

Strategic Innovation Management



Zhidebekkyzy Aknur

Lecture 8. Choosing innovation projects - part II

- ▶ 1. Quantitative methods for choosing innovation projects
- ▶ 2. Combining quantitative and qualitative information: Conjoint Analysis and Data Envelopment Analysis
- ▶ The main **objective** of this lecture is to consider quantitative methods for selecting innovation projects.

QUANTITATIVE METHODS FOR CHOOSING PROJECTS

Quantitative methods of analyzing new projects usually entail converting projects into some estimate of future cash returns from a project. Quantitative methods enable managers to use rigorous mathematical and statistical comparisons of projects, though the quality of the comparison is ultimately a function of the quality of the original estimates. The accuracy of such estimates can be questionable—particularly in highly uncertain or rapidly changing environments. The most commonly used quantitative methods include discounted cash flow methods and real options.

Discounted Cash Flow Methods

- ▶ Many firms use some form of discounted cash flow analysis to evaluate projects. Discounted cash flows are quantitative methods for assessing whether the anticipated future benefits are large enough to justify expenditure, given the risks. Discounted cash flow methods take into account the payback period, risk, and time value of money. The two most commonly used forms of discounted cash flow analysis for evaluating investment decisions are net present value (NPV) and internal rate of return (IRR). Both methods rely on the same basic discounted cash flow mechanics, but they look at the problem from different angles. NPV asks, “Given a particular level of expenditure, particular level(s) and rate of cash inflows, and a discount rate, what is this project worth today?” IRR asks instead, “Given a particular level of expenditure and particular level(s) and rate of cash inflows, what rate of return does this project yield?” For either method, managers must use estimates of the size and timing of expenditures and cash inflows. Both methods enable the decision maker to incorporate some basic measure of risk. For example, riskier projects may be examined by using a higher discount factor in NPV analysis. Managers also often calculate discounted cash flow measures using best-case and worst-case cash flow estimates.

Net Present Value (NPV)

- ▶ To calculate the NPV of a project, managers first estimate the costs of the project and the cash flows the project will yield (often under a number of different “what if” scenarios). Costs and cash flows that occur in the future must be discounted back to the current period to account for risk and the time value of money. The present value of cash inflows can then be compared to the present value of cash outflows:
- ▶ **NPV = Present value of cash inflow - Present value of cash outflows**
- ▶ The present value of the costs and future cash flows can also be used to calculate the discounted payback period (that is, the time required to break even on the project using discounted cash flows).
- ▶ **Discounted payback period** - The time required to break even on a project using discounted cash flows.

Internal Rate of Return (IRR)

- ▶ The internal rate of return of a project is the discount rate that makes the net present value of the investment zero. Managers can compare this rate of return to their required return to decide if the investment should be made. Calculating the IRR of a project typically must be done by trial and error, substituting progressively higher interest rates into the NPV equation until the NPV is driven down to zero. Calculators and computers can perform this trial and error. This measure should be used cautiously, however; if cash flows arrive in varying amounts per period, there can be multiple rates of return, and typical calculators or computer programs will often simply report the first IRR that is found.
- ▶ Both net present value and internal rate of return techniques provide concrete financial estimates that facilitate strategic planning and trade-off decisions. They explicitly consider the timing of investment and cash flows, and the time value of money and risk. They can make the returns of the project seem unambiguous, and managers may find them very reassuring.

Real Options

- ▶ When a firm develops new core technologies, it is simultaneously investing in its own learning and in the development of new capabilities. Thus, development projects can create valuable future opportunities for the firm that would otherwise be unavailable.² Even development projects that appear unsuccessful (as Intel's DRAM discussed above) may prove to be very valuable when they are considered from the perspective of the options they create for the future of the firm. Some managers and scholars have begun arguing that new product development decisions should be evaluated as "real options."
- ▶ Options are valuable when there is uncertainty, and because technology trajectories are uncertain, an options approach may be useful. Though there has not yet been much empirical work in the area, several authors have developed methodologies and applications of options analysis to valuing technology development investments.⁷ Also, some evidence shows that an options approach results in better technology investment decisions than a cash flow analysis approach.

DISADVANTAGES OF QUANTITATIVE METHODS

- ▶ Quantitative methods for analyzing potential innovation projects can provide concrete financial estimates that facilitate strategic planning and trade-off decisions. They can explicitly consider the timing of investment and cash flows and the time value of money and risk. They can make the returns of the project seem unambiguous, and managers may find them very reassuring. However, this minimization of ambiguity may be deceptive; discounted cash flow estimates are only as accurate as the original estimates of the profits from the technology, and in many situations, it is extremely difficult to anticipate the returns of the technology. It is very difficult to compute the size of a market that does not yet exist.
- ▶ Furthermore, such methods discriminate heavily against projects that are long term or risky, and the methods may fail to capture the strategic importance of the investment decision. Technology development projects play a crucial role in building and leveraging firm capabilities and creating options for the future. Investments in new core technologies are investments in the organization's capabilities and learning, and they create opportunities for the firm that might otherwise be unavailable.
- ▶ Thus, standard discounted cash flow analysis has the potential to severely undervalue a development project's contribution to the firm. For example, Intel's investment in DRAM technology might have been considered a total loss by NPV methods (Intel exited the DRAM business after Japanese competitors drove the price of DRAM to levels Intel could not match). However, the investment in DRAM technology laid the foundation for Intel's ability to develop microprocessors—and this business has proved to be enormously profitable for Intel.

Combining quantitative and qualitative information

As demonstrated previously, both quantitative methods and qualitative methods offer a number of benefits to managers in choosing development projects. Thus, many firms use a combination of methods to arrive at an investment decision. For example, a firm might have screening questions that require quantitative analysis in addition to qualitative responses. Firms might also use quantitative methods to estimate the cash flows anticipated from a project when balancing their R&D portfolio on a project map. There are also valuation techniques that attempt to translate qualitative assessments into quantitative measures, such as conjoint analysis and data envelopment analysis, as discussed below.

Questions:

- ▶ 1. What are the advantages and disadvantages of discounted cash flow methods such as NPV and IRR?
- ▶ 2. For what kind of development projects might a real options approach be appropriate? For what kind of projects would it be inappropriate?
- ▶ 3. Identify a development project you are familiar with. What methods do you believe were used to assess the project? What methods do you believe *should have been* used to assess the project?
- ▶ 5. Will different methods of evaluating a project typically yield the same conclusions about whether to fund its development? Why or why not?

▶ Literature:

1. Melissa Schilling: Strategic Management of Technological Innovation, McGrawHill, International Edition 2011.
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Thank you for your attention!