
Mini-Case: Decision Rule Dilemma¹

Audrey Cameron is a co-founder at a small graphic chip manufacturer, VideoChip, located in Santa Clara, Silicon Valley. The firm has built a strong reputation for building the very highest quality graphic chips and has remained small in order to maintain this level of quality. This strategy served the company well in 2008-2010; though the recession led to a drop in overall demand, VideoChip gained market share and managed to operate at or near capacity throughout the recession. Over the last several years, demand has surged and its customers are now pressuring VideoChip to increase their production. The firm is now considering a number of possible strategies to meet this increased demand over the next 2-4 years.

Audrey recently met with her team of engineers and financial analysts to discuss four potential options. The first project (A) involves a small expansion at their main facility in the production of their baseline chip model. The second project (B) involves a larger investment at a different facility, but one that will also allow for a larger increase in the production of their base-line graphic chip. Another possibility (C) is to expand the production of a newer graphic chip model. The newer graphic chip model is not currently as popular, but demand is expected to surpass that of the baseline model in the near future. Finally, a fourth possibility (D) is to ramp up R&D and production of a new prototype chip. Table 1 contains the expected cash flows from each of the potential strategies.

When it comes to making investment decisions, Audrey uses net-present value (NPV) with an 8% cost of capital to discount cash flows from projects related to their core business. She firmly believes that choosing projects with the highest NPV delivers the greatest value to the firm. However, her business partner and co-founder, Ernesto, sometimes complains that she is picking low-return projects and often argues that VideoChip should be selecting projects with the highest internal rate of return (IRR). Furthermore, Ernesto prefers communicating with their investors in terms of percentage return. Jacqueline agrees that IRR can be a useful communication device, but she stands firm in her belief of choosing projects based on the NPV decision rule.

Most of the time, Audrey has found that the NPV and IRR decision rules agree and therefore, the disagreements with Ernesto are generally resolved without much conflict. However, in this case she faces a more serious dilemma as the two decision rules seem quite clearly not to be aligned. She wonders how best to account for scale differences between projects when working with IRR. She is also concerned about whether IRR even correctly measures the percentage return on a project given that its implicit assumption that any intermediate cash flow can be reinvested at the IRR seems very unrealistic.

¹ Firms and characters in this case are fictitious.

With your help, she presents a case in terms of percentage return to Ernesto for why her preferred project is the right one, assuming the projects are mutually exclusive. Ernesto listens to Audrey's arguments, but he does not agree. He says that she is thinking about the wrong constraint: She is doing the analysis as if doing one project rules out doing another. He argues that these particular projects are not mutually exclusive and that the more relevant consideration is that they have only limited capital to invest and hence they need to pick projects in the order to decreasing IRR in order to maximize the bang-for-their-buck.

Audrey counters by arguing that VideoChip can always raise more capital if the firm has positive NPV projects. However, she recognizes that the firm may face other constraints. For example, currently they only have a handful of employees that would be capable of managing new projects of this magnitude and any new hires would not have sufficient knowledge of the company yet to be put in charge.

Concepts covered: Net Present Value, Internal Rate of Return, Modified Internal Rate of Return, Profitability Index, Payback Period.

Case Questions:

1. Calculate the NPV and IRR of each of the four projects.
2. In this question you are asked to try to reconcile the discrepancy between the decision rules when choosing between *mutually exclusive* projects:
 - a. Comparing only A and B, can Audrey use IRR or MIRR in some way to convince Ernesto that B is better than A?
 - b. Comparing only B and C, can Audrey use IRR or MIRR in some way to convince Ernesto that C is better than B?
 - c. Comparing only C and D, can Audrey use IRR or MIRR in some way to convince Ernesto that D is better than C?
3. Now suppose that the projects are not mutually exclusive but that VideoChip has only \$3M of capital budgeted toward the expansion.
 - a. Suppose that Audrey chooses projects with the highest NPV until reaching their capital budgeting constraint? Which project(s) would she choose?
 - b. Suppose instead that Audrey listens to Ernesto and chooses projects with the highest IRR until reaching the budget constraint. Which project(s) would she choose?
 - c. Are either of the approaches in 3(a) and 3(b) optimal? Can Audrey do even better using Profitability Index to choose projects?
4. Discuss how an approach similar to that in 3(c) could be used if, instead of facing capital constraints, VideoChip was constrained in the number of employees capable of managing new projects.
5. Suppose now that due to a limited number of employees, VideoChip can take on at most one of the four projects. One of Audrey's financial analysts argues that due to the difficulty of projecting product demand far out in the future in a rapidly changing industry, they should look for a project with a 2-year payback period, thereby ruling out Strategy D.
 - a. Discuss the merits of this argument.
 - b. Suppose that projections for strategy D do not reflect a small chance that the demand for the prototype chip falls to zero at $t=3$ and 4 such that cash flows at those dates would be zero for that strategy (projections for all other strategies reflect all relevant risk). If the probability of this zero demand risk is 5%, which project should Jacqueline choose?
 - c. How large must be the probability of zero demand at time 3 and 4 be in order to make strategy D as attractive as the next best strategy?