Garage Case: Detail

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Background

The "garage case" is a prototype example that presents the essential parts of the course.

The technology is simple enough so we can see through it and gain insights into the how flexibility in design increases expected value

This Presentation

First presentation focused on concepts
The emphasis was on:
How flexibility paradigm is different;
Why flexibility increases expected value;
How to implement effectively.

This presentation examines a key detail of the analysis:
Rules for Exercising Flexibility

Outline

1: What is different about analysis for "garage case"?

2: How we implement flexibility in spreadsheet analysis

What is different?

Here is image of a spreadsheet for garage case: How does it differ from standard format?

PERFORMANCE CALCULATION							
Year	0	1	2	3	4	…	15
Levels		4	4	4	5		8
Realised demand		750	893	1015	1120	…	1634
Capacity		800	800	800	1000	…	1600
Expansion?				expand	expand	…	
Build extra capacity		0	0	200	200	…	0
Revenue		7.5	8.0	8.0	10.0	…	16.0
Operating costs		2.4	2.4	2.4	3.0	…	4.8
Land leasing costs	3.3	3.3	3.3	3.3	3.3	…	3.3
Expansion cost	0.0	0.0	0.0	4.5	5.0	…	0.0
Cashflow	-3.3	1.8	2.3	-2.3	-1.3	…	7.9
DCF	-3.3	1.6	1.9	-1.7	-0.9	…	1.9
Present value of cashflow	20.4						
Capacity cost for up to two levels	8.8						
Capacity costs for levels above 2	7.9						
Net present value	3.7						

- **Figure D.17: Spreadsheet for Garage Case (Source: "Flexibility in Design")**

Difference subtle but crucial

- **Difference not immediately visible**
- **Difference is in formulas behind number:**
- **… Rules for exercising flexibility**
  - **The way we implement flexibility in spreadsheet**
  - **"If" statements that trigger actions based on past situations**

Implementation of a Rule

- **In cell E6:**
  - **IF(AND(D4<MAX_CAP, MIN(D4,D5) + MIN(E4,E5) = D5+E5), “expand”, “”)**
- **Interpretation**
  - **IF(AND => two conditions to be respected**
  - **(D4<MAX_CAP => number of spaces in previous year less than maximum capacity**
  - **MIN(D4,D5) + MIN(E4,E5) = D5+E5 => demand in past 2 years more than current capacity of garage**
  - **Then “expand”, triggers expansion cost in E11, for more capacity next year – or “”**

How many “rules” ?

- **What is limit on number of rules?**
  - **No theoretical limit**
  - **Practical limit … we and eventual audience for analysis … may get confused**
- **Rules need to cover important possible decisions**
  - **Expand or not?**
  - **Close?**
  - **Raise prices? Etc.**

Can rules vary over time?

- Often should, to reflect changing situations
- Examples for garage case?
  - Expansion at end of project may not make sense. Not enough time to make profits to pay for costs.
  - May want to include consideration of changing construction costs

Is it "right" rule?

- What is criterion for "right" rule?
- Two perspectives:
  - Descriptive (you do): Rule reflecting managers' choices (might not be optimal!)
  - Normative (you should): Rule to maximize Expected Net Present Value (ENPV)
- Not obvious how to determine optimal
  - Can try several possibilities

Reference

Cardin SM Thesis:

Cardin, M.-A., "Facing Reality: Design and Management of Flexible Engineering Systems," Master of Science thesis, MIT Technology and Policy Program, May, 2007.

http://ardent.mit.edu/real_options/Real_Opts_papers/Cardin_SM_Thesis.pdf

Summary

- **Rules for exercising flexibility are key ingredient ("secret sauce") for analysis of flexibility**
- **They are:**
  - **Easy to implement**
  - **May vary over time**
  - **Can be descriptive or normative**
  - **Difficult to optimize**