

## Capital Rationing as an Incentive Instrument for Growth Options

### 3.1 Relevance of Growth Options for R&D-Investments

The purpose of this chapter is to analyze capital rationing as an incentive device for an investment opportunity that has the form of a growth option by using a formal principal-agent model. A growth option is an investment opportunity which is available, if a company makes an initial investment and the uncertain environment evolves favorable. Only this initial investment decision allows the company to make a follow-up investment. Typical examples for growth options are research and development (R&D) investments, particularly in uncertain markets. Investment activities in research provide options to engage in product development, if the research results are promising. In case of bad news on the results or the product market, the follow-up investment will not be made, i.e., the growth option will not be exercised.<sup>1</sup>

While the valuation of investment opportunities as growth options has been addressed by a large stream of literature in the context of real options<sup>2</sup>, at least to my knowledge a formal analysis of incentive issues in the presence of growth options has been remaining undone up to now. There might be two reasons for this fact. First, an analysis of incentive issues and growth options requires a dynamic principal-agent setting. Dynamic agency-settings, however, are difficult to analyze because of a lot of tractability problems<sup>3</sup>. General predictions in these types of models can hardly be made. Second, as pointed out above, growth options

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<sup>1</sup> From this definition, it is clear that growth options and abandonment options are just two sides of the same medal. The term growth option emphasizes the decision to continue, while the focus of the abandonment option is the decision to quit the project.

<sup>2</sup> For an overview see, e.g., Dixit & Pindyck (1994); Trigeorgis (1996).

<sup>3</sup> See, e.g., Lambert (2001) pp. 77-79.

frequently appear in the context of R&D investments. Compensating R&D employees on the basis of cash flows from the project is difficult, if not impossible. These cash flows often realize far in the future, when employees have been assigned new tasks within the firm, or when they have already left the firm. Hence, performance-based payment-schemes cannot be used as an efficient incentive device.

Although performance-based payments are inappropriate to motivate R&D employees, there might be another incentive scheme which is particularly important for investment opportunities with growth options. Corporate R&D funds are usually allocated on projects by a capital budgeting procedure which specifies the goals of the project. Headquarters normally has limited information regarding the issue to what extent single expenditures are really necessary for successfully completing the whole project. To some extent, the expenditures lie in the discretion of the manager of the R&D division and she can use them for own purposes without any benefits for headquarters. These excessive funds are organizational slack. My hypothesis is that they provide incentives for employees particularly in the area of R&D investments<sup>4</sup>. Furthermore, the possibility to gain some slack in future periods if uncertainty resolves in a good state of nature may also serve as an incentive scheme. Growth options have exactly this kind of investment structure.

I analyze the incentives provided by organizational slack in a two-period principal-agent setting with both parties being risk-neutral. Headquarters hires a manager who is better informed about the costs of a two stage investment. A conflict of interests arises, because the manager has a preference for organizational slack, which is costly to headquarters. I analyze two scenarios. First, in my basic model I assume that the manager has no own resources. In this case, a severe underinvestment problem occurs. The investment thresholds in each period in terms of investment costs are lower than in the case without an incentive problem. Headquarters responds to the managerial private information by rationing the investment budget in both periods. Second, as a modification of my basic model, I assume that the managerial resource restriction is lowered. One can think of this case in terms of a manager, who is responsible for several projects and can shift excessive funds from one project to another. In this case, the option on future slack from growth opportunities can be used as an incentive device. In order to achieve this option, the manager invests from his own resources. In this way the underinvestment problem is significantly relaxed.

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<sup>4</sup> Antle & Eppen (1985) have analyzed the role of organizational slack for a single one-period investment project based on the same hypothesis.