Invention *versus* Engineering

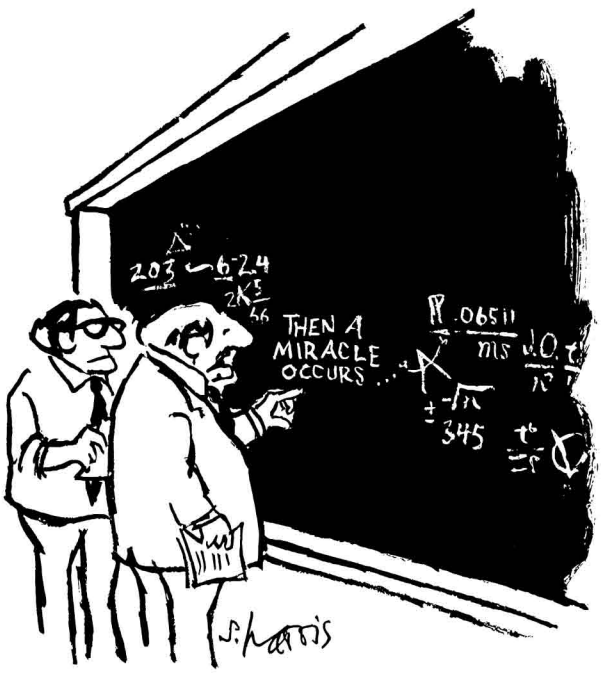
Have you ever wondered why some product development projects run like clockwork and others are train wrecks? One reason some projects succeed while others do not is the failure to differentiate between what new aspects of the project will require invention as opposed to engineering. Engineering is, for the most part, predictable and lends itself to planning and scheduling. Invention, not so much. Failure to identify inventions necessary to a product's success and to conduct that invention off the critical path is responsible for most of the train wrecks.

Invention versus Engineering

What's the difference and who cares?

Invention:
The act or process of creating a new device, method or process from study and experimentation.

Engineering:
The application of scientific and mathematical principles to practical ends such as the design of efficient and economical devices, methods or processes.



"I think you should be more explicit here in step two."

Upon initial consideration, the difference between the two definitions doesn't appear all that significant. The objective of both invention and engineering is the creation or development of a device, method or process. Consequently, in the broad realm of new product development, it is very easy to lose sight of the fact that invention and engineering are not the same.

1044 East Chestnut Street
Louisville, KY 40204

Phone: 502.714.7200
Fax: 502.714.7201

What's the difference?

The difference between invention and engineering is that engineering is based on previously established scientific and mathematical principles. Invention typically establishes the basis for those scientific and mathematical principles. Losing sight of this difference in product development can be catastrophic. It can wreak havoc with development budgets, schedules and even the ultimate outcome of the development project.

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Engineering is typically an investment that is undertaken to produce a well-defined return on an investment in a relatively well-defined period of time. A market is targeted, a need within that market is identified, a solution that economically satisfies that need is defined and an engineering project to bring that solution to that market is planned and executed. The intended result is a product with a positive ROI within a specified time period. New product development tends to be successful as long as the solution is sufficiently well understood at the start of the project, the solution solves a real market need and a viable development plan is generated and followed.

Invention, on the other hand, typically consists of a series of repeated experiments and a succession of trials and errors that, hopefully, ultimately converge on a repeatable means of satisfying the original objective. By definition, the entire scope of the invention process is unpredictable as are the final results. Consequently, invention cannot reliably be planned nor can the outcome be predicted with a sufficient degree of confidence to anticipate a near-term ROI.

Why the confusion?

If the difference between engineering and invention is so apparent, why do so many product development projects stall or even die while a successful solution for a critical aspect of the product remains elusive? One answer goes back to the definitions above. Whether it's new features, form factor, price point or an entirely new product category, the product development process consists of creating a solution that previously did not exist. Consequently, it is easy to confuse what can be created using existing scientific and mathematical principles with what needs to be invented through trial and error. Couple this obfuscation with the [over] confidence required to succeed in product development and it becomes clear how invention can be mistaken for engineering and erroneously incorporated as such into a product development plan.

What to do about it?

How do you distinguish engineering from invention? More importantly, what to do when you realize that your new product requires invention? Distinguishing between engineering and invention requires experience and expertise. If no one on the team has done what you need to do, go outside and look for someone who has. The bottom line is that if no one on the team has done what you need and you cannot find someone on the outside that has already done what you need to do, you must treat that aspect of the new solution as an invention. Determining that you need an invention typically results in the initiation of a dedicated and focused program. The sole purpose of this program is to investigate and experiment with that singular invention until sufficient proof-of-concept is established. Proof-of-concept means that you can now confidently plan and engineer a production-worthy design. It is essential that no proof-of-concept program ever lay on what is or can become the product development critical path. Proof-of-concept should be established prior to starting a product development project or as part of the conceptual design phase.

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Failure to identify and complete invention and proof-of-concept prior to initiating the detailed design phase where extensive design resources are committed to the project can have severe consequences. The entire project may stall in the detailed design phase, waiting for the critical invention that may or may not ever prove viable. What is frequently worse is that the other aspects of the project may not stall and proceed with full resources and at full speed. The project continues unabated based on the initial assumptions regarding the intended form and function of the invention. Then, even if the invention does prove viable and not-too-far behind schedule, it is highly unlikely to take the form originally intended and anticipated by other aspects of the product's design. Consequently, when the invention is finally ready, extensive design changes to the complementary components are required, consuming substantial incremental time and resources. The worst possible outcome is that the invention may be achieved, at least in part, but fail to fully satisfy the product requirements and compromise the product's ultimate market success. This unintended consequence is often overlooked during the elation of finally achieving an invention break-through and the pressure and desire to advance a project that is woefully behind plan. Under these circumstances, it is both easy and expedient to minimize the invention's shortcomings.

Failure to identify the need for an invention until you are in the detailed design stage requires suspending all other aspects of the project until the invention has been reduced to the scientific and mathematical principles required to commence engineering the final product design. Why such a dire reaction to the late identification of the need for an invention? By its nature, invention frequently leads to unknown results and those results may, or more typically may not, be compatible with the original design concept. Invention also tends to take much longer than engineering. Consequently, other parts of the project are likely to be delayed anyway, waiting for

the invention while the associated resources continue to be consumed during the delay. This is exacerbated by the fact that the burn rate at this stage of a project is typically at its highest rate of the entire product development cycle.

The bottom line is that the best outcome of a failure to differentiate invention from engineering at the onset may be schedule, budget and product cost overruns. Another likely outcome is the termination of the entire project because the requisite invention has either taken too long or may never be realized. The worst outcome is completion of the project with an invention that compromises the requirements and, for that reason, fails in the market.