

Project Management for Scientists

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"You need to manage your laboratory the same way you do your science: boldly but methodically, with the right balance of purposefulness and opportunism."

All science involves some boring, routine labor--repetitive work in the laboratory, grant writing, keeping the books, and so on--but scientific research is fundamentally creative, and often unpredictable. As often as not, the course the research takes is unexpected. A principle investigator's (PI's) central challenge is to keep the lab afloat while stimulating and supporting the highest levels of creative insight and technical innovation. Few scientists are trained to do this; with most, it comes only from experience. Some never learn to manage their laboratories effectively, and this puts them at a considerable disadvantage compared to their colleagues.

Small research laboratories have their predictable aspects; indeed, they must be viable business entities to survive and thrive. This means assuring a sufficient flow of funds to attract and keep topnotch staff, as well as to obtain and maintain the required facilities and equipment. Furthermore, like shareholders of a corporation, the stakeholders in a laboratory--funding organizations, host institutions, taxpayers, and so on---demand a demonstration of the value they get for the money they spend. This is especially important for the PI when the time comes to seek a grant renewal--or tenure.

Herein lies the real challenge for the small laboratory manager: How can you create and maintain an environment that allows free and unbounded creative exploration, yet assures solvency and maintains accountability to those who have a stake in the lab's operation?

The answer is effective management. You need to manage your laboratory the same way you do your science: boldly but methodically, with the right balance of purposefulness and opportunism. Project management provides the tools you need to systematize the management of your laboratory, to make sure the risks you take are calculated. Best of all, you're likely to find that taking a structured approach to managing laboratory nurtures, rather than inhibits, creativity.

What is project management?

Project management was created more than 50 years ago to manage technical development and manufacturing projects of great complexity. In its early days it was a highly technical field known best, perhaps, for generating reams of paperwork. Even today, many people think of project management as a series of graphs, charts, and procedures, often implemented through a software package, designed to plan and guide to completion

repetitive and highly predictable work...or--worse--to fill the empty hours of soulless bureaucrats.

Project management has evolved over the years. Today's project management is less an arcane technical discipline than a set of principles intended to provide a structured approach to making the everyday decisions that keep a business running, even a small business. Or a laboratory.

Project management begins, as it should, by defining its subject: A project, according to project management theory, is an activity with three characteristics:

- Specific outcomes or results
- Definite start and end dates
- Established resource budgets

Projects can be large or small, planned and tracked formally or informally, and defined by a legal contract or an informal agreement. They can involve activities that have been performed many times before or entirely new approaches and technologies.

Science projects

At first blush the above definition of projects may not seem a perfect fit for the work that goes on in a science lab. The outcomes of a research effort often lack a precise definition. While a project might have a definite start date, a specific end date is rarely specified. Even when the funding ends on a specific date, it's usually assumed that a renewal will be sought. Even budgets--which are, regrettably, fixed--often seem fluid.

So how can we bridge this gap between a project's technical definition and a PI's daily experience? First, by realizing that these difficulties are not limited to science. Indeed, some degree of ambiguity exists in every project. Yet, in science as in other kinds of projects, there is value in trying to eliminate as much ambiguity as possible.

Second--and this may be the most important point in relating project management to science--the specified outcomes, end dates, and budgets are always provisional. Project management allows--indeed, insists--that the components of a project be constantly revised as new information arises. Defining, for example, the desired project outcome means deciding what you hope to accomplish **as of now**, with the understanding that those definitions will probably change with time.

The key components of project management

Project management is simply guiding a project from inception to successful completion, making coordinated use of processes and systems to guide and encourage people to successfully perform a project's work.

The three key steps of project management are:

Planning--clarifying:

- Desired project outcomes

- Stakeholders: who will be affected by, are needed to support, or will be interested in the project outcome?
- Activities that have to be performed to complete the project
- Dates on which each project activity will start and end
- Budgets for all required project resources (including, but not limited to, money)
- Significant project risks and how they will be managed

Organizing--specifying roles and responsibilities for project personnel

Controlling the performance of project work--including:

- Organizing, focusing, and continually motivating project personnel
- Tracking and comparing project work and results against the plan
- Considering and making changes to plans when tracking suggests a change is called for
- Keeping everyone informed of project accomplishments, issues, and changes
- Continuously tracking and dealing with evolving project risk

Organization information systems can be used to support project planning and control, including the maintenance of records of:

- The dates on which activities are started and completed and milestones are reached
- The amount of work effort expended by people on project activities
- The funds expended on project activities

Put another way: Project management expands the concept of "budgeting" to cover not just monetary resources, but other resources such as time and personnel.

Encouraging people to perform up to their maximum potential means:

- Helping each person to appreciate:
 - The value to him or herself and to the organization of the project in general and of his or her assignment, in particular
 - The feasibility of successfully accomplishing the project objectives
- Regularly providing project personnel information about how their actual performance and accomplishments compare to what is planned
- Acknowledging people's contributions to overall project success

Project plans, expenditure reports and team meetings will not, in and of themselves, guarantee project success. The greatest chances for success are achieved when project information is used to align, guide and motivate team members, and when these team members, in turn, use this information to guide their work. A project rarely sticks to a predetermined course. Projects flow and evolve; project management is a way of making sure that the key players remain motivated, and that their objectives remain aligned.

Key premises that lead to project success

The greatest chances for project success are realized when PIs, acting as managers, embrace the following premises.

- ***Project management is a way of thinking and behaving, rather than just a way of analyzing and presenting data.*** Managing a project effectively means thinking before acting, identifying and dealing with potential problems before they occur, and constantly monitoring to determine whether your actions are achieving their desired results. The goal is to internalize project management, to make it second nature, a way of thinking about the decisions you make in managing your laboratory.
- ***Attempting to control all aspects of a project assures the greatest chance of success, but you will never succeed at controlling everything. That's okay.*** Project plans represent your current thought, at any given time, about how the goals of the project will be achieved. Even if anticipated approaches have never been tried before, it is important to describe what you propose to do, how you expect the project to unfold, and the results you hope to achieve. The less certain you are that the plan will work, the more closely you should monitor ongoing performance to identify deviations from the plan as quickly as possible. If a planned approach seems not to be working, clear choices should be made about how to modify existing plans and guide the work in new directions.

People, not numbers and graphs, create successful projects. The major purpose of project management is to align and motivate people and to support their decision-making. It is people's creative insights and performance that will ultimately lead to project success, not a number or a graph. So keep your people on the same page, but make sure they're happy and have room to breathe.

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