

## **Real Options and Resource Reallocation Processes**

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Decision making using a real options lens can be an important guide for resource allocation in organizations. This guide, however, makes some key assumptions about the nature of subsequent resource reallocation processes in the organization. This article considers some potential drivers and consequences of mismatches between initial resource allocation logics and subsequent reallocation realities, highlighting a process of rational escalation in the presence of sunk costs. It also presents a new perspective on the traditional stage gate process, and considers some recent empirical evidence on the efficiency of resource reallocation processes in organizations.

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Whether advocated in its strong form as a core valuation tool, or in its more moderate forms as a ranking tool, a heuristic or a metaphor, the appeal of real options thinking lies in its promise of structuring decision making under uncertainty. Because it explicitly incorporates the ability of decision makers to make sequential commitments to a course of action, and to benefit from updated information as this sequence unfolds, real options thinking has been held out as an appealing lens through which to view the content and process of strategy making. The appropriate application of real options theory to the strategy field, however, has been a subject of some debate (e.g., Adner and Levinthal, 2004a,b; Coff and Laverty, 2001)

### **Matching Resource Allocation Logics with Resource Reallocation Decisions**

At its core, real options thinking presents an approach to managing the resource allocation process. An attractive feature of the real options perspective is its seeming correspondence to the resource allocation process at many firms. In many organizations, the process of winnowing down investment candidates takes place over multiple rounds, with the formal expectation that selection criteria become stricter, and that resource commitments become larger, in each subsequent round. This stage-gate process, often represented as a filtering funnel in which proposals pass through a series of increasingly challenging screens, is a standard feature of multitudes of corporate presentations (Figure 1a).

It is important to remember, however, that the resource allocation process has two sides: the initial allocation of resources to initiatives, as well as the subsequent

*reallocation* of resources away from initiatives. Hence, a more appropriate representation of the resource allocation process may therefore be one, as in Figure 1b, which explicitly incorporates the reallocation philosophy for the firms – the modes by which project can exit from the organization’s activity set.

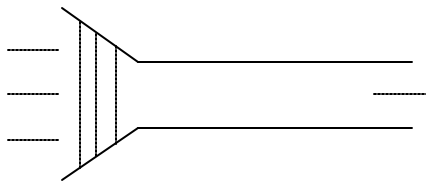


Fig 1a.

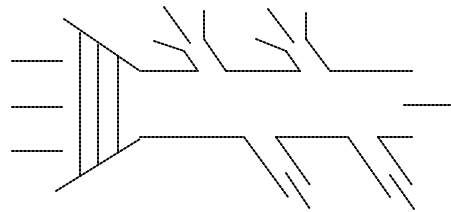


Fig 1b.

Figure 1: Two alternative representations of the stage-gate process for resource allocation in organizations.

As noted in Adner and Levinthal (2004a,b), sequential decision making *per se* is a general property of path dependent processes; therefore, it is the correspondence between initial resource allocation justifications and subsequent reallocation decisions that is the litmus test for the use of real options in real organizations. At the core of the Adner and Levinthal critique of the use of real options in strategy is a concern with the consistency between the logics and expectations that underpin a firm’s initial resource allocation decisions, and the organizational realities that govern firm’s subsequent resource reallocation decisions. Table 1 characterizes the possible combinations. The debate on the applicability of real options hinges on whether organizations are able to discipline themselves to reside in the lower right quadrant, and resist drifting to the lower left.

		<b>Subsequent Reallocation Process</b>	
		Persistence in Search	Disciplined pruning of portfolio activities
<b>Initial Resource Allocation Logic</b>	High commitment investment	Coherent decisions and actions	Mismatched
	Low commitment investment	Mismatched (flexible exploration, not consistent with real options logic used in initial project justification)	Coherent decisions and actions

Table 1: Correspondence between initial resource allocation logic and subsequent resource reallocation process

In assessing the applicability of real options to strategy, it is important to separate arguments about the *possibility* that real options logic can be correctly applied to inform strategy decision making, from arguments about the *probability* that the assumptions that underlie this logic will hold in real organizations.

An assumption of particular interest regards the consequence for an initiative when target goals are not met. Such negative information can lead to two different courses of subsequent investment. One possibility is that the cause of the negative outcome is explored and steps are taken to overcome the obstacle. This first type of flexibility is what many would expect of successful organizations – giving up in the face of adversity seems contrary to our image of what good managers should do. A second possibility is that, since the project failed to meet the targets on which its continuation had been premised, the project is terminated, thereby freeing up resources to be used elsewhere. It is this second type of flexibility that is implied by disciplined investment guidelines that underlies a real options perspective.

If one takes as a null hypothesis that organizations are subject to path dependence, then it is only by confronting the question of resource reallocation we can understand the descriptive value of using a real options lens to understand organizational decisions.

### **Rational Escalation in the Presence of Sunk Costs**

A rich literature in psychology and organizational behavior has explored underlying drivers that act against the ability of individuals and of organizations to efficiently reallocate resources away from existing initiatives. The psychological factors that act to support the escalation of commitment to a course of action even in the face of negative information are numerous (c.f., Staw, 1976, 1981; Staw and Ross 1978). Of particular relevance for real options, is the relationship between the way in which information is presented and the way in which it is processed. When negative information does not arrive all at once, but rather is sequenced over time (as is generally the case in any path dependent exploration activity) and when the overall stream of negative information is occasionally interrupted by promising developments, managers have a more difficult time convincing themselves that the course of action which they are pursuing is a failing one, and not worthy of additional attempts to improve the situation.

In such settings, managers are often argued to be particularly vulnerable to ‘self-justification bias.’ Alternatively, managers in such situations are often accused of succumbing to the ‘sunk cost fallacy,’ throwing away good money after bad.

This is a possible misattribution. In fact, the opposite logic may be at play – a manager who understands that sunk costs are sunk, and that they should not affect

future decision making will have a very difficult time justifying terminating a project in which additional investment might lead to success (that is, a project whose outcomes are at least partially endogenous to the manager's investments and actions). Consider the following scenario: An R&D project is initiated with the expectation of a sufficient payoff three years hence. At the end of three years of investment, the project is not yet a success. Hopes are as high as ever, but an additional two years of investment will be required to achieve the initial expected payoff. One perspective on the problem would argue that the payoff was worth three years of investment and no more; therefore, it is time to abandon the project and move on. Another perspective, however, would argue that it is precisely because the payoff is worth three years of investment that investment should continue – the initial investment is now sunk, and so should not enter the calculation. Since the payoff is now available with only two years of investment, investing in the initiative is even more attractive than when it required three years of investment. We can imagine how this logic can continue to justify additional investment long into the future.

In settings characterized by an “impossibility of proving failure,” (Adner and Levinthal, 2004a) in which managers can affect outcomes through additional resource investments, the potential for such rational escalation looms large. When the cost of incremental search is low relative to the initial costs of the project, to the cost of terminating a project, or to the cost initiating a new project, there is likely to be an economic rationale for continuing investment. This rationale, when operating on an entire portfolio, will tend to shift organizations from the lower right quadrant to the lower left quadrant of Table 1.

### **Externally vs. Internally generated options**

Note that this discussion has focused on an individual manager's perspective on the resource reallocation choice.. Expanding the treatment to consider the potential impact of social psychology, organizational politics, or economic agency would uncover additional drivers that may further reduce the likelihood that initiatives will be terminated in a manner consistent with the assumptions that were in place at the time of their initiation. Organizational design will clearly play a role in the extent to which organizations will drift to escalation.

While this discussion has focused on the challenges of effective project termination, organizations can also fail on the side of overzealous termination. Indeed, Coff and Laverly (this volume) examine the role that organization design can play in leading firm to under invest in real options and terminate opportunities prematurely.

Isolating initiatives within the organizations makes them easier to shut down. In the extreme, running initiatives entirely outside of the organization should make the management of over commitment even easier. This is essentially the case of joint ventures. As Reuer and Tong (2007) note, however, if opportunities are to be sourced outside the firm, they are necessarily sourced at a price. The question then become, whether the value of the initiative will be captured by the acquiring firm, or by the factor market from which the initiative is acquired. This suggests a tradeoff between ease of termination and potential for value capture net of acquisition price, where internally sourced initiatives offer higher expected value capture net of acquisition cost, but at the price of greater escalation risk; while externally sourced initiatives offer a clearer path to de-escalation but at the price of higher acquisition costs.

It should be noted, however, that empirical examinations of the efficiency with which firms are able to terminate even externally sourced opportunities paints a

relatively unflattering picture of the discipline with which firms approach the pruning of their portfolios. Reuer and Leiblein (2000), for example, studied the effectiveness with which firms were able to use joint ventures to reduce their downside risk. They found however, for both domestic and international joint ventures, the opposite to be the case – that joint ventures actually served to increase firm’s downside risk. Tong, Reuer and Peng (2007) examine a sample of international joint ventures and find that the likelihood that they impact firm’s growth option value as predicted by theory is contingent on the structure of the IJV, where initiatives where the firm has a large equity stake, are core to the firm’s main line of business, or are located in developed economies are unlikely to be managed in a way that exploits the flexibility inherent in real options thinking.

Most directly, in a recent working paper, Cuypers and Martin (2006) specifically examine the effectiveness of endogenous uncertainty resolution on the likelihood that firms manage their joint ventures in way that are consistent with real options predictions. Their findings support the arguments put forward in Adner and Levinthal (2004a,b) that endogenous uncertainty resolution degrades the discipline with which firms adhere to a real options logic.

### **Some Additional Empirical Observations**

To be clear – this article is not questioning whether firms can terminate initiatives. The question is whether the abandonment processes that we observe in firms are efficient – in the post mortem, does it appear to be the case the organization was able to stick to its initial, planned thresholds for decisions, or did it shift into a mode of managing by exception, succumbing to the temptation to keep projects alive because

'success is just around the corner'. It is this distinction which allows us to consider the probability (rather than the possibility) that real options are at play in real organizations.

The bulk of empirical investigations in the real options literature have attempted to show that sequential decision making is a better descriptor of organizational behavior than is the all-or-nothing commitment structure implied by traditional valuation techniques such as discounted cash flow analysis. While such analyses offer compelling evidence that sequential decision making is a better characterization of investment processes, they shed little light on the sub-processes that underlie sequential decision making in organizations. They are therefore ill-suited to distinguishing between the rational, consistent, and disciplined approach to sequential decisions implied by a real options perspective, and the more fluid, chaotic, and opportunistic non-approach implied by path dependence.

Distinguishing between these competing perspectives requires a finer grained examination of resource reallocation processes. Those studies that have pursued more detailed investigations of the resource reallocation processes present a picture that is at best mixed, and at worst depressing. I highlight a subset of findings here:

The innovation and learning literatures are replete with examples and explanations of organizational inertia. Sull's work in the automobile tire industry is particularly interesting in this regard (Sull, 1999, 2005). Exploring the contextual forces that prevented established tire manufacturers from reallocating resources away from their traditional bias and belted-bias tires towards the production of radial tire, this work sheds light on the complex stakeholder relationships that propel organizations along existing trajectories.

While significant inertia may have been expected to characterize broad shifts in corporate strategy, it may be somewhat more surprising to encounter it in the context of

corporate venture units, which are specifically designed to efficiently and aggressively screen projects as they move through the funneling process. In a their detailed study of the corporate venturing arm of a large European electronics manufacturer, Keil, McGrath and Tukiainen(2005) examine the management of a population of 37 ventures through a selection process involving four formal stage-gates. While the firms own expectations were for significant increases in selectiveness across stages, commensurate with the significant increases in resource commitments which progress through each gate represented, Keil, McGrath and Tukiainen report that of the 37 initiated projects, 65% of the population (23 projects) passed on to the second stage of investment, that of these 61% passed on to the third stage (14 projects), and that of these, 100% were either still in the pipeline or already integrated into the firm at the time they ended their observation. While the terminations per se may or may not be related to failure, the observation of termination rates is particularly interesting because it suggests that, at least in this case, the firm's own initial expectations for selectivity at its own stage gates were dramatically out of line with its subsequent reallocation decisions.

The importance and prevalence of social networks among the project initiators and project evaluators in corporate venturing settings might be seen as an explanation for the slippage between initial expectations for strict selection and a *de facto* munificence in resource reallocation decisions. The venture capital industry, in contrast, should represent a best-case setting for disciplined exit from initial investment commitments. The industry's structure, with explicit funding rounds, and with (nominally) dispassionate partners who have a fiduciary responsibility to maximize returns for their own investors as well as high powered incentives to assure that their interests are aligned with investors rather than with portfolio companies, seems ideally suited to the task. In this regard, however, Guler's recent studies (2005, 2007) of

investment patterns in the venture capital industry give some reason for pause. She finds statistical evidence, supported by qualitative field work, that venture capital investors escalate their commitment to portfolio company investments, and ignore incoming information in sequential investment rounds. She also finds that those firms that are more disciplined in their ability to terminate their commitments to portfolio companies have higher performing portfolios. Since these funds are managed by general partners who are in fact agents of limited partners, it does raise the additional question of the degree to which inefficiency in exist is being driven by decision biases compared to more traditional agency problems. In either case, however, it highlights the challenges of efficient exit on which the real options approach is predicated.

The indicative findings from the corporate and private venture capital settings are consistent with the results of studies of the investment patterns of stock market investors. As a class of decision makers, individual investors are making among the most reversible commitments possible, buying and selling shares in a very liquid market. They are also among the least able to influence the outcomes of their investments. Despite this, a number of studies in the finance field show that investors display over commitment to the shares of stock that they own (c.f., Shefrin and Sstatman, 1985; Odean, 1998). Shapira and Vinezia (2001) report similar findings for professional investors.

### **Empirical Baselines and Standards of Evidence**

If we are to really understand the use of real options logic in organizations, it seems imperative that we develop a better understanding of the resource reallocation process. What actually happens within the project filtering funnel? What is the relative

balance between “flexibility as redirection of activity” and “flexibility as reassignment of resources”? How closely does reality approximate the ideal that underlies visions of real options? More importantly, how closely does the reality within an organization approximate the organization’s own assumptions about its behaviors. It is only with a better sense for baseline approaches to managing sequential decision making in organizations that we can begin to make crisper distinctions between unstructured evolution constrained by path dependence, and structured progress guided by a real options logic.

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