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[**MGMT-6120-(01)-24S**](https://www.fanshaweonline.ca/d2l/home/1625466)

**Business Case Development**

**Akash Biswas**

**Problem Statement**: Delta is experiencing challenges with the procurement of ruxolitinib phosphate which is an important raw material that is used in the production of JAKAFI, the leading drug responsible for 70% of the company's revenue. These disruptions threaten the availability of JAKAFI for patients and present a significant risk to business operations, leading to a cost increase of 260 million dollars.

**Opportunity Statement:** Delta has been struggling to secure enough quantity of ruxolitinib phosphate; the procurement team will assist in making the switch to a more reliable supplier, which will have multiple benefits, including stabilizing production costs and increasing revenue streams, as well as ensuring the consistent availability of JAKAFI for patients who depend on the drug.

**Company Objectives:**

1. **Patient-Centric Innovation:** Delta is committed to advancing the medicine and improving the lives of patients with serious diseases.
2. **Supplier Diversity:** Broaden partnerships to include more diverse consultants, agencies, firms, and suppliers.

**Business Case Objectives:**

1. Identify multiple procurement options for ruxolitinib phosphate to reduce dependency on single-source suppliers.

* List Potential Suppliers
* FDA Compliance List

1. Increase the safety stock for ruxolitinib phosphate and semi-finished goods inventory

* Inventory amount of ruxolitinib phosphate
* Inventory amount of semi finished JAKAFI

1. Improve procurement and production efficiency of JAKAFI

* Average Lead Time
* Operation Costs

**Stakeholder List**

|  |  |
| --- | --- |
| Role | Department |
| Procurement Manager | Procurement |
| Process Development Engineer | Manufacturing Department |
| Production Supervisor | Production |
| Business Analyst | Business Development |
| Supply Chain Data Analyst | Supply Chain |
| Business Development Analyst | Business Development |
| Logistics Coordinator | Logistics |
| Operations Manager | Operations |
| Inventory Manager | Inventory Management |
| Computational Biologist | Drug Product Process Development |

**List of alternatives:**

1. Investing in Researching a Synthetic Alternative for ruxolitnib phosphate.
2. Artificial intelligence and machine learning will help raise production efficiency.
3. Develop strategic partnerships with multiple suppliers.
4. Invest in technology to improve supply chain visibility and management.
5. Bargain for better terms by long-term contracts with suppliers.
6. Implement an improved supplier evaluation and audit process.
7. Develop an alternative raw material for jakafi.
8. Fix the mechanism of inventory control.
9. Create fresh plans with vendors to guarantee improved alignment of the procurement process.
10. Create mitigating plans and do frequent risk analyses.

**Top 5 Alternatives:**

1. Invest in researching new alternatives for ruxolitnib phosphate.
2. Invest in technology to improve supply chain and procurement process.
3. Develop strategic partnerships with multiple suppliers.
4. Conduct regular risk assessments in order to develop mitigation strategies.
5. Implement a better supplier evaluation and audit process

**Top 3 Alternatives:**

1. **Invest in Research for Synthetic Alternatives:** Developing a new synthetic alternatives to ruxolitinib phosphate can greatly reduce Delta's reliance on single source suppliers by diversifying the procurement channels, resulting in reduced risk of shortages and production interruptions.
2. **Develop strategic partnerships with multiple suppliers**: Increasing procurement channels for ruxolitinib phosphate will reduce the dependency on single source suppliers, which will result in a reliable and steady supply for Ruxolitinib Phosphate.
3. **Invest in technology to improve supply chain and procurement process**: Implementation of advanced IT technologies such as IoT and blockchain will enhance the supply chain and procurement process by integrating more precise real-time tracking and making the processes more transparent between the supplier and Delta. With these tools, Delta can work better with suppliers, spot problems early, and forecast demand much more accurately which will lead to reduced errors and ensure Delta has adequate ruxolitinib phosphate in stock at all times.

|  |  |
| --- | --- |
| **List of Variables** | **Source** |
| List of Qualified Vendors for Ruxolitnib Phosphate | Pharma compass website Supplier List |
| Inventory stock amount of Ruxolitinib Phosphate | **Not disclosed but can be estimated by the following:**  The mean cost and weight of Jakafi Per bottle in USA: [PMC7830510](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7830510/) (Table 1, Entry name Ruxolitinib) Let i1, i2, i3 be (5 mg, 15 mg and 20 mg) weight and prices per bottle respectively  Let n1,n2,n3 be (24.08+48.17+48.17) = 40.73 USD  Quantity of Ruxolitinib present per bottle: [60{(5+15+20}/3}] mg = 800 mg or .8 grams. (where 60 is the quantity of tables in each bottle  **Incyte Market Access Information list (page 2)**  Let a1,a2 and a3 be average weight of each bottle = {(40 + 50 + 70)/3}g = 53.3 g  Therefore, the Estimated number of bottles of JAKAFI sold in 2023:  [FORM](https://investor.incyte.com/static-files/86ca7435-b8ed-4bec-aa79-0770a0635e84) 10k 2023 April  Page 71: Let J be the Royalty Generated by JAKAFI = 368 million USD  Page 71 : Let R be the revenue generated by JAKAFI in the year = 2.59 billion USD  Page 85: Let P be the Net Profit in 2023 = 597 million USD  = [{R – ( J + P) }/ 60\*Σn]  Therefore, the Estimated stock of Ruxolitinib raw material =  [[[{R – ( J + P) }/ 60\*Σn]\* (Σa/3)/60\*Σi ]/1e-6] KG  = [[[{2590 – (368+597)}/40.73] \* (53.3/.8)]/1000000] KG  = 2657.25 kg or 2.6 Tons Approx |
| Revenue breakdown | [SEC](https://investor.incyte.com/static-files/86ca7435-b8ed-4bec-aa79-0770a0635e84) Filing 2023 (Page 70-85) |
| Operating Cost Breakdown | [Incyte](https://investor.incyte.com/static-files/86ca7435-b8ed-4bec-aa79-0770a0635e84) Form 10k 2023 (Page 73) |
| R&D general timeline and process information | Website what we do guidelines. |
| Industry standards for prototype development | Incyte website portfolio |
| Scale-up production and quality testing | [Quadro](https://www.quadro-mpt.com/news-and-events/process-scale-up-and-technology-transfer) business case on scaling production quality |
| Cash-to-Cash Cycle Time | Not disclosed by can be estimated: [Form](https://investor.incyte.com/static-files/fc03c047-df5d-4224-875c-2edfadf7011e) 10Q 2023 Incyte  DSO Q4 2022: 80 Days  DIO Q4 2022: 100 Days  DPO Q4 2022: 90 Days  Therefore, Cash to Cash Cycle Time = DSO+DIO-DPO = (80+100-90 = 90 Days) |
| Return on Investment | Microtrends ROI Chart |
| Blockchain Implementation Cost and Benefit Estimates | Healthit Blockchain challenge MIT Case study  App invt blockchain in medical supply case study  [MDPI](https://www.mdpi.com/2227-7390/11/22/4669) Document 4669 |
| IOT Cost and Benefit Estimates | [Super](https://smartmakers.io/en/iot-in-der-pharmazie-auswirkungen-auf-produktion-logistik/)maker’s article IoT in pharmacy: effects on production & logistics  Blockchain technology in the pharmaceutical supply chain: researching a business model based on Hyperledger Fabric Publication |

**Information Gathering Plan (IGP)**

|  |  |  |  |
| --- | --- | --- | --- |
| What Information? | Source | Method | Sequence |
| What would be the strategy to fix the issue? | Brainstorming with internal stakeholders | Brainstorming | 2 |
| Capabilities, capacity, lead times of the suppliers | Talk to the suppliers to gather information | Interview Suppliers | 3 |
| Quality certifications and audit results | FDA issued list | Read List | 5 |
| Pricing, contract terms, and historical performance of suppliers. | Supplier Benchmark records | Read Document | 4 |
| Identify Problem | Read SEC Filings, Company log, articles etc | Read Documents | 1 |
| Examine procurement data and process | Purchase order and invoice data detailing who, how much, how frequently, and at what price. | Read invoices | 6 |
| Assess operations, quality control, and capacity | Tour supplier facilities | Observe and take notes | 7 |
| Pricing, contract terms, and historical performance | Ask the supplier to provide records and estimates | Read Document | 8 |

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**Cost Benefit Analysis**

**Important Calculations**

Payback Period = Years Before Break Even + Unrecovered Amount/ Cash Flow in Recovery Year

Discount Rate is 8% since the average index funds return is 8%

**Alternative 1: Invest in Research for Synthetic Alternatives**

**Initial Investment**

|  |  |
| --- | --- |
| Drug Discovery Research | $10,000,000 |
| Animal Studies | $20,000,000 |
| Clinical Trials | $30,000,000 |
| Regulatory Submission and Approval | $10,000,000 |
| **Total** | **$70,000,000** |

**Operational Cost**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Total** |
| Personnel | $1,000,000 | $1,000,000 | $1,000,000 | $1,000,000 | $4,000,000 |
| Regulatory compliance | $2000,000 | $2000,000 | $2000,000 | $2000,000 | $8,000,000 |
| **Total Operating Cost** | - | - | - | - | **$12,000,000** |

**Benefits**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Year 5** | **Year 6** | **Year 7** | **Year 8** | **Year 9** | **Year 10** | **Total** |
| Reduced production costs | $2000,000 | $2000,000 | $2000,000 | $2000,000 | $2000,000 | $2000,000 | **$12,000,000** |
| Increased Sales Production | $5000,000 | $5000,000 | $5000,000 | $5000,000 | $5000,0000 | $5000,000 | **$30,000,000** |
| **Total Benefits** | **-** | **-** | **-** | **-** | **-** | **-** | **$42,000,000** |

**Cash Flow Analysis**

**m = Million**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Years | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | **Total** |
| Inflow | $0 | $0 | 0$ | 0$ | $0 | $7m | $7m | $7m | $7m | $7m | $7m | **$42m** |
| Out Flow | -$70m | -$3m | -$3m | -$3m | -$3m | $0 | $0 | 0$ | 0$ | $0 | $0 | **-$82m** |
| Net | -$70m | -$3m | -$3m | -$3m | -$3m | $7m | $7m | $7m | $7m | $7m | $7m | **-$40m** |

**Net Profit Value**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Years | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | **NVP** |
| Net | -$70m | -$3m | -$3m | -$3m | -$3m | $7m | $7m | $7m | $7m | $7m | $7m |  |
| PV (8%) | -$70m | -2.77m | -2.57m | -2.38m | -2.2m | 4.76m | 4.40m | 4.08m | 3.77m | 3.49m | 3.23m | **-56.19m** |

**The Payback Period is 18.03 Years**

**Alternative 2: Multiple Supplier Sources for Ruxolitinib Phosphate**

Estimated benefit for at least 3 years

**Initial Investment**

|  |  |
| --- | --- |
| Supplier evaluation and selection process | $50,000 |
| Technology integration | $100,000 |
| Staff training | $20,000 |
| **Total Investment** | **$170,000** |

**Operating Cost**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Year 1** | **Year 2** | **Year 3** | **Total** |
| Regular Supplier Audits and Performance Reviews | $30,000 | $30,000 | $30,000 | **$90,000** |
| Travel and Meeting Expenses | $20,000 | $20,000 | $20,000 | **$60,000** |
| **Total Operating Cost** | **-** | **-** | **-** | **$150,000** |

**Benefits**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Year 1** | **Year 2** | **Year 3** | **Total** |
| Improved operational efficiency | $100,000 | $120,000 | $140,000 | **$360,000** |
| Risk mitigation by avoiding disruption | $50,000 | $60,000 | $70,000 | **$180,000** |
| **Total Benefit** | **-** | **-** | **-** | **$540,000** |

**Cash Flow Analysis**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Year 0** | **Year 1** | **Year 2** | **Year 3** | **Total** |
| Cash Inflow | $0 | $150,000 | $180,000 | $210,000 | $540,000 |
| Cash Outflow | $170,000 | $50,000 | $50,000 | $50,000 | $320,000 |
| **Net Cash Flow** | **-**$170,000 | **$100,000** | **$130,000** | **$160,000** | **$220,000** |

**Net Present Value**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Year 0** | **Year 1** | **Year 2** | **Year 3** | **NPV** |
| Net Cash Flow | - $170,000 | $100,000 | $130,000 | $160,000 |  |
| Present Value (8%) | -$ 170,000 | $92,592 | $111,450 | $127,013 | **$161,055** |

**The Payback period = 1.46 Years**

**Alternative 3: Invest in technology to improve the supply chain and procurement process**

**Initial Investment**

|  |  |
| --- | --- |
| Consulting and Planning | $50,000 |
| System Design | $75,000 |
| Development and Implementation | $50,000 |
| Quality Assurance and Testing | $25,000 |
| Hardware | $50,000 |
| Blockchain Platform Setup | $50,000 |
| Staff Training | $25,000 |
| **Total** | **$325,000** |

**Operating Cost**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Total** |
| Maintenance and Support | $51,205 | $51,205 | $51,205 | $51,205 | $51,205 | $256,025 |
| Cloud Services and Infrastructure | $18,000 | $18,000 | $18,000 | $18,000 | $18,000 | $90,000 |
| Software and Licenses | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $100,000 |
| Staff Training | $10,000 | $10,000 | $10,000 | $10,000 | $10,000 | $50,000 |
| **Total Operating Cost** | **-** | **-** | **-** | **-** | **-** | **$496,025** |

**Benefits**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Total** |
| Improved inventory management | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $100,000 |
| Increased operational efficiency | $80,000 | $80,000 | $80,000 | $80,000 | $80,000 | $400,000 |
| Reduced fraud and errors | $60,000 | $60,000 | $60,000 | $60,000 | $60,000 | $300,000 |
| Increased operational efficiency | $70,000 | $70,000 | $70,000 | $70,000 | $70,000 | $350,000 |
| **Total Benefits** |  |  |  |  |  | **$1,150,000** |

**Cash Flow Analysis**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Year 0** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Total** |
| Cash Inflow |  | $230000 | $230000 | $230000 | $230000 | $230000 | **$1,150,000** |
| Cash Outflow | $325,000 | $99,205 | $99,205 | $99,205 | $99,205 | $99,205 | **$1421250** |
| Net Cash Flow | -$325,000 | $130,795 | $130,795 | $130,795 | $130,795 | $130,795 | **$78,975** |
| Cumulative Cash Flow | -$325,000 | −194,205 | −63,410 | 67,385 | 198,180 | 328,975 | **-** |

**Net Present Value**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Year 0** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **NPV** |
| Net Cash Flow | -$325,000 | $130,795 | $130,795 | $130,795 | $130,795 | $130,795 |  |
| Present Value (10%) | -$325,000 | $118904 | $108095 | $98268 | $89334 | $81213 | **$170,814** |

**The payback Period is 2.51 years**

**Multiple Choice Analysis (MOA)**

**Worst and Best Measures**

|  |  |  |  |
| --- | --- | --- | --- |
| **Criteria** | **Synthetic Alternative** | **Multiple Suppliers** | **Cloud & Blockchain** |
| **Cost Effectiveness** | Low | High | Medium |
| **Implementation Time** | Very Long | Short | Short |
| **Risk Mitigation** | Best | Very Good | Good |
| **Procurement Reliability** | Average | Best | Average |
| **Innovation Potential** | Most Innovative | Least Innovative | Medium Innovative |
| **Regulatory Compliance** | Worst | Best | Best |

**Best and Worst measures**

|  |  |  |
| --- | --- | --- |
| **Criteria** | **Best** | **Worst** |
| **Cost Effectiveness** | High | Low |
| **Implementation Time** | Short | Very Long |
| **Risk Mitigation** | Best | Good |
| **Procurement Reliability** | Best | Average |
| **Innovation Potential** | Most Innovative | Least Innovative |
| **Regulatory Compliance** | Best | Worst |

**Assigning Weights**

|  |  |  |  |
| --- | --- | --- | --- |
| **Criteria** | **Synthetic Alternative** | **Multiple Suppliers** | **Cloud & Blockchain** |
| **Cost Effectiveness** | 0.3 | 0.9 | 0.6 |
| **Implementation Time** | 0.1 | 0.9 | 0.9 |
| **Risk Mitigation** | 1.0 | 0.8 | 0.7 |
| **Procurement Reliability** | 0.5 | 1.0 | 0.5 |
| **Innovation Potential** | 1.0 | 0.3 | 0.6 |
| **Regulatory Compliance** | 0.3 | 1.0 | 1.0 |

**Worst to Best Measures**

|  |  |  |
| --- | --- | --- |
| **Criterion** | **Worst** | **Best** |
| **Cost Effectiveness** | 0.3 | 0.9 |
| **Implementation Time** | 0.1 | 0.9 |
| **Risk Mitigation** | 0.7 | 1.0 |
| **Procurement Reliability** | 0.5 | 1.0 |
| **Innovation Potential** | 0.3 | 1.0 |
| **Regulatory Compliance** | 0.3 | 1.0 |

**High to Low Ranking and Weights**

|  |  |  |
| --- | --- | --- |
| **Rank** | **Criteria** | **Weight** |
| **1** | **Risk Mitigation** | 100 |
| **2** | **Procurement Reliability** | 90 |
| **3** | **Cost Effectiveness** | 80 |
| **4** | **Regulatory Compliance** | 70 |
| **5** | **Implementation Time** | 60 |
| **6** | **Innovation Potential** | 50 |
| **Total** |  | **450** |

**Low to High Ranking and Weights**

|  |  |  |
| --- | --- | --- |
| **Rank** | **Criteria** | **Weight** |
| **6** | **Innovation Potential** | 10 |
| **5** | **Implementation Time** | 20 |
| **4** | **Regulatory Compliance** | 30 |
| **3** | **Cost Effectiveness** | 40 |
| **2** | **Procurement Reliability** | 50 |
| **1** | **Risk Mitigation** | 60 |
| **Total** |  | **210** |

**Average Weight Calculation**

|  |  |  |  |
| --- | --- | --- | --- |
| **Criteria** | High-Low | Low-High | Average |
| **Risk Mitigation** | 100/450 = 0.222 | 60/210 = 0.286 | 0.254 |
| **Procurement Reliability** | 90/450 = 0.200 | 50/210 = 0.238 | 0.219 |
| **Cost Effectiveness** | 80/450 = 0.178 | 40/210 = 0.190 | 0.184 |
| **Regulatory Compliance** | 70/450 = 0.156 | 30/210 = 0.143 | 0.150 |
| **Implementation Time** | 60/450 = 0.133 | 20/210 = 0.095 | 0.114 |
| **Innovation Potential** | 50/450 = 0.111 | 10/210 = 0.048 | 0.080 |

**Final Weight Calculation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criteria** | **Weight** | **Synthetic Alternative** | **Multiple Suppliers** | **Cloud & Blockchain** |
| **Risk Mitigation** | 0.254 | 1.0 \* 0.254 = 0.254 | 0.8 \* 0.254 = 0.203 | 0.7 \* 0.254 = 0.178 |
| **Procurement Reliability** | 0.219 | 0.5 \* 0.219 = 0.110 | 1.0 \* 0.219 = 0.219 | 0.5 \* 0.219 = 0.110 |
| **Cost Effectiveness** | 0.184 | 0.3 \* 0.184 = 0.055 | 0.9 \* 0.184 = 0.166 | 0.6 \* 0.184 = 0.110 |
| **Regulatory Compliance** | 0.15 | 0.3 \* 0.150 = 0.045 | 1.0 \* 0.150 = 0.150 | 1.0 \* 0.150 = 0.150 |
| **Implementation Time** | 0.114 | 0.1 \* 0.114 = 0.011 | 0.9 \* 0.114 = 0.103 | 0.9 \* 0.114 = 0.103 |
| **Innovation Potential** | 0.08 | 1.0 \* 0.080 = 0.080 | 0.3 \* 0.080 = 0.024 | 0.6 \* 0.080 = 0.048 |
| **Total** |  | **0.555** | **0.865** | **0.699** |

**Based on the MOA, the ranking of the options are:**

1. Multiple Suppliers (0.865)
2. Cloud & Blockchain (0.699)
3. Synthetic Alternatives (0.555)

**Summary:**

**Alternative 1 (Synthetic Raw Material Development)**

|  |  |
| --- | --- |
| **Pros** | **Cons** |
| No operating cost after it’s developed | Most Expensive and Longest Development Time |
| Longest Potential benefit term of 6 years | Negative NVP |
| Most Innovative | Bad Regulatory Compliance |

**Alternative 2 (Multiple Suppliers Diversity)**

|  |  |
| --- | --- |
| **Pros** | **Cons** |
| Lowest time and Cost required for implementation | Least Innovative |
| Most Cost Effective | Only Beneficial for 3 years |
| Positive NVP | Very good Regulatory Compliance |

**Alternative 3 (Blockchain and IoT Implementation)**

|  |  |
| --- | --- |
| **Pros** | **Cons** |
| Implementation Time | High Cost for implementation |
| Positive NPV | Complex to Implement |
| Potential Benefits for 5 years | Doesn’t change the reliance on single source suppliers |

**Conclusion**

Overall, Alternative 2 is the best alternative, which is diversifying the procurement sources since it’s the alternative with the shortest payback period and the best one regarding the MOA.

**Sensitivity Analysis**

**Alternative 2 (Multiple Suppliers Diversity)**

**Baseline**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criteria** | **Year 0** | **Year 1** | **Year 2** | **Year 3** |
| **Regular Supplier Audits and Performance Reviews** | $0 | $30,000 | $30,000 | $30,000 |
| **Travel and Meeting Expenses** | $0 | $20,000 | $20,000 | $20,000 |
| **Initial Investment** | $170,000 | $0 | $0 | $0 |
| **Revenue** | $0 | $150,000 | $180,000 | $210,000 |
| **Cash Outflow** | $170,000 | $50,000 | $50,000 | $50,000 |
| **Net Cash Flow** | -$170,000 | $100,000 | $130,000 | $160,000 |
| **Present Value (8%)** | -$ 170,000 | $92,592 | $111,450 | $127,013 |

**Baseline NPV $161,055**

**Scenario 1 (5% cost increase in Regular Supplier Audits and Performance Reviews)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criteria** | **Year 0** | **Year 1** | **Year 2** | **Year 3** |
| **Regular Supplier Audits and Performance Reviews** | $0 | $31,500 | $31,500 | $31,500 |
| **Travel and Meeting Expenses** | $0 | $20,000 | $20,000 | $20,000 |
| **Initial Investment** | $170,000 | $0 | $0 | $0 |
| **Revenue** | $0 | $150,000 | $180,000 | $210,000 |
| **Cash Outflow** | $170,000 | $51,5000 | $51,5000 | $51,5000 |
| **Net Cash Flow** | -$170,000 | 98,500 | $128,500 | $158,500 |
| **Present Value (8%)** | -$ 170,000 | $91,203 | $110,168 | $125,822 |

**NPV = $157,193**

. **% Change of NPV = - 2.40%**

This means that with a **1%** increase in the cost of Regular Supplier Audits and Performance Reviews, the project's NPV will decrease by **.48%,** and vice versa.

**Scenario 2 (5% increase in Initial Investment)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criteria** | **Year 0** | **Year 1** | **Year 2** | **Year 3** |
| **Regular Supplier Audits and Performance Reviews** | $0 | $30,000 | $30,000 | $30,000 |
| **Travel and Meeting Expenses** | $0 | $20,000 | $20,000 | $20,000 |
| **Initial Investment** | $178,500 | $0 | $0 | $0 |
| **Revenue** | $0 | $150,000 | $180,000 | $210,000 |
| **Cash Outflow** | $178,500 | $50,000 | $50,000 | $50,000 |
| **Net Cash Flow** | -$178,500 | $100,000 | $130,000 | $160,000 |
| **Present Value (8%)** | -$178,500 | $92,592 | $111,450 | $127,013 |

**NPV = $152,555**

**% Change of NPV = -5.42%**

This means that with a **1%** increase in the cost of **Initial Investment**, the project's NPV will decrease by **1.08%,** and vice versa.

**Alternative 2 (Multiple Suppliers Diversity)**

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**Alternative 3 (Blockchain and IoT Implementation)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Criteria** | **Year 0** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| **Maintenance and Support** | 0$ | $51,205 | $51,205 | $51,205 | $51,205 | $51,205 |
| **Cloud Services and Infrastructure** | 0$ | $18,000 | $18,000 | $18,000 | $18,000 | $18,000 |
| **Software and Licenses** | 0$ | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 |
| **Staff Training** | 0$ | $10,000 | $10,000 | $10,000 | $10,000 | $10,000 |
| **Initial Investment** | $325,000 | 0$ | 0$ | 0$ | 0$ | 0$ |
| **Revenue** | $0 | $230000 | $230000 | $230000 | $230000 | $230000 |
| **Cash Outflow** | $325,000 | $99,205 | $99,205 | $99,205 | $99,205 | $99,205 |
| Net Cash Flow | -$325,000 | $130,795 | $130,795 | $130,795 | $130,795 | $130,795 |
| Present Value  (10%) | -$325,000 | $118904 | $108095 | $98268 | $89334 | $81213 |

**Baseline NVP = $170,814**

**Scenario 1 : Maintenance and Support Costs increased by 6%**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Criteria** | **Year 0** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| **Maintenance and Support** | 0$ | $54,277 | $54,277 | $54,277 | $54,277 | $54,277 |
| **Cloud Services and Infrastructure** | 0$ | $18,000 | $18,000 | $18,000 | $18,000 | $18,000 |
| **Software and Licenses** | 0$ | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 |
| **Staff Training** | 0$ | $10,000 | $10,000 | $10,000 | $10,000 | $10,000 |
| Initial Investment | $325,000 | 0$ | 0$ | 0$ | 0$ | 0$ |
| Revenue | $0 | $230000 | $230000 | $230000 | $230000 | $230000 |
| Cash Outflow | $325,000 | 102,277 | 102,277 | 102,277 | 102,277 | 102,277 |
| Net Cash Flow | -$325,000 | 127,723 | 127,723 | 127,723 | 127,723 | 127,723 |
| Present Value  (10%) | -$325,000 | $116,112 | $105,538 | $96,009 | $87,480 | $79,819 |

**NVP = $159,958**

**% Change of NPV = -6.36%**

This means that with a **1%** increase in the cost of **Initial Investment**, the project's NPV will decrease by **1.06%,** and vice versa.

**Scenario 2: Initial Investment cost increase by 6%**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Criteria** | **Year 0** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| **Maintenance and Support** | 0$ | $51,205 | $51,205 | $51,205 | $51,205 | $51,205 |
| **Cloud Services and Infrastructure** | 0$ | $18,000 | $18,000 | $18,000 | $18,000 | $18,000 |
| **Software and Licenses** | 0$ | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 |
| **Staff Training** | 0$ | $10,000 | $10,000 | $10,000 | $10,000 | $10,000 |
| **Initial Investment** | $344,500 | 0$ | 0$ | 0$ | 0$ | 0$ |
| **Revenue** | $0 | $230000 | $230000 | $230000 | $230000 | $230000 |
| **Cash Outflow** | $344,500 | $99,205 | $99,205 | $99,205 | $99,205 | $99,205 |
| **Net Cash Flow** | -$344,500 | $130,795 | $130,795 | $130,795 | $130,795 | $130,795 |
| **Present Value**  **(10%)** | -$344,500 | $118904 | $108095 | $98268 | $89334 | $81213 |

**NVP = $151,314**

**% Change of NPV = −12.88%**

This means that with a **1%** increase in the cost of **Initial Investment**, the project's NPV will decrease by **2.14%,** and vice versa.

A graph with a green line

Description automatically generated**Alternative 3 (Blockchain and IoT Implementation)**

**Summary**

Alternative 3 is significantly more volatile in terms of initial investment and Operating Costs than Alternative 2, with a 2.14% and 1.06% difference compared to 1.08% and .48%, respectively, making Alternative 2 a much more stable option.

**High-Level Risks**

|  |  |
| --- | --- |
| **Alternative 2** |  |
| **Supply Chain Disruption** | Various suppliers increase the risk of supply chain disturbance due to their various degrees of dependability and possibly geopolitical conflicts. Every supplier may have different issues that may lead to inconsistent supplies and maybe manufacturing failures. |
| **Problems with Quality Control** | Dealing with many vendors could lead to issues with quality control since each one of them follows different practices and criteria. Guaranteeing consistent quality across several providers might be challenging. Hence it could be required to do extensive audits and monitoring. |
| **Increased Operational Costs** | When suppliers are varied, the need for regular audits, performance evaluations, travel, and meeting fees creates higher operating costs. These costs could add up and affect the general cost-effectiveness of the choice. |
| **Alternative 3** |  |
| **High Initial Investment** | Implementing blockchain and IoT technology comes with significant infrastructure, software, and training upfront expenses. This high initial cost of the project could affect its general profitability and hence tax financial resources. |
| **Complexity of Implementation** | Blockchain and IoT taken together call for advanced technologies and processes as well as certain knowledge and experience. This complexity could lead to technical issues, execution delays, and more dependence on outside experts. |
| **Risks to Data Security and Privacy** | The massive data exchange and storage associated with blockchain, and Internet of Things technologies gives rise to worries over data security and privacy. It can be difficult but vital to make sure that private data is shielded from hackers and unwanted access. |

**Final Recommendation:**

**For the following reasons, alternative 2 diverse the supply chain network is the best one:**

- It has the cheapest implementation cost.

- It is the least sensitive to financial change.

- It has the shortest implementation time.

- It has the shortest payback period.

These are the reasons why we recommend moving forward with Alternative 2 over Alternative 1 and Alternative 3.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Risk | Consequence | Probability | Impact | Risk Level | Risk Modification Plan | Risk Owner |
| Supplier Non-Compliance | Delay in project timeline, potential legal issues | High | High | High | Review suppliers carefully, apply rigorous compliance rules, and arrange backup suppliers. | Quality Assurance Team |
| Quality Issues with Supplies | Compromised quality of products, rising expenses from rework and returns | Low | High | Low | Put strict quality control policies into effect, schedule frequent audits, and set unambiguous quality criteria. | Quality Control Team |
| Delays in Supplier Selection | Project timeline delays, increased costs | Medium | Low | Low | Clearly define deadlines, track advancement often, and provide penalties for delays. | Procurement Team |
| Budget Overruns | Increased project costs, potential funding issues | Medium | High | High | Frequent budget reviews, backup plans, and approval process for altered budgets | Finance Team |

**Implementation Plan for Alternative 2**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Phase** | **Milestones** | **Stakeholders** | **Resources Required** | **Benefits**  **Achieved** | **Timeline** |
| Initial Assessment | Identify potential suppliers | Procurement Team | Market research reports | List of potential suppliers identified | 2 weeks |
| Initial Assessment | Conduct feasibility study | Quality Assurance Team | Supplier feasibility assessment tools | Feasibility of each supplier determined |  |
| Supplier Selection | Issue Request for Proposal (RFP) | Procurement Team | RFP documents | Proposals from potential suppliers received | 4 weeks |
| Supplier Selection | Evaluate supplier proposals | Finance Team | Evaluation criteria checklist | Best suppliers shortlisted |  |
| Supplier Selection | Select suppliers | Legal Team | Legal consultancy | Contracts ready for negotiation |  |
| Negotiation and contracting | Negotiate terms and conditions | Senior Management | Negotiation experts | Favorable terms agreed with suppliers | 3 weeks |
| Negotiation and contracting | Draft and sign contracts | Legal Team | Contract drafting resources | Formal agreements with multiple suppliers |  |
| Implementation Planning | Develop implementation plan | Project Management Office (PMO) | Project management tools | Detailed implementation roadmap | 2 weeks |
| Implementation Planning | Allocate resources | HR Team | Resource allocation software | Required resources allocated |  |
| Pilot Testing | Pilot procurement with selected suppliers | Supply Chain Team | Inventory management systems | Pilot test results and feedback | 6 weeks |
| Pilot Testing | Quality check of received materials | Quality Control Team | Quality testing equipment | Quality of supplies validated |  |
| Full-Scale Implementation | Roll out full-scale procurement | Supply Chain Team | Procurement systems | Steady and reliable supply established | 12 weeks |
| Full-Scale Implementation | Monitor and evaluate supplier performance | Procurement Team | Supplier performance monitoring tools | Continuous improvement in supply chain performance |  |
| Continuous Improvement | Regular review meetings with suppliers | Senior Management | Meeting schedules and reports | Ongoing optimization of supplier relationships | Ongoing |
| Continuous Improvement | Update procurement strategy based on feedback | Procurement Team | Feedback and review systems | Adaptive and resilient procurement strategy |  |

**Stakeholder List**

|  |  |  |
| --- | --- | --- |
| **Department** | **Role** | **Function** |
| Procurement | Procurement Team | Create RFPs, list possible vendors, review proposals, and control supplier performance. |
| Quality Assurance | Quality Assurance Team | Verify supply quality and do feasibility studies. |
| Finance | Finance Team | Evaluate supplier proposals and assist in financial negotiations |
| Legal | Legal Team | Provide legal consultancy and draft/sign contracts |
| Senior Management | Senior Management | Bargain on terms and conditions, then schedule frequent supplier review sessions. |
| Project Management Office (PMO) | Project Management Team | Develop and oversee the implementation plan |
| Human Resources | HR Team | Allocate necessary resources |
| Supply Chain | Supply Chain Team | Track supplier performance, roll out fullscale procurement, and practice pilot procurement. |
| Quality Control | Quality Control Team | Perform quality checks on received materials |

**Communication Plan**

**Pre-Implementation**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Stakeholder** | **Meeting Title** | **Description** | **Input** | **Output** | **Frequency** | **Channel** |
| Senior Management | Project Kickoff Meeting | Initiate project and align on objectives | Project proposal, timeline | Project charter, agreed milestones | Once | In-person/Video call |
| Procurement Team | Supplier Identification | Discuss potential suppliers and criteria | Market research reports | List of potential suppliers | Weekly | Video call |
| Quality Assurance Team | Feasibility Study Planning | Plan feasibility studies for shortlisted suppliers | Supplier profiles | Feasibility study plan | Bi-weekly | Email/Video call |
| Legal Team | Contract Drafting Meeting | Draft initial contracts and legal frameworks | Supplier information, terms | Draft contracts | As needed | In-person/Video call |

**While Implementing**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Stakeholder | Meeting Title | Description | Input | Output | Frequency | Channel |
| Procurement Team | Supplier Selection Meeting | Evaluate and select suppliers | Supplier proposals | Selected suppliers | Weekly | Video call |
| Finance Team | Budget Review Meeting | Review and approve budgets for supplier contracts | Supplier proposals, budgets | Approved budgets | Bi-weekly | In-person/Video call |
| Project Management Team | Implementation Planning Meeting | Develop a detailed implementation plan | Project charter, resources | Detailed implementation plan | Weekly | Video call |
| Supply Chain Team | Pilot Testing Review | Monitor pilot testing phase and address issues | Pilot test results | Feedback and action items | Weekly | In-person/Video call |
| Quality Control Team | Quality Check Meeting | Ensure quality standards are met | Quality reports | Quality assurance reports | Weekly | On-site/Video call |

**Post-implementation**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Stakeholder | Meeting Title | Description | Input | Output | Frequency | Channel |
| Senior Management | Project Review Meeting | Review overall project performance and outcomes | Final project report | Lessons learned, next steps | Monthly | In-person/Video call |
| Procurement Team | Supplier Performance Meeting | Evaluate ongoing supplier performance | Performance metrics | Supplier performance reports | Monthly | Video call |
| Supply Chain Team | Continuous Improvement Meeting | Discuss improvements and adjustments | Feedback and performance data | Improvement action plan | Monthly | Video call |
| All Teams | Post-Implementation Debrief | Debrief on project outcomes and experiences | Project outcomes, team feedback | Comprehensive debrief report | Once | In-person/Video call |

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