Russell Ackoff Fellowship Proposal

Managing Uncertainty through Choice:
R&D Pipelines within the Pharmaceutical Industry

Joel Wooten
The Wharton School, OPIM Department
jwooten@wharton.upenn.edu

1. Project summary

1.1 Introduction

New drug pipelines are the most significant asset of a pharmaceutical firm. While firms are becoming increasingly similar in some skills (marketing, financial, etc.), new drug pipelines remain a key differentiating characteristic and a source of strategic advantage.

There are a number of difficult managerial decisions associated with optimizing a new drug pipeline. Some of the most imminent challenges are:

- Investing in development resources such as scientists, testing capacity, etc.
- Allocating development resources to new drugs
- Estimating the probability of success or failure of new drugs
- Deciding which drugs to invest in and how to managing the compound library

These challenges are compounded by the enormous uncertainty within the process, which arises from large arrays of options, long planning horizons, and low probabilities of success. In effect, uncertainty plays a large role in these outcomes and decision models for dealing with such ambiguity are often inadequate.

1.2 Current work

To date, we have turned to mathematical simulation modeling to help understand pharmaceutical drug pipelines and evaluate decisions within that environment. This work has focused on the search for profit-maximizing decisions using the simulation platform to research characteristics that impact the various outcomes. By analyzing the effects of different choices, the optimal strategies can begin to be described.

Coming out of this work, we have started to examine the relationship between number of choices, cost of delaying choices, and reduction in uncertainty. In the intractable scenario of

pharmaceutical R&D pipelines, simulation is the best method to examine these relationships. However, having gained some insight, we have noticed that practice and theory are at odds with one another. In practice, it appears that decision makers in these environments reduce options and delay decisions. For the pharmaceutical industry, that means that they push a very small number of drugs through the entire FDA approval process until they are either launched or rejected. In theory, our simulation would suggest that entertaining more options and then culling them early delivers improved decision making and greater success.

1.3 Research questions

We hope to address two main issues. The first issue, around choice, is the primary area of interest. (1) Mitigating uncertainty via choice: What is the impact of more choices on outcome? Is there an advantage to be gained in situations with high degrees of randomness (pharmaceutical drug development pipelines) and can it be described formally? (2) Effects on decision making: After understanding these ideal or normative models, are decision makers able to implement these, given the uncertainty and perceived lack of correlation between normative models and desired outcomes? This second issue may be best explored in the Behavioral Lab but could also be examined via the Pharmanopoly™ game in a classroom or other setting.

We note that the idea of redefining a strategic set of choices so as to make decisions (and eliminate options) early in the process, even in the face of uncertainty, is not currently well-researched or -supported. This could be particularly useful in contexts where decisions must be made on the basis of limited information, particularly since it contradicts what is seen to occur, at least anecdotally. As a result, this could have useful applications in any area where randomness or uncertainty is a dominant factor in the strategic considerations.