



Starting an Ice Cream Business, to be an entrepreneur, a tenant or a franchise owner?

IE 2140 Project - Group 10

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Executive Summary

This report analyses the profitability of different methods of opening an ice cream cafe in Woodlands. We have examined three alternatives: leasing a retail unit (Alternative A), buying a retail unit (Alternative B), and operating a Cold Stone Creamery ice cream franchise (Alternative C). We have performed an annual worth analysis for all three alternatives. The study period is 20 years with an assumed MARR of 10%. Accounting for revenue, annual loan repayments and expenses, operating a franchise resulted in the highest annual worth of \$299,380.34. We conducted sensitivity and risk analysis on all 3 alternatives to find the important variables that may affect the economic feasibility of each alternative. The most critical factor for leasing a retail unit is found to be the cost per ice cream, whereby the most critical factor for buying a retail unit and operating a franchise is the number of scoops sold. Probabilistic risk analysis was carried out through a monte-carlo simulation. Our findings found that operating a franchise dominates the other two alternatives. We have considered certain scenarios where there is a shortage in supply, a business expansion and change in the location of the cafe. Lastly, we conducted an analytical hierarchy process to rank the non-economic and economic factors that may influence the final decision. The most important factor was profitability, followed by entrepreneurship. Taking into account all six factors, our final recommendation is to buy a retail unit.

1. Problem Description

An Ice cream enthusiast and businessman, Chris, has dreams of owning his own establishment and would like to start an ice cream business in Woodlands. He has 3 options: running his own business for a short time by leasing a retail unit (alternative A), running his business for a long time by purchasing a retail unit (alternative B) or purchasing the rights to a well-known franchise, Cold Stone Creamery (alternative C). The 3 choices comes with different costs and revenues. He is trying to decide which option is best for him. If he chooses to purchase the rights to a franchise, he will have higher profits initially but has limited growth potential. Whereas if he chooses to lease or purchase a retail unit he will have lower profits initially but has much more growth potential and would have achieved his desire to own his store. Should Chris lease a retail unit, purchase a retail unit or purchase the rights to a franchise?

We will evaluate and analyse each of the 3 options in this report and find out the most feasible option to start an ice cream business. We have assumed a 20 year study period, which is the average useful life of a homegrown business.

2. Decision Alternatives and Key Assumptions

2.1 Alternative A: Lease a cafe (Base-case)

The base and first decision we have decided on is for Chris, an aspiring entrepreneur, to lease a unit in Woodlands to open his ice cream store. He is not confident in running a successful business so he decides to lease a unit for his business. The criteria for success will be based on the net annual worth (AW) of the business as compared to the other alternatives over a 20-year study period. As the calculation to derive Minimum Attractive Rate of Return (MARR) is complex and varies yearly, we assume a MARR of 10% for simpler calculation purposes.

Data for Alternative	
	Alternative A
Useful life (years)	10
Number of Ice Cream Sold	120,000
Initial Investment Cost	
Bank Loan	\$190,000.00
Annual Loan Repayment (5 Years)	51,253
Loan Processing Fee	3,800
Annual Fixed Costs	
Annual Lease	\$ 25,000.00
Franchise Fee	\$ -
Advertising	\$ 3,500.00
Operation & Maintenance	\$ 30,000.00
Manpower	\$ 116,800.00
Manpower Requirements & Costs	
No. of staff	4
Manpower Cost/worker/hour	\$ 8.00
Ingredients Cost	
Cost per Ice Cream	\$ 1.50
Revenue	
Unit selling price	\$ 4.00
Annual Increase in revenue	5.00%
Salvage Value	\$ 10,000.00
AW of A	\$119,431.56
PW of A	\$733,855.26
Feasibility	Feasible

Figure 1: Data for Alternative A

1. General Considerations:

MARR	10%	
Study Period (years)	20	
Loan Processing Fee (2%)	2%	
Loan repayment period (years) Interest rate	5	10.88%
Working Days/year Working Hours	365	10
Assumption	Repeatability	

Figure 2: General Data

All values included in calculation are after tax and we assume that he will not invest personal savings into this project, his starting capital will solely be from bank loans.

2. Cost-side Considerations:

Chris will be leasing a unit in Woodlands for a 10 year period:

Table 1: Leasing Details for alternative A

Size (sq.ft)	Price / sq.ft / year	Annual Lease
350	\$6.94	\$25000

His initial investment is split up into the following:

Table 2: Initial Investments for Alternative A

Type of expenditure	Amount	Payee
Architectural Fees	\$8,000	Architect
Leasehold Improvements	\$75,000	Contractors
Exterior Signage	\$12,000	Advertising Company
Equipment	\$55,000	Vendors
Payment Card Industry (PCI Compliance Costs)	\$2,000	Vendors
Grand Opening Advertising	\$5,000	Advertising Company
Insurance Premium	\$2,500	Insurance Carrier
Permits and Licenses	\$3,000	Government Entities
Telephone and Utilities	\$2,500	Utilities Companies

He will take up loan from DBS to cover the initial cost:

Table 3: Bank Loan Details for Alternative A

Loan Amount	\$190,000
Loan Repayment period	5 years
Loan Repayment amount per annum (Inclusive 10.88% per annum)	\$51,253.27
Processing Fee (2% of loan amount)	\$3,800

Chris takes a loan of \$190,000 from DBS bank to be repaid in 5 years, he will pay a one off processing fee of \$3,800 and annual installments of \$51,232.27. Taking into consideration inflation and that Chris has gone through the various vendors to get the best price.

The breakdown for the annual fixed costs are as follows:

Annual Fixed Costs	
Annual Lease	\$ 25,000.00
Franchise Fee	\$ -
Advertising	\$ 3,500.00
Operation & Maintenance	\$ 30,000.00
Manpower	\$ 116,800.00

Figure 3: Annual Costs for Alternative A

Operation and maintenance costs are the variable costs that Chris must spend to keep her business running. In this report, we have divided the variable costs into the following categories namely: annual lease, advertising costs, manpower costs, operating costs, and ingredient costs. He pays \$25,000 for annual lease for a 350 sq. ft unit at \$6.94/sq. ft. For advertising fees, Chris spends about 1% of his annual revenue on advertising. For manpower costs, Chris will only hire 4 part-timers to help him mend his cafe and he pays them \$8 per hour. The cafe is open all year round and operates for 10 hours every day. Operation and Maintenance (O&M) fees includes water bills, utility bills and basic upkeep of the cafe. Lastly, for ingredient cost he

pays an average of \$1.5 per scoop for an average of 125,000 scoops. We assume constant annual operating and maintenance costs and we assume that the cost of ingredients increases per year by a constant 5% as his business gains popularity. We also assume that the above costs are fixed and are only affected by the time value of money.

3. Revenue-side Considerations:

Revenue is the total income from the sale of goods and services, or any other use of capital or assets, associated with the main operations of an organization before any costs or expenses are deducted. Chris receives revenue purely from sales of ice cream, the base revenue of the cafe is assumed to be \$300,000 annually. We obtained this value by assuming that the average scoop of ice cream costs \$4.0 and the average number of ice cream sold per year is 120,000. We assume that Chris has a great recipe and his ice cream is well received so his sales increases per year by a constant 5%. His business is owned for 10 years before he decides to sell it off, it is worth 10,000 in salvage value.

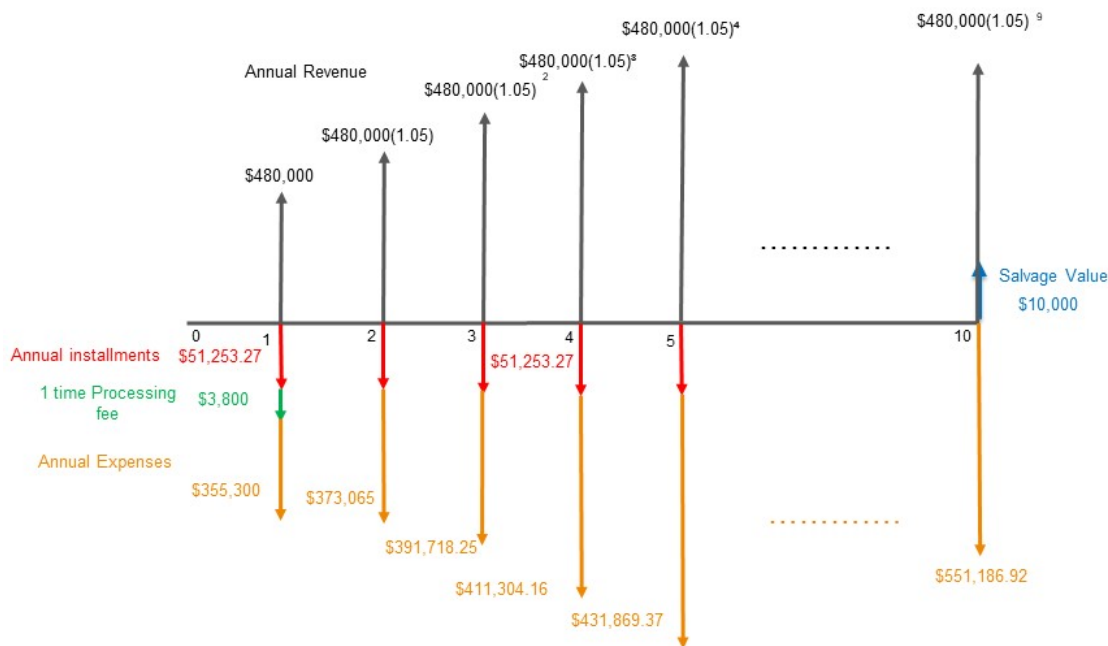


Figure 4: Cash Flow for Alternative A

EOY	A Revenue	Loan Payments	A Expenses	PROFIT
0				
1	\$480,000.00	\$ 55,053.27	\$ 355,300.00	\$ 69,646.73
2	\$ 504,000.00	\$ 51,253.27	\$ 373,065.00	\$ 79,681.73
3	\$ 529,200.00	\$ 51,253.27	\$ 391,718.25	\$ 86,228.48
4	\$ 555,660.00	\$ 51,253.27	\$ 411,304.16	\$ 93,102.57
5	\$ 583,443.00	\$ 51,253.27	\$ 431,869.37	\$ 100,320.36
6	\$ 612,615.15		\$ 453,462.84	\$ 159,152.31
7	\$ 643,245.91		\$ 476,135.98	\$ 167,109.93
8	\$ 675,408.20		\$ 499,942.78	\$ 175,465.42
9	\$ 709,178.61		\$ 524,939.92	\$ 184,238.69
10	\$ 754,637.54		\$ 551,186.92	\$ 203,450.63

Figure 8: Cash Flow Calculations for Alternative A

Assume Chris repeats the lease at EOY 10 for another 10 years.

Using Excel, Annual Worth (Leasing) = \$119,431.56

2.2 Alternative B: Buy over a café:

The second alternative is for Chris, an aspiring entrepreneur, to buy over a unit in woodlands to open his ice cream store. He is confident in this project and is willing to take out a large loan for this it. The criteria for success will be based on the net annual worth (AW) of the business as compared to the other alternatives over a 20-year study period. As the calculation to derive Minimum Attractive Rate of Return (MARR) is complex and varies yearly, we assume a MARR of 10% for simpler calculation purposes.

Data for Alternative	
	Alternative B
Useful Life (years)	20
Number of Ice Cream Sold	150,000.00
Initial Investment Cost	
Bank Loan A	250,000.00
Annual Loan Repayment (5 Years)	67,438.51
Loan Processing Fee	5,000.00
Bank Loan Total	500,000.00
Annual Loan Repayment (5 Years)	134,877.02
Loan Processing Fee	10,000.00
Annual fixed Costs	
Annual Lease	\$ -
Franchise Fee	\$ -
Advertising	\$ 4,000.00
Operation & Maintenance	\$ 30,000.00
Manpower	\$ 116,800.00
Manpower Requirements & Costs	
No. of staff	4.00
Manpower Cost/worker/hour	\$ 8.00
Ingredients Cost	
Cost per Ice Cream	\$ 1.50
Revenue	
Unit Selling Price	\$ 4.00
Annual Increase in revenue	5.00%
Salvage Value	\$ 800,000.00
AW of B	\$241,247.13
PW of B	\$2,053,872.78
Feasibility	Feasible

Figure 9: Data for Alternative B

1. General Considerations:

MARR	10%	
Study Period (years)	20	
Loan Processing Fee	2%	
Loan repayment period (years) Interest rate	5	10.88%
Working Days/year Working Hours	365	10
Assumption		

Figure 10: General Data

All values included in calculation are after tax and we assume that he will not invest personal savings into this project, his starting capital will solely be from bank loans.

2. Cost-side Considerations:

Chris will be buying a unit in woodlands at once. He will be taking up loans from 2 separate banks to pay for this venture.

He will take out his first loan from DBS:

Table 4: Bank Loan 1 for Alternative B

Loan Amount	\$500,000
Loan Repayment period	5 years
Loan Repayment amount per annum (Inclusive 10.88% per annum)	\$134,877.02
Processing Fee (2% of loan amount)	\$10,000.00

He will take out his second loan from OCBC:

Table 5: Bank Loan 2 for alternative B

Loan Amount	\$250,000
Loan Repayment period	5 years
Loan Repayment amount per annum (Inclusive 10.88% per annum)	\$67,438.51
Processing Fee (2% of loan amount)	\$5,000.00

Chris will be buying a unit in Woodlands:

Table 6: Leasing Details for Alternative B

Size (sq.ft)	Price / sq.ft	Price
350	\$1,428.57	\$500,000

His initial investment is split up into the following:

Table 7: Initial Investments for Alternative B

Type of expenditure	Amount	Payee
Architectural Fees	\$10,000	Architect
Leasehold Improvements	\$75,000	Contractors
Exterior Signage	\$14,000	Advertising Company
Equipment	\$75,000	Vendors
Payment Card Industry	\$2,000	Vendors

(PCI Compliance Costs)		
Grand Opening Advertising	\$5,000	Advertising Company
Insurance Premium	\$4,000	Insurance Carrier
Permits and Licenses	\$3,000	Government Entities
Telephone and Utilities	\$3,000	Utilities Companies
Miscellaneous	\$9,000	Self

He takes a first loan of \$500,000 from DBS to be repaid in 5 years which incurs a one off processing fee of \$10000, and a second loan of \$250,000 from OCBC to be repaid in 5 years which also incurs a one-off processing fee of \$5000. Chris pays annual installments of \$202,315.52.

The rest of the initial investment by Chris will be similar to alternative A (leasing), though, he spends more on factors such as leasehold improvements, exterior signage, equipment and insurance premium as he is more financially invested in this venture.

Taking into consideration inflation and that Chris has gone through the various vendors to get the best price.

The breakdown for the annual fixed costs are as follows:

Annual Lease	\$ -
Franchise Fee	\$ -
Advertising	\$ 4,000.00
Operation & Maintenance	\$ 30,000.00
Manpower	\$ 116,800.00

Figure 11: Annual Costs for Alternative B

Operation and maintenance costs are the variable costs that Chris must spend to keep her business running. In this report, we have divided the variable costs into the following categories namely: advertising costs, manpower costs, operating costs, and ingredient costs. For advertising fees, Chris spends about 1% of his annual revenue on advertising. For manpower costs, Chris will only hire 4 part-timers to help him mend his cafe and he pays them \$8 per hour. The cafe is open all year round and operates for 10 hours every day. Operation and Maintenance (O&M) fees includes water bills, utility bills and basic upkeep of the cafe. Lastly, for ingredient cost he pays an average of \$1.5 per scoop for an average of 150,000 scoops. We assume constant annual operating and maintenance costs and we assume that the cost of ingredients increases per year by a constant 5% as his business gains popularity. We also assume that the above costs are fixed and are only affected by the time value of money.

3. Revenue-side Considerations:

Revenue is the total income from the sale of goods and services, or any other use of capital or assets, associated with the main operations of an organization before any costs or expenses are deducted. Chris receives revenue purely from sales of ice cream, the base revenue of the cafe is assumed to be \$300,000 annually. We obtained this value by assuming that the average scoop of ice cream costs \$4.0 and the average number of ice cream sold per year is 150,000. We assume that Chris has a great recipe and his ice cream is well received so his sales increases per year by a constant 5%. His unit and business is owned for 20 years before he decides to sell it off, they are worth \$800,000 in salvage value.



Figure 12: Cash Flow for Alternative B

EOY	A Revenue	Loan Payments	A Expenses	PROFIT
0				
1	\$ 600,000.00	\$ 217,315.52	\$ 375,800.00	\$ 6,884.48
2	\$ 630,000.00	\$ 202,315.52	\$ 394,590.00	\$ 33,094.48
3	\$ 661,500.00	\$ 202,315.52	\$ 414,319.50	\$ 44,864.98
4	\$ 694,575.00	\$ 202,315.52	\$ 435,035.48	\$ 57,224.00
5	\$ 729,303.75	\$ 202,315.52	\$ 456,787.25	\$ 70,200.98
6	\$ 765,768.94		\$ 479,626.61	\$ 286,142.33
7	\$ 804,057.38		\$ 503,607.94	\$ 300,449.44
8	\$ 844,260.25		\$ 528,788.34	\$ 315,471.91
9	\$ 886,473.27		\$ 555,227.76	\$ 331,245.51
10	\$ 930,796.93		\$ 582,989.14	\$ 347,807.79
11	\$ 977,336.78		\$ 612,138.60	\$ 365,198.18
12	\$ 1,026,203.61		\$ 642,745.53	\$ 383,458.08
13	\$ 1,077,513.80		\$ 674,882.81	\$ 402,630.99
14	\$ 1,131,389.49		\$ 708,626.95	\$ 422,762.54
15	\$ 1,187,958.96		\$ 744,058.30	\$ 443,900.66
16	\$ 1,247,356.91		\$ 781,261.21	\$ 466,095.70
17	\$ 1,309,724.75		\$ 820,324.27	\$ 489,400.48
18	\$ 1,375,210.99		\$ 861,340.48	\$ 513,870.51
19	\$ 1,443,971.54		\$ 904,407.51	\$ 539,564.03
20	\$ 2,316,170.12		\$ 949,627.88	\$ 1,366,542.23

Figure 13: Cash flow calculations for Alternative B

Using Excel, Annual Worth (Buying) = \$241,247.13

2.3 Alternative C: Buy an ice cream franchise

The second alternative is for Chris to buy an ice cream franchise, Cold Stone Creamery. He is Interested in owning a store but unwilling to take the risk of creating a new brand. He is more interested in owning a business and earning money rather than creating his own brand.

Data for Alternative	
	Alternative C
Useful life (years)	15
Number of Ice Cream Sold	150,000
Initial Investment Cost	
Bank Loan	\$ 468,850.00
Annual Loan Repayment (5 Years)	\$ 126,474.18
Loan Processing Fee	\$ 9,377.00
Annual fixed Costs	
Annual Lease	\$ 25,000.00
Royalty	\$ 45,000.00
Franchise Advertising	\$ 22,500.00
Advertising	\$ 4,000.00
Operation & Maintenance	\$ 7,400.00
Manpower	\$ 131,400.00
Manpower Requirements & Costs	
No. of staff	4.00
Manpower Cost/worker/hour	\$ 9.00
Ingredient Cost	
Cost per Ice Cream	\$ 1.20
Revenue	
Unit Selling Price	\$ 5.00
Annual Increase in revenue	2.00%
Salvage Value (EOY 5)	\$3,000
Salvage Value (EOY 15)	\$10,000
AW of C	\$199,630.41
PW of C	\$9,981.52
Feasibility	Feasible

Figure 14: Data for Alternative C

1. General Consideration:

MARR	10%	
Study Period (years)	20	
Loan Processing Fee (2%)	2%	
Loan repayment period (years) Interest rate	5	10.88%
Working Days/year Working Hours	365	10
Assumption	Repeatability	

Figure 15: General Data

All values included in calculation are after tax and we assume that he will not invest personal savings into this project, his starting capital will solely be from bank loans.

2. Cost-side assumption:

Chris will be buying a unit in woodlands at once. He will be taking up a DBS bank loan. He will take out a loan from DBS:

Table 8: Bank Loan for Alternative C

Loan Amount	\$468,850.00
Loan Repayment period	5 years
Loan Repayment amount per annum (Inclusive 10.88% per annum)	\$126,474.18
Processing Fee (2% of loan amount)	\$9,377

Table 9: Leasing Details for Alternative C

Size (sq.ft)	Price / sq.ft / year	Annual Lease
350	\$6.94	\$25,000

He takes a loan of \$500,000 from DBS to be repaid in 5 years which incurs a one off processing fee of \$9,377 and annual installments of \$202,315.52.

His initial investment is split up into the following:

Table 10: Initial Investments for Alternative C

Type of Expenditure	Amount	Who to Pay
Initial Franchise Fee	\$27,000.00	Franchise
Security Deposit/Rent	\$26,000.00	Landlord(s)
Training expenses	\$7,500.00	Airlines, hotels, car rental agency & restaurants
Lease Review Fee	\$2,500.00	Franchise
Architectural Fees	\$10,000.00	Licensed and Approved Architect
Leasehold Improvements	\$200,000.00	Approved Contractors and Vendors
Exterior Signage	\$12,000.00	Approved Sign Company
Equipment	\$130,000.00	Approved Vendors and Suppliers
Payment Card Industry (PCI Compliance Costs)	\$1,300.00	Approved Vendor
Opening Inventory	\$8,000.00	Vendors & suppliers
Employee Uniforms	\$800.00	Vendors
Grand Opening Advertising	\$10,000.00	Media, printing vendors, event planners

Insurance Premiums	\$2,500.00	Insurance carrier
Permits and Licenses	\$3,000.00	Governmental entities
Telephone	\$1,000.00	Utility companies
Food Safety Certification Course	\$250.00	Vendors, Suppliers
Miscellaneous	\$4,000.00	Vendors, etc.
Depository Account	\$3,000.00	Your bank (We have the right to withdraw from this account)
Additional Funds -3 month initial period	\$20,000.00	Franchise, Employees, Various Third Parties

He takes a loan of \$468,850 from DBS to be repaid in 5 years which also incurs a one-off processing fee of \$9,377. Chris pays annual installments of \$126,474.18. The breakdown of the initial cost is provided by the franchise.

The breakdown for the annual fixed costs are as follows:

Annual fixed Costs	
Annual Lease	\$ 25,000.00
Royalty	\$ 45,000.00
Franchise Advertising	\$ 22,500.00
Advertising	\$ 4,000.00
Operation & Maintenance	\$ 7,400.00
Manpower	\$ 131,400.00

Figure 16: Annual Cost for Alternative C

Operation and maintenance costs are the variable costs that Chris must spend to keep her business running. In this report, we have divided the variable costs into the following categories namely: annual lease, royalty, advertising costs, manpower costs, operating costs, and ingredient costs.

He pays \$25,000 for annual lease for a 350 sq. ft unit at \$6.94/ sq. ft. Chris is required to contribute 3% of his annual revenue for franchise advertising and 6% of his annual revenue as royalty to the franchise. He also pays an additional 1% of his annual revenue for his own advertisements. For manpower costs, Chris will only hire 4 part-timers to help him mend his cafe and he pays them \$9 per hour. The cafe is open all year round and operates for 10 hours every day. Operation and Maintenance (O&M) fees includes water bills, utility bills and basic upkeep of the cafe. We assume that the O&M costs for a franchise is significantly lower compared to leasing and buying as the franchise would likely have contractual agreements that offers low operation and maintenance fees. We assume constant annual operating and maintenance costs and we assume that the cost of ingredients increases per year by a constant 2% as the franchise gains popularity at a slower rate. We also assume that the above costs are fixed and are only affected by the time value of money.

3. Revenue-side assumption:

Revenue is the total income from the sale of goods and services, or any other use of capital or assets, associated with the main operations of an organization before any costs or expenses are deducted. Chris receives revenue purely from sales of ice cream, the base revenue of the cafe is assumed to be \$750,000 as a result of it being a popular franchise.. We obtained this value by assuming that the average scoop of ice cream sells for \$5.0 and the average number of ice cream sold per year is 150,000. We assume that Chris has a great recipe and his ice cream is well received so his sales increases per year by a constant 5%. He owns the unit and has rights to the franchise for 15 years before he decides to sell it off, they are worth \$10,000 in salvage value at the end of year 15.

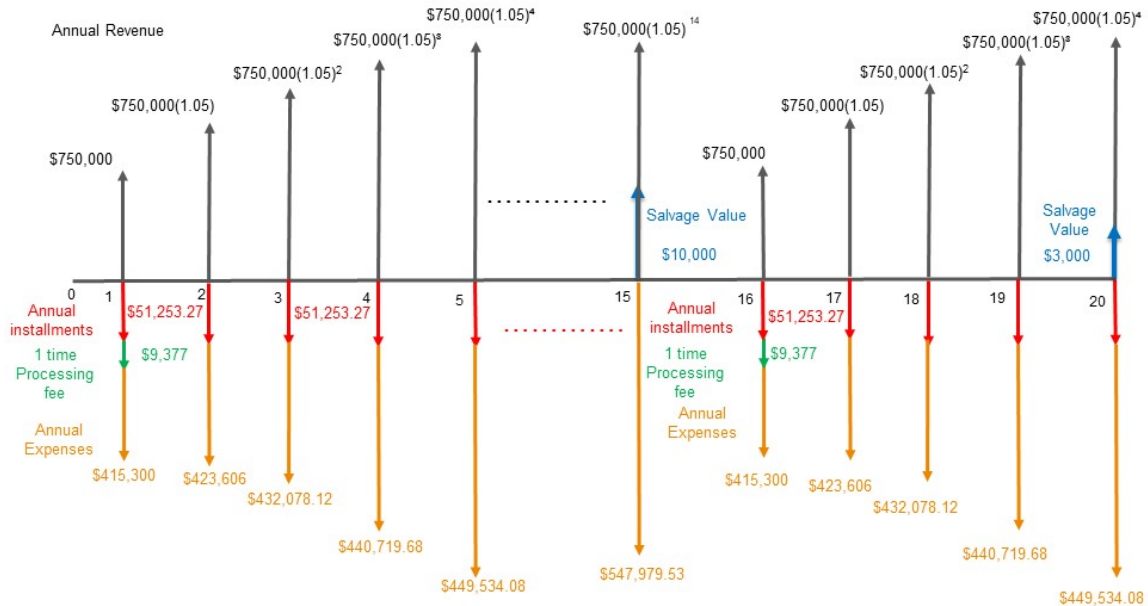


Figure 17: Cash Flow for Alternative C

EOY	A Revenue	Loan Payments	A Expenses	PROFIT
0				
1	\$ 750,000.00	\$ 135,851.18	\$ 415,300.00	\$ 198,848.82
2	\$ 765,000.00	\$ 126,474.18	\$ 423,606.00	\$ 214,919.82
3	\$ 780,300.00	\$ 126,474.18	\$ 432,078.12	\$ 221,747.70
4	\$ 795,906.00	\$ 126,474.18	\$ 440,719.68	\$ 228,712.14
5	\$ 811,824.12	\$ 126,474.18	\$ 449,534.08	\$ 235,815.87
6	\$ 828,060.60		\$ 458,524.76	\$ 369,535.84
7	\$ 844,621.81		\$ 467,695.25	\$ 376,926.56
8	\$ 861,514.25		\$ 477,049.16	\$ 384,465.09
9	\$ 878,744.54		\$ 486,590.14	\$ 392,154.39
10	\$ 896,319.43		\$ 496,321.94	\$ 399,997.48
11	\$ 914,245.81		\$ 506,248.38	\$ 407,997.43
12	\$ 932,530.73		\$ 516,373.35	\$ 416,157.38
13	\$ 951,181.35		\$ 526,700.82	\$ 424,480.53
14	\$ 970,204.97		\$ 537,234.83	\$ 432,970.14
15	\$ 999,609.07		\$ 547,979.53	\$ 451,629.54
16	\$ 750,000.00	\$ 135,851.18	\$ 415,300.00	\$ 198,848.82
17	\$ 765,000.00	\$ 126,474.18	\$ 423,606.00	\$ 214,919.82
18	\$ 780,300.00	\$ 126,474.18	\$ 432,078.12	\$ 221,747.70
19	\$ 795,906.00	\$ 126,474.18	\$ 440,719.68	\$ 228,712.14
20	\$ 814,824.12	\$ 126,474.18	\$ 449,534.08	\$ 238,815.87

Figure 18: Cash flow calculations for Alternative C

Assume Chris closes down his franchise at EOY 15 and reopens the same franchise for another 5 years before co-terminating the project at EOY 20.

Using Excel, Annual Worth (Franchise) = \$299,380.34

3. Base Case Solutions

In this analysis, we would let study period to be 20 years and Chris's MARR to be 10%.

For alternative A, assuming project is repeated at the end of year (EOY) 10 for another cycle till EOY 20. For alternative B, assuming the project life is EOY 20. For alternative C, assuming project is repeated at EOY 15 and co-terminated at EOY 20.

We compared the annual worth (10%) for all three alternatives and determine that the one with the highest AW (10%) would be the one that Chris should choose as it is the most economically feasible.

Table 11: Annual Worth for Alternatives

	Alternative A (Leasing)	Alternative B (Buying)	Alternative C (Franchise)
AW (10%)	\$58,891.81	\$165,107.94	\$306,638.54

Since the AW of alternative C > AW of alternative B > AW of alternative A, Chris should choose alternative C.

4. Key Uncertainties and Probabilistic Risk Analysis

4.1 Revenue-Side Uncertainties:

1. Number of Ice cream Sold:

Depending on the tastes and preferences of customers, the number of ice cream sold varies yearly.

2. Unit Selling Price :

Variety of ice cream offered to customers at different prices.

3. Salvage Value:

The salvage value of the cafe will depend on market sentiments and market conditions

4.2 Cost-side Uncertainties:

1. Annual Lease:

The annual lease of the cafe and franchise may be subjected to changes that may be implemented by the landlord.

2. Advertising:

The advertising fees incurred for all 3 options may vary year by year depending on the market sentiments. If the demand for ice cream is low, Chris may need to spend more on advertising to attract more customers. In the case of the franchise, advertisement fees are capped at a fixed percentage of gross sales which may also vary each year.

3. Operation and Maintenance (O&M):

The O&M costs incurred in all 3 choices will most likely differ year by year depending on the condition of equipment in the cafe. In the case of owning a cafe, there is more uncertainty in O&M costs each year and may fluctuate greatly. This is because franchise stalls and landlord owned stalls are likely to have contractual agreements with maintenance firms that offers maintenance services at lower rates.

4. Number of Staff:

The staff headcount may vary annually depending on the customer traffic. Depending on the success of the business, Chris may need more or less staff.

5. Manpower Cost:

Labour costs of hiring workers to run the cafe is uncertain and depends on economic conditions and government policies.

6. Cost per ice cream:

Costs incurred in making each unit of ice cream may differ every year depending on the cost of raw ingredients which is affected by market conditions.

7. Selling price per cream:

The selling price per ice cream sold also varies as Chris's cafe offers a variety of different ice cream combinations and choices with different selling price.

4.3 Analysis for Alternative A:

Table 12: Sensit Analysis Table for Alternative A

	Corresponding Input Value			Output Value (AW of A)				Percent
Input Variable	Low Output	Base Case	High Output	Low	Base	High	Swing	Swing ^2
Cost per Ice Cream	\$4.00	\$1.50	\$1.00	-\$243,806.99	\$119,431.56	\$192,079.27	\$435,886.26	30.8%
Unit selling price	\$3.00	\$4.00	\$6.00	-\$25,863.86	\$119,431.56	\$410,022.40	\$435,886.26	30.8%
Number of Ice Cream Sold	40,000	120,000	180,000	-\$122,727.47	\$119,431.56	\$301,050.84	\$423,778.31	29.1%
Manpower	\$219,000.00	\$116,800.00	\$23,725.00	-\$4,311.70	\$119,431.56	\$232,126.32	\$236,438.02	9.1%
Operation & Maintenance	\$55,000.00	\$30,000.00	\$20,000.00	\$89,161.69	\$119,431.56	\$131,539.52	\$42,377.83	0.3%
Annual Lease	\$26,000.00	\$25,000.00	\$24,000.00	\$118,220.77	\$119,431.56	\$120,642.36	\$2,421.59	0.0%
Advertising	\$4,500.00	\$3,500.00	\$3,000.00	\$118,220.77	\$119,431.56	\$120,036.96	\$1,816.19	0.0%
Salvage Value	\$9,000.00	\$10,000.00	\$11,000.00	\$119,368.82	\$119,431.56	\$119,494.31	\$125.49	0.0%

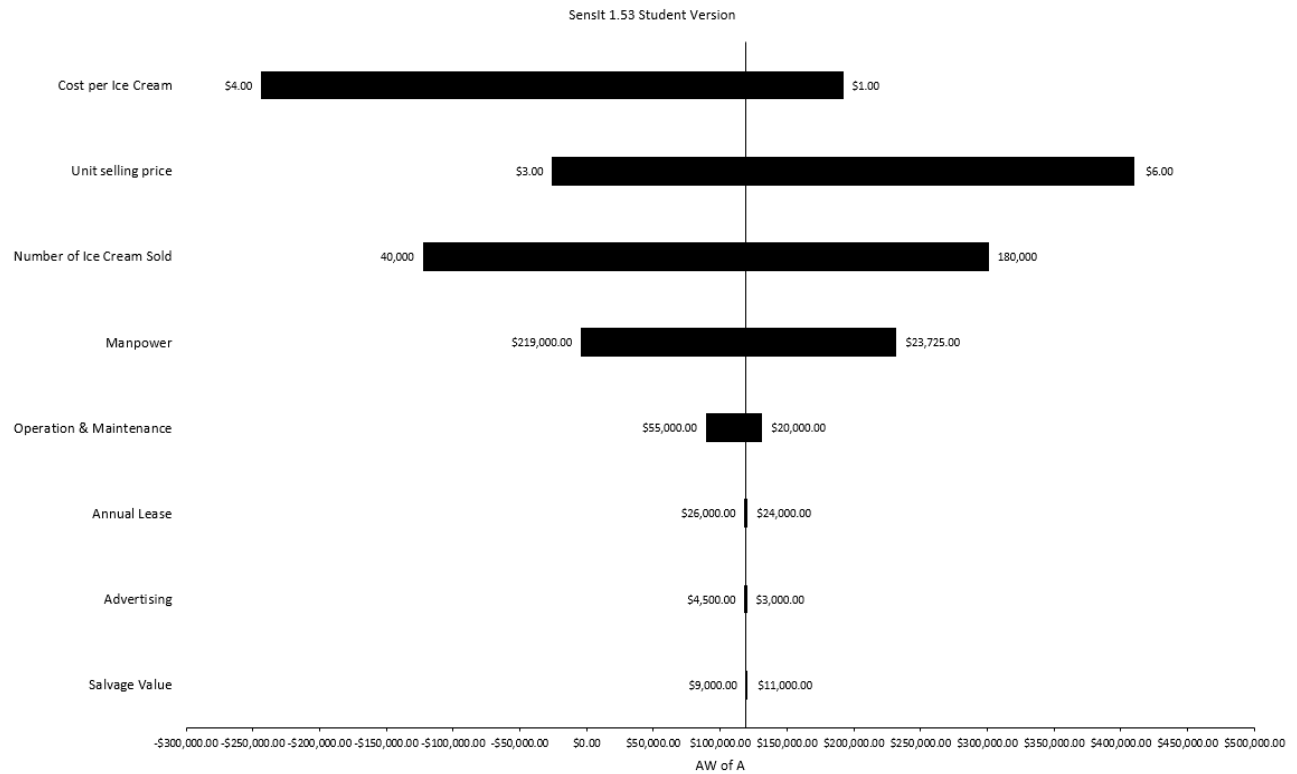


Figure 19: Tornado Diagram for Alternative A

The width of the tornado indicates the “swing” in AW and hence the sensitivity of each of the factor. The most sensitive factor is “Cost per Ice-Cream”. When its value was varied from \$4 to \$1, the AW changed from -\$243,806.99 to \$192,097.27, creating a swing of \$435,886.26. The next two sensitive factors are “Unit Selling Price” and “Number of Ice-Cream Sold” which both have swing of \$435,886.26. The least sensitive factor is “Salvage Value” which has a swing of only \$125.49. The project is feasible ($AW > 0$) for all values of “Operation & Maintenance”, “Annual Lease” and “Advertising”. The project becomes infeasible ($AW > 0$) when “Cost per Ice Cream”, “Unit Selling Price”, “Number of Ice Cream Sold” and “Manpower” is at the low end of the range.

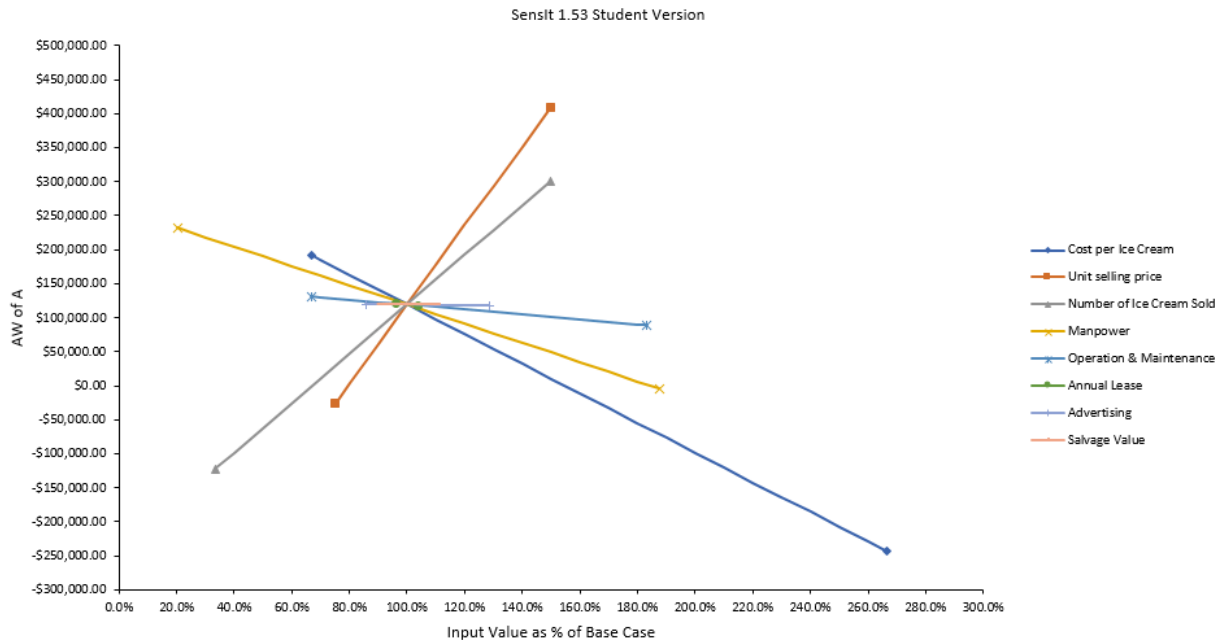


Figure 20: Spider Diagram for Alternative A

All the lines in the spider diagram pass through the base case at 0% change at $AW = \$119,431.56$.

Directions of change w.r.t. Single factor:

- AW increases with “Unit selling price” and “Number of Ice Cream Sold”.
- AW decreases with “Operation & Maintenance”, “Annual Lease”, “Advertising”, “Manpower”, “Salvage Value” and “Cost per Ice Cream”.

Rates of change of PW w.r.t. % -change of single factor:

- AW is sensitive to “Unit selling price”, “Number of Ice Cream Sold” and “Cost per Ice Cream”.
- AW is not sensitive to “Operation & Maintenance”, “Annual Lease”, “Advertising”, “Salvage Value” and “Manpower”.

Swing:

- The horizontal projection of each line on the AW-axis gives the “swing” of the AW as in the tornado diagram. Hence “Cost per Ice Cream” has the largest swing while “Salvage Value” has the smallest swing.

4.4 Analysis for Alternative B (Buying)

Table 13: Sensit Analysis Table for Alternative A

	Corresponding Input Value			Output Value				Percent
Input Variable	Low Output	Base Case	High Output	Low	Base	High	Swing	Swing^2
Number of Ice Cream Sold	40,000.00	150,000.00	250,000.00	-\$149,990.11	\$241,247.13	\$596,917.34	\$746,907.45	37.2%
Cost per Ice Cream	\$4.00	\$1.50	\$1.00	-\$292,258.19	\$241,247.13	\$347,948.19	\$640,206.38	27.4%
Unit Selling Price	\$3.00	\$4.00	\$6.00	\$27,845.00	\$241,247.13	\$668,051.38	\$640,206.38	27.4%
Manpower	\$262,800.00	\$116,800.00	\$23,725.00	\$33,535.72	\$241,247.13	\$373,663.15	\$340,127.43	7.7%
Operation & Maintenance	\$65,000.00	\$30,000.00	\$20,000.00	\$191,453.30	\$241,247.13	\$255,473.93	\$64,020.63	0.3%
Salvage Value	\$250,000.00	\$800,000.00	\$1,200,000.00	\$231,644.33	\$241,247.13	\$248,230.98	\$16,586.65	0.0%
Advertising	\$6,000.00	\$4,000.00	\$3,000.00	\$238,401.76	\$241,247.13	\$242,669.81	\$4,268.05	0.0%

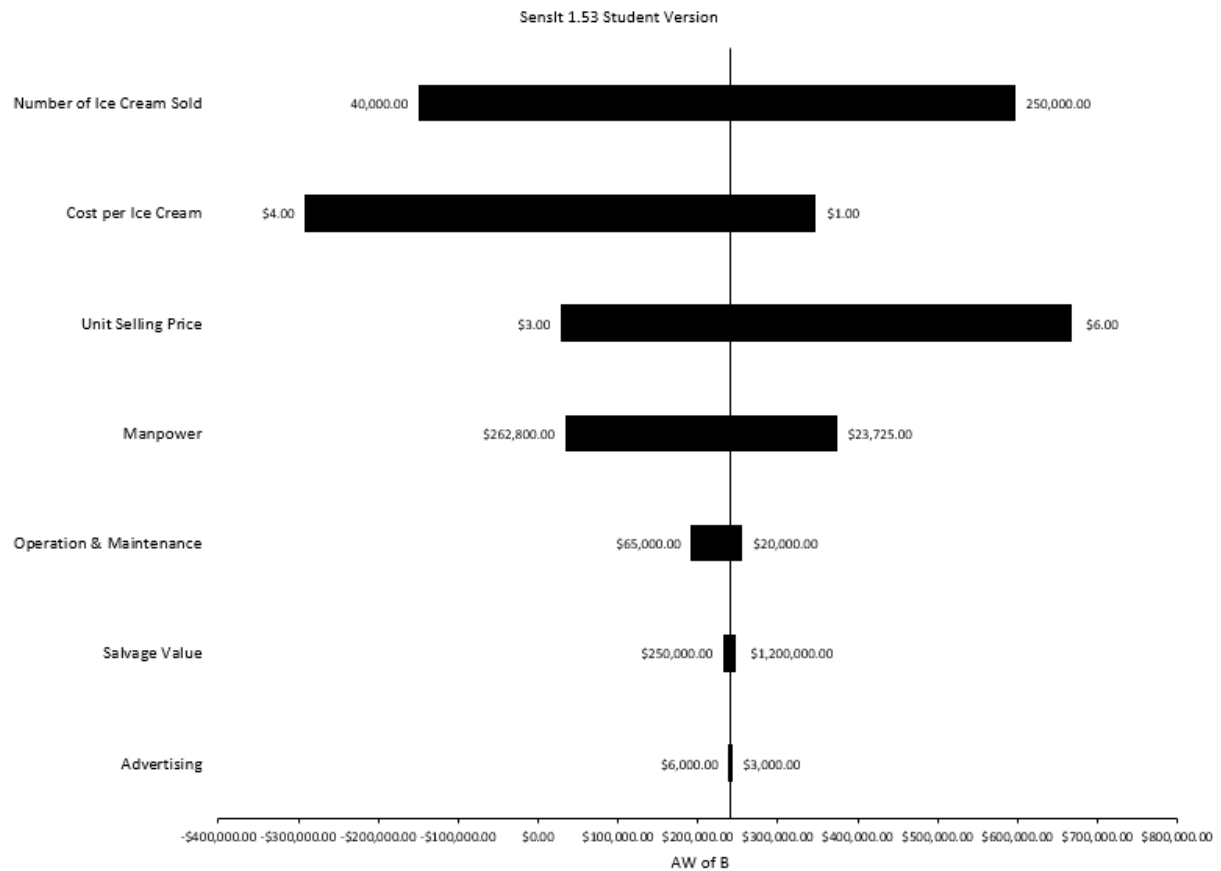


Figure 21: Tornado Diagram for Alternative B

The width of the tornado indicates the “swing” in AW and hence the sensitivity of each of the factor. The most sensitive factor is “Number of Ice Cream Sold”. When its value was varied from 40,000 to 250,000, the AW changed from -\$149,990.11 to \$596,917.34, creating a swing of \$746,907.45. The next two sensitive factors are “Cost per Ice Cream” and “Unit Selling Price” which both have swing of \$640,206.38. The least sensitive factor is “Advertising” which has a swing of only \$4,268.05. The project is feasible ($AW > 0$) for all values of factors except “Number of Ice Cream Sold” and “Cost per Ice Cream”. The project becomes infeasible ($AW > 0$) when “Cost per Ice Cream” and “Number of Ice Cream Sold” is at the low end of the range.

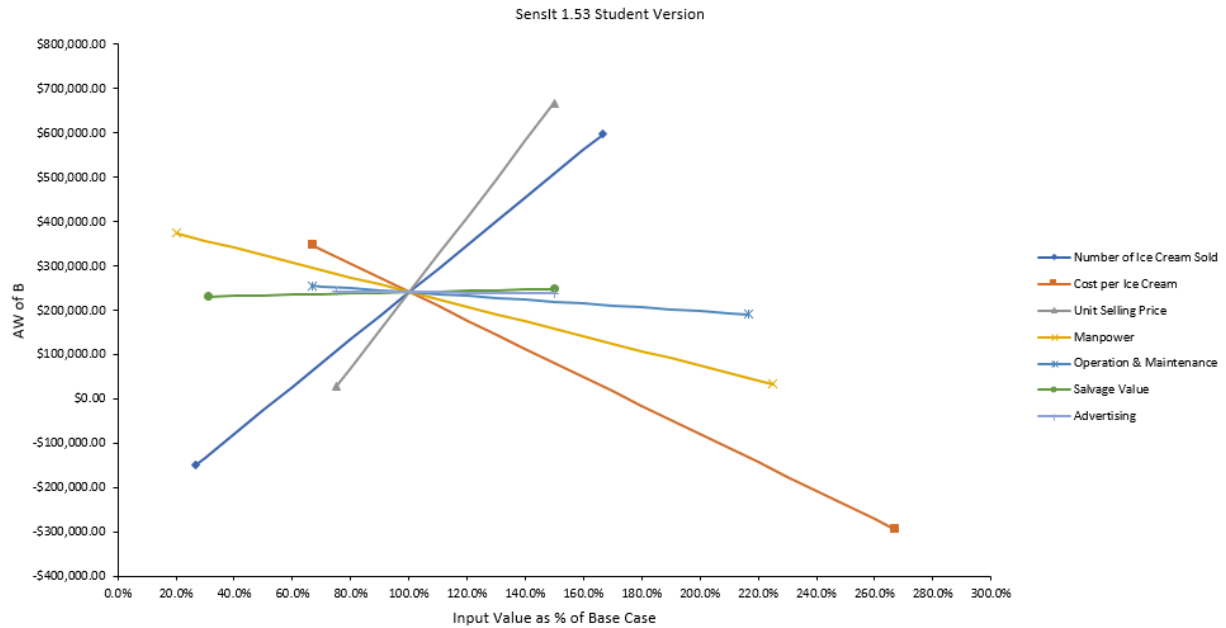


Figure 22: Spider Diagram for Alternative B

All the lines in the spider diagram pass through the base case at 0% change at $AW = \$241,247.13$.

Directions of change w.r.t. Single factor:

- AW increases with “Unit selling price” and “Number of Ice Cream Sold”.
- AW decreases with “Operation & Maintenance”, “Advertising”, “Manpower”, “Salvage Value” and “Cost per Ice Cream”.

Rates of change of PW w.r.t. % -change of single factor:

- AW is sensitive to “Unit selling price”, “Number of Ice Cream Sold” and “Cost per Ice Cream”.
- AW is not sensitive to “Operation & Maintenance”, “Annual Lease”, “Advertising”, “Salvage Value” and “Manpower”.

Swing:

- The horizontal projection of each line on the AW -axis gives the “swing” of the AW as in the tornado diagram. Hence “Number of Ice Cream Sold” has the largest swing while “Advertising” has the smallest swing.

4.5 Analysis for Alternative C (Franchise)

Table 13: Sensit Analysis Table for Alternative A

	Corresponding Input Value			Output Value				Percent
Input Variable	Low Output	Base Case	High Output	Low	Base	High	Swing	Swing^2
Number of Ice Cream Sold	95,000	150,000	250,000	\$82,808.60	\$313,903.43	\$734,075.85	\$651,267.25	52.8%
Unit Selling Price	\$4.00	\$5.00	\$7.00	\$148,045.90	\$313,903.43	\$645,618.50	\$497,572.60	30.8%
Manpower	\$ 328,500.00	\$ 131,400.00	\$31,755.00	\$117,751.27	\$313,903.43	\$413,069.25	\$295,317.98	10.9%
Cost per Ice Cream	\$2.00	\$1.20	\$0.90	\$181,217.40	\$313,903.43	\$363,660.69	\$182,443.29	4.1%
Royalty	\$105,000.00	\$45,000.00	\$22,800.00	\$247,560.42	\$313,903.43	\$338,450.35	\$90,889.93	1.0%
Franchise Advertising	\$52,500.00	\$22,500.00	\$11,400.00	\$280,731.92	\$313,903.43	\$326,176.89	\$45,444.97	0.3%
Advertising	\$6,000.00	\$4,000.00	\$3,000.00	\$311,692.00	\$313,903.43	\$315,009.15	\$3,317.15	0.0%
Operation & Maintenance	\$9,700.00	\$7,400.00	\$6,800.00	\$311,360.28	\$313,903.43	\$314,566.86	\$3,206.58	0.0%
Annual Lease	\$26,000.00	\$25,000.00	\$24,000.00	\$312,797.71	\$313,903.43	\$315,009.15	\$2,211.44	0.0%
Salvage Value (EOY 15)	\$9,000	\$10,000	\$11,000	\$313,875.31	\$313,903.43	\$313,931.55	\$56.24	0.0%
Salvage Value (EOY 5)	\$2,000	\$3,000	\$4,000	\$313,885.97	\$313,903.43	\$313,920.89	\$34.92	0.0%
No. of staff	1.00	4.00	6.00	\$313,903.43	\$313,903.43	\$313,903.43	\$0.00	0.0%
Manpower Cost/worker/ hour	\$8.70	\$9.00	\$15.00	\$313,903.43	\$313,903.43	\$313,903.43	\$0.00	0.0%

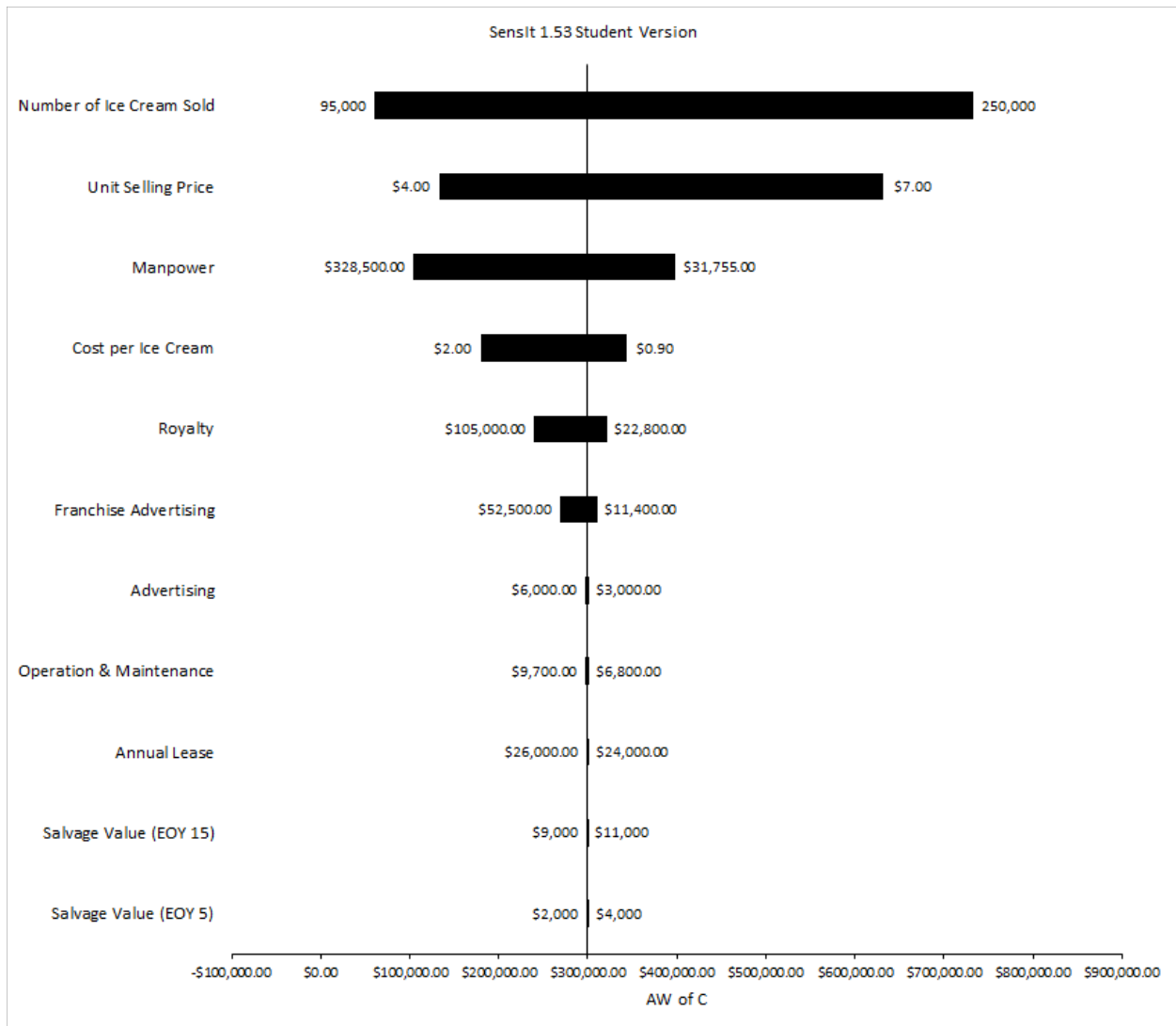


Figure 23: Tornado Diagram for Alternative C

The width of the tornado indicates the “swing” in AW and hence the sensitivity of each of the factor. The most sensitive factor is “Number of Ice Cream Sold”. When its value was varied from 95,000 to 250,000, the AW changed from \$82,808.60 to \$734,075.85, creating a swing of \$651,267.25. The next two sensitive factors are “Manpower” and “Unit Selling Price” which have swing of \$497,572.60 and \$295,317.98 respectively. The least sensitive factor is “Salvage Value (EOY 5)” which has a swing of only \$34.92. The project is feasible ($AW > 0$) for all values of factors.

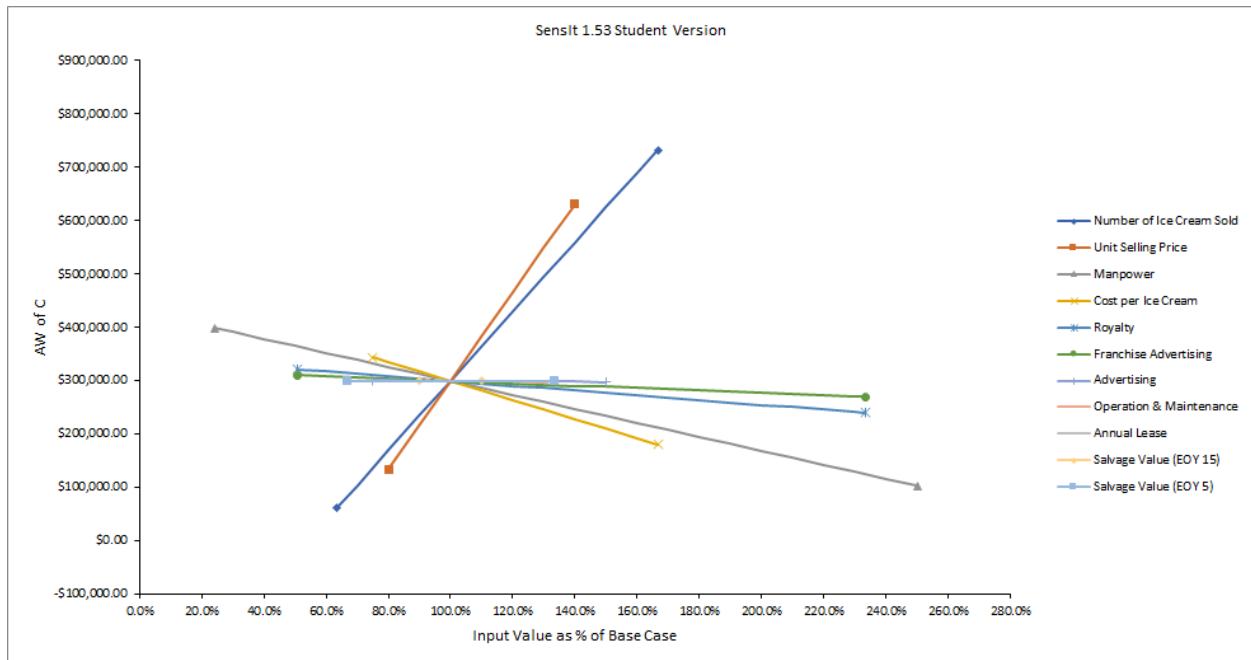


Figure 24: Spider Diagram for Alternative C

All the lines in the spider diagram pass through the base case at 0% change at $AW = \$303,903.43$.

Directions of change w.r.t. Single factor:

- AW increases with “Unit selling price” and “Number of Ice Cream Sold”.
- AW decreases with “Operation & Maintenance”, “Advertising”, “Manpower”, “Salvage Value (EOY 15)”, “Salvage Value (EOY 5)”, “Royalty”, “Franchise Advertising”, “Annual Lease” and “Cost per Ice Cream”.

Rates of change of PW w.r.t. % -change of single factor:

- AW is sensitive to “Unit selling price”, “Number of Ice Cream Sold”
- AW is not sensitive to “Operation & Maintenance”, “Advertising”, “Manpower”, “Salvage Value (EOY 15)”, “Salvage Value (EOY 5)”, “Royalty”, “Franchise Advertising”, “Annual Lease” and “Cost per Ice Cream”.

Swing:

- The horizontal projection of each line on the AW-axis gives the “swing” of the AW as in the tornado diagram. Hence “Number of Ice Cream Sold” has the largest swing while “Salvage Value (EOY 5)” has the smallest swing.

4.6 Probabilistic Risk Analysis

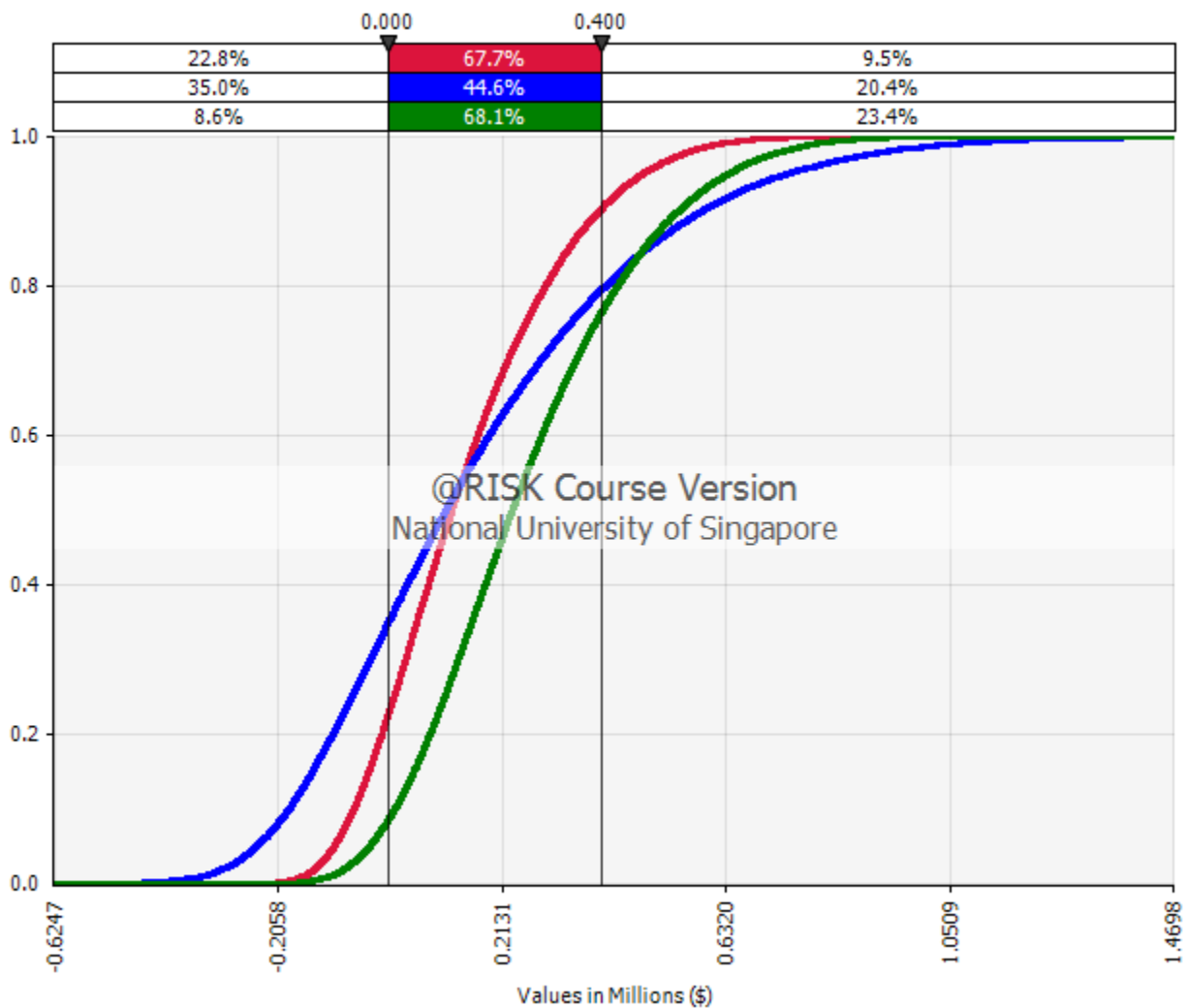


Figure 24: Project Risk Profiles for all Alternatives

This diagram depicts the project risk profiles for all three alternatives. Red for A (leasing), blue for alternative B (buying) and green for alternative C (franchise).

Table 14: Analysis Table for Risk Profiles

Information	Alternative A	Alternative B	Alternative C
Downside Risk	22.8%	35%	8.6%
Upside Potential	9.5%	20.4%	23.4%

Comparing the risk profiles, alternative C has the lowest downside risk at 8.4% which is significantly lower than alternative A's and B's at 22.8% and 35% respectively. This means that it is highly unlikely that alternative C will be infeasible and is therefore the safest choice. The upside potential for B is the highest at 14.7% where alternative A's and B's is at 4.4% and 13.9%. This means that alternative B has the highest potential for greater than expected AW.

Buying a franchise has first order stochastic dominance over leasing a stall but does not have first order stochastic dominance over buying a stall due to the intersection of the risk profiles. It does however have second order dominance over buying a stall. Before the intersection, the risk profile of C dominates B, and this area is greater than the area between the risk profiles where alternative B dominates alternative C.

This means that the alternative of opening a Stone Cold Creamery franchise will be preferred over the two other alternatives, assuming that making more money is preferred.

4.7 Break-even Analysis

The most critical factor for the three alternatives is the number of ice cream sold. The rainbow diagram determines the break-even value in order for each alternative to be economically feasible. For alternative A (leasing a stall) approximately 85000 ice creams are required, for alternative B (buying a stall) approximately 70000 ice creams are required, and for alternative C (franchise) approximately 65000 ice creams are required. Alternative C can be seen to always lie above the other two alternatives. This means that regardless of the number of ice creams sold, alternative C would always be the preferred option.

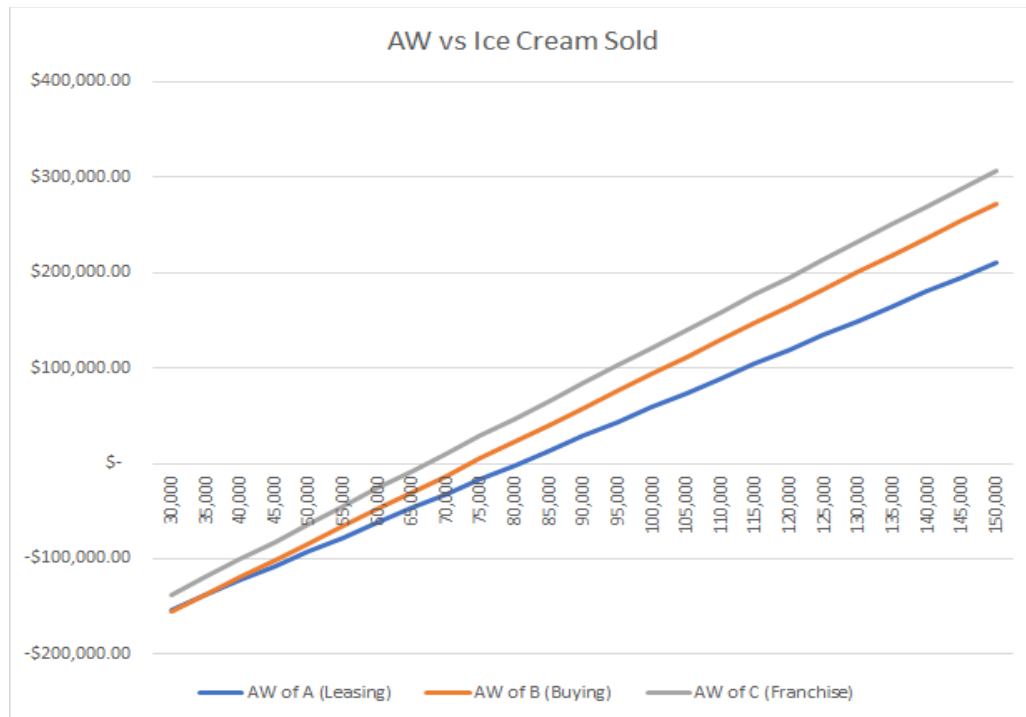


Figure 25: Break-even analysis for all Alternatives

5. What-If and Scenario Analysis

5.1 Fall in the supply of ice cream

At EOY 5 of the project, there was a disease that broke out in New Zealand which affected the cows and resulted in a decrease in the supply of milk. The production of ice cream fell as a result and there will be a fall in the ice-cream supplied to Singapore. This effects of the disease lasts for 3 years until EOY 8. The number of ice cream sold for all 3 alternatives decreases drastically from EOY 5 to EOY 6 because the cost of making ice-cream increases and the revenue earned will continue to decrease at a rate of 1% till EOY 8. Assume that the market for ice cream recovers from EOY 9 onwards and revenue generated will continue to increase at a steady rate thereafter. As a result, it will affect the revenue for the period of time. Break-even analysis is done as shown in Figure 25, Chris has to sell more ice-cream to break even. It is may be harder for alternative A (Lease) and alternative B (Buy) to break even as they need to increase their ice cream sales.

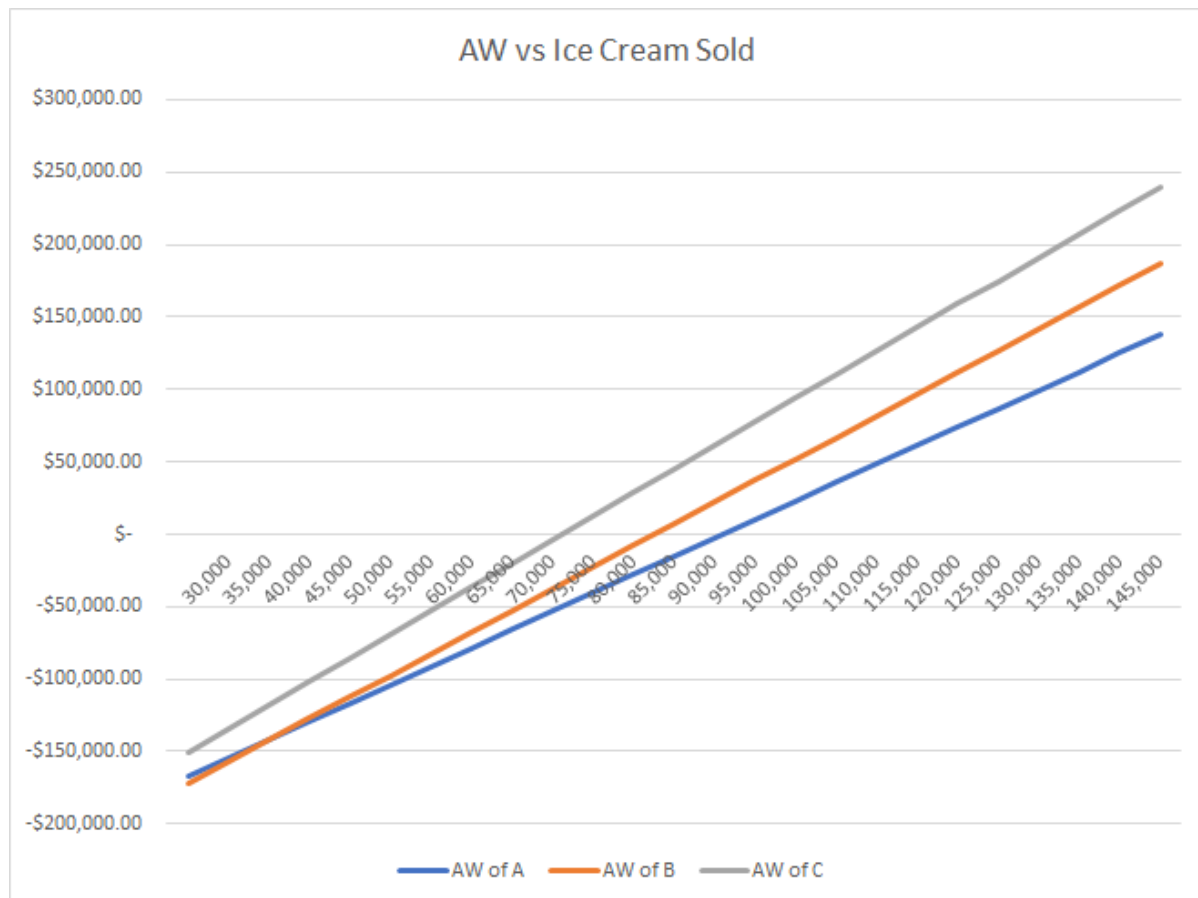


Figure 26: Break-even analysis for all Alternatives

5.2 Opening the cafe in the City.

If Chris decides to open his ice-cream cafe in the City instead of Woodlands, the outcome may be different. The customer traffic in the City is also generally greater than that in Woodlands and the average number of ice cream sold will be higher than that in Woodlands. However, the rental cost in Central Area is also significantly higher than Woodlands per month. We would also assume that in the City area, there will be many Cold Stone Creamery franchises within close proximity with one another and hence if Chris were to open the franchise in the City instead, he would not be able to sell as many ice cream as in the heartlands. We assume that Chris can only sell a maximum of 150,000 units of ice cream if he were to open the Cold Stone franchise in the City.

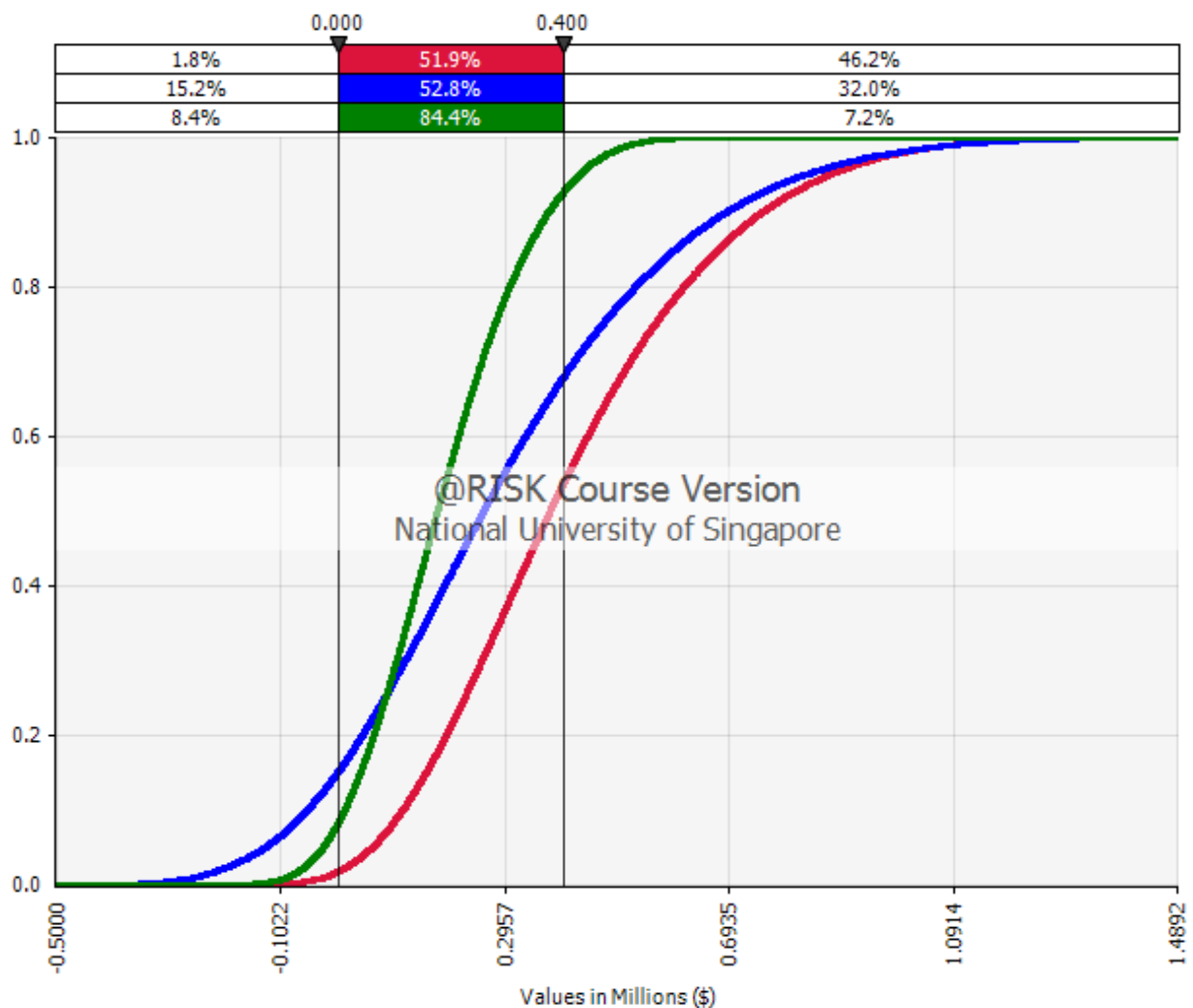


Figure 27: Project Risk Profiles for all alternatives (City)

This diagrams depicts the project risk profiles for all three alternatives. Red for A (leasing), blue for alternative B (buying) and green for alternative C (franchise).

Table 15: Analysis Table for Risk Profiles (City)

Information	Alternative A	Alternative B	Alternative C
Downside Risk	1.8%	15.2%	8.4%
Upside Potential	46.2%	32.0%	7.2%

Comparing the risk profiles, alternative A has the lowest downside risk at 1.8% which is significantly lower than alternative B's and C's at 15.2% and 8.4% respectively. This means that it is highly unlikely that alternative A will be infeasible and is therefore the safest choice. The upside potential for A is the highest at 46.2% where alternative A's and B's is at 32.0% and 7.2%. This means that alternative B has the highest potential for greater than expected AW.

Leasing a stall has first order stochastic dominance over leasing a stall but does not have first order stochastic dominance over buying a stall due to the intersection of the risk profiles. It does however have second order dominance over buying a stall. Before the intersection, the risk profile of A dominates B, and this area is greater than the area between the risk profiles where alternative B dominates alternative A.

This means that the alternative of leasing a unit is preferred over the two other alternatives, assuming that making more money is preferred.

5.3 Business Expansion (Lease/buy)

If Chris chooses to buy over a cafe and the business of the ice-cream cafe is doing very well after 10 years of opening, Chris might expand his business by widening the size of his cafe provided that. Assumes that Chris uses his savings to expand his stall at the half life (at EOY 10 for buying) which would allow him to serve more customers and hence sell more ice cream. If Chris were to opt for opening the franchise or leasing a cafe, he would not have the option to expand the business.

We assume Chris expands his business at EOY 10 at the same initial investment cost of \$750,000. His annual revenue would increase at a constant rate of 11.2% year on year and his annual expenses will increase at a constant rate of 8%.

Using excel, AW (Buying a cafe with expansion) = \$300,000

EOY	A Revenue	Loan Payments	A Expenses	Expansion	PROFIT
0					
1	\$ 600,000.00	\$ 217,315.52	\$ 375,800.00		\$ 6,884.48
2	\$ 630,000.00	\$ 202,315.52	\$ 394,590.00		\$ 33,094.48
3	\$ 661,500.00	\$ 202,315.52	\$ 414,319.50		\$ 44,864.98
4	\$ 694,575.00	\$ 202,315.52	\$ 435,035.48		\$ 57,224.00
5	\$ 729,303.75	\$ 202,315.52	\$ 456,787.25		\$ 70,200.98
6	\$ 765,768.94		\$ 479,626.61		\$ 286,142.33
7	\$ 804,057.38		\$ 503,607.94		\$ 300,449.44
8	\$ 844,260.25		\$ 528,788.34		\$ 315,471.91
9	\$ 886,473.27		\$ 555,227.76		\$ 331,245.51
10	\$ 930,796.93		\$ 582,989.14	\$ 300,000.00	\$ 47,807.79
11	\$ 1,035,331.91		\$ 629,628.28		\$ 405,703.64
12	\$ 1,151,606.90		\$ 679,998.54		\$ 471,608.36
13	\$ 1,280,940.38		\$ 734,398.42		\$ 546,541.96
14	\$ 1,424,798.91		\$ 793,150.29		\$ 631,648.61
15	\$ 1,584,813.75		\$ 856,602.32		\$ 728,211.43
16	\$ 1,762,799.38		\$ 925,130.50		\$ 837,668.87
17	\$ 1,960,774.03		\$ 999,140.94		\$ 961,633.09
18	\$ 2,180,982.61		\$ 1,079,072.22		\$ 1,101,910.40
19	\$ 2,425,922.16		\$ 1,165,398.00		\$ 1,260,524.16
20	\$ 2,698,370.12		\$ 1,258,629.84		\$ 1,439,740.28

Figure 28: Cash Flow Calculations for Business Expansion

Since AW (Buying a cafe with expansion) > AW (leasing) > AW (Franchise), Chris should buy a cafe.

6. Further Analysis: Consideration of Non-Economic Factors

6.1 Non-Economic Factors

1. Innovation

Innovation focuses on Chris' freedom to be innovative. This may include what flavour ice creams he would like to invent, thus sell, or how he decides to attract his customer base. For example, if Chris would like to have freedom to innovate, he should consider either buying a cafe or leasing a cafe as compared to being a franchise owner. This is because owning a franchise comes with many restrictions and strings attached.

2. Flexibility

Flexibility refers to the control Chris may or may not have on the operating hours of his stall. For example, franchises would have stipulated operating hours that Chris would have to adhere to; owning a cafe or being a tenant would give Chris more control over his cafe as compared to owning a franchise.

3. Stability

Stability focuses on Chris' ability to be financial secure depending on the alternative chosen. If Chris is very risk averse, he would value stability very highly compared to the other non-economic factors. Opening a franchise, Cold Stone Creamery, would provide more guarantee for a steady stream of annual revenue as it is already an established and reputable brand. Opening his ice cream cafe via leasing or buying a unit would result in high volatility in revenue and expenses, hence lower stability.

4. Sense of business ownership

Sense of business ownership refers to the pride Chris can derive from his experience of being a business owner. For example, Chris would feel more satisfaction in buying a stall and establishing his own business as opposed to purchasing a pre-established franchise.

5. Low Capital Cost

Capital cost refers to the initial upfront capital that would be required in order to start the business. A low capital cost may be preferred if Chris has financial difficulty with high upfront investments. Leasing a stall has the lowest initial cost and is weighted heavily in terms of low capital cost.

6.2 Analytical Hierarchy Process

The analytical hierarchy process is a pairwise comparison analysis to help determine the best alternative, taking into account economic and non-economic factors. Six criteria are considered, profitability, innovation, flexibility, stability, entrepreneurship and capital cost. Our analysis through pairwise comparisons resulted in the criterion profitability being the most important factor, with flexibility in operating hours being the least important. The weighting factors for each criteria can be seen in on our analytical hierarchy diagram. It is worth noting that the consistency ranking is below 10% ensuring consistent pairwise comparisons.

The three alternatives, leasing, buying or owning a franchise are compared amongst each other against each criteria, forming a final rating matrix. This information is combined with the criteria weightings to result in an overall weighting for each of the alternatives. The alternative with the most weighting is buying a cafe, at 0.391, followed by buying a franchise, at 0.352, ending with leasing a cafe with a weighting of 0.257.

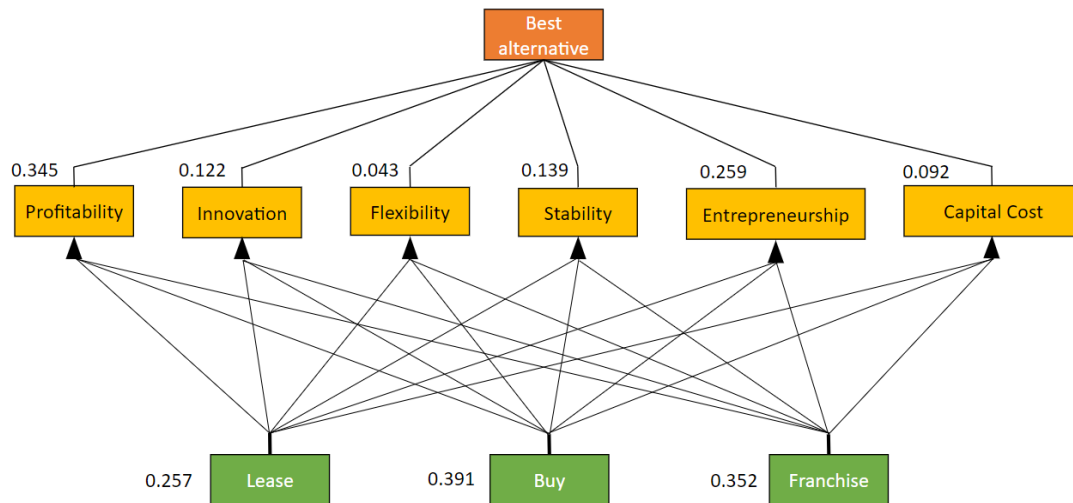


Figure 29: Analytical hierarchy Process

We assigned the above rankings based on the assumptions that Chris is profit-driven and would like to be an Entrepreneur. He is also risk averse and would like his business to be financially secure. Hence, profitability and entrepreneurship are given the highest ratings.

6.3 Decision Reversal

In order to determine how the weighting of each criteria affect the final decision, rainbow diagrams are generated to compare the three alternatives. The preferred alternative is the one with the highest weighting, and can be determined graphically by the line which lies above the other two for any given weight for any given criteria.

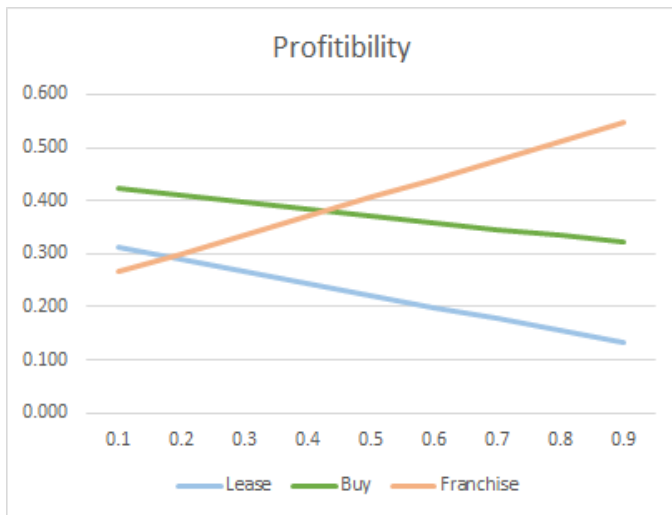


Figure 30: Effect of Profitability

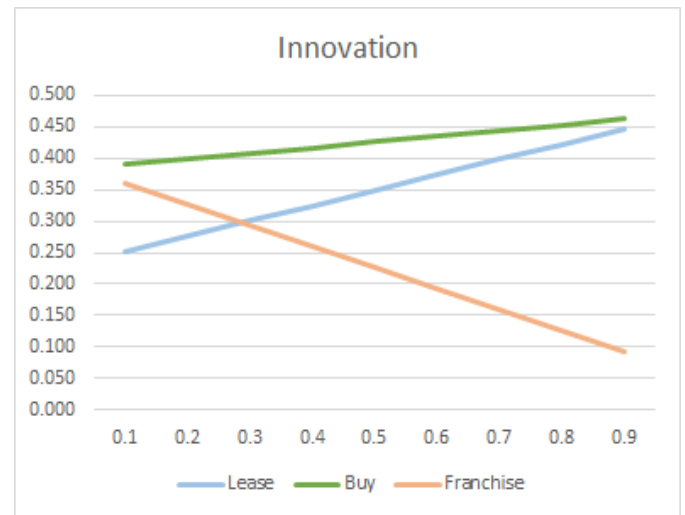


Figure 31: Effect of Innovation

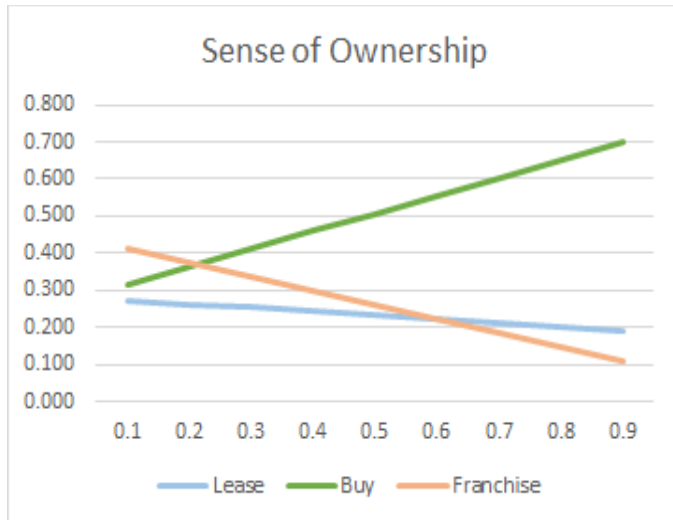


Figure 32: Effect of Sense of Ownership

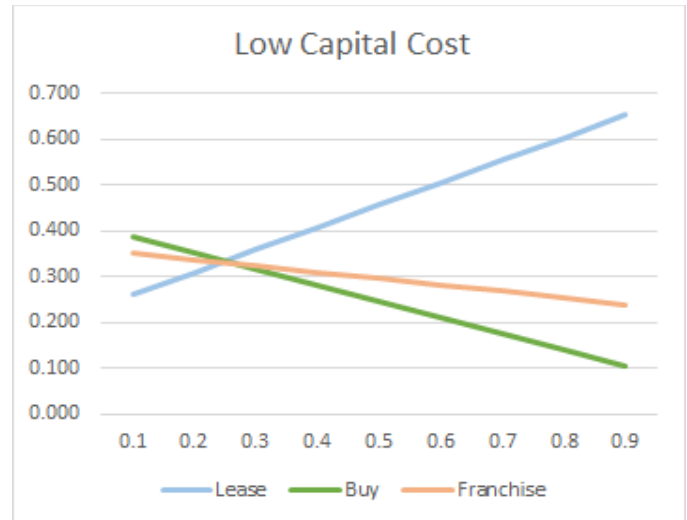


Figure 33: Effect of Low Capital Cost

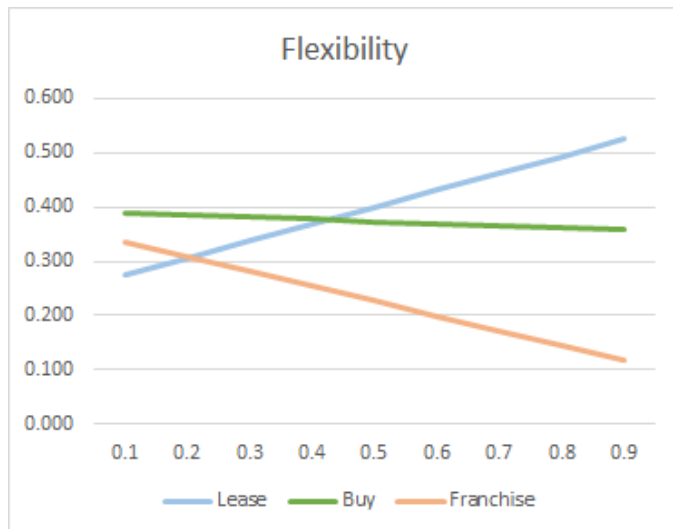


Figure 34: Effect of Flexibility

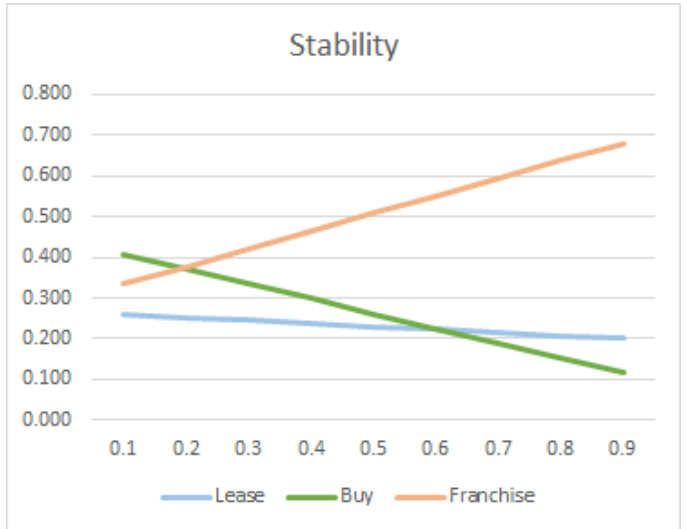


Figure 35: Effect of Stability

The profitability diagram shows that buying a cafe when the weighting for profitability is below 0.4, Otherwise the decision for preferred alternative would reverse to buying a franchise. The innovation diagram shows that with all other criteria fixed, the preferred decision would always to buy a cafe regardless of preference for innovation. The flexibility diagram shows that for weightings under 0.4, the preferred alternative is to buy a cafe. For weightings above, the preferred alternative would be to lease a stall. In terms of financial stability, for a weighting below 0.2, buying a cafe is the preferred alternative. If the weighting was to increase past this point, the preferred decision would be to buy a franchise. For a sense of ownership weighting below 0.2,

the preferred alternative would be to buy a franchise. Above this weighting, the decision would be reversed to buying a cafe. Lastly. When the weighting for low capital cost is below 0.25, the decision would be to buy a franchise. Beyond this weighting, leasing a stall would become the preferred alternative.

7. Recommendations and Conclusion

In this analysis, the study period is chosen to be 20 years and Chris's MARR is chosen to be 10%. The three options that he has, owning the business for a short time by leasing a retail unit, running his own business by purchasing a retail unit, and purchasing the rights to a well-known Franchise (e.g Cold Stone-Creamery) each have an annual worth of \$119,431.56, \$241,247.13 and \$299,380.34 respectively. The most economically feasible alternative is therefore to purchase the rights to a well-known franchise, as it results in the highest annual worth.

The sensitivity and risk analysis performed showed that the most critical factor for leasing a unit is the cost per ice cream, followed closely by the unit selling price and number of scoops to be sold. On the other hand, the most critical factor for buying a unit and operating a franchise is the number of scoops sold. A rainbow diagram was generated for the number of scoops to be sold, and it showed that operating a franchise would always be the most economically feasible regardless of the number of scoops to be sold. Our risk analysis from our monte carlo simulation showed that operating a franchise has first order dominance over leasing a stall, and has second order stochastic dominance over buying a stall. This shows that operating a franchise is the preferred alternative out of the three.

Three difference scenarios were investigated to determine their effects. In the scenario where supply of ice cream falls as a result of external factors, the number of scoops of ice cream to be sold would increase due to increases in expense. It may be harder to sell the number of scoops needed to break even. In this scenario, owning a franchise is more economically feasible. In the scenario Chris decides to expand his business at EOY 10 after he purchases the stall unit, 11.2% annual increase in revenue would be required for the decision to be reversed to purchasing the stall unit. Furthermore, in the case where Chris decides to start his business in the City, he should lease a cafe instead. This is because leasing a unit has first order stochastic dominance over the other two alternatives, making it the preferred option.

Non-economic factors may also influence Chris' decision on which alternative he should pursue. Six factors underwent pairwise comparisons to determine their relative importance through the analytical hierarchy process; alternatives were also compared in pairs to see how best they fit against each criteria. The criteria, in order of highest weighting, profitability, sense of business ownership, stability, innovation, low capital cost and flexibility, were used to rank the three alternatives. Leasing a unit resulted in a weighting of 0.257, buying a unit with a weighting of 0.391, and purchasing a franchise with a weighting of 0.352. Based on the analytical hierarchy process, the final recommended alternative for Chris is therefore to start his ice-cream cafe business by purchasing a retail unit.

Chris should take precautions against external factors such as the cost of raw ingredients that may affect the profitability of his business by diversifying his supply sources. He should also seek contractual agreements with maintenance firms that offers him a fixed rate of maintenance over a long period of time.

8. Appendixes

Tax:

Corporate Tax rates. Retrieved from:

www.iras.gov.sg/irashome/Quick-Links/Tax-Rates/Corporate-Tax-Rates/

Singapore Corporate Tax Guide. Retrieved from:

www.guidemesingapore.com/business-guides/taxation-and-accounting/corporate-tax/singapore-corporate-tax-guide

Business Costs:

Lui, Seth. (2017) How To Start a Restaurant or Food Business in Singapore. Retrieved from:

<https://sethlui.com/start-restaurant-food-business-singapore/#ixzz5ksx504IDsethlui.com/start-restaurant-food-business-singapore/>

Lui, Seth .(2014) Guide to Leasing A Retail Outlet. Retrieved from:

sethlui.com/a-guide-to-leasing-a-retail-outlet/

Hudson, Matthew.(2018) What It Costs to Rent a Retail Space. Retrieved from:

<https://www.thebalancesmb.com/what-it-costs-to-rent-a-building-space-2890493>

Shop Space for rent in Singapore. Retrieved from:

www.iproperty.com.sg/rent/shop-shop-space/?gclid=CjwKCAjwmq3kBRB_EiwAJkNDp2aOJ9K0Nc2VrCXngFE_PeDrr_nyg1AS9Z_8lnp1-sO0cnpPC_DszBoCn20QAvD_BwE&gclsrc=aw.ds

Your Way to Work. Retrieved from:

www.99.co/singapore/commercial?gclid=CjwKCAjwmq3kBRB_EiwAJkNDp4bS3WuUmjP-Ft12Guzksk9nRkVqNr3yVY5YtsDJRibh9qiriKjbcxoCXdcQAvD_BwE

Starting an Ice Cream Cafe in Singapore?. (2017) Retrieved from:

www.icecreamcookieco.com/blogs/news/starting-an-ice-cream-cafe-in-singapore

Business Loans In Singapore Comparison. Retrieved from:

smeloan.sg/business-loans-compare

Restaurant Operating Costs. Retrieved from:

<https://www.ichefpos.com/en-sg/blog/budgeting-for-your-restaurants-operational-costs>

Make your own Ice Cream. (2011) Retrieved from:

<https://www.aol.com/2011/06/01/savings-experiment-make-your-own-ice-cream/>

Ong, Ryan (2017). How Much Does it Cost to Start a Restaurant in Singapore? Retrieved from:

<https://www.singsaver.com.sg/blog/much-cost-start-restaurant-singapore>

"What Are My Start Up Costs", (2019). Cold Stone Creamery Ice Cream Franchise. Retrieved from:

coldstonecreameryfranchise.com/research/startup-costs/