



Strategic Simulation - Support of Innovation and Operation in Distribution and production Networks

Hansen, Mette Sanne

Publication date:
2012

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Hansen, M. S. (2012). *Strategic Simulation - Support of Innovation and Operation in Distribution and production Networks*. DTU Management Engineering.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Appendix 1 – List of information needed0

The list of information needed was:

- Amount of spares going into the GDC
- Amount of hearing aids going into the GDC
- Inventory at the GDC
- How often do the GDC ship out
- How much do the GDC ship out
- Which locations do they ship to
- What does it cost to ship
- How many people work with the shipments
- What is their salary
- How long are the products in the inventory
- What are your principles (FIFO etc)
- How many spares go in to Xiamen
- Inventory at Xiamen
- How often do Xiamen ship out
- How much do Xiamen ship out
- Which locations do they ship to
- What does it cost to ship
- How long time does it take to ship
- How many people work with the shipments
- What is their salary
- What are their principles (FIFO etc)
- How many sales companies are there
- Where are they placed
- What are their throughput of products
- What is their inventory
- How many people work there
- What is their salary
- How much and where do they ship to
- Cost and time of shipments
- How many dispensers are there

- What are their location
- How much do they receive from the sales companies
- How many suppliers are there
- Where are they placed
- Who do they ship to
- What are the costs
- What are the time frame for delivery

Appendix 2 – A representation of the grouping of ideas from workshop

Scenario 1

- Growing middle class in China can become a potential market – closeness to market
- Increased complexity having three hubs
- Good contingency in having three hubs as the others can take over if one stops functioning
- Area specific specialisation – specialised items per region
- Good knowledge of local requirements
- Clearer reversed logistics
- Quicker response to quality problems
- Delivery time and service from Hub to customer is better
- No complexity with customs – import license etc. But still Brazil complexity
- Labour cost in GDC
- System complexity in managing three hubs without increasing inventory
- Alignment of processes across different locations
- DK / EU salary level
- Growing middle class can influence labour
- Cultural issues in dealing with dispenser in every country, especially CN dealing with JP
- Central customer service (in all scenarios)
- Labour costs and inventory in three hubs versus one
- Chinese customs
- Chinese holidays
- Economic situation (oil price)

Scenario 2

- Close to customers – no import documents (GDC)
- Streamline products
- Quicker service (ship same or next day)
- Mass production – economies of scale
- Delivery time reduced to European customers
- Return logistics easier for customers

- Quality issues managed more effectively
- Centralised customer service
- Lead time to customers – same day service
- Proven knowledge of how to manage the business
- 1 hub – easier to control (in reality not only one hub, but everything controlled through one hub)
- Buffer to impact on supply from China, Holidays, Freight, Quality , Shortage
- Problem in not reducing the delivery time to all customers
- Freight cost high
- DK labour costs
- No contingency
- No local variations and requirements
- Lead time / shipment time for Asian markets
- Local knowledge Cultural issues in dealing direct with dispensers

Scenario 3

- Potentially less inventory
- Inventory holding costs in GDC
- Simpler supply chain
- Quicker turnaround
- Short lead time to Asian markets
- Local closeness – high specialisation
- Cost reducing in GDC – reduced hub costs
- Holiday impact on supply from China
- Time difference between XMN and subs
- No or poor contingency
- Import requirements for EU subs
- Customs
- Holidays
- Culture
- Visible CN produced parts

- No direct shipments to dispensers
- Longer lead time to EU dispensers
- Slower response to quality related issues
- Language, time and culture
- Reverse logistics difficult to manage
- Complexity
- No local variations
- Higher freight costs
-

Appendix 3 - Causal maps scenario 2 and 3

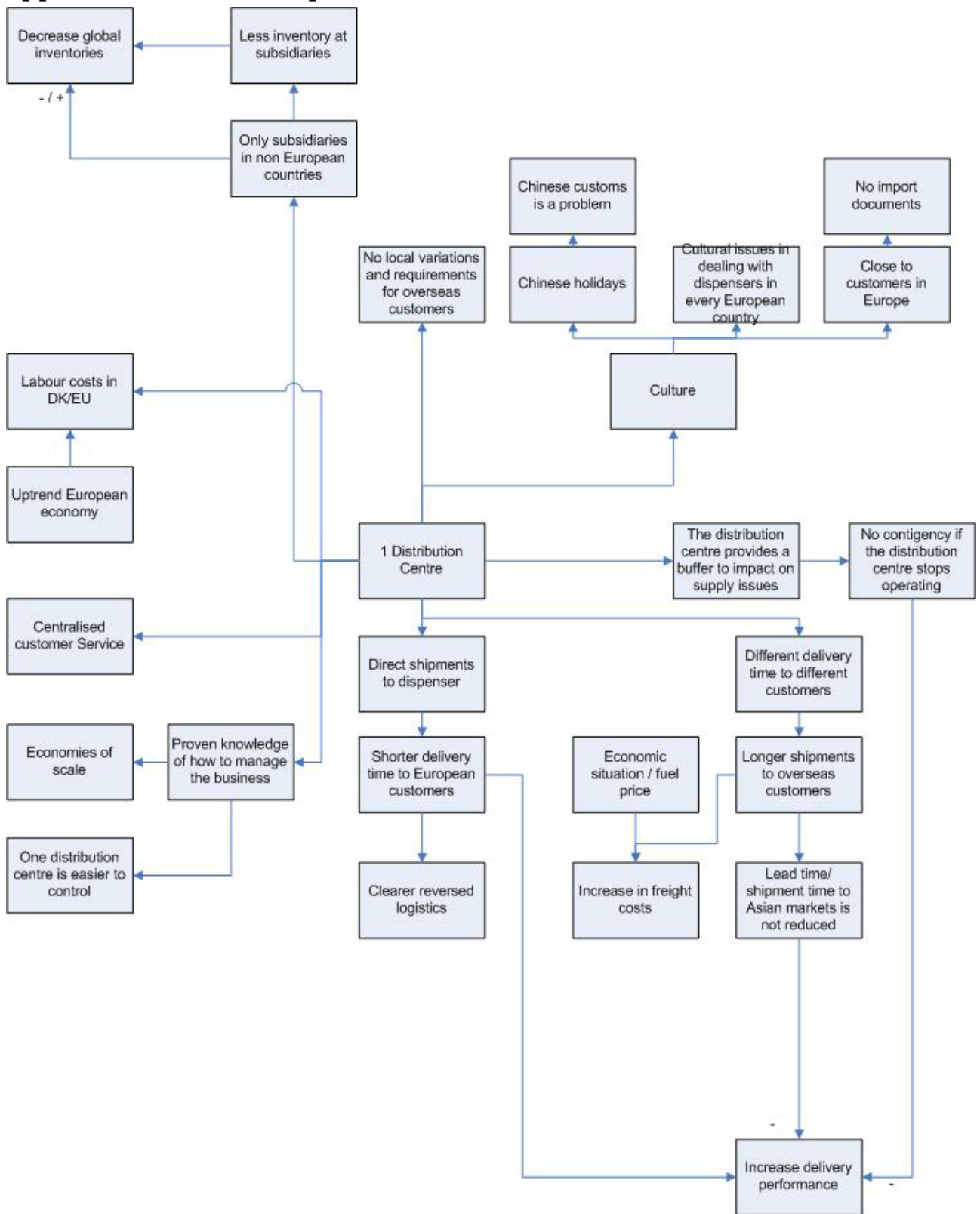


Figure A3.1x: Causal map of scenario 2.

The differences from the first causal map is that this scenario only partly supports direct sales to end customers, which reduces the time needed to ship the goods. However, this is only relevant for the European customers and this will mean that there will be a different treatment of customers from different countries. In this way the time to deliver is not shortened to the non European customers. One distribution centre can be easier to manage as this is the current situation and as the system then is less complex, however it will create a dependency on the distribution centre to function, since there is no contingency if the distribution centre stops operating. There is a reduction of inventory as the European subsidiaries are reduced, and thereby their inventories as well as there is only one distribution centre. However, not all subsidiaries are closed so that direct shipments to end customers can be made. There will only be direct shipments in Europe, and therefore there will still be sales companies in Asia and the US, which this means that there will still be inventory. This also means that the distribution centres closeness to market will only exist for the European customers.

A causal map of scenario 3 shows what effect distribution from the Xiamen manufacturing site (the box in the middle) will have on global inventories (top left corner) and the delivery performance (bottom right corner).

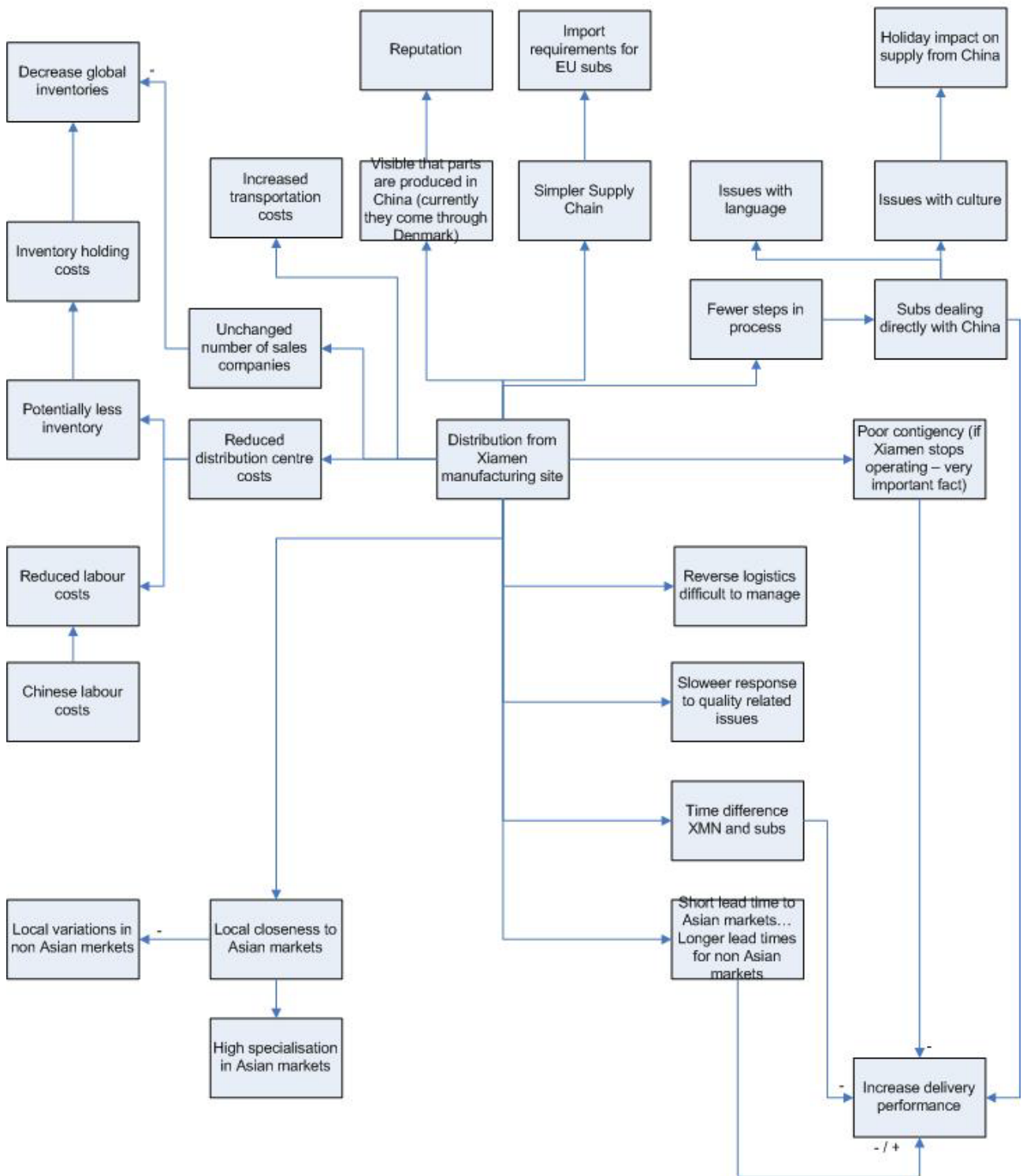


Figure A3.2: A Causal Map of scenario 3

The causal map of this scenario is different in the way that it reduces the inventory in the distribution centres to only one place, namely the Xiamen manufacturing site. This reduces the number of inventory in

distribution centres, but there is still inventory in every subsidiary. The delivery performance increases for Asian subsidiaries, but decreases for North American and European. This means that there is a differentiation between the different customers. Furthermore, the transportation costs could increase as all goods have to be sent from the Xiamen manufacturing site to the different subsidiaries. This scenario could mean fewer steps in the process, which could result in a simpler supply chain in accordance with the Lean principles, but it could also give issues with the logistics as there can be difficulties related to language and culture. One part of this is that the Chinese manufacturing site would have to deal directly with all subsidiaries. A very important part is also the contingency as mentioned in the other scenarios. For this scenario the contingency can be a critical point if Xiamen and thereby the distribution centre stops operating, i.e. due to break down in supply, then there would be not supply from the distribution centre as the two other scenarios both have distribution centres and a manufacturing site. The labour cost would for this scenario be decreased as the salaries would be reduced as an effect of the distribution centre being part of the Xiamen manufacturing site.

Appendix 4 - Inventory Level Scenario 2 and 3

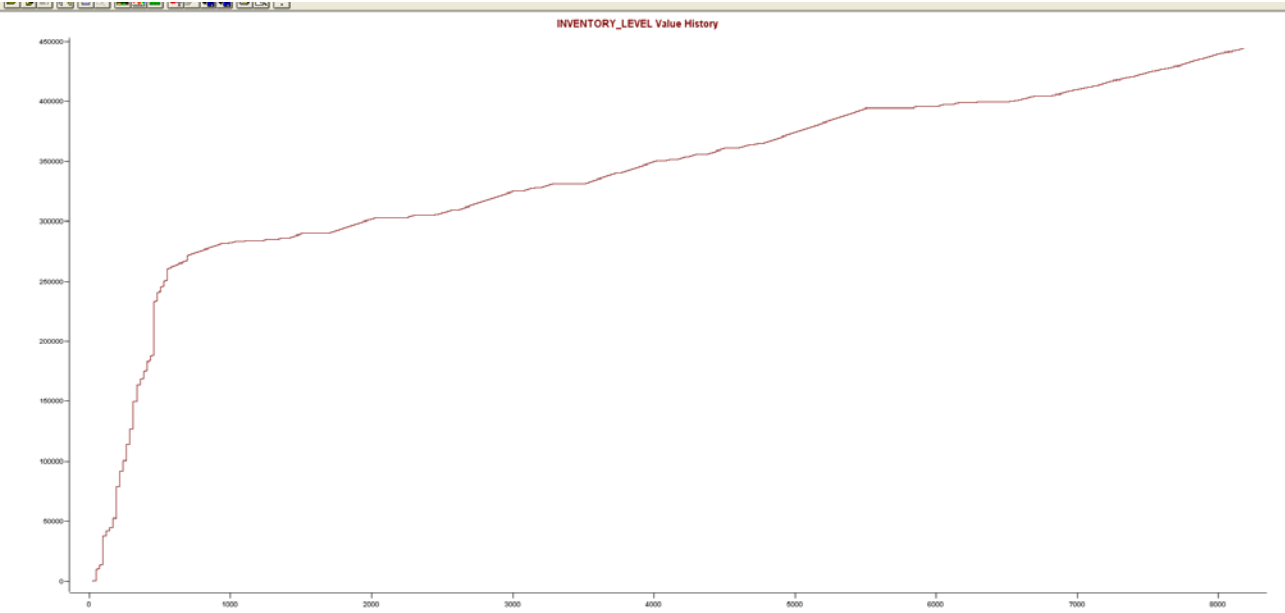
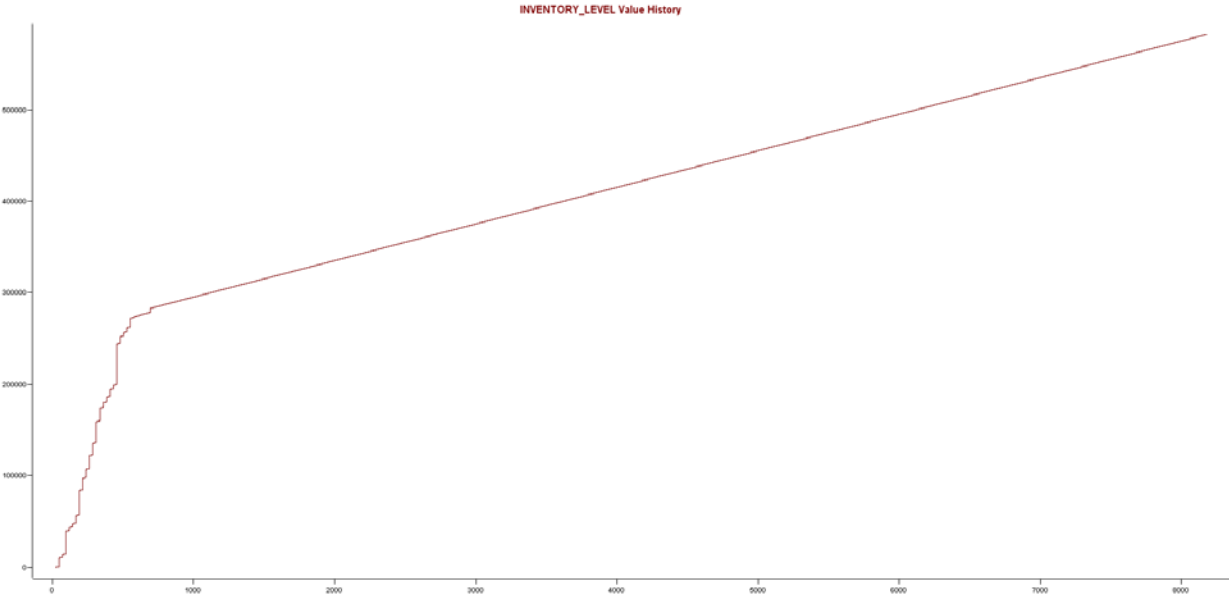


Figure A4.1: Accumulated Inventory Level Scenario 2



FigureA4.2:x Accumulated Inventory Level Scenario 3

Appendix 5 – Transport Costs Scenario 2 and 3

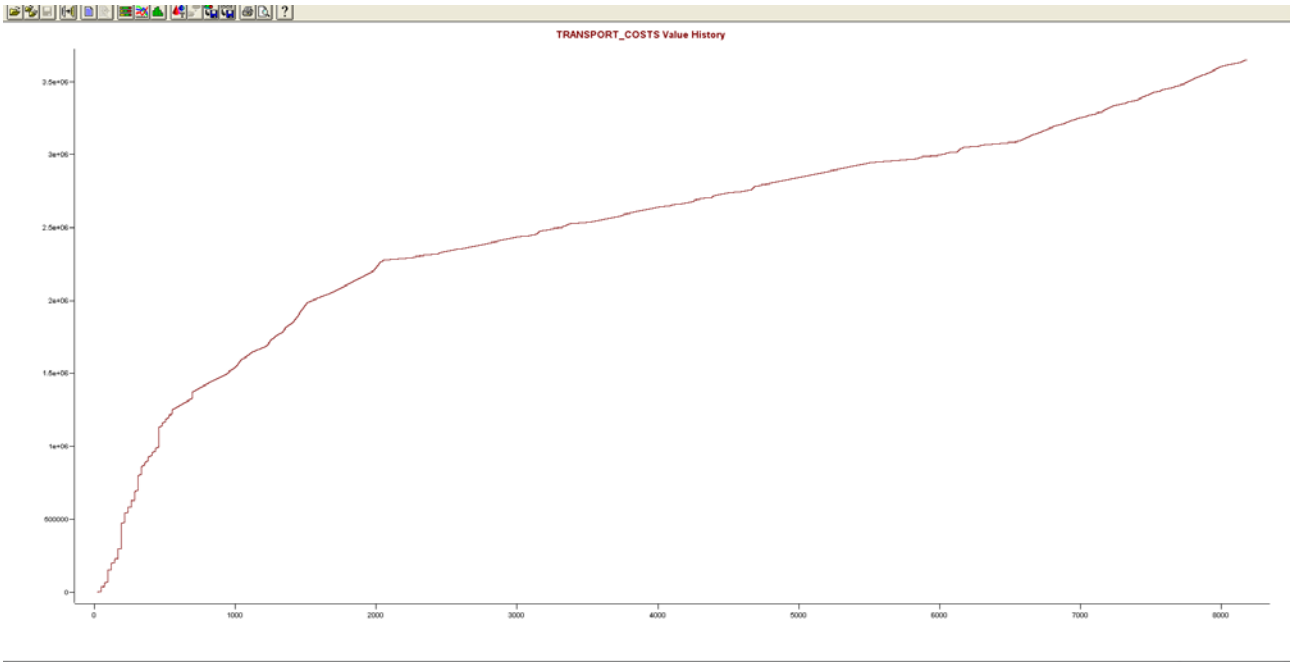


Figure A5.2: Transport Costs Scenario 2

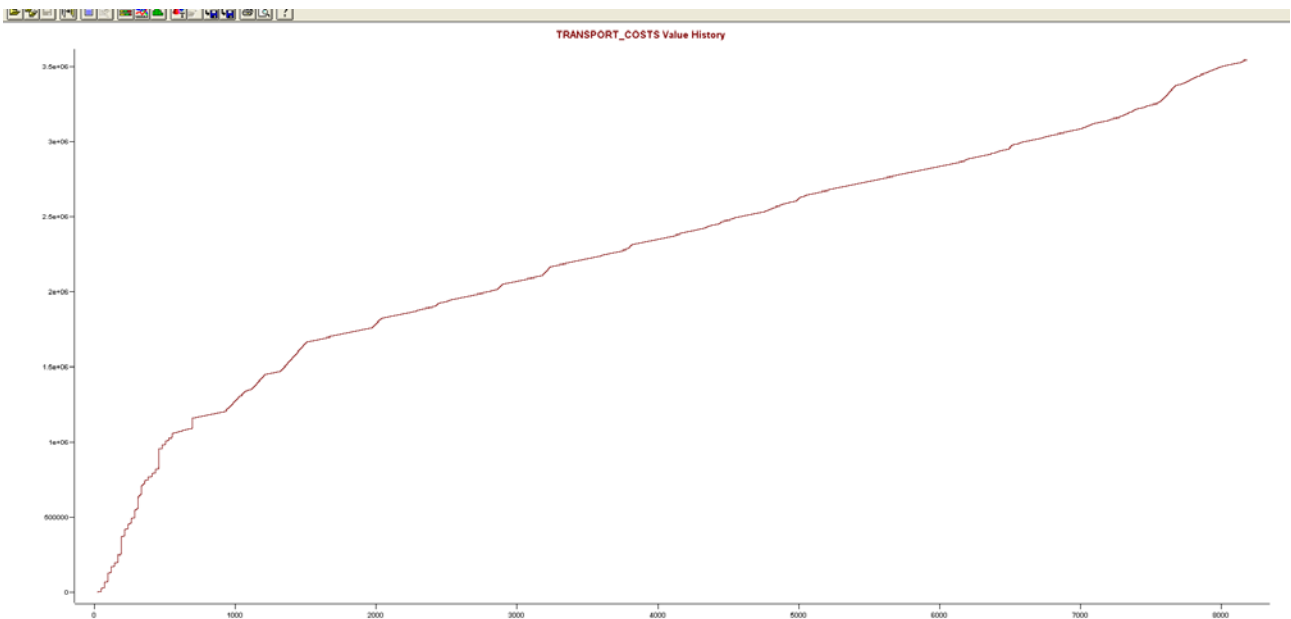


Figure A5.1: Transport Costs Scenario 3

Appendix 6 – Ressource costs scenario 2 and 3

Scenario 2

RESOURCES COSTING

Resource Name	Units	\$		\$		\$	
		NonUse Cost	% NonUse Cost	Usage Cost	% Usage Cost	Total Cost	% Total Cost
Distribution worker XMN.1	1	64530.47	0.24	17265.00	0.11	81795.47	0.19
Distribution worker XMN.2	1	64540.47	0.24	17255.00	0.11	81795.47	0.19
Distribution worker XMN.3	1	64545.47	0.24	17250.00	0.11	81795.47	0.19
Distribution worker XMN.4	1	64550.47	0.24	17245.00	0.11	81795.47	0.19
Distribution worker XMN.5	1	64550.47	0.24	17245.00	0.11	81795.47	0.19
Distribution worker XMN.6	1	64550.47	0.24	17245.00	0.11	81795.47	0.19
Distribution worker XMN.7	1	64555.47	0.24	17240.00	0.11	81795.47	0.19
Distribution worker XMN.8	1	64555.47	0.24	17240.00	0.11	81795.47	0.19
Distribution worker XMN.9	1	64560.47	0.24	17235.00	0.11	81795.47	0.19
Distribution worker XMN.10	1	64560.47	0.24	17235.00	0.11	81795.47	0.19
Distribution worker XMN	10	645499.71	2.35	172455.00	1.14	817954.71	1.92
Distribution worker GDC.1	1	6007.07	0.02	1220925.00	8.07	1226932.07	2.88
Distribution worker GDC.2	1	6007.07	0.02	1220925.00	8.07	1226932.07	2.88
Distribution worker GDC.3	1	6007.07	0.02	1220925.00	8.07	1226932.07	2.88
Distribution worker GDC.4	1	6007.07	0.02	1220925.00	8.07	1226932.07	2.88
Distribution worker GDC.5	1	6007.07	0.02	1220925.00	8.07	1226932.07	2.88
Distribution worker GDC.6	1	6007.07	0.02	1220925.00	8.07	1226932.07	2.88
Distribution worker GDC.7	1	6082.07	0.02	1220850.00	8.07	1226932.07	2.88
Distribution worker GDC.8	1	6082.07	0.02	1220850.00	8.07	1226932.07	2.88
Distribution worker GDC.9	1	6157.07	0.02	1220775.00	8.07	1226932.07	2.88
Distribution worker GDC.10	1	6157.07	0.02	1220775.00	8.07	1226932.07	2.88
Distribution worker GDC	10	60520.72	0.22	12208800.00	80.75	12269320.72	28.85
Distribution worker US.1	1	421683.30	1.54	150885.00	1.00	572568.30	1.35
Distribution worker US.2	1	421998.30	1.54	150570.00	1.00	572568.30	1.35
Distribution worker US.3	1	422663.30	1.54	149905.00	0.99	572568.30	1.35
Distribution worker US.4	1	423013.30	1.54	149555.00	0.99	572568.30	1.35
Distribution worker US.5	1	423293.30	1.54	149275.00	0.99	572568.30	1.35
Distribution worker US.6	1	423538.30	1.55	149030.00	0.99	572568.30	1.35
Distribution worker US.7	1	423958.30	1.55	148610.00	0.98	572568.30	1.35
Distribution worker US.8	1	424378.30	1.55	148190.00	0.98	572568.30	1.35
Distribution worker US.9	1	424588.30	1.55	147980.00	0.98	572568.30	1.35
Distribution worker US.10	1	424763.30	1.55	147805.00	0.98	572568.30	1.35
Distribution worker US	10	4233878.00	15.44	1491805.00	9.87	5725683.00	13.46
Distribution worker CN.1	1	77980.47	0.28	3815.00	0.03	81795.47	0.19
Distribution worker CN.2	1	78020.47	0.28	3775.00	0.02	81795.47	0.19
Distribution worker CN.3	1	78025.47	0.28	3770.00	0.02	81795.47	0.19
Distribution worker CN.4	1	78040.47	0.28	3755.00	0.02	81795.47	0.19
Distribution worker CN.5	1	78075.47	0.28	3720.00	0.02	81795.47	0.19
Distribution worker CN.6	1	78140.47	0.29	3655.00	0.02	81795.47	0.19
Distribution worker CN.7	1	78165.47	0.29	3630.00	0.02	81795.47	0.19
Distribution worker CN.8	1	78190.47	0.29	3605.00	0.02	81795.47	0.19
Distribution worker CN.9	1	78220.47	0.29	3575.00	0.02	81795.47	0.19
Distribution worker CN.10	1	78245.47	0.29	3550.00	0.02	81795.47	0.19
Distribution worker CN	10	781104.71	2.85	36850.00	0.24	817954.71	1.92
Distribution worker JP.1	1	537183.30	1.96	35385.00	0.23	572568.30	1.35
Distribution worker JP.2	1	537323.30	1.96	35245.00	0.23	572568.30	1.35
Distribution worker JP.3	1	537498.30	1.96	35070.00	0.23	572568.30	1.35
Distribution worker JP.4	1	537673.30	1.96	34895.00	0.23	572568.30	1.35
Distribution worker JP.5	1	537918.30	1.96	34650.00	0.23	572568.30	1.35

Distribution worker	JP .4	1	537673.30	1.96	34895.00	0.23	572568.30	1.35
Distribution worker	JP .5	1	537918.30	1.96	34650.00	0.23	572568.30	1.35
Distribution worker	JP .6	1	538233.30	1.96	34335.00	0.23	572568.30	1.35
Distribution worker	JP .7	1	538548.30	1.96	34020.00	0.22	572568.30	1.35
Distribution worker	JP .8	1	538863.30	1.97	33705.00	0.22	572568.30	1.35
Distribution worker	JP .9	1	539178.30	1.97	33390.00	0.22	572568.30	1.35
Distribution worker	JP .10	1	539423.30	1.97	33145.00	0.22	572568.30	1.35
Distribution worker	JP	10	5381843.00	19.63	343840.00	2.27	5725683.00	13.46
Distribution worker	AU.1	1	531618.30	1.94	40950.00	0.27	572568.30	1.35
Distribution worker	AU.2	1	531863.30	1.94	40705.00	0.27	572568.30	1.35
Distribution worker	AU.3	1	532318.30	1.94	40250.00	0.27	572568.30	1.35
Distribution worker	AU.4	1	532598.30	1.94	39970.00	0.26	572568.30	1.35
Distribution worker	AU.5	1	532948.30	1.94	39620.00	0.26	572568.30	1.35
Distribution worker	AU.6	1	533123.30	1.94	39445.00	0.26	572568.30	1.35
Distribution worker	AU.7	1	533263.30	1.95	39305.00	0.26	572568.30	1.35
Distribution worker	AU.8	1	533403.30	1.95	39165.00	0.26	572568.30	1.35
Distribution worker	AU.9	1	533648.30	1.95	38920.00	0.26	572568.30	1.35
Distribution worker	AU.10	1	533788.30	1.95	38780.00	0.26	572568.30	1.35
Distribution worker	AU	10	5328573.00	19.44	397110.00	2.63	5725683.00	13.46
Distribution worker	NZ.1	1	558603.30	2.04	13965.00	0.09	572568.30	1.35
Distribution worker	NZ.2	1	558918.30	2.04	13650.00	0.09	572568.30	1.35
Distribution worker	NZ.3	1	559023.30	2.04	13545.00	0.09	572568.30	1.35
Distribution worker	NZ.4	1	559233.30	2.04	13335.00	0.09	572568.30	1.35
Distribution worker	NZ.5	1	559373.30	2.04	13195.00	0.09	572568.30	1.35
Distribution worker	NZ.6	1	559618.30	2.04	12950.00	0.09	572568.30	1.35
Distribution worker	NZ.7	1	559793.30	2.04	12775.00	0.08	572568.30	1.35
Distribution worker	NZ.8	1	560003.30	2.04	12565.00	0.08	572568.30	1.35
Distribution worker	NZ.9	1	560213.30	2.04	12355.00	0.08	572568.30	1.35
Distribution worker	NZ.10	1	560318.30	2.04	12250.00	0.08	572568.30	1.35
Distribution worker	NZ	10	5595098.00	20.41	130585.00	0.86	5725683.00	13.46
Distribution worker	CA.1	1	538688.30	1.97	33880.00	0.22	572568.30	1.35
Distribution worker	CA.2	1	538688.30	1.97	33880.00	0.22	572568.30	1.35
Distribution worker	CA.3	1	538688.30	1.97	33880.00	0.22	572568.30	1.35
Distribution worker	CA.4	1	538688.30	1.97	33880.00	0.22	572568.30	1.35
Distribution worker	CA.5	1	538688.30	1.97	33880.00	0.22	572568.30	1.35
Distribution worker	CA.6	1	538688.30	1.97	33880.00	0.22	572568.30	1.35
Distribution worker	CA.7	1	538688.30	1.97	33880.00	0.22	572568.30	1.35
Distribution worker	CA.8	1	538688.30	1.97	33880.00	0.22	572568.30	1.35
Distribution worker	CA.9	1	538723.30	1.97	33845.00	0.22	572568.30	1.35
Distribution worker	CA.10	1	538723.30	1.97	33845.00	0.22	572568.30	1.35
Distribution worker	CA	10	5386953.00	19.65	338730.00	2.24	5725683.00	13.46
SUM		-	27413470.18	100.00	15120175.00	100.00	42533645.18	100.00

Scenario 3



RESOURCES COSTING

Resource Name	Units	\$ NonUse Cost	% NonUse Cost	\$ Usage Cost	% Usage Cost	\$ Total Cost	% Total Cost
Distribution worker XMN.1	1	400.29	0.00	81395.00	0.90	81795.29	0.04
Distribution worker XMN.2	1	400.29	0.00	81395.00	0.90	81795.29	0.04
Distribution worker XMN.3	1	400.29	0.00	81395.00	0.90	81795.29	0.04
Distribution worker XMN.4	1	400.29	0.00	81395.00	0.90	81795.29	0.04
Distribution worker XMN.5	1	400.29	0.00	81395.00	0.90	81795.29	0.04
Distribution worker XMN.6	1	400.29	0.00	81395.00	0.90	81795.29	0.04
Distribution worker XMN.7	1	405.29	0.00	81390.00	0.90	81795.29	0.04
Distribution worker XMN.8	1	405.29	0.00	81390.00	0.90	81795.29	0.04
Distribution worker XMN.9	1	410.29	0.00	81385.00	0.90	81795.29	0.04
Distribution worker XMN.10	1	410.29	0.00	81385.00	0.90	81795.29	0.04
Distribution worker XMN	10	4032.91	0.00	813920.00	8.97	817952.91	0.40
Distribution worker US.1	1	421892.04	0.22	150675.00	1.66	572567.04	0.28
Distribution worker US.2	1	422102.04	0.22	150465.00	1.66	572567.04	0.28
Distribution worker US.3	1	422592.04	0.22	149975.00	1.65	572567.04	0.28
Distribution worker US.4	1	423082.04	0.22	149485.00	1.65	572567.04	0.28
Distribution worker US.5	1	423292.04	0.22	149275.00	1.65	572567.04	0.28
Distribution worker US.6	1	423502.04	0.22	149065.00	1.64	572567.04	0.28
Distribution worker US.7	1	423887.04	0.22	148680.00	1.64	572567.04	0.28
Distribution worker US.8	1	424202.04	0.22	148365.00	1.64	572567.04	0.28
Distribution worker US.9	1	424447.04	0.22	148120.00	1.63	572567.04	0.28
Distribution worker US.10	1	424867.04	0.22	147700.00	1.63	572567.04	0.28
Distribution worker US	10	4233865.40	2.19	1491805.00	16.45	5725670.40	2.83
Distribution worker UK.1	1	1132354.37	0.59	94575.00	1.04	1226929.37	0.61
Distribution worker UK.2	1	1132954.37	0.59	93975.00	1.04	1226929.37	0.61
Distribution worker UK.3	1	1133554.37	0.59	93375.00	1.03	1226929.37	0.61
Distribution worker UK.4	1	1134454.37	0.59	92475.00	1.02	1226929.37	0.61
Distribution worker UK.5	1	1135054.37	0.59	91875.00	1.01	1226929.37	0.61
Distribution worker UK.6	1	1135879.37	0.59	91050.00	1.00	1226929.37	0.61
Distribution worker UK.7	1	1136479.37	0.59	90450.00	1.00	1226929.37	0.61
Distribution worker UK.8	1	1136779.37	0.59	90150.00	0.99	1226929.37	0.61
Distribution worker UK.9	1	1137229.37	0.59	89700.00	0.99	1226929.37	0.61
Distribution worker UK.10	1	1137454.37	0.59	89475.00	0.99	1226929.37	0.61
Distribution worker UK	10	11352193.72	5.88	917100.00	10.11	12269293.72	6.07
Distribution worker DEL.1	1	1084804.37	0.56	142125.00	1.57	1226929.37	0.61
Distribution worker DEL.2	1	1085254.37	0.56	141675.00	1.56	1226929.37	0.61
Distribution worker DEL.3	1	1085929.37	0.56	141000.00	1.55	1226929.37	0.61
Distribution worker DEL.4	1	1086154.37	0.56	140775.00	1.55	1226929.37	0.61
Distribution worker DEL.5	1	1087279.37	0.56	139650.00	1.54	1226929.37	0.61
Distribution worker DEL.6	1	1088329.37	0.56	138600.00	1.53	1226929.37	0.61
Distribution worker DEL.7	1	1088854.37	0.56	138075.00	1.52	1226929.37	0.61
Distribution worker DEL.8	1	1089529.37	0.56	137400.00	1.52	1226929.37	0.61
Distribution worker DEL.9	1	1089904.37	0.56	137025.00	1.51	1226929.37	0.61
Distribution worker DEL.10	1	1090504.37	0.57	136425.00	1.50	1226929.37	0.61
Distribution worker DEL	10	10876543.72	5.64	1392750.00	15.36	12269293.72	6.07
Distribution worker DE2.1	1	1226554.37	0.64	375.00	0.00	1226929.37	0.61
Distribution worker DE2.2	1	1226554.37	0.64	375.00	0.00	1226929.37	0.61
Distribution worker DE2.3	1	1226554.37	0.64	375.00	0.00	1226929.37	0.61
Distribution worker DE2.4	1	1226629.37	0.64	300.00	0.00	1226929.37	0.61
Distribution worker DE2.5	1	1226629.37	0.64	300.00	0.00	1226929.37	0.61

Distribution worker	DE2.6	1	1226629.37	0.64	300.00	0.00	1226929.37	0.61
Distribution worker	DE2.7	1	1226629.37	0.64	300.00	0.00	1226929.37	0.61
Distribution worker	DE2.8	1	1226704.37	0.64	225.00	0.00	1226929.37	0.61
Distribution worker	DE2.9	1	1226779.37	0.64	150.00	0.00	1226929.37	0.61
Distribution worker	DE2.10	1	1226854.37	0.64	75.00	0.00	1226929.37	0.61
Distribution worker	DE2	10	12266518.72	6.36	2775.00	0.03	12269293.72	6.07
Distribution worker	NL.1	1	1200454.37	0.62	26475.00	0.29	1226929.37	0.61
Distribution worker	NL.2	1	1201279.37	0.62	25650.00	0.28	1226929.37	0.61
Distribution worker	NL.3	1	1201654.37	0.62	25275.00	0.28	1226929.37	0.61
Distribution worker	NL.4	1	1201954.37	0.62	24975.00	0.28	1226929.37	0.61
Distribution worker	NL.5	1	1202404.37	0.62	24525.00	0.27	1226929.37	0.61
Distribution worker	NL.6	1	1203004.37	0.62	23925.00	0.26	1226929.37	0.61
Distribution worker	NL.7	1	1203529.37	0.62	23400.00	0.26	1226929.37	0.61
Distribution worker	NL.8	1	1204054.37	0.62	22875.00	0.25	1226929.37	0.61
Distribution worker	NL.9	1	1204054.37	0.62	22875.00	0.25	1226929.37	0.61
Distribution worker	NL.10	1	1204579.37	0.62	22350.00	0.25	1226929.37	0.61
Distribution worker	NL	10	12026968.72	6.23	242325.00	2.67	12269293.72	6.07
Distribution worker	BE.1	1	1186804.37	0.62	40125.00	0.44	1226929.37	0.61
Distribution worker	BE.2	1	1186954.37	0.62	39975.00	0.44	1226929.37	0.61
Distribution worker	BE.3	1	1187329.37	0.62	39600.00	0.44	1226929.37	0.61
Distribution worker	BE.4	1	1187404.37	0.62	39525.00	0.44	1226929.37	0.61
Distribution worker	BE.5	1	1187629.37	0.62	39300.00	0.43	1226929.37	0.61
Distribution worker	BE.6	1	1188079.37	0.62	38850.00	0.43	1226929.37	0.61
Distribution worker	BE.7	1	1188304.37	0.62	38625.00	0.43	1226929.37	0.61
Distribution worker	BE.8	1	1188604.37	0.62	38325.00	0.42	1226929.37	0.61
Distribution worker	BE.9	1	1188754.37	0.62	38175.00	0.42	1226929.37	0.61
Distribution worker	BE.10	1	1188904.37	0.62	38025.00	0.42	1226929.37	0.61
Distribution worker	BE	10	11878768.72	6.16	390525.00	4.31	12269293.72	6.07
Distribution worker	FR1.1	1	1176754.37	0.61	50175.00	0.55	1226929.37	0.61
Distribution worker	FR1.2	1	1177279.37	0.61	49650.00	0.55	1226929.37	0.61
Distribution worker	FR1.3	1	1177504.37	0.61	49425.00	0.54	1226929.37	0.61
Distribution worker	FR1.4	1	1177654.37	0.61	49275.00	0.54	1226929.37	0.61
Distribution worker	FR1.5	1	1178104.37	0.61	48825.00	0.54	1226929.37	0.61
Distribution worker	FR1.6	1	1178404.37	0.61	48525.00	0.54	1226929.37	0.61
Distribution worker	FR1.7	1	1178854.37	0.61	48075.00	0.53	1226929.37	0.61
Distribution worker	FR1.8	1	1178929.37	0.61	48000.00	0.53	1226929.37	0.61
Distribution worker	FR1.9	1	1179304.37	0.61	47625.00	0.53	1226929.37	0.61
Distribution worker	FR1.10	1	1179679.37	0.61	47250.00	0.52	1226929.37	0.61
Distribution worker	FR1	10	11782468.72	6.11	486825.00	5.37	12269293.72	6.07
Distribution worker	FR2.1	1	1204804.37	0.62	22125.00	0.24	1226929.37	0.61
Distribution worker	FR2.2	1	1205029.37	0.62	21900.00	0.24	1226929.37	0.61
Distribution worker	FR2.3	1	1205554.37	0.62	21375.00	0.24	1226929.37	0.61
Distribution worker	FR2.4	1	1206154.37	0.63	20775.00	0.23	1226929.37	0.61
Distribution worker	FR2.5	1	1206604.37	0.63	20325.00	0.22	1226929.37	0.61
Distribution worker	FR2.6	1	1206679.37	0.63	20250.00	0.22	1226929.37	0.61
Distribution worker	FR2.7	1	1207054.37	0.63	19875.00	0.22	1226929.37	0.61
Distribution worker	FR2.8	1	1207279.37	0.63	19650.00	0.22	1226929.37	0.61
Distribution worker	FR2.9	1	1207579.37	0.63	19350.00	0.21	1226929.37	0.61
Distribution worker	FR2.10	1	1207729.37	0.63	19200.00	0.21	1226929.37	0.61
Distribution worker	FR2	10	12064468.72	6.25	204825.00	2.26	12269293.72	6.07
Distribution worker	ES1.1	1	1189204.37	0.62	37725.00	0.42	1226929.37	0.61
Distribution worker	ES1.2	1	1189579.37	0.62	37350.00	0.41	1226929.37	0.61
Distribution worker	ES1.3	1	1189729.37	0.62	37200.00	0.41	1226929.37	0.61
Distribution worker	ES1.4	1	1190254.37	0.62	36675.00	0.40	1226929.37	0.61
Distribution worker	ES1.5	1	1190479.37	0.62	36450.00	0.40	1226929.37	0.61

Distribution worker	ES1.5	1	1190479.37	0.62	36450.00	0.40	1226929.37	0.61
Distribution worker	ES1.6	1	1190704.37	0.62	36225.00	0.40	1226929.37	0.61
Distribution worker	ES1.7	1	1191079.37	0.62	35850.00	0.40	1226929.37	0.61
Distribution worker	ES1.8	1	1191229.37	0.62	35700.00	0.39	1226929.37	0.61
Distribution worker	ES1.9	1	1191529.37	0.62	35400.00	0.39	1226929.37	0.61
Distribution worker	ES1.10	1	1191979.37	0.62	34950.00	0.39	1226929.37	0.61
Distribution worker	ES1	10	11905768.72	6.17	363525.00	4.01	12269293.72	6.07
Distribution worker	ES2.1	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	ES2.2	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	ES2.3	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	ES2.4	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	ES2.5	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	ES2.6	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	ES2.7	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	ES2.8	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	ES2.9	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	ES2.10	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	ES2	10	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	CH.1	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	CH.2	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	CH.3	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	CH.4	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	CH.5	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	CH.6	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	CH.7	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	CH.8	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	CH.9	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	CH.10	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	CH	10	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	IT.1	1	1187254.37	0.62	39675.00	0.44	1226929.37	0.61
Distribution worker	IT.2	1	1187929.37	0.62	39000.00	0.43	1226929.37	0.61
Distribution worker	IT.3	1	1188529.37	0.62	38400.00	0.42	1226929.37	0.61
Distribution worker	IT.4	1	1188829.37	0.62	38100.00	0.42	1226929.37	0.61
Distribution worker	IT.5	1	1189429.37	0.62	37500.00	0.41	1226929.37	0.61
Distribution worker	IT.6	1	1189804.37	0.62	37125.00	0.41	1226929.37	0.61
Distribution worker	IT.7	1	1190029.37	0.62	36900.00	0.41	1226929.37	0.61
Distribution worker	IT.8	1	1190629.37	0.62	36300.00	0.40	1226929.37	0.61
Distribution worker	IT.9	1	1191229.37	0.62	35700.00	0.39	1226929.37	0.61
Distribution worker	IT.10	1	1191379.37	0.62	35550.00	0.39	1226929.37	0.61
Distribution worker	IT	10	11895043.72	6.16	374250.00	4.13	12269293.72	6.07
Distribution worker	AT.1	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	AT.2	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	AT.3	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	AT.4	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	AT.5	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	AT.6	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	AT.7	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	AT.8	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	AT.9	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	AT.10	1	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	AT	10	0.00	0.00	0.00	0.00	0.00	0.00
Distribution worker	BR.1	1	1204879.37	0.62	22050.00	0.24	1226929.37	0.61
Distribution worker	BR.2	1	1204954.37	0.62	21975.00	0.24	1226929.37	0.61
Distribution worker	BR.3	1	1205104.37	0.62	21825.00	0.24	1226929.37	0.61
Distribution worker	BR.4	1	1205404.37	0.62	21525.00	0.24	1226929.37	0.61

Distribution worker BR. 4	1	1205404.37	0.62	21525.00	0.24	1226929.37	0.61
Distribution worker BR. 5	1	1205554.37	0.62	21375.00	0.24	1226929.37	0.61
Distribution worker BR. 6	1	1205704.37	0.62	21225.00	0.23	1226929.37	0.61
Distribution worker BR. 7	1	1205779.37	0.62	21150.00	0.23	1226929.37	0.61
Distribution worker BR. 8	1	1205854.37	0.62	21075.00	0.23	1226929.37	0.61
Distribution worker BR. 9	1	1206154.37	0.63	20775.00	0.23	1226929.37	0.61
Distribution worker BR. 10	1	1206154.37	0.63	20775.00	0.23	1226929.37	0.61
Distribution worker BR	10	12055543.72	6.25	213750.00	2.36	12269293.72	6.07
Distribution worker DK1.1	1	1226554.37	0.64	375.00	0.00	1226929.37	0.61
Distribution worker DK1.2	1	1226629.37	0.64	300.00	0.00	1226929.37	0.61
Distribution worker DK1.3	1	1226629.37	0.64	300.00	0.00	1226929.37	0.61
Distribution worker DK1.4	1	1226704.37	0.64	225.00	0.00	1226929.37	0.61
Distribution worker DK1.5	1	1226704.37	0.64	225.00	0.00	1226929.37	0.61
Distribution worker DK1.6	1	1226704.37	0.64	225.00	0.00	1226929.37	0.61
Distribution worker DK1.7	1	1226704.37	0.64	225.00	0.00	1226929.37	0.61
Distribution worker DK1.8	1	1226779.37	0.64	150.00	0.00	1226929.37	0.61
Distribution worker DK1.9	1	1226929.37	0.64	0.00	0.00	1226929.37	0.61
Distribution worker DK1.10	1	1226929.37	0.64	0.00	0.00	1226929.37	0.61
Distribution worker DK1	10	12267268.72	6.36	2025.00	0.02	12269293.72	6.07
Distribution worker DK2.1	1	1146454.37	0.59	80475.00	0.89	1226929.37	0.61
Distribution worker DK2.2	1	1147279.37	0.59	79650.00	0.88	1226929.37	0.61
Distribution worker DK2.3	1	1148629.37	0.60	78300.00	0.86	1226929.37	0.61
Distribution worker DK2.4	1	1149229.37	0.60	77700.00	0.86	1226929.37	0.61
Distribution worker DK2.5	1	1150204.37	0.60	76725.00	0.85	1226929.37	0.61
Distribution worker DK2.6	1	1150954.37	0.60	75975.00	0.84	1226929.37	0.61
Distribution worker DK2.7	1	1151779.37	0.60	75150.00	0.83	1226929.37	0.61
Distribution worker DK2.8	1	1152229.37	0.60	74700.00	0.82	1226929.37	0.61
Distribution worker DK2.9	1	1153129.37	0.60	73800.00	0.81	1226929.37	0.61
Distribution worker DK2.10	1	1153729.37	0.60	73200.00	0.81	1226929.37	0.61
Distribution worker DK2	10	11503618.72	5.96	765675.00	8.44	12269293.72	6.07
Distribution worker SE.1	1	1213354.37	0.63	13575.00	0.15	1226929.37	0.61
Distribution worker SE.2	1	1213654.37	0.63	13275.00	0.15	1226929.37	0.61
Distribution worker SE.3	1	1213879.37	0.63	13050.00	0.14	1226929.37	0.61
Distribution worker SE.4	1	1214179.37	0.63	12750.00	0.14	1226929.37	0.61
Distribution worker SE.5	1	1214629.37	0.63	12300.00	0.14	1226929.37	0.61
Distribution worker SE.6	1	1214779.37	0.63	12150.00	0.13	1226929.37	0.61
Distribution worker SE.7	1	1215154.37	0.63	11775.00	0.13	1226929.37	0.61
Distribution worker SE.8	1	1215379.37	0.63	11550.00	0.13	1226929.37	0.61
Distribution worker SE.9	1	1215679.37	0.63	11250.00	0.12	1226929.37	0.61
Distribution worker SE.10	1	1215904.37	0.63	11025.00	0.12	1226929.37	0.61
Distribution worker SE	10	12146593.72	6.29	122700.00	1.35	12269293.72	6.07
Distribution worker NO.1	1	1222279.37	0.63	4650.00	0.05	1226929.37	0.61
Distribution worker NO.2	1	1222429.37	0.63	4500.00	0.05	1226929.37	0.61
Distribution worker NO.3	1	1222579.37	0.63	4350.00	0.05	1226929.37	0.61
Distribution worker NO.4	1	1222879.37	0.63	4050.00	0.04	1226929.37	0.61
Distribution worker NO.5	1	1223029.37	0.63	3900.00	0.04	1226929.37	0.61
Distribution worker NO.6	1	1223179.37	0.63	3750.00	0.04	1226929.37	0.61
Distribution worker NO.7	1	1223479.37	0.63	3450.00	0.04	1226929.37	0.61
Distribution worker NO.8	1	1223854.37	0.63	3075.00	0.03	1226929.37	0.61
Distribution worker NO.9	1	1224004.37	0.63	2925.00	0.03	1226929.37	0.61
Distribution worker NO.10	1	1224454.37	0.63	2475.00	0.03	1226929.37	0.61
Distribution worker NO	10	12232168.72	6.34	37125.00	0.41	12269293.72	6.07
Distribution worker CN.1	1	78040.29	0.04	3755.00	0.04	81795.29	0.04
Distribution worker CN.2	1	78050.29	0.04	3745.00	0.04	81795.29	0.04
Distribution worker CN.3	1	78075.29	0.04	3720.00	0.04	81795.29	0.04

Distribution worker	CN. 4	1	78085.29	0.04	3710.00	0.04	81795.29	0.04
Distribution worker	CN. 5	1	78090.29	0.04	3705.00	0.04	81795.29	0.04
Distribution worker	CN. 6	1	78105.29	0.04	3690.00	0.04	81795.29	0.04
Distribution worker	CN. 7	1	78130.29	0.04	3665.00	0.04	81795.29	0.04
Distribution worker	CN. 8	1	78145.29	0.04	3650.00	0.04	81795.29	0.04
Distribution worker	CN. 9	1	78180.29	0.04	3615.00	0.04	81795.29	0.04
Distribution worker	CN. 10	1	78200.29	0.04	3595.00	0.04	81795.29	0.04
Distribution worker	CN	10	781102.91	0.40	36850.00	0.41	817952.91	0.40
Distribution worker	JP. 1	1	537077.04	0.28	35490.00	0.39	572567.04	0.28
Distribution worker	JP. 2	1	537427.04	0.28	35140.00	0.39	572567.04	0.28
Distribution worker	JP. 3	1	537602.04	0.28	34965.00	0.39	572567.04	0.28
Distribution worker	JP. 4	1	537742.04	0.28	34825.00	0.38	572567.04	0.28
Distribution worker	JP. 5	1	538022.04	0.28	34545.00	0.38	572567.04	0.28
Distribution worker	JP. 6	1	538302.04	0.28	34265.00	0.38	572567.04	0.28
Distribution worker	JP. 7	1	538547.04	0.28	34020.00	0.38	572567.04	0.28
Distribution worker	JP. 8	1	538792.04	0.28	33775.00	0.37	572567.04	0.28
Distribution worker	JP. 9	1	539072.04	0.28	33495.00	0.37	572567.04	0.28
Distribution worker	JP. 10	1	539247.04	0.28	33320.00	0.37	572567.04	0.28
Distribution worker	JP	10	5381830.40	2.79	343840.00	3.79	5725670.40	2.83
Distribution worker	AU. 1	1	531617.04	0.28	40950.00	0.45	572567.04	0.28
Distribution worker	AU. 2	1	531932.04	0.28	40635.00	0.45	572567.04	0.28
Distribution worker	AU. 3	1	532247.04	0.28	40320.00	0.44	572567.04	0.28
Distribution worker	AU. 4	1	532597.04	0.28	39970.00	0.44	572567.04	0.28
Distribution worker	AU. 5	1	532982.04	0.28	39585.00	0.44	572567.04	0.28
Distribution worker	AU. 6	1	533157.04	0.28	39410.00	0.43	572567.04	0.28
Distribution worker	AU. 7	1	533297.04	0.28	39270.00	0.43	572567.04	0.28
Distribution worker	AU. 8	1	533437.04	0.28	39130.00	0.43	572567.04	0.28
Distribution worker	AU. 9	1	533612.04	0.28	38955.00	0.43	572567.04	0.28
Distribution worker	AU. 10	1	533682.04	0.28	38885.00	0.43	572567.04	0.28
Distribution worker	AU	10	5328560.40	2.76	397110.00	4.38	5725670.40	2.83
Distribution worker	NZ. 1	1	558672.04	0.29	13895.00	0.15	572567.04	0.28
Distribution worker	NZ. 2	1	558742.04	0.29	13825.00	0.15	572567.04	0.28
Distribution worker	NZ. 3	1	559092.04	0.29	13475.00	0.15	572567.04	0.28
Distribution worker	NZ. 4	1	559372.04	0.29	13195.00	0.15	572567.04	0.28
Distribution worker	NZ. 5	1	559442.04	0.29	13125.00	0.14	572567.04	0.28
Distribution worker	NZ. 6	1	559617.04	0.29	12950.00	0.14	572567.04	0.28
Distribution worker	NZ. 7	1	559827.04	0.29	12740.00	0.14	572567.04	0.28
Distribution worker	NZ. 8	1	559967.04	0.29	12600.00	0.14	572567.04	0.28
Distribution worker	NZ. 9	1	560072.04	0.29	12495.00	0.14	572567.04	0.28
Distribution worker	NZ. 10	1	560282.04	0.29	12285.00	0.14	572567.04	0.28
Distribution worker	NZ	10	5595085.40	2.90	130585.00	1.44	5725670.40	2.83
Distribution worker	CA. 1	1	538687.04	0.28	33880.00	0.37	572567.04	0.28
Distribution worker	CA. 2	1	538687.04	0.28	33880.00	0.37	572567.04	0.28
Distribution worker	CA. 3	1	538687.04	0.28	33880.00	0.37	572567.04	0.28
Distribution worker	CA. 4	1	538687.04	0.28	33880.00	0.37	572567.04	0.28
Distribution worker	CA. 5	1	538687.04	0.28	33880.00	0.37	572567.04	0.28
Distribution worker	CA. 6	1	538687.04	0.28	33880.00	0.37	572567.04	0.28
Distribution worker	CA. 7	1	538687.04	0.28	33880.00	0.37	572567.04	0.28
Distribution worker	CA. 8	1	538687.04	0.28	33880.00	0.37	572567.04	0.28
Distribution worker	CA. 9	1	538722.04	0.28	33845.00	0.37	572567.04	0.28
Distribution worker	CA. 10	1	538722.04	0.28	33845.00	0.37	572567.04	0.28
Distribution worker	CA	10	5386940.40	2.79	338730.00	3.74	5725670.40	2.83
SUM		-	192965355.00	100.00	9069015.00	100.00	202034370.00	100.00

Appendix 7 – Total Costs of Sourcing

Table I A framework of TAC of China sourcing (adapted and revised from Song et al., 2007)

1 Set up costs	<p>1 Cost of collecting information to search for suppliers (e.g. participate trade fairs, pay for agent, etc)</p> <p>2 Cost of engineering time involved for transfer (e.g. gather information, modify the design due to different environment and IP concern, etc)</p> <p>3 Postage for sending technical data, samples, etc</p> <p>4 IP registration fee in the host country</p> <p>5 Payment to the previous supplier for the design</p> <p>6 Quality audit and validation cost</p> <p>7 Staff's time cost for searching for, visiting and negotiating with supplier, preparing contracts, adding the supplier to internal IT system etc</p> <p>8 Travel expenditure (transport, food and hotel)</p> <p>9 Cost of phone call, fax or video conference</p> <p>10 Tooling cost</p> <p>11 Invest in suppliers' IT systems (e.g. MRP, ERP)</p> <p>12 Cost of expanding warehouse</p> <p>13 Personnel recruit and training</p> <p>14 Cost of removing redundant capacity and labour</p> <p>15 Cost of sending employees to work overseas for a long term (e.g. costs of settlement, children's international school, insurance, etc)</p>
2 Extended Price (ongoing)	<p>1 Price</p> <p>2 Tax and import duty</p> <p>3 Loss from payment terms changes</p> <p>4 Loss from currency exchange rate fluctuation</p>
3 Administrative costs (ongoing)	<p>5 Extra cost of forecasting/ordering process</p> <p>6 Extra cost of payment/billing process</p> <p>7 Bank charges</p>
4 Logistics costs (ongoing)	<p>8 Transportation by sea, by road or by train (including cost for transportation agents)</p> <p>9 Insurance</p> <p>10 Expediting by airfreight</p> <p>11 Loss of sales due to late deliveries or longer lead time</p> <p>12 Holding and administrative costs related to unexpected early delivery</p> <p>13 Compared with before China sourcing, extra costs for receiving (e.g. handling the products into warehouse, disposal of the heavy packaging)</p> <p>14 Compared with before China sourcing, extra costs for inspecting the products (labour and equipment)</p>
5 Inventory costs (ongoing)	<p>15 Extra warehouse costs due to sourcing from China (rent, rate, light, heating, maintenance, insurance, etc)</p> <p>16 Obsolescence</p> <p>17 Capital cost of increasing inventory</p>
6 Quality issue (ongoing)	<p>18 Rejection, returning and re-receiving</p> <p>19 Rework</p> <p>20 Cost of disposal or discarding of defective products</p> <p>21 Loss from scrap, including labour cost of handling scraps</p> <p>22 Loss from production line downtime</p> <p>23 Cost of staff's time of analysing quality problem, re-arranging schedule, asking for compensation</p> <p>24 Cost of handling warranty and customer complaints</p> <p>25 Loss of sales because of quality</p>
7 Supplier management (ongoing)	<p>26 Ongoing travel expenditure (transport, food and hotel)</p> <p>27 Cost of engineering time for technical support</p> <p>28 Cost of staff's time of performance review and, meeting and renegotiation</p> <p>29 Costs of phone calls, faxes, video conferences with the supplier</p> <p>30 Costs resulting from culture and language differences (translators, gifts, social events, etc)</p> <p>31 Cost of litigation with the supplier</p> <p>32 In case of buying other parts from the previous supplier, the loss because of the increasing prices of other parts supplied by this supplier due to the reduced order volume</p>
8 Other costs related to China sourcing	<p>33 Cost of dealing with inferior infrastructure (e.g. road, power supply, internet)</p> <p>34 Impact of "made in China" on customers</p>

	35 Cost of dealing with special regulations or even corruption from local government 36 Cost for dealing with counterfeit products or IP infringement
--	--