

APPENDIX **1A**

The Timken Company on Real Options in R&D and Manufacturing

The following is contributed by Kenneth P. English, Director of R&D Emerging Technology, The Timken Company, Canton, Ohio. The Timken Company is a public company traded on the NYSE, and is a leading international manufacturer of highly engineered bearings, alloy and specialty steels and components, as well as related products and services. With operations in 24 countries, the company employs about 18,700 associates worldwide.

The Timken Company's journey toward real options analysis began in 1996 when the corporation made the decision to focus on profitably growing the business by 10 percent per year. We started with the creation of a gate-type process to identify and evaluate project opportunities that would generate the necessary profits for our growth requirements. During the numerous gate meetings, the process actually highlighted gaps in our process more than the anticipated growth project opportunities we had expected. The first group of gaps identified during the process was the lack of expertise in project management and market research; the second was poorly defined and documented product and corporate strategies; and, finally, financial evaluation capabilities. The gaps identified in project management, market research, and strategy were addressed over the following years by recruiting various consulting firms to assist with those disciplines. The financial evaluation gap was initially addressed with the assistance of our internal financial department by applying the same financial modeling tools used when the corporation built new physical plants. These models focused on NPV, payback, and project terminal value. Project terminal value caused considerable controversy with the reviewers.

As these parallel consulting efforts continued for months/years, the corporation became more adroit at the terminology of product development. As

the refinements and understanding of these other areas evolved, it was realized that the financial model used on the gate templates was not adequate for the dynamic uncertain environment of product development. At this time, Monte Carlo simulation was being used in benchmarked growth industries to determine the range of risk for projects. Our first response was to acquire books on the subject of Monte Carlo simulation.

The financial department was familiar with the model but was not prepared to assist with implementation of it in the product development environment. After some time and frustration, the *Risk Simulator* software product for Monte Carlo simulation at a company named Real Options Valuation was discovered. The timing was excellent, since the corporation was reviewing a high-profile project that contained hidden ranges of risk. The simulation product was immediately purchased and inserted into our gate templates to address the issue of risk. Within weeks, some of our corporate leadership was looking at risk with a much different perspective. Previously, we identified risk and noted it, then proceeded on a product development path without sensitivity to the dynamic ramifications of the risk. The Monte Carlo simulation put focus on the importance of the corporation's gaps in detailed market research and the absence of aligned product and corporate strategy for Horizon II projects. The software made the complex and time-consuming financial formulas into a quick, user-friendly tool to assist with the difficult task of defining the range of risk and promoting timely decision making. It was painfully obvious that the real object of successful product development was to enable speedy decisions to either fund or kill projects and not the joy of being comfortable with seeing the old favorite projects and connected potential acquisitions lingering on with several lives.

Two and a half years into the quest for profitable growth, we identified the next barrier to our success. That barrier was the absence of a project portfolio process. The major issue with any initially installed gate-oriented process in a previous incremental corporate culture structure is that the gatekeepers only have the opportunity to evaluate the presented projects against other projects presented during that particular gate meeting. This situation exerts pressure to find a tool/process that will allow the gatekeepers to prioritize all the product and project efforts of the corporation to give maximum return on investment. The concept of projects in a portfolio becomes very important to the corporate allocation of funds. Portfolio management was a very foreign concept to us because our corporate orientation to projects was based on NPV and payback and not mitigation of risk, maximizing efforts, and cost of capital. We responded to the corporate learning piece of the puzzle by creating a manual portfolio simulation exercise to sensitize our executives and gatekeepers to how they looked at projects and their synergies. It also broadened their view of the significant impact that strategic fit, selection, and timing has with respect to financial success.

With the success of the portfolio simulation, we were then sensitized to the issue of the corporate benefit of cultivating a mindset of timing projects (*timing options*) in a way that could maximize the impact to our growth requirements. The writings regarding real options began appearing in the business literature, magazines, and seminars, but the application was initially geared toward the practice of financial options. Again, we were put in a position of educating ourselves (the change agents) and subsequently the corporate culture to a different way of thinking. We searched the available real options course selection taught at the university level. The universities were interested in real options but did not have coursework in place to conduct educational sessions.

The Timken Company established the R&D Emerging Technology Department in June of 2002. The focus of the department is to scan the world for dispersed technologies that are not part of the present corporate portfolio. These technologies contain varying degrees of risk, which require an even higher level of evaluation techniques to take advantage of numerous options.

Publicity from Dr. Johnathan Mun about the upcoming real options software and the lectures and workshops on real options appeared to be the best vehicle to take us to the next level of portfolio decision making. We contacted Dr. Mun to give a real options lecture and workshop to bring our financial department and executives up to speed. The time spent was very useful, and the culture is starting to communicate in real option terms. We at The Timken Company are anticipating that the new software for real options from Real Options Valuation, Inc., will get us closer to the target of achieving more confident corporate project decisions, resulting in assisting us in our goal of sustained profitability and growth.