

Decision Management Community's Challenge Dec-2024 "Pricing Policy"

The solution proposed by ChatGPT

The [Dec-2024 DMCommunity Challenge](#) asks DM vendors and practitioners to build a simple decision model that handles different order pricing policies.

The problem looks very simple. So, before even trying to implement it in OpenRules, I asked ChatGPT to solve it. Here is my dialog with ChatGPT and its DMN-based solution (that contains simple arithmetic errors).

First, I started with the problem description in plain English:

A company sells Standard and Premium products manufactured in different countries. It uses a mixed bracket volume and cost policy for orders with multiple units:

1-99 units: \$10 per unit (Standard), \$15 per unit (Premium)

100-499 units: \$9 per unit (Standard), \$14 per unit (Premium)

500+ units: \$8 per unit (Standard), \$13 per unit (Premium)

For products that originated not in the US or Canada, there is a handling fee of \$50 per order. If the order includes hazardous material, the total price should be increased by 30%.

Here is an example of the order:

200 Premium products originated in Germany with hazardous materials

50 Standard products originated in the US without hazardous materials

200 Premium products originated in the Canada without hazardous materials

150 Standard products originated in China with hazardous materials.

ChatGPT responded:

To calculate the total cost of the given order, we need to break down the pricing and apply all applicable rules, including the mixed bracket volume pricing, handling fees for non-US/Canada products, and the surcharge for hazardous materials. Let's calculate the total cost for each item in the order.

Step-by-step Calculation:

1. 200 Premium products from Germany with hazardous materials:

- **Pricing:** 100-499 units -> \$14 per unit (Premium).
- **Handling Fee:** Germany is not the US or Canada, so there is a \$50 handling fee.
- **Hazardous Material Surcharge:** 30% increase on the total price due to hazardous materials.

Initial cost = 200 units * \$14 = \$2800

Handling fee = \$50

Cost with hazardous surcharge = (\$2800 + \$50) * 1.30 = \$3650

2. 50 Standard products from the US without hazardous materials:

- **Pricing:** 1-99 units -> \$10 per unit (Standard).
- **Handling Fee:** No fee since the product is from the US.
- **Hazardous Material Surcharge:** No surcharge since there are no hazardous materials.

Initial cost = 50 units * \$10 = \$500

Handling fee = \$0

Hazardous surcharge = \$0

Total cost = \$500

3. 200 Premium products from Canada without hazardous materials:

- **Pricing:** 100-499 units -> \$14 per unit (Premium).
- **Handling Fee:** No fee since the product is from Canada.
- **Hazardous Material Surcharge:** No surcharge since there are no hazardous materials.

Initial cost = 200 units * \$14 = \$2800

Handling fee = \$0

Hazardous surcharge = \$0

Total cost = \$2800

4. 150 Standard products from China with hazardous materials:

- **Pricing:** 100-499 units -> \$9 per unit (Standard).
- **Handling Fee:** China is not the US or Canada, so there is a \$50 handling fee.
- **Hazardous Material Surcharge:** 30% increase on the total price due to hazardous materials.

Initial cost = 150 units * \$9 = \$1350

Handling fee = \$50

Cost with hazardous surcharge = (\$1350 + \$50) * 1.30 = \$1810

Total Order Cost:

- **Premium from Germany:** \$3650
- **Standard from the US:** \$500
- **Premium from Canada:** \$2800
- **Standard from China:** \$1810

Total cost = \$3650 + \$500 + \$2800 + \$1810 = **\$9760**

Thus, the total cost for the entire order is **\$9760**.

I said:

Can you create a DMN decision model that calculates the total cost for similar orders?

ChatGPT said:

Creating a **DMN (Decision Model and Notation)** decision model for calculating the total cost of similar orders involves defining the decision logic and breaking it down into individual decision tables that can be implemented in a DMN-compatible tool.

Key Inputs and Outputs:

1. Inputs:

- **Product Type** (Standard, Premium)
- **Quantity** (Number of units in the order)
- **Origin Country** (US, Canada, Other countries)
- **Hazardous Material** (Yes/No)

2. Outputs:

- **Total Cost**

DMN Decision Model Overview:

The decision model will include a set of decisions, each encapsulating part of the logic:

1. **Determine Unit Price:** Based on the quantity and product type.

2. **Determine Handling Fee:** Based on the origin country.
3. **Apply Hazardous Material Surcharge:** Based on whether the product contains hazardous materials.
4. **Calculate Total Cost:** The final decision that sums up the costs from the previous decisions.

Decision Tables:

1. **Determine Unit Price** (based on product type and quantity):

Quantity Range Standard Price Premium Price

1-99 units	\$10	\$15
100-499 units	\$9	\$14
500+ units	\$8	\$13

- Input: Quantity, Product Type
- Output: Unit Price

2. **Determine Handling Fee** (based on origin country):

Origin Country Handling Fee

US/Canada \$0

Other Countries \$50

- Input: Origin Country
- Output: Handling Fee

3. **Apply Hazardous Material Surcharge** (based on hazardous material status):

Hazardous Material Surcharge (%)

Yes 30%

No 0%

- Input: Hazardous Material (Yes/No)
- Output: Surcharge Factor (1.30 for Yes, 1.00 for No)

4. **Calculate Total Cost** (final decision that combines all previous decisions):

- Formula:

$$\text{Total Cost} = (\text{Quantity} \times \text{Unit Price} + \text{Handling Fee}) \times \text{Surcharge Factor}$$
$$\text{Total Cost} = (\text{Quantity} \times \text{Unit Price} + \text{Handling Fee}) \times \text{Surcharge Factor}$$

- Input: Quantity, Product Type, Origin Country, Hazardous Material
- Output: Total Cost

DMN Diagram:

The DMN diagram will consist of these decisions, with their dependencies as follows:

1. **Unit Price Decision** depends on Quantity and Product Type.
2. **Handling Fee Decision** depends on Origin Country.
3. **Surcharge Decision** depends on Hazardous Material.
4. **Total Cost Decision** depends on the results of the three previous decisions.

This structure can be represented visually with the following steps:

1. **Unit Price** is derived from the decision table for quantity and product type.

2. **Handling Fee** is derived from the decision table for origin country.
3. **Surcharge Factor** is derived from the decision table for hazardous materials.
4. Finally, **Total Cost** is calculated by combining the outputs from all previous decisions.

Example DMN Model:

Inputs:

- Product Type: "Premium"
- Quantity: 200
- Origin Country: "Germany"
- Hazardous Material: "Yes"

Decision Table Outputs:

- **Unit Price:** \$14 (from the range 100-499 units for Premium)
- **Handling Fee:** \$50 (because the origin is Germany, not the US or Canada)
- **Surcharge Factor:** 1.30 (because there is hazardous material)

Total Cost Calculation:

Total Cost = $(200 \times 14 + 50) \times 1.30 = 3650$
 $\text{Total Cost} = (200 \times 14 + 50) \times 1.30 = 3650$

I said:

Can you show the decision table that calculates the total cost in the DMN format?

ChatGPT said:

Certainly! Below is a **DMN decision table** that calculates the **total cost** for the order based on the logic we discussed earlier. It includes all the rules for determining the **unit price**, **handling fee**, and **hazardous material surcharge**, leading to the final **total cost**.

DMN Decision Table for Total Cost Calculation

The **decision table** below calculates the total cost based on the quantity, product type, origin country, and whether the order includes hazardous materials.

Total Cost Decision Table

Quantity Range	Product Type	Unit Price	Origin Country	Handling Fee	Hazardous Material	Surcharge Factor	Formula for Total Cost
1-99	Standard	\$10	US/Canada	\$0	No	1.00	(Quantity * \$10)
1-99	Standard	\$10	Other	\$50	No	1.00	(Quantity * \$10 + \$50)
1-99	Standard	\$10	US/Canada	\$0	Yes	1.30	(Quantity * \$10) * 1.30
1-99	Standard	\$10	Other	\$50	Yes	1.30	(Quantity * \$10 + \$50) * 1.30
100-499	Standard	\$9	US/Canada	\$0	No	1.00	(Quantity * \$9)
100-499	Standard	\$9	Other	\$50	No	1.00	(Quantity * \$9 + \$50)

Quantity Range	Product Type	Unit Price	Origin Country	Handling Fee	Hazardous Material	Surcharge Factor	Formula for Total Cost
100-499	Standard	\$9	US/Canada	\$0	Yes	1.30	$(\text{Quantity} * \$9) * 1.30$
100-499	Standard	\$9	Other	\$50	Yes	1.30	$(\text{Quantity} * \$9 + \$50) * 1.30$
1-99	Premium	\$15	US/Canada	\$0	No	1.00	$(\text{Quantity} * \$15)$
1-99	Premium	\$15	Other	\$50	No	1.00	$(\text{Quantity} * \$15 + \$50)$
1-99	Premium	\$15	US/Canada	\$0	Yes	1.30	$(\text{Quantity} * \$15) * 1.30$
1-99	Premium	\$15	Other	\$50	Yes	1.30	$(\text{Quantity} * \$15 + \$50) * 1.30$
100-499	Premium	\$14	US/Canada	\$0	No	1.00	$(\text{Quantity} * \$14)$
100-499	Premium	\$14	Other	\$50	No	1.00	$(\text{Quantity} * \$14 + \$50)$
100-499	Premium	\$14	US/Canada	\$0	Yes	1.30	$(\text{Quantity} * \$14) * 1.30$
100-499	Premium	\$14	Other	\$50	Yes	1.30	$(\text{Quantity} * \$14 + \$50) * 1.30$
500+	Standard	\$8	US/Canada	\$0	No	1.00	$(\text{Quantity} * \$8)$
500+	Standard	\$8	Other	\$50	No	1.00	$(\text{Quantity} * \$8 + \$50)$
500+	Standard	\$8	US/Canada	\$0	Yes	1.30	$(\text{Quantity} * \$8) * 1.30$

Quantity Range	Product Type	Unit Price	Origin Country	Handling Fee	Hazardous Material	Surcharge Factor	Formula for Total Cost
500+	Standard	\$8	Other	\$50	Yes	1.30	$(\text{Quantity} * \$8 + \$50) * 1.30$
500+	Premium	\$13	US/Canada	\$0	No	1.00	$(\text{Quantity} * \$13)$
500+	Premium	\$13	Other	\$50	No	1.00	$(\text{Quantity} * \$13 + \$50)$
500+	Premium	\$13	US/Canada	\$0	Yes	1.30	$(\text{Quantity} * \$13) * 1.30$
500+	Premium	\$13	Other	\$50	Yes	1.30	$(\text{Quantity} * \$13 + \$50) * 1.30$

Explanation of the Columns:

- **Quantity Range:** This defines the bracket for quantity (e.g., 1-99, 100-499, 500+).
- **Product Type:** Whether the product is Standard or Premium.
- **Unit Price:** The price per unit, determined based on the quantity and product type.
- **Origin Country:** Defines whether the product comes from the US, Canada, or other countries.
- **Handling Fee:** An additional fee for products originating from non-US/Canada countries.
- **Hazardous Material:** Indicates whether the product includes hazardous material (Yes or No).
- **Surcharge Factor:** A factor applied to the cost if the product contains hazardous materials (1.30 for Yes, 1.00 for No).

- **Formula for Total Cost:** A formula representing how the total cost is calculated based on the inputs. This includes multiplying the quantity by the unit price, adding the handling fee if necessary, and applying the hazardous material surcharge.

DMN Formula for Total Cost:

The total cost is calculated by the formula:

$$\text{Total Cost} = (\text{Quantity} \times \text{Unit Price} + \text{Handling Fee}) \times \text{Surcharge Factor}$$

Example Calculation:

Let's walk through an example from the table:

Example Order:

- 200 Premium products from Germany (hazardous material).
- From the decision table:
 - **Unit Price:** \$14 (for Premium, 100-499 units)
 - **Handling Fee:** \$50 (since the product is from Germany, not US or Canada)
 - **Surcharge Factor:** 1.30 (since the product has hazardous material)

Total Cost Calculation:

$$\text{Total Cost} = (200 \times 14 + 50) \times 1.30 = (2800 + 50) \times 1.30 = 3650$$

Thus, the total cost for this order is **\$3650**, which matches our previous calculation.

This decision table can be used in any DMN-compliant tool to automate the cost calculation for various similar orders.

COMMENTS: As you can see, ChatGPT did an outstanding job of extracting business concepts and variables from plain English text. It produced the correct calculation formulas but unfortunately made simple arithmetic errors:

$(\$2800 + \$50) * 1.30 = \$3650$ (should be **\$3705**)

$(\$1350 + \$50) * 1.30 = \$1810$ (should be **\$1820**)

And at the end in the regular addition:

$\$3650 + \$500 + \$2800 + \$1810 = \$9760$ (should be **\$8760** that still would be wrong because of previous errors).

The proposed DMN-like table looks not bad but should be executed to check for correctness. Still, it is awkward, too big, repeats the same costs many times, and could be difficult to maintain. It's more natural to split it into 3 decision tables: one defines Handling Fee, another defines Surcharge, and the third one applies the formula:
Total Cost=(Quantity×Unit Price+Handling Fee)×Surcharge.