

1. Introduction

- Importance of risk assessment for product quality/supply chain
- Use of quantitative analysis → simulated and non-simulated
 - MCS
 - TOPSIS
 - SMART
 - Conditional probability
- Remaining report layout

2. Quality and Safety Risks

- Layout of section

2.1 Preliminary Risk Assessment

- Operational and Hazardous risk importance
- Role in qualitative analysis – simulated and non-simulated

Table 1: Risks to Product Quality & Supply Chain

Operational Risks	Hazardous Risks
<p>Internal</p> <p style="padding-left: 40px;">Cyber Threats</p> <ul style="list-style-type: none"> Excavation Hardware integrity attack Malicious logic insertion Manipulation during distribution Metadata Spoofing Modification during manufacture Resource location spoofing Software integrity attack <p>External</p> <p style="padding-left: 40px;">Product Quality</p> <ul style="list-style-type: none"> Raw materials Regional standards Transport Interruption 	<p>External</p> <p style="padding-left: 40px;">Natural Disasters</p> <ul style="list-style-type: none"> Earthquake Flood Snow/ice Powergrid failure Hurricane Landslide Storm <p style="padding-left: 40px;">Climate Change</p> <ul style="list-style-type: none"> Drought Extreme Heat Wildfire

2.2 Historical and Non-Simulated Risk Data

- Importance of historical / objective data in risk assessment
- section layout

2.2.1 Natural and Man-Made Disasters

- Explanation of quan analysis (Appendix I)
- Explanation of data

- Implications for possible mitigations

Table 2: Natural and Man-Made Disasters 1980-2021 by Probability

Disaster Category	Country					
	France	Germany	Greece	Italy	Netherlands	Romania
Climatological	1.45%	0.09%	1.45%	1.03%	0.00%	0.17%
Geophysical	0.09%	0.17%	2.22%	2.22%	0.09%	0.26%
Hydrological	5.39%	1.88%	2.22%	4.62%	0.34%	4.36%
Meteorological	8.04%	5.90%	1.28%	2.99%	2.82%	2.48%
Technological	5.22%	3.85%	4.02%	7.10%	1.37%	1.80%
Total % (Country)	20.19%	11.89%	11.21%	17.96%	4.62%	9.07%

Disaster Category	Country				Total % (Category)
	Poland	Portugal	Spain	UK	
Climatological	0.26%	1.54%	1.88%	N/A	7.87%
Geophysical	0.09%	0.00%	0.17%	N/A	5.30%
Hydrological	1.28%	0.94%	2.74%	N/A	23.78%
Meteorological	3.59%	1.37%	2.91%	N/A	31.39%
Technological	1.88%	1.28%	5.13%	N/A	31.65%
Total % (Country)	7.10%	5.13%	12.83%	N/A	100.00%

2.2.2 Cyber Security Vulnerabilities

- CAPEC supply chain (can also effect product quality)
- Explain. of quan analysis (Appendix II)
- Explain. of relevant data (Appendix III)

Table 3: TOPSIS Pi Top Ten (Ver 2)

Vulnerability	Pi	Percentage
Leveraging/Manipulating Configuration File Search Paths	1	1.27%
WSDL Scanning (var. 1)	0.91	1.27%
WSDL Scanning (var. 2)	0.83	1.27%
Directory Indexing (var. 1)	0.82	1.27%
Bluetooth Impersonation Attacks (BIAS)	0.82	1.27%
Repo Jacking	0.82	1.27%
Collect Data from Registeries	0.76	1.27%
Collect Data from Screen Capture	0.76	1.27%
Metadata Spoofing	0.76	1.27%

Altered Component Firmware (var. 3)

0.73

1.27%

Total Attack Surface:**12.66%**

2.3 Pampered Pets' Simulated Risk Assessment

- Explanation of simulated assessment
- Explanation of MCS
- Explanation of intent and assumptions

2.3.1 Assessment Results

- Explanation of data
- Possible implications

Table 4: Monte Carlo Simulation – Product Quality & Supply Chain Risk

Risk Category	Target	Timeframe	Subjective Prob.	Quantitative Prob.
Cloud server breach	Inventory	>24 months	20%	5%
Supply chain disruption	Ingredients	<12 months	10%	7%
Warehouse disruption	Orders	<12 months	66%	5%
Warehouse disruption	Machine failure	<18 months	10%	1%
Cloud server breach	Supplier info	>24 months	5%	4%
Warehouse disruption	Power outage	< 24 months	3%	5%
Supply chain disruption	Flooding	>36 months	7%	5%
Supply chain disruption	Drought	>48 months	2%	4%

Risk Category	90% Confidence Interval		Std. Deviation	Financial Impact
	Lower Range	Upper Range		
Cloud server breach	\$2,000,000	\$3,000,000	0.1232417	\$2,458,486.01
Supply chain disruption	\$40,000	\$60,000	0.1232417	\$54,470.46
Warehouse disruption	\$70,000	\$105,000	0.1232417	\$93,423.34
Warehouse disruption	\$250,000	\$380,000	0.1272676	\$362,304.74
Cloud server breach	\$70,000	\$155,000	0.24162	\$95,763.21
Warehouse disruption	\$90,000	\$150,000	0.1552661	\$122,324.88
Supply chain disruption	\$240,000	\$500,000	0.2230909	\$341,853.60
Supply chain disruption	\$180,000	\$260,000	.1117704	\$231,815.70

Table 5: Pampered Pets' Risk Assessment Conclusions

Avg. Subjective Probability	Avg. Quantitative Probability	Potential Disruption Cost
15.3%	4.45%	\$2,693,846.51

2.4 Possible Mitigations

- Why mitigations are necessary

2.3.1 Natural and Man-Made Disaster Mitigation

- Assumptions of mitigation plan

- Quantitative simulation

-Why another Monte Carlo?

- Data implications

Table 6: Monte Carlo Simulation – Inventory

Policy	Observation Count	Mean Profit	Std. Deviation	Minimum Profit	Maximum Profit
1	5000	\$230,075.88	54397.63	\$165,468	\$318,210
2	5000	\$230,599.23	54269.19	\$166,105	\$317,606
3	5000	\$230,960.33	54432.20	\$166,105	\$317,606
4	5000	\$231,867.46	54401.95	\$165,637	\$318,210
5	5000	\$230,749.71	54342.21	\$165,637	\$318,210
6	5000	\$230,837.02	54287.12	\$165,217	\$316,768
7	5000	\$230,506.15	54371.16	\$165,217	\$316,768

Table 7: MC Simulation – Stock, 24 Months

Policy	Order Cost	Sales Revenue	Holding Cost	Out-of-Stock	O-of-S Prob.	Salvage Value
1	\$104,650	\$432,268	\$108,015	0	0%	\$15,099
2	\$104,650	\$536,030	\$84,496	2	8%	\$17,682
3	\$3,600	\$57,000	\$4,957	22	92%	\$300
4	\$109,800	\$540,335	\$178,415	0	0%	\$30,699
5	\$8,050	\$78,500	\$4,857	22	92%	\$900
6	\$10,800	\$73,200	\$5,257	22	92%	\$1,200
7	\$12,650	\$100,500	\$4857	22	92%	\$1,500

Policy	Overall Rating	Risk of Loss
2	Middle	33%
3	Worst	200%
4	Best	0%

- Explanation of SMART (Appendix IV)

- Why not include risk prob score from above: UK was not included, skewed data

- Subjective quant. analysis based on what PP is assumed to value

- Implications of data if the above is to be utilized

Table 8: SMART Calculation -- Supplier by Country

Supplier Country	Crop Output (€M)	Crop Price	Animal Output (€M)	Animal Price
France	€47,973.66	€128.30	€26,847.40	€112.80
Germany	€29,698.62	€129.30	€25,917.59	€116.50
Greece	€8,725.22	€156.10	€2,455.55	€125.80
Italy	€34,283.10	€124.30	€16,353.91	€113.70
Netherlands	€15,671.56	€118.70	€10,954.00	€113.50
Poland	€13,620.87	€131.10	€13,584.02	€117.20
Portugal	€6,072.62	€126.60	€3,053.82	€115.20
Romania	€15,028.32	€334.50	€4,245.42	€287.30
Spain	€34,999.84	€121.40	€20,478.57	€116.10
UK	€9,803.06	€164.40	€16,574.00	€150.10

Supplier Country	Organic Crops (tonne)	Organic Livestock (head)	SMART Score
France	692,243.00	860,308.00	86.57
Germany	0.00	861,272.00	65.34
Greece	152,118.00	163,066.00	31.85
Italy	968,425.00	397,187.00	80.81
Netherlands	19,591.00	76,069.00	48.20
Poland	315,269.00	31,102.00	43.03
Portugal	0.00	92,673.00	35.03
Romania	229,794.00	19,870.00	11.85
Spain	382,153.00	219,769.00	65.82
UK	129,297.00	300,788.00	32.98

2.3.2 Cyber Security Risk Mitigations

- CAPEC list of mitigations

[Table here]

3. Disaster Recovery

3.1

(Appendix V)

4. End Summary

5. Appendix

5.1

5.2

6. References