

Other Comparisons

Storage Need @ Peak (in pp)

	SP	PE	MG	TOTAL
Logistics	68.889	15.532	31.800	116.222
	59%	*13%*	*27%*	
Tax	56.404	17.946	41.872	116.222
	49%	*15%*	*36%*	

Throughput (in units)

	SP	PE	MG	TOTAL
Logistics	5.822.546	722.046	966.866	7.511.458
	78%	*10%*	*13%*	
Tax	3.675.453	1.624.603	2.211.402	7.511.458
	50%	*22%*	*29%*	

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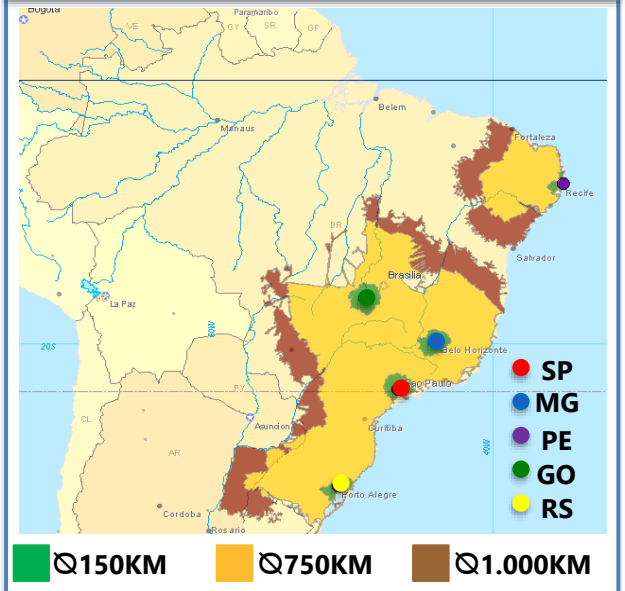
Scenarios Comparison

NETWORK DESIGN REVIEW – JULY 15

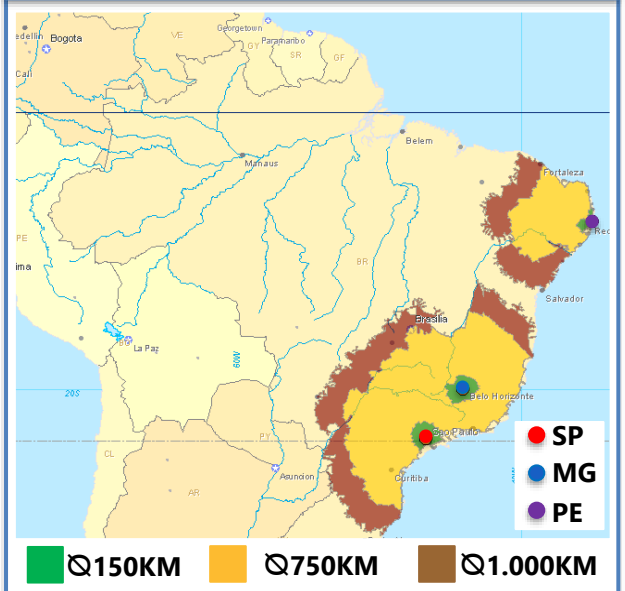
Scenarios Comparison

5 FC's – Service Scenario



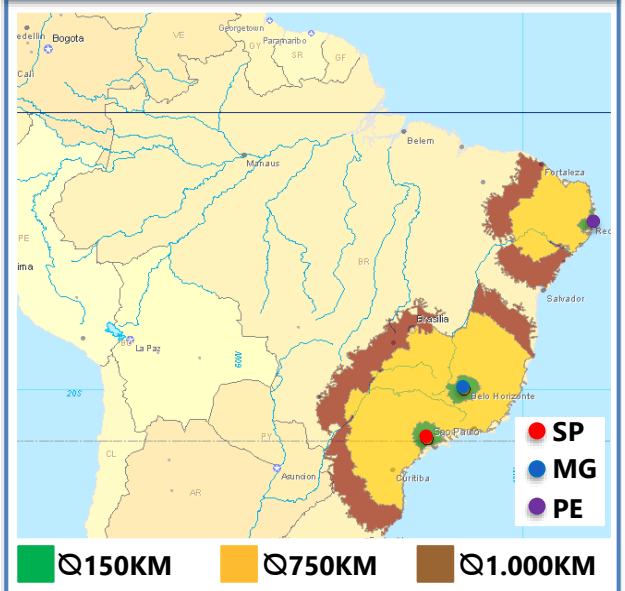
⌀150KM ⌀750KM ⌀1.000KM

3FCs – Optimized by Logistics Cost



⌀150KM ⌀750KM ⌀1.000KM

3FCs – Optimized by Total Cost



⌀150KM ⌀750KM ⌀1.000KM

- The scenarios that will be compared are:
  - Service, Min Logistics Cost and Min Total Cost
- And with 2 delivery options
  - Same standard than today and D+2 to all possible customers

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Comparison

Cost Comparison (in R$ Mio)

		CURRENT SHIPMENT STANDARD			D+2 SHIPMENT STANDARD		
		SERVICE	MIN. LOG. COST	MIN. TT. COST	SERVICE	MIN. LOG. COST	MIN. TT. COST
2015 Tax Rates	FIXED WH	94,9	78,7	65,1	94,9	88,9	73,6
	VARIABLE WH	58,6	58,6	58,6	89,1	89,1	89,1
	FREIGHT	183,8	180,7	221,0	210,6	204,7	228,9
	TAXES	453,4	442,5	308,9	453,4	442,5	308,9
	TT LOG	***337,3***	***317,9***	***344,7***	***394,6***	***382,7***	***391,5***
	TT COST	***790,7***	***760,4***	***653,6***	***848,0***	***825,2***	***700,4***
		+137	*+107,0*		*+148*	*+125*	
2018 Tax Rates	FIXED WH	94,9	78,7	65,1	94,9	88,9	73,6
	VARIABLE WH	58,6	58,6	58,6	89,1	89,1	89,1
	FREIGHT	183,8	180,7	211,0	210,6	204,7	233,0
	TAXES	476,5	477,4	444,2	476,5	477,4	444,2
	TT LOG	***337,3***	***317,9***	***334,7***	***394,6***	***382,7***	***395,6***
	TT COST	***813,8***	***795,4***	***778,9***	***871,1***	***860,1***	***839,8***
		+35	*+16*		*+31*	*+20*	

Storage Need @ Peak (pp in 2018)

FC	SERVICE	MIN. LOG. COST	MIN. TT. COST
SP	60.191	68.889	56.404
MG	24.523	31.800	41.872
PE	14.544	15.532	17.946
RS	6.338	-	-
GO	10.625	-	-
TT	**116.222**	**116.222**	**116.222**

Final recommendations:

- **Minimize Total Cost (Scenario);**
- **Keep BTS in MG to replace BET and VES (review capacities in pp);**
- **Renegotiate Transportation Contracts (fast deliveries and own fleet) to improve SL (from 67% to around 75%).**

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