TradeExtensions™

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Generating maximum value from your supply chain

ABSTRACT

Powerful new optimisation methods mean it is now possible to optimise complex multi-leg supply chains simultaneously while taking into account user defined business constraints. When used in conjunction with online tendering it can result in dramatic cost reductions, improved service levels and truly optimised supply chains.

Introduction

Every supply chain is unique and even organisations in similar industries will have very different challenges. 'Optimising' supply chains has long been a goal for businesses and today, there are many solutions that offer tools to model supply chains with various degrees of complexity. Unfortunately most solutions have a very narrow scope and they tend to focus mainly on costs rather than considering the 'total value' that can be derived from the supply chain. However, there are a new set of solutions that use 'optimisation' – a branch of mathematics that uses complex algorithms to analyse data and identify the best available solution taking into account chosen constraints – to analyse simultaneously the vast amounts of data involved in each leg of the supply chain. What this means in reality is that it is now possible to optimise the supply chain as one entity as opposed to attempting to optimise each leg in isolation. To understand how optimisation can add value, let us consider a simple supply chain case. This example simulates a real-life situation and uses tangible data to demonstrate how optimisation can help you.

The Supply Chain Example

The example considers three different products A, B and C, each produced at a single factory located in three different European cities – Genoa, Madrid, Warsaw. The supply chain includes ten potential warehouse/distribution centres and 20 market locations.

Fig 1: Map with Factory and Warehouse Locations

In this example we only consider the costs of transport and warehousing however in reality it is possible to include any number of additional scenarios e.g. to allow all products to be made in all factories, to include manufacturing costs in the analysis or to find the optimum allocation of products to factories.

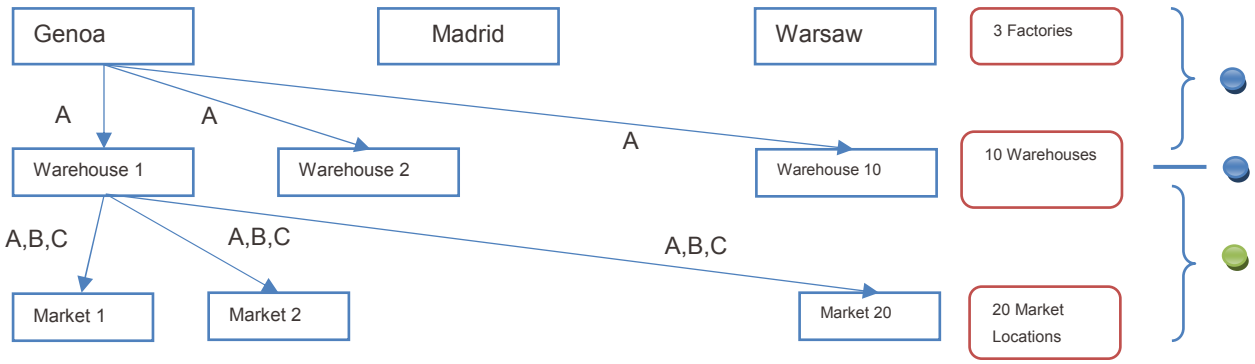

Fig 2: Supply Chain Example

Transportation from factory to the warehouse is constrained to one product per lane whereas co-transportation of products (any combination of A, B and C) is possible during transportation from warehouse to the market location. For simplicity, we use fixed prices per pallet in this example. But prices could easily be provided from a transport tender, potentially providing a powerful combination of network and price optimisation.

Supply chain summary

Factories

Factory	Product	Annual Volume	Unit
Genoa	A	400,000	pallets
Madrid	B	600,000	pallets
Warsaw	C	800,000	pallets

Transport

Warehouse	Maximum Annual Throughput	Cost per Pallet (EUR)	Annual Fixed Cost (EUR)
Birmingham	640,000	10.52	100,000
Brussels	480,000	6.71	100,000
Budapest	320,000	10.90	80,000
Copenhagen	320,000	7.01	100,000
Genoa	220,000	5.26	70,000
Madrid	240,000	7.15	30,000
Munich	480,000	6.81	80,000
Paris	480,000	6.68	80,000
Rotterdam	640,000	8.47	30,000
Warsaw	320,000	9.34	100,000

Warehouses

Transport

Markets

Country	Annual Demand (Pallets)		
	Product A	Product B	Product C
Austria	8,000	12,000	16,000
Belgium	16,000	24,000	32,000
Czech Republic	16,000	24,000	32,000
Denmark	8,000	12,000	16,000
Finland	4,000	6,000	8,000
France	48,000	72,000	96,000
Germany	56,000	84,000	112,000
Hungary	12,000	18,000	24,000
Ireland	4,000	6,000	8,000
Italy	40,000	60,000	80,000
Netherlands	20,000	30,000	40,000
Norway	8,000	12,000	16,000
Poland	28,000	42,000	56,000
Portugal	4,000	6,000	8,000
Slovakia	12,000	18,000	24,000
Slovenia	8,000	12,000	16,000
Spain	36,000	54,000	72,000
Sweden	16,000	24,000	32,000
Switzerland	8,000	12,000	16,000
UK	48,000	72,000	96,000
Total	400,000	600,000	800,000

Fig 3: Supply Chain Summary

Costs

There are three main costs in this simple supply chain model: transport costs from factory to warehouse; cost of warehousing (fixed and variable costs) and transport costs from warehouse to market location

Transport Cost to Warehouse per Pallet (EUR)			
	From Factory		
To Warehouse	Genoa	Madrid	Warsaw
Birmingham	71.60	75.95	103.00
Brussels	23.88	42.59	38.35
Budapest	25.80	62.58	17.84
Copenhagen	40.80	64.34	30.74
Genoa	3.25	37.51	37.61
Madrid	30.48	2.88	59.77
Munich	16.21	42.50	25.73
Paris	20.88	14.11	43.57
Rotterdam	28.24	46.62	29.50
Warsaw	33.76	74.46	2.92

Warehouse	Maximum Annual Throughput	Cost per Pallet (EUR)	Annual Fixed Cost (EUR)
Birmingham	640,000	10.52	100,000
Brussels	480,000	6.71	100,000
Budapest	320,000	10.90	80,000
Copenhagen	320,000	7.01	100,000
Genoa	220,000	5.26	70,000
Madrid	240,000	7.15	30,000
Munich	480,000	6.81	80,000
Paris	480,000	6.68	80,000
Rotterdam	640,000	8.47	30,000
Warsaw	320,000	9.34	100,000

Transport Cost to Market per Pallet (EUR)										
	From Warehouse									
Country / Market	Birmingham	Brussels	Budapest	Copenhagen	Genoa	Madrid	Munich	Paris	Rotterdam	Warsaw
Austria	16.43	29.44	14.65	29.75	20.28	55.02	9.69	32.07	26.33	18.46
Belgium	9.45	8.16	27.95	32.01	25.45	44.65	19.35	13.03	8.21	32.54
Czech Republic	19.00	28.21	15.99	29.07	20.37	47.83	13.13	28.36	29.14	16.25
Denmark	17.41	24.31	37.77	7.94	42.97	68.27	27.97	33.83	27.69	32.02
Finland	29.23	46.11	52.96	36.04	54.66	90.15	59.33	65.87	53.04	35.07
France	11.34	19.61	37.51	36.85	17.37	25.23	24.58	12.87	18.67	38.65
Germany	15.23	20.01	20.16	31.94	22.44	51.00	20.01	19.29	13.83	26.53
Hungary	26.42	41.11	10.01	43.64	28.28	50.52	18.67	40.87	32.29	21.14
Ireland	15.62	63.15	129.18	81.98	102.44	100.48	100.13	58.72	66.21	117.82
Italy	20.39	34.39	32.42	43.75	11.06	42.65	22.06	37.42	33.02	36.56
Netherlands	7.81	10.97	31.88	26.45	32.14	51.60	22.77	17.20	5.10	36.20
Norway	18.38	33.24	51.46	21.78	58.18	78.86	41.14	36.29	36.64	33.90
Poland	20.81	32.87	18.78	27.83	31.31	67.04	26.66	46.41	33.63	10.15
Portugal	21.36	46.66	77.73	77.36	46.21	17.35	58.80	43.63	50.87	66.42
Slovakia	24.29	34.08	7.34	32.66	35.37	55.64	18.26	40.73	32.38	11.48
Slovenia	21.87	29.08	11.40	40.82	19.60	45.46	17.82	30.27	31.03	27.80
Spain	21.41	40.32	52.62	54.19	40.31	14.10	48.41	29.70	48.04	76.27
Sweden	22.44	35.88	42.92	27.13	50.17	84.59	41.33	39.17	36.54	26.71
Switzerland	14.20	18.35	24.86	41.81	9.44	38.67	11.38	19.61	21.78	31.22
UK	12.01	39.24	89.78	59.89	73.36	77.37	74.31	40.70	34.60	93.21

Fig 4: Supply Chain Costs

Using data (price per pallet) for all the available routes, the individual transport costs incurred are calculated.

Even this simplified model generates vast levels of data and means it is very difficult, to manually calculate the 'optimum' solution that is aligned with the physical constraints of the supply chain i.e. the annual demand at the market locations must balance with the production at each factory and there must be a balanced flow through the warehouses that adheres to any transportation constraints.

What is the optimum solution?

This amount of data and number of potential combinations presents an overwhelming challenge for any buyer and traditional analysis methods will not provide the optimum solution. Faced with this situation a buyer using traditional analysis methods may choose to optimise one of the legs and be happy with the savings generated. However, with the new optimisation tools it is possible to optimise all legs simultaneously and as is shown in the table below the results are interesting – and definitely worth saving.

The following table (fig.5) shows seven scenarios - each one optimising one or more of the legs.

	OPTIMISED LEG	FACTORY TO WAREHOUSE TRANSPORT COSTS ('000 EUR)	WAREHOUSING COSTS ('000 EUR)	WAREHOUSE TO MARKET TRANSPORT COST ('000 EUR)	TOTAL COSTS '000 EUR
1	Warehouse to Market	91,284	16,287	21,793	129,364
2	Factory to Warehouse	20,164	14,510	57,803	92,477
3	Warehousing	37,064	12,214	46,921	96,199
4	Warehousing AND Warehouse to Market	76,911	15,386	22,247	114,545
5	Factory to Warehouse AND Warehousing	20,164	14,510	57,803	92,477
6	Factory to Warehouse AND Warehouse to Market	25,237	14,434	45,975	85,646
7	All legs optimised	25,425	13,890	49,975	85,291

Fig 5: Optimisation results

From this analysis we can see that there is a difference of €45 million between the solution with all legs optimised (scenario 7) and the scenario where only transport costs from Warehouse to Market have been optimised (scenario 1). In reality if a buyer was faced with this situation they are more likely to optimise the Factory to Warehouse (scenario 2) leg because it is the leg with the longest combined distances. Even so, optimising this leg in isolation fails to uncover over €7 million of additional savings that could be achieved by optimising all legs simultaneously.

The effectiveness of the optimisation is shown again in scenario 7 in that none of the individual elements have the lowest possible cost when compared to the other scenarios. However, the combined cost of all elements is €7 million less than the next best. Based on the data we have seen this is the optimum solution but to identify this result requires an extremely powerful optimiser. And because the new methods of analysis are so fast, it is possible to run numerous optimisation scenarios so you can be sure you have the best solution for your needs.

Further improvements from tendering

Optimisation is only one component of an efficient supply chain modelling solution. The other component that ties into this process is tendering. Solutions that readily handle complex tenders and can also make use of optimisation techniques make the task of supply chain modelling significantly less cumbersome. The initial results (fig.5) can then be re-optimised quickly and easily with the tender results, perhaps leading to very different supply chain solutions.

Bid capture is an important part of tendering and the user needs powerful control over bid forms to flexibly create tailored spreadsheets to capture prices, discounts and other similar information. A well rounded solution must enable both offline and online editing of data, detailed tailoring of visual detail including look and feel, logos, etc., while retaining the integrity of the data. The tendering process can result in completely different price points for each route from individual transportation providers. This

means the optimum solution requires new prices from all providers/suppliers to be considered for the volumes being purchased throughout the supply chain. A simple supply chain optimisation process like the one described above leads to over 1,800 bids but in reality a large transport tender will generate hundreds of thousands of bids making a powerful optimiser even more essential.

Up until now we have considered an existing supply chain with one set of costs. Now let us consider what happens if we use competitive tendering to get an even better solution. We will consider the situation where all the possible transport flows are put out to tender.

In the above example when all the flows were put out to tender and the results were optimised the lowest cost solution fell to €78 million or €7 million less than a solution that relied on optimisation alone.

While a €7 million saving looks attractive, in reality it will probably not be possible – or desirable – to implement the lowest cost scenario as there will be other criteria to consider. This is a vital part of the analysis when considering 'total value' and when choosing a solution provider it is imperative that it allows you to incorporate your own business constraints into any analysis. In a supply chain example the constraints that have to be met could be to award a maximum of €20 million per carrier; have a maximum of two carriers per factory and a maximum of five carriers in total. Once these types of constraints are considered the cost will increase but the supply chain will be optimised to reflect an organisation's individual requirements and it will provide the best 'total value' solution. In the example above when the optimised tender results were reanalysed to reflect business constraints the total optimised cost was €82.5 million.

Conclusion

The example showcased is a relatively simple supply chain where transport was the major cost component to be optimised. The modelling of similar supply chains where raw materials and services are major cost components (with transportation accounting for a lower percentage of total costs) can easily be visualised. Furthermore, a complex supply chain comprising several distribution channels, markets involving numerous routes and exponentially growing network possibilities can be modelled and optimised. In one example, the Trade Extensions platform was used by a financial services firm to tender all components of a direct mail project sending 1.8 billion letters to its customers. The value of goods and services tendered was US$1 billion; there were 65,000 separate items and 400,000 bids from over 100 suppliers. In this case there were five legs in the supply chain from design to delivery and the supply chain was optimised as a whole.

The supply chain example and the experience of the financial institution mentioned above shows combining competitive tendering with optimisation can result in significantly lower costs. However, identifying the best available 'total value' solution is only possible with tools that also allow companies to apply their own business constraints and this is the way to ultimately generate maximum value from a supply chain.

If you would like to discuss how you can use tendering and optimisation to generate maximum value from your supply chain please contact Joe Critchley, Trade Extensions VP Sales and Business Development: joe.critchley@tradeext.com +44 (0)7795 804 655.

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Trade Extensions

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