CBAM - Cost Benefit Analysis Method

Use the Cost-Benefit Analysis Method (CBAM) to assess which alternative solution to use to implement a middleware system upgrade for a fleet management application that tracks the real-time locations of delivery trucks, CBAM considers utility and expected utility in the decision-making process.

The current middleware system processes 1,000 locations updates per minute with an average response time of 200 milliseconds, The theoretical minimum possible is 50 milliseconds with upto 5000 location updates perminute. The current utility is computed as 5000 utility points.

The cost for each improvement is presented below:

2000 updates/min	3000 updates/min	4000 updates/min	5000 updates/min
3 lakhs	7 lakhs	10 lakhs	20 lakhs

150 milliseconds	100 milliseconds	50 milliseconds
3 Lakhs	7 Lakhs	10 Lakhs

Three alternative approaches to upgrading the infrastructure have been presented.

Alternative 1 provides 4000 locations updates per min - 100 seconds response time
Alternative 2 provides 2000 locations updates per min - 50 seconds response time
Alternative 3 provides 4000 locations updates per min - 150 seconds response time

Every 1000 location updates per minute gives a utility of 100 points and every 50 milliseconds improvement gives a utility of 300 points.

By implementing each alternative, you anticipate that the middleware can dynamically allocate the resources based on the network conditions in a better way.

Solutions

Calculating utility points, NPV and BCR for alternative solutions

<u>Alternative 1</u>
Location update improvement - ((4000 - 1000)/1000) * 100 = 3 * 100 = 300

Response update improvement - ((200 - 100) / 50) * 300 = 2 * 300 = 600

Total utility points = 300 + 600 = 900

NPV = ∑ PV of benefits (cash inflows) – ∑ PV of costs (cash outflows)
= 900 - (10+7)
= 900 - (17)
= 883

BCR = ∑ PV of Benefits (cash inflows) / ∑ PV of costs (cash outflows)
= 900/17
= 52.94

Alternative 2

Location update improvement - ((2000 - 1000)/1000) * 100 = 1 * 100 = 100
Response update improvement - ((200 - 50) / 50) * 300 = 3 * 300 = 900

Total utility points = 100+ 900 = 1000

NPV = ∑ PV of benefits (cash inflows) – ∑ PV of costs (cash outflows)
= 1000 - (3+10)
= 1000 - (13)
= 987

BCR = ∑ PV of Benefits (cash inflows) / ∑ PV of costs (cash outflows)
= 900/13
= 76.92

Alternative 3

Location update improvement - ((4000 - 1000)/1000) * 100 = 3 * 100 = 300
Response update improvement - ((200 - 150) / 50) * 300 = 1 * 300 = 300

Total utility points = 300+ 300= 600

NPV = ∑ PV of benefits (cash inflows) – ∑ PV of costs (cash outflows)
= 600 - (3+10)
= 600 - (13)
= 587

BCR = ∑ PV of Benefits (cash inflows) / ∑ PV of costs (cash outflows)
= 600/13
= 46.15

	Alternative 1	Alternative 2	Alternative 3
NPV	883	987	587
BCR	52.94	76.92	46.15

As we can see that NPV and BCR are higher for Alternative 2, We will choose Alternative 2 for upgrade.