Master of Science in Project Management

Risk Management

Acquisition of Costa Coffee by Coca-Cola

Applying PEST Framework to Identify Associated Risks

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1. Background

The Coca-Cola Company recently announced that it has reached a definitive agreement to acquire Costa Limited, which was established in London in 1971 and has expanded to become a major coffee brand across. Costa operations include nearly 4,000 retail outlets with trained baristas. Costa is considered as the leading coffee company in the UK and has a growing footprint in China and other emerging markets. the global.

Figure 1 Costa and Coca-Cola

The acquisition of Costa was valued around $5.1 billion and will give Coca-Cola a powerful coffee industry platform across parts of Europe, the Middle East, Asia Pacific and Africa, with a potential for additional expansion in new markets. It will also bring to Coca-Cola valuable know-how and expertise in the fast-growing industry.

The general list of the objectives for this acquisition are:

- Financial Objectives
  - Maximizing the value of the deal
  - Diversifying and securing their portfolio
  - Reducing operational cost
- Market Objectives
  - Geographic expansion
  - Expanding into the fast-growing coffee market
  - Having new customers

- o Having a better brand reputation
- Operational Objectives
  - o Acquiring talents and expertise across the coffee supply chain
  - o Integrating Coca Cola and Costa capabilities to introduce new products
  - o Adopting new management and leadership practices

The goal for this project is to perform risk analysis and management for this acquisition with applying PEST (Political, Economic, Social, Technological) analysis for identifying risk sources.

We will start with identifying the events that could happen and have impact on the project which Coca-Cola may face, and we will identify the sources for those events. Then we will present how we measured the likelihood and impact of the events and their interdependency with the sources and will analyze the resulted risks. Finally, we will move into discussing the risk controls, their identification and assessment, and how to select of optimize risk controls.

All of these activities were performed in Riskion software that is used by professionals responsible for identifying and analyzing losses that can occur in an organization, activity, or process, from the occurrence of one or more risk events. It provides a mechanism for executive, mid-level, and operational managers to collaborate in identifying, analyzing, and reducing risks to their organization.

The audience for this analysis would be Coca Cola's executives, as the analysis will be performed from their perspective, and the potential risk is expected to be valid for about 5 years of operation.

2. Risk Identification

Many companies and organizations have difficulties in performing comprehensive risk management. The main reason is the inconsistency and illusion in identifying risk. First, it's important to distinguish between risk-we-face and risk-we-take, where a risk is an uncertain event that results in losses to our objectives, as discussed in Enterprise Risk

Management -A New Paradigm, by Forman. In risk-we-face, we focus on events that organizations may face which can result in losses to organizations' objectives. It is what we call it risk analysis and management, and it is the focus of this report analysis. On the other hand, risk-we-take is related to decision analysis when choosing alternatives or a combination of alternatives.

Regarding the acquisition of Costa Coffee by Coca-Cola, we identified twelve uncertain events that matter to Coca-Cola:

1) Return on investing and acquiring Costa is less than expected
2) Unsuccessful integration for the businesses
3) Disruption of their ongoing businesses and products
4) Losing some of their mutually exclusive loyal customers
5) Facing threatening legal events: expiring patents, lawsuits, hidden liabilities
6) Losing key employees
7) Challenges and mismanagement of cultural issues
8) Slow response for the fast-changing market
9) Customer rejection for new products
10) Inconsistent plans and execution, contradicting strategies
11) Inability to maintain good relationships with the vendors
12) Inability to expand operations in emerging markets

We also identified the sources or causes of loss in a hierarchical structure:

- Political:
  - Industry-specific regulations
  - Local content and employment requirements
- Economic:
  - Inadequate process of the due diligence to assess Costa
  - New competitors with undiscovered competition strategies
  - Challenges with obtaining the necessary financing
- Social:

- o Unhealthy reputation about Coca Cola products
- o Changes in the benefits and salaries for the employees
- o Different cultures inside the two companies
- o Different values for the two companies
- o Uncertainty of customers loyalty due to pressure on sugary beverages
- o Contribution in pollution
- o Recycling requirements
- Technological:
  - o Different standards of the two companies
  - o Poor integration of the systems in the two companies
  - o Management unfamiliarity with the other company's dynamics
  - o Inefficient organizational communications
  - o Disturbance on Coca-Cola's strategy on its main products

Then, many relationships were identified given the objectives, events, and causes or threats. First, we identified the vulnerabilities of the events to the threats and identified links between them, which will help later in measuring the likelihood of the events. Also, we identified the consequences of each event on objectives, which will help later in measuring the impact of events on objectives.

Events	Industry-specific	Local content and	Inadequate proce	New competitors	Challenges with o	Unhealthy reputat	Changes in the b	Different cultures	Different values fo	Uncertainty of cu	Contribution in po	Recycling require	Different standard	Poor integration o	Management unf	Inefficient organiz	Disturbance on C
Return on investing and a			✔		✔												
Unsuccessful integration													✔	✔			
Disruption of their ongoin				✔	✔								✔	✔			✔
Loss of some of their mut									✔	✔	✔						
Loss of aggressive court		✔	✔														
Loss of key employees				✔			✔		✔								
Challenges and mismana								✔								✔	
Slow response to the fast				✔										✔	✔		
Customer rejected new p						✔			✔	✔	✔						
Inconsistent plans and ex									✔					✔	✔	✔	✔
Inability to maintain good	✔	✔				✔				✔							
Inability to expand operat	✔	✔			✔						✔	✔			✔		

Figure 2 Events vulnerabilities Grid

3. Measuring Likelihood and Impact of Events

To have a clear understanding of risks and then how to deal with them, we need to measure risks. Measuring risk require measuring and synthesizing causes likelihoods, events likelihoods given sources, objectives importance and priorities, and events consequences to objectives. The measurements need to be practical and scientifically valid measurements that incorporate ration scale measures which have no restrictions on mathematical operations.

In Riskion, there a variety of measurement methods that are available for deriving ratio scale measures:

1) Pairwise comparisons

   It expresses how much more likely or important one element of a pair is than the other. This method derives accurate priorities from pairwise judgments, even when judgments were in a verbal form, and that is due to the eigenvector computations that are involved in. There is also an option to have pairwise comparisons with a given likelihood when we know the likelihoods of some elements.

2) Rating scale

   It is helpful to use rating scale method when pairwise comparisons are too time consuming.

3) Direct entry

   This method is used when data is available, either from historical observations or scientific instruments.

4) Utility curve

   This method is also used when data is available, and a utility curve is used to translate data to priorities.

5) Step function

   It is a combination between some properties of rating scales and utility curves. It has rating intensities, and priorities are derived using pairwise comparisons.

Measure Likelihood	Measurement Type	Measurement Scale or Given Likelihood	Action	# of Elements, # of Probabilities	# of Judgments in Cluster	# of Comparisons Default: All pairs (maximum accuracy)	Display Default: One pair	Pairwise Type Default: Verbal
▲ Sources	Pairwise with Give ▾	Technological: 0.35	Copy	4	4-1 = 3	One diagonal (lea ▾	All pairs ▾	Verbal ▾
▲ Political	Utility Curve ▾	Default Utility Curve For Likelihood ▾	Copy Edit	2	2			
Industry-specific regulations								
Local content and employment requirem								
▲ Economic	Pairwise with Give ▾	Challenges with obtaining the …: 0.0!	Copy	3	3-1 = 2	One diagonal (lea ▾	All pairs ▾	Graphica ▾
Inadequate process of the due diligence								
New competitors with undiscovered com								
Challenges with obtaining the necessary								
▲ Social	Rating Scale ▾	Default Likelihood Scale ▾	Copy Edit	7	7			
Unhealthy reputation about Coca Cola pr								
Changes in the benefits and salaries for								
Different cultures inside the two compani								
Different values for the two companies								
Uncertainty of customers loyalty due to p								
Contribution in pollution								
Recycling requirements								
▲ Technological	Rating Scale ▾	MID LIKELIHOOD RATING SCALE ▾	Copy Edit	5	5			
Different standards of the two companies								
Poor integration of the systems in the two								
Management unfamiliarity with the other								
Inefficient organizational communications								
Disturbance on Coca-Cola's strategy in it								

Figure 3 Measurement options page in Riskion

In our project, we used a variety of these method to derive ratio scale measures for our assessments. We also identified participants and their roles to help in these evaluations and judgments.

4. Analyzing Risks

Our risk register shows all events and their computed likelihood, impact and risk. The simulated results using Monte Carlo simulation are used since they are more realistic than the computed ones and it can overcome the non-linearity issue in computing the likelihood. The computed results are exaggerated because of the issue of double counting in the event likelihood when the event is caused by more than one source if these sources are not mutually exclusive. The computed risk result for this acquisition is 17.56% and the simulated risk result is 14.11%.

| No. ▲ | Event | | All Participants | | |
			Likelihood Computed	Impact Computed	Risk Computed
[01]	Return on investing and acquiring Costa is less than expected	≡	1.31%	26.26%	0.34%
[02]	Unsuccessful integration for the businesses	≡	18.28%	15.77%	2.88%
[03]	Disruption of their ongoing businesses and products	≡	18.10%	17.89%	3.24%
[04]	Loss of some of their mutually exclusive loyal customers	≡	0.53%	9.88%	0.05%
[05]	Loss of aggressive court cases: expiring patents, lawsuits, or hidden liabilities	≡	1.23%	48.42%	0.60%
[06]	Loss of key employees	≡	0.63%	8.46%	0.05%
[07]	Challenges and mismanagement of cultural issues	≡	9.94%	11.36%	1.13%
[08]	Slow response to the fast-changing market	≡	15.75%	14.86%	2.34%
[09]	Customer rejected new products	≡	2.20%	31.09%	0.69%
[10]	Inconsistent plans and execution, contradicting strategies	≡	16.32%	27.45%	4.48%
[11]	Inability to maintain good relationships with the vendors	≡	0.69%	12.30%	0.08%
[12]	Inability to expand operations in emerging markets	≡	5.57%	29.98%	1.67%
					Computed
				Total Risk	17.56%

Figure 4 Computed risk register

The analysis shows that the highest risk event is the inconsistent plans and execution, and contradicting strategies. That event has a high impact and likelihood, which resulted in being the highest risk.

| No. ▲ | Event | | All Participants | | |
			Likelihood Simulated	Impact Simulated	Risk Simulated
[01]	Return on investing and acquiring Costa is less than expected	≡	1.00%	21.06%	0.21%
[02]	Unsuccessful integration for the businesses	≡	17.10%	12.62%	2.16%
[03]	Disruption of their ongoing businesses and products	≡	17.90%	15.56%	2.79%
[04]	Loss of some of their mutually exclusive loyal customers	≡	0.70%	8.48%	0.06%
[05]	Loss of aggressive court cases: expiring patents, lawsuits, or hidden liabilities	≡	1.50%	41.09%	0.62%
[06]	Loss of key employees	≡	0.50%	7.60%	0.04%
[07]	Challenges and mismanagement of cultural issues	≡	9.10%	9.74%	0.89%
[08]	Slow response to the fast-changing market	≡	14.40%	12.89%	1.86%
[09]	Customer rejected new products	≡	2.20%	26.81%	0.59%
[10]	Inconsistent plans and execution, contradicting strategies	≡	14.90%	22.50%	3.35%
[11]	Inability to maintain good relationships with the vendors	≡	0.80%	10.48%	0.08%
[12]	Inability to expand operations in emerging markets	≡	5.80%	25.44%	1.48%
					Simulated
				Total Risk	14.11%

Figure 5 Risk register using simulation

To calculate the monetary equivalent for risks of the acquisition, we entered in the software the total value of the acquisition was $5.1 billion. Based on this value, RISKION calculates the associated monetary equivalents for each risk, as well as the total risk which equals to $719,690,892.

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No. ▲	Event		Likelihood Simulated	Impact, $ Simulated	Risk, $ Simulated
				All Participants	
[01]	Return on investing and acquiring Costa is less than expected	≡	1.00%	1,074,213,957	10,742,139
[02]	Unsuccessful integration for the businesses	≡	17.10%	643,604,979	110,056,451
[03]	Disruption of their ongoing businesses and products	≡	17.90%	793,789,549	142,088,329
[04]	Loss of some of their mutually exclusive loyal customers	≡	0.70%	432,702,461	3,028,917
[05]	Loss of aggressive court cases: expiring patents, lawsuits, or hidden liabilities	≡	1.50%	2,095,566,131	31,433,491
[06]	Loss of key employees	≡	0.50%	387,490,506	1,937,452
[07]	Challenges and mismanagement of cultural issues	≡	9.10%	496,829,249	45,211,461
[08]	Slow response to the fast-changing market	≡	14.40%	657,159,899	94,631,025
[09]	Customer rejected new products	≡	2.20%	1,367,424,544	30,083,339
[10]	Inconsistent plans and execution, contradicting strategies	≡	14.90%	1,147,324,063	170,951,285
[11]	Inability to maintain good relationships with the vendors	≡	0.80%	534,609,659	4,276,877
[12]	Inability to expand operations in emerging markets	≡	5.80%	1,297,415,871	75,250,120
				Simulated Total Risk	Simulated $719,690,892

Figure 6 Risk register with monetary equivalents

One way to look at the analysis is by Bow-Tie diagrams. For each event, a bow-tie diagram shows its causes on left-hand side with their likelihoods, and the affected objectives on the right-hand side with percentages of the impact. The letter "L" represents the likelihood of the cause, "V" -vulnerability- represents the likelihood of the event given the cause, "P" represents the priority of objectives, and "C" represents the consequences of the event on the objectives. By multiplying the likelihood of an event by its impact, we can have the event risk.
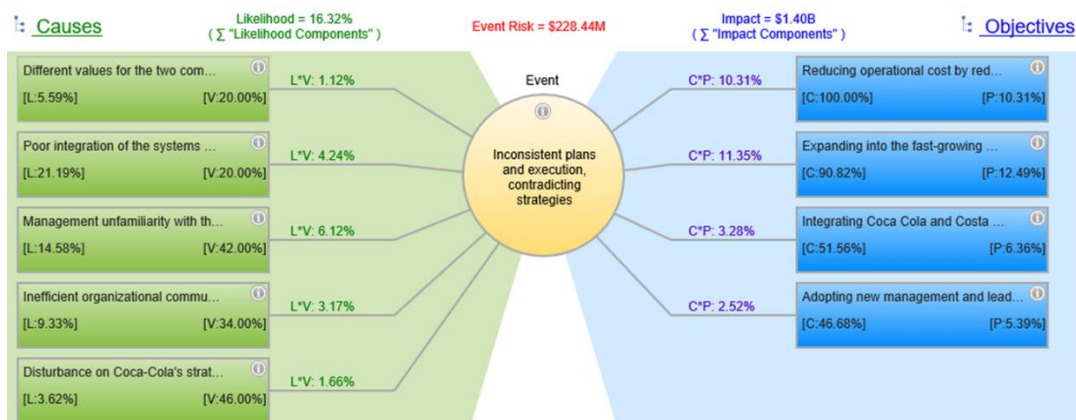
Figure 7 Example of Bow-Tie diagram for an event

The loss exceedance curve shows us that there is 5% chance of losing more than $2.5B in our project. It also shows that there is 21% chance of losing more than $1.5B.
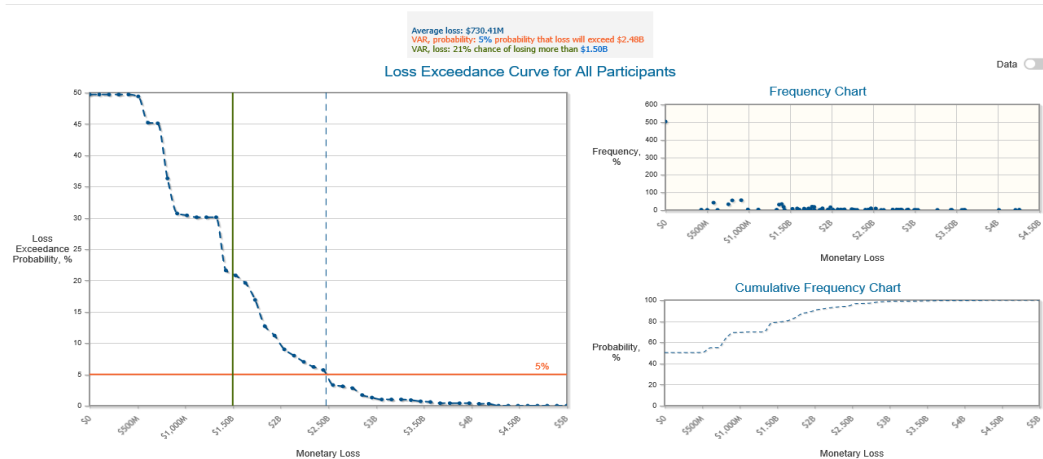
Figure 8 Loss exceedance curve

The heat map graph shows the risk "impact vs. likelihood" for all events and distributes the events in regions based on their risk values.
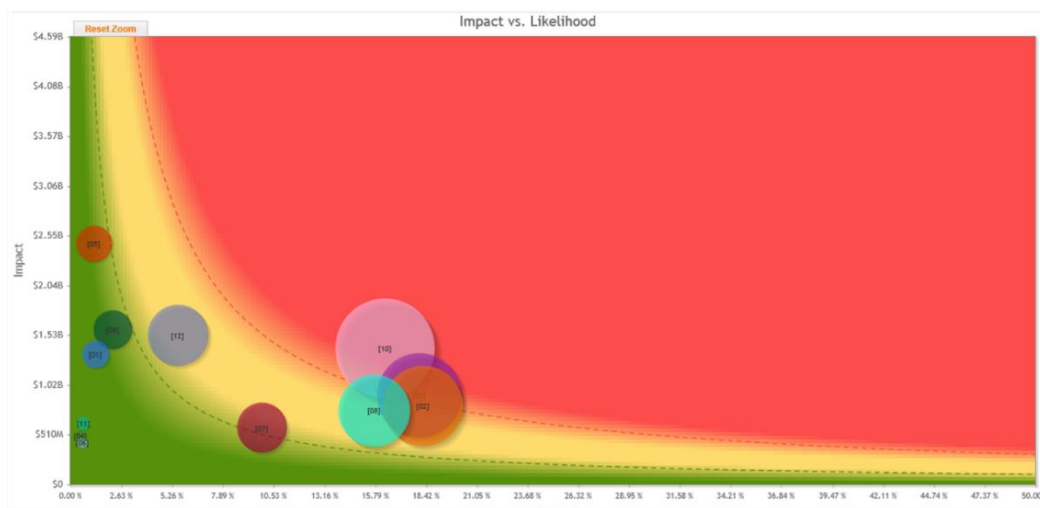
Figure 9 Heat map

The sensitivity analysis shows the relation between risks and objectives. It shows the overall risks based on the importance and priorities of the objectives, and we can see how risks change when changing the importance of objectives. Therefore, we say that risk itself is subjective as the importance of objectives is subjective.
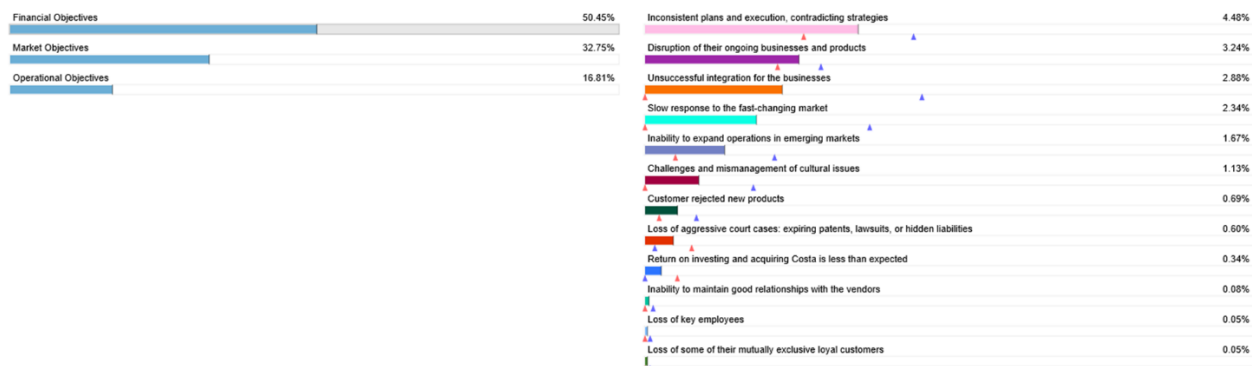
Figure 10 Sensitivity analysis

5. Identifying and Assessing Risk Controls

As we identified and measured the risks for our project, we can now manage and reduce the risks by applying controls. Controls can be applied to reduce the likelihood of sources, reduce the likelihood of events given sources, and to reduce the impact of event on objectives.

Controls for "RM Project 2018: KA_YA_Applying PEST Framework to Identify Risks Associated with..."

Selected controls: 14
Cost Of Selected Controls: $10,170,000 (unfunded: $0)
Total Cost Of All Controls: $10,170,000

Index ▲	☐	Control Name		Control for	Selected ⇕	Cost ≡ ⇕	Applications ⇕	Categories ⇕
01	☐	Developing unified quality standards	≡	Cause ⌄	Yes	300000	1	✛
02	☐	Advertising campaigns	≡	Cause ⌄	Yes	2000000	4	✛
03	☐	Maintaining Costa's key management staff	≡	Cause ⌄	Yes	1000000	2	✛
04	☐	Contracting with IT systems specialized company for systems integration	≡	Cause ⌄	Yes	100000	2	✛
05	☐	Adding new benefits for employees	≡	Cause ⌄	Yes	1500000	1	✛
06	☐	Spending efforts in identifying common and separate objectives and strategies	≡	Cause ⌄	Yes	20000	3	✛
07	☐	Monthly market analysis reports	≡	Cause ⌄	Yes	700000	7	✛
08	☐	Hiring a legal specialist	≡	Cause ⌄	Yes	500000	3	✛
09	☐	Provide intensive trainings for managers	≡	Vulnerability ⌄	Yes	400000	12	✛
10	☐	Using environment friendly packaging materials	≡	Vulnerability ⌄	Yes	1000000	13	✛
11	☐	Introducing new healthy products	≡	Vulnerability ⌄	Yes	50000	9	✛
12	☐	Hiring organizational communication expert	≡	Consequence ⌄	Yes	500000	19	✛
13	☐	Processing the due diligence carefully	≡	Consequence ⌄	Yes	100000	5	✛
14	☐	Contracting with insurance companies	≡	Consequence ⌄	Yes	2000000	6	✛

Figure 11 Risk controls

12

We identified 14 controls for our project, as well as their costs. Some of them are for the reducing the likelihood of sources, likelihood of events given sources, or consequences of events on objectives. For each type of controls, the measurements method was identified, and the relations and effectiveness levels were identified and evaluated by the project participants.

	Email	Participant Name		Permission	Has Data
☐	Financialexpert@gwu.edu	Financial Expert		Evaluator	Yes
☐	alsulaiman@gwmail.gwu.edu	Khalid Alsulaiman (Project Manager)		Evaluator	Yes
☐	Marketingexpert@gwu.edu	Marketing Expert		Evaluator	Yes
☐	nstavrakakis@gwu.edu	Nicholas Stavrakakis		Project Manager	
☐	forman@gwu.edu	Professor Forman		Project Manager	
☐	Technialexpet@gwu.edu	Technical Expert		Evaluator	Yes
☐	alshaya@gwu.edu	Yousef Saleh Alshaya (Project Manager)		Project Manager	Yes

Figure 12 Project evaluations participants

If we decided to choose selecting all controls, this will cost Coca-Cola $10,170,000 and the total risk cost will go down from $730,409,996 to $132,668,077.

Select Controls

Total Risk*: $730,409,996
Risk With Selected Controls*: $132,668,077 (Δ: $597,741,918)
Risk With All Controls: $132,668,077 (Δ: $597,741,918)
☑ Show Monetary Values (Value of Enterprise: $5,100,000,000) ✎

Selected controls: 14
Cost Of Selected Controls: $10,170,000 (unfunded: $0)
Total Cost Of All Controls: $10,170,000

Simulations Settings
Number of trials: 1000 Seed: 498 ☑ Keep Seed

Figure 13 Controls total cost and their result on risk

The question now is whether it's efficient to spend all that budget on risk controls or not, also it depends on how much budget do Coca-Cola plans to have for that. Therefore, we need to select some of those controls, either manually or by optimization, which is discussed in the next part.

7. Selecting and Optimizing Risk Controls

We can either select some of the controls manually based on some management strategies, or we can ask the software to optimize choosing the controls based on a budget

or risk limit. If we decided that the budget limit for controls is $4000,000 and we chose to select manually the controls, we selected 8 risk controls as shown in Fig.13 which will cost $3,770,000 and the resulted risk reduction will be $530,202,127.

Select Controls

Total Risk*: $730,409,996
Risk With Selected Controls*: $200,207,868 (Δ: $530,202,127)
Risk With All Controls: $132,668,077 (Δ: $597,741,918)

Selected controls: 8
Cost Of Selected Controls: $3,770,000 (unfunded: $6,400,000)
Total Cost Of All Controls: $10,170,000

Simulations Settings
Number of trials: 1000   Seed: 498 ✓ Keep Seed

☑ Show Monetary Values (Value of Enterprise: $5,100,000,000) ✎

Index ▲	Selected	Control Name		Control for	Selected	Cost ≡	Applications		Categories	Must	Must Not
01	☑	Developing unified quality standards	≡	Cause	Yes	300000	1	✛		☐	☐
02	☐	Advertising campaigns	≡	Cause		2000000	4	✛		☐	☐
03	☐	Maintaining Costa's key management staff	≡	Cause		1000000	2	✛		☐	☐
04	☑	Contracting with IT systems specialized company for systems integration	≡	Cause	Yes	100000	2	✛		☐	☐
05	☐	Adding new benefits for employees	≡	Cause		1500000	1	✛		☐	☐
06	☑	Spending efforts in identifying common and separate objectives and strategies	≡	Cause	Yes	20000	3	✛		☐	☐
07	☑	Monthly market analysis reports	≡	Cause	Yes	700000	7	✛		☐	☐
08	☐	Hiring a legal specialist	≡	Cause		500000	3	✛		☐	☐
09	☐	Provide intensive trainings for managers	≡	Vulnerability		400000	12	✛		☐	☐
10	☐	Using environment friendly packaging materials	≡	Vulnerability		1000000	13	✛		☐	☐
11	☑	Introducing new healthy products	≡	Vulnerability	Yes	50000	9	✛		☐	☐
12	☑	Hiring organizational communication expert	≡	Consequence	Yes	500000	19	✛		☐	☐
13	☑	Processing the due diligence carefully	≡	Consequence	Yes	100000	5	✛		☐	☐
14	☑	Contracting with insurance companies	≡	Consequence	Yes	2000000	6	✛		☐	☐

Figure 14 Manual controls selection

However, when we asked the software to optimize our risk controls selection, given the same budget limit, the optimized number of controls became 10 risk controls, which will cost $3,670,000 and the risk reduction was $588,418,973.

Controls optimization for "RM Project 2018: KA_YA_Applying PEST Framework to Identify Risks Associated with…"

Total Risk*: $730,409,996
Risk With Selected Controls*: $141,991,022 (Δ: $588,418,973)
Risk With All Controls: $132,668,077 (Δ: $597,741,918)
Selected controls: 10
Cost Of Selected Controls: $3,670,000 (unfunded: $6,500,000)
Total Cost Of All Controls: $10,170,000

Budget Limit: $ 4,000,000

☑ Show Monetary Values (Value of Enterprise: $5,100,000,000)

Index ▲	Selected	Control Name	Control for	Selected	Cost	Applications	Categories	Must	Must Not
01	☑	Developing unified quality standards	Cause	Yes	300000	1		☐	☐
02	☐	Advertising campaigns	Cause		2000000	4		☐	☐
03	☑	Maintaining Costa's key management staff	Cause	Yes	1000000	2		☐	☐
04	☑	Contracting with IT systems specialized company for systems integration	Cause	Yes	100000	2		☐	☐
05	☐	Adding new benefits for employees	Cause		1500000	1		☐	☐
06	☑	Spending efforts in identifying common and separate objectives and strategies	Cause	Yes	20000	3		☐	☐
07	☑	Monthly market analysis reports	Cause	Yes	700000	7		☐	☐
08	☑	Hiring a legal specialist	Cause	Yes	500000	3		☐	☐
09	☑	Provide intensive trainings for managers	Vulnerability	Yes	400000	12		☐	☐
10	☐	Using environment friendly packaging materials	Vulnerability		1000000	13		☐	☐
11	☑	Introducing new healthy products	Vulnerability	Yes	50000	9		☐	☐
12	☑	Hiring organizational communication expert	Consequence	Yes	500000	19		☐	☐
13	☑	Processing the due diligence carefully	Consequence	Yes	100000	5		☐	☐
14	☐	Contracting with insurance companies	Consequence		2000000	6		☐	☐

Figure 15 Optimized controls selection

In the case that the management decided to cut the budget limit for controls into half to be $2,000,000, the optimized number of selected risk controls became 5 controls as shown in Fig. 15 and the budget for the risk reduction was $505,714,537.

Controls optimization for "RM Project 2018: KA_YA_Applying PEST Framework to Identify Risks Associated with…"

Total Risk*: $730,409,996
Risk With Selected Controls*: $224,695,458 (Δ: $505,714,537)
Risk With All Controls: $132,668,077 (Δ: $597,741,918)
Selected controls: 5
Cost Of Selected Controls: $2,000,000 (unfunded: $8,170,000)
Total Cost Of All Controls: $10,170,000

Budget Limit: $ 2,000,000

☑ Show Monetary Values (Value of Enterprise: $5,100,000,000)

Index ▲	Selected	Control Name	Control for	Selected	Cost	Applications	Categories	Must	Must Not
01	☑	Developing unified quality standards	Cause	Yes	300000	1		☐	☐
02	☐	Advertising campaigns	Cause		2000000	4		☐	☐
03	☐	Maintaining Costa's key management staff	Cause		1000000	2		☐	☐
04	☑	Contracting with IT systems specialized company for systems integration	Cause	Yes	100000	2		☐	☐
05	☐	Adding new benefits for employees	Cause		1500000	1		☐	☐
06	☐	Spending efforts in identifying common and separate objectives and strategies	Cause		20000	3		☐	☐
07	☑	Monthly market analysis reports	Cause	Yes	700000	7		☐	☐
08	☐	Hiring a legal specialist	Cause		500000	3		☐	☐
09	☑	Provide intensive trainings for managers	Vulnerability	Yes	400000	12		☐	☐
10	☐	Using environment friendly packaging materials	Vulnerability		1000000	13		☐	☐
11	☐	Introducing new healthy products	Vulnerability		50000	9		☐	☐
12	☑	Hiring organizational communication expert	Consequence	Yes	500000	19		☐	☐
13	☐	Processing the due diligence carefully	Consequence		100000	5		☐	☐
14	☐	Contracting with insurance companies	Consequence		2000000	6		☐	☐

Figure 16 Optimized selection of risk controls with $2M budget

Because of applying the chosen optimized 10 controls, there is 5% chance of losing more than $1.2B, instead of $2.5B without having any risk controls. If we say that the risk tolerance for the company is $1.5B, the chance of losing $1.5B without having any risk controls is 21%, and it became only 2% change when applying the risk controls. Also, the average loss, which is the result of multiplying each monetary value loss with its probability, went down from $730.41 to $141.99 with those controls.
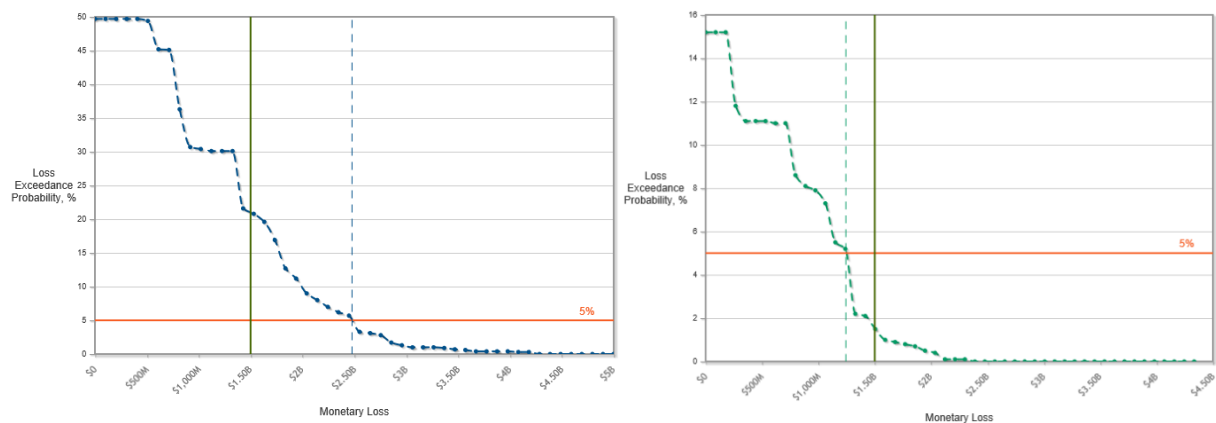

Figure 17 Loss exceedance curves, on the left: without having controls, on the right: with applying controls

In addition, the risk maps with and without applying controls also show clearly how controls reduce the likelihood and impact of the risk events.
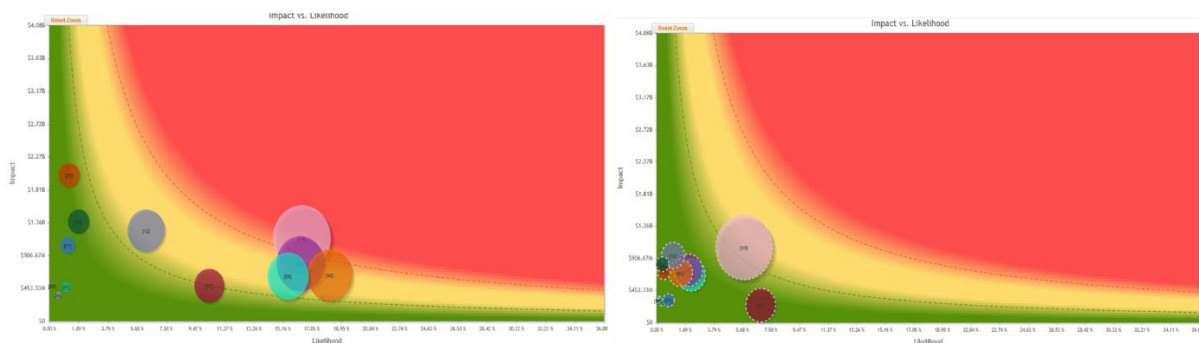

Figure 18 Risk maps, on the left: without having controls, on the right: with applying controls

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ID ▲	Event Name	Likelihood	Impact	Risk	Likelihood with controls	Impact with controls	Risk with controls
1	Return on investing and acquiring Costa is less than expected	1.31%	26.26%	0.34%	0.96%	6.40%	0.06%
2	Unsuccessful integration for the businesses	18.28%	15.77%	2.88%	1.42%	15.77%	0.22%
3	Disruption of their ongoing businesses and products	18.10%	17.89%	3.24%	2.82%	14.98%	0.42%
4	Loss of some of their mutually exclusive loyal customers	0.53%	9.88%	0.05%	0.05%	6.80%	0.003%
5	Loss of aggressive court cases: expiring patents, lawsuits, or hidden liabilities	1.23%	48.42%	0.60%	0.63%	14.86%	0.09%
6	Loss of key employees	0.63%	8.46%	0.05%	0.26%	6.39%	0.02%
7	Challenges and mismanagement of cultural issues	9.94%	11.36%	1.13%	6.64%	5.02%	0.33%
8	Slow response to the fast-changing market	15.75%	14.86%	2.34%	1.59%	14.86%	0.24%
9	Customer rejected new products	2.20%	31.09%	0.69%	0.25%	17.49%	0.04%
10	Inconsistent plans and execution, contradicting strategies	16.32%	27.45%	4.48%	4.49%	21.94%	0.98%
11	Inability to maintain good relationships with the vendors	0.69%	12.30%	0.08%	0.19%	6.09%	0.01%
12	Inability to expand operations in emerging markets	5.57%	29.98%	1.67%	0.95%	19.71%	0.19%

Figure 19 Risk register with and without applying risk controls

By looking into the Efficient Frontier graph for the risk controls, we can easily see that the risks will be dramatically decreased with applying few controls. However, apply more and more controls will not give the same risks reduction as the first one, and a reasonable budget limit for risk controls is around $2.5M.
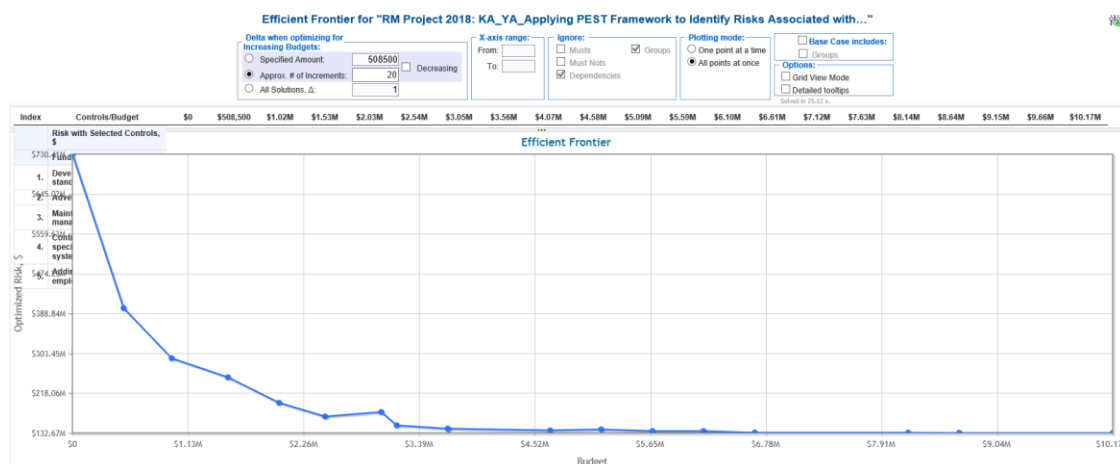

Figure 20 Efficient Frontier

7. Conclusion

In this project, we tried to identify, measure and analyze risks that Coca-Cola company may face after acquiring Costa coffee company, which was event focused risk management. Similarly, we identified risk controls for this acquisition, measured their effectiveness, and worked on their optimization. Many to many relationships among

threats, events, objectives and controls were identified and measured in methods that result in ration scales measures to allow for mathematically valid operations. The procedures that we followed and the software that we used offer a very useful mechanism for analyzing, managing and reducing risk. We also explored via sensitivity analysis how risk itself is subjective as the setting the importance of objectives is subjective.