Pharmaceutical R&D Productivity Monitoring Using an NPV Model

Executive Summary
A leading generics manufacturer had entered the NCE R&D space with a large investment and had setup a professional R&D organization. It however lacked a fact-based performance-monitoring tool to track R&D performance and productivity for making strategic decisions on go/no-go for the pipeline candidates.

Numantra team built an NPV-based simulation dashboard tool that helped the CEO and the R&D head to view molecule-wise profitability outlook, and conduct sensitivity analysis on the key variables.

The developed tool enhanced the strategic capability of the organization to decide to continue or ‘fail’ or out-license the molecules.

Context
A leading generics manufacturer, traditionally not in the Pharma R&D space, had entered the Pharma NCE R&D space with an initial investment of USD 300+ million.

It had built world-class R&D organization and facilities led by a team of experienced professionals to research and develop the new molecular entities.

However, with the very long lead times for new molecule development, probabilities of success attached to various phases of development, and the uncertainties around quantum and time window available for revenue generation, the investors had no measure to understand the R&D performance.

A quick audit analysis of the initial R&D MIS by the Numantra team revealed that:

1. Costs were not reported at project level for better accountability
2. No clear determination of the sunk costs on a project
3. Limited quantitative information for the management to understand the quantum of progress achieved on the road to development of a molecule and its relationship with activities undertaken and cost incurred
4. Huge variability and risk on perceived financials returns due to changes in various pertinent factors like time to development, cost of development, window for realizing revenues, futuristic revenue projections and cost of capital
5. No ability to project Go/No-Go, Out-licensing decisions based on facts

The company was keen to develop KPIs to track R&D performance and build a supporting tool to enable strategic decision-making.
Exhibit 1 outlines the key focus for the project.
**APPROACH**

The first prong of the approach involved secondary research to understand how traditional big players in the Pharma R&D space tracked and monitored their R&D performance. This study concluded that this space of knowledge was not well developed at least in the public domain.

The approach taken was then to develop a proprietary logical model based on the outcome of research and brainstorming for a solution based on first principles.

*Exhibit 2* shows a master list of R&D productivity metrics shortlisted by the consulting team.

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**EXHIBIT 2 – UNDERSTANDING R&D PRODUCTIVITY**

Productivity and Return Measures could provide valuable insights to the top management

<table>
<thead>
<tr>
<th>Process Measure</th>
<th>Details</th>
<th>Priority</th>
<th>Perspective</th>
<th>Nature of Information</th>
<th>Measure Type</th>
<th>Predictive Capability</th>
<th>Performance Drivers</th>
<th>Presentation</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D Finance Budget Allocation by study/project stage</td>
<td>Total R&amp;D costs - revenue analysis</td>
<td>High</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Project NPV</td>
<td>R&amp;D project cost of all R&amp;D projects based on project revenue and expenses</td>
<td>High</td>
<td>Financial</td>
<td>Productivity</td>
<td>Cost</td>
<td>Outcome</td>
<td>- ROI for project revenue - Total Costs - Cost of capital</td>
<td>Bar charts</td>
<td>NPV of project where: ROI = (R&amp;D project revenue - Total Costs) / Cost of capital</td>
</tr>
<tr>
<td># successful expensive R&amp;Ds</td>
<td># successful applications per therapeutic area</td>
<td>High</td>
<td>Financial</td>
<td>Productivity</td>
<td>Cost</td>
<td>Outcome</td>
<td>- ROI for project revenue - Total Costs - Cost of capital</td>
<td>Bar charts</td>
<td>NPV of project where: ROI = (R&amp;D project revenue - Total Costs) / Cost of capital</td>
</tr>
<tr>
<td>Value basis on critical path in R&amp;D</td>
<td># of successful applications per therapeutic area - Total R&amp;D expenses - Total R&amp;D costs - Total expenses - Total revenue</td>
<td>Medium</td>
<td>int Process</td>
<td>Productivity</td>
<td>Efficiency</td>
<td>Performance Driver</td>
<td># of successful applications per therapeutic area - Total R&amp;D costs - Total expenses - Total revenue</td>
<td>Bar charts</td>
<td>NPV of project where: ROI = (R&amp;D project revenue - Total Costs) / Cost of capital</td>
</tr>
<tr>
<td>Cash flow basis on milestones and stages</td>
<td>Revenue from milestones and expected return on R&amp;D and marketing stages</td>
<td>High</td>
<td>Learning &amp; Growth</td>
<td>Resource Allocation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td># patents per year per researcher</td>
<td>Total patents / number of researchers</td>
<td>High</td>
<td>int Process</td>
<td>Productivity</td>
<td>Efficiency</td>
<td>Performance Driver</td>
<td># of successful applications per therapeutic area - Total R&amp;D costs - Total expenses - Total revenue</td>
<td>Bar charts</td>
<td>NPV of project where: ROI = (R&amp;D project revenue - Total Costs) / Cost of capital</td>
</tr>
<tr>
<td>% of Active projects</td>
<td>Missions to sales ratio of development and importance</td>
<td>High</td>
<td>int Process</td>
<td>Productivity</td>
<td>Efficiency</td>
<td>Performance Driver</td>
<td># of successful applications per therapeutic area - Total R&amp;D costs - Total expenses - Total revenue</td>
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<td>NPV of project where: ROI = (R&amp;D project revenue - Total Costs) / Cost of capital</td>
</tr>
</tbody>
</table>

Since the model required enabling decision-making by the promoter investor, it was decided to build a cashflow-based model to guide therapeutic / molecule-level decisions.

The model would then be translated into a decision-making dashboard tool using simulation feature for sensitivity analysis.

Since 90+% of R&D costs were captured in shared cost centres, it was critical for the project to arrive at a rational and fair basis of allocation of shared costs and sunk costs of aborted molecules to therapeutics and onward to surviving molecules. See *Exhibit 3* for the allocation model framework that was used.
Since the involvement of the key R&D leaders was critical to success of the project, and loss of morale was an attendant risk, they would need to be well bought into the solution.
**SOLUTION**

Numantra built a simulation NPV (net present value) dashboard tool that took in various inputs such as sunk R&D costs, future stream of costs, probabilities of success at various drug development stages, future revenue stream projections and cost of capital.

Refer Exhibit 4 for the solution architecture that achieved data consolidation across multiple systems like SAP, LIMS, 3rd party feeds and internal Excel and databases.

The sunk costs were gathered from existing project and cost monitoring systems. The inputs of the Head R&D were critical to build an allocation model for cost center costs. A proprietary approach to progressive allocation of sunk costs on aborted molecules to related surviving molecules was ‘sold’ to the CEO and R&D leadership team, and applied to arrive at molecule level sunk costs.

The R&D team agreed to provide regular molecule-wise updates on projected future stream of R&D costs.

The R&D team would also provide regular updates on the outlook regarding stage-wise probabilities of success for current and future stages of development of molecule, based on the progress in development of the molecule.

The regular updated inputs on future revenue streams for the molecules would be provided by the Strategic Marketing Head of the R&D organization.
Inputs on the risk-adjusted cost of capital were piped in from Corporate Finance to complete the model.

The molecule-wise NPV was determined mixing the revenue stream, the cost streams (actual and projected) and risk-adjusted cost of capital.

Four NPV-based kpis were made available for decision-making:

1. Total NPV
2. Sunk NPV (component of NPV based only on sunk costs brought forward to the present; negative in nature as no revenues generated)
3. Forward NPV (component of NPV based on projected future cost and revenue streams)
4. Alternate NPV (NPV based on any alternate option like out-licensing)

The dashboard simulation tool allowed sensitivity analysis; it allowed the CEO and board to vary the various inputs (projected time to complete development, projected future cost stream, probabilities of success, projected revenue window, projected revenue stream, and cost of capital) and see the corresponding effect on the NPV / NPV components.

Refer Exhibit 5 for representative outputs from the executive dashboards.
**BENEFITS**

The board was able to take fact-based decisions to out-license molecules at appropriate stage of development and also take go / no-go decisions to continue with development of molecules and get the R&D aligned with the same.

Numantra Technologies is the technology division of 2S Consulting. The firm is a specialized BI player that helps companies make data a strategic asset and derive business value through fact-based decision-making. 2S Consulting was started by ex-Deloitte team from USA in 2003 and has maintained high-impact outcomes from Plan and Manage Business programs across Pharmaceuticals, Chemicals and Engineering industries. Numantra brings strong business consulting bundled with high-speed technology implementations using all leading BI platforms like SAP BI-BO, Hana, IBM Cognos, SAS, Tableau and Power BI.

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