

Choosing a product customers will buy

The right product will provide the cash flow to build the infrastructure needed to establish your business.

In the first half of this series of articles encouraging engineers to become entrepreneurs, I concentrated on such basics as developing a business plan, forming a team, and finding startup money. In the second half, I'll discuss various hands-on aspects of growing a business from a seat-of-the-pants startup into a systematic organization, moving from manufacturing, marketing, and sales to finance, administration, and maximizing shareholder value. This article deals with the critical step of developing and shipping your first product.

Successful product development requires identifying a product people want to buy, designing it, devising an efficient manufacturing process, then producing it. Your ultimate goals are to make better products for the customer and more profits for your company. What makes the process work? People make it work. Miracles can happen if capable people are excited about their work. All we have to do is provide a supportive work environment and adequate resources. In this article, I emphasize people and organizational strategies as much as productivity tools and methodologies.

Identifying the right product

Most engineers don't start companies because they can't seem to identify the right product. They're accustomed to thinking of product opportunities that are right for the companies they work for, and these ideas are usually too complicated for a small company to tackle. So you ought to begin with simple products you can complete and introduce quickly. Those products will help you build a business infrastructure and generate the cash flow to tackle

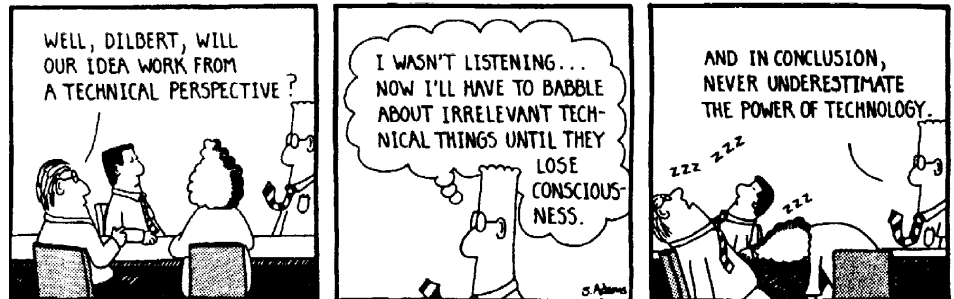
bigger products. And if you plan ahead, the early products can also become building blocks for future products.

When we started New Focus, we didn't have any specific product idea. We decided to concentrate on the market for optics research because that's what we did ourselves. In that market we could identify with our customers, understand their problems,

logical to establish direct contact between customers and the people in R&D. Once the designers are in communication with the customers, they will intuitively design into the product features that will capture the customers' attention before the sale and meet their needs afterward.

At New Focus, all of our engineers are in direct contact with customers. Many of our product ideas come from our

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and sell to colleagues! Within six months, we introduced photodetectors with the fastest risetime, optical receivers with the lowest noise, electro-optic modulators with the lowest drive voltage, optical mounts with significantly more stability, and dielectric mirrors with the lowest scattering. Most people were surprised by this "weird combination." The point is that these were products we knew how to develop and put together quickly, and they were better than competing products. The motto "Simply Better Photonics Tools" became a positioning statement to challenge ourselves. We were pounding stakes into the ground to mark the territory where we could succeed!

How do you define products that customers would want to buy? The persons best qualified to tell a product designer what they want are the customers themselves. The person best qualified to make real-time tradeoffs between what customers want and what the company can realistically deliver is an engineer. Therefore it's only

customers, and we make licensing technologies from anywhere in the world an explicit strategy of the company. This approach is realistic because small companies don't have the resources to sustain long-term research. (On the positive side, small companies have a lower overhead cost and also the agility to make development decisions faster than big companies.) By making technology licensing an explicit part of our strategy, we eliminated the not-invented-here syndrome, avoided reinventing any wheels, and encountered many more opportunities.

Nurturing creativity

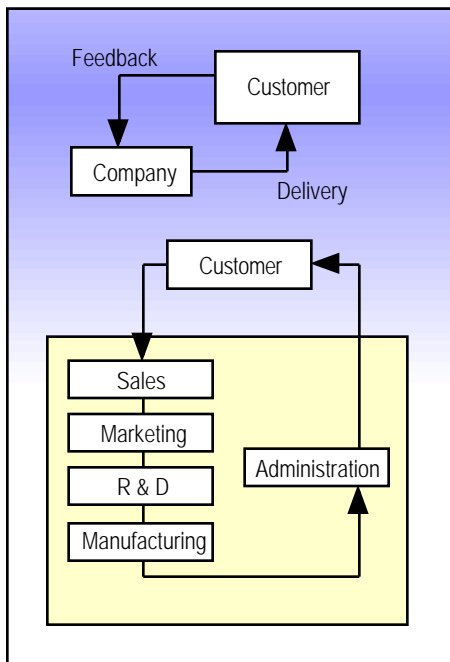
Individual creativity is high on the list of qualities needed for developing new products. We all work more productively and more creatively if we're excited and passionate about what we do and if a project is based on our own ideas. Engineers who are involved in identifying and defining new products, rather than just receiving the specifications from marketing, develop a feeling of ownership that drives their individual commit-

ment. They will work even more intensely if they participate in every phase, including having some say in marketing and ultimately sharing the profits.

Creative people need nurturing. You don't want them to be afraid to make mistakes. When you must offer criticism to maintain a high standard of excellence, make constructive comments and direct them to the issues rather than the individual. Another way to nurture creative people is to encourage them to broaden their horizons. They need an ever-increasing knowledge base to create with, as well as ever-increasing wisdom to make better decisions. Encourage creative people to focus externally by attending conferences, reading journals, and participating in the community.

Evaluating engineering performance

Developing excellent products at a rapid pace is a challenging goal. The two parameters, excellence and speed, are interrelated and very much impacted by attitudes. The figure of merit for product excellence is the degree of market acceptance, so your compa-



In the "superbrain" stage (top), the product development team shares and applies knowledge, and everybody knows and agrees what must be done to please the customer. As the company grows, however, delays are more likely and management decisions may not be totally customer oriented.

ny's definitions of excellence must be externally focused and must be related to customer needs, customer wants, and competing products.

Standards for speed are more subjective; they depend on expectations, opinions, or preconceived notions. Since it's possible to go on improving a product indefinitely, standards for speed also depend on the definition of what's "good enough" for people on the project. Here again, a sense of ownership helps. You will want your people to set their own deadlines. To some extent, we all dread facing the judgment day at the end of a project. I have known bright individuals who refuse to bring any project to conclusion for fear of being judged. In a nurturing environment, people are more likely to say it's good enough sooner, and they're often willing to provide information or make decisions to move the project forward even before they have all the facts. The need to clarify often stems from a fear of being judged.

Subconsciously we all do what we can to avoid pain. So there's a natural tendency to jump into the fun and easy parts of a project for instant gratification. You can get away with it in a big organization because generally there are adequate resources available to solve any tough problems that occur. But that paradigm can be harmful to the health of a small company because there's not enough staying power. You can avoid this pitfall by completing a crude prototype, then tending to the details of refining the design.

Tending to details is an important point for people to consider as they make the transition from research to product development, from science to engineering, or from big company to small company. Creative people will create on their own because that's the part they enjoy, but they may need to be encouraged to pay attention to details. A product must have every knob a customer would want, and the whole thing must work flawlessly before anyone will buy. Your product development team may need a majority of people with patience and tenacity to implement the ideas generated. And because you will require diverse personalities, you must also be sensitive to individual needs.

Optimizing the whole

Because every part of the company

impacts every other part, successful product development involves every aspect of the company (see figure on p. 20). In the beginning you have a small group working hand-in-glove as a team in close proximity. That's the fun "superbrain" stage, where the group shares and applies the knowledge, experience, and judgment of all its members. Because you're dealing with customers directly, you can define the products. You know what can be done, and everyone in the organization knows and agrees what must be done. There is no filter and no delay, and you have the power to make decisions. Wonderful!

As the company grows, however, the need to specialize tends to make the company compartmentalized. Because various parts of the company are interdependent, delays grow exponentially and provide negative feedback that slows things down even further. Your solution is to reduce the number of steps, shorten the time of each step, remove the bottlenecks, reduce the number of interfaces, and do everything possible to make the interfaces seamless.

To achieve better "conductivity" at the interfaces as the company grows, you can simulate a superbrain company by seeding different functions of the company with the founders and early employees who know the culture and understand how the company works. When different parts of the company understand and trust each other, they are much more likely to be responsive and to take action quickly with less precise information.

People will give you their best efforts only if you respect them and make them feel that their work is important to the overall success of the company. You can also employ techniques that big companies find useful, such as cross training, formal meetings and reports, interdisciplinary project teams, and people performing multiple functions. For sure, you want to bridge the interfaces by stamping out any negatives, from unnecessary approvals to not-invented-here syndromes. There's no easy way to keep everyone working at a high level of excellence; you have to be constantly on the lookout to guard the culture.

Building an infrastructure

We worked on no specific products during our first three months when we

started New Focus. Instead, we focused on building what vice president Frank Luecke called "The Path," to facilitate the product development process. We got our CAD system working. We found prototype shops to supplement what Frank already had in his garage. We scoped out our manufacturing needs and developed relationships with the shops or foundries that would ultimately be making our parts and products.

We didn't want to be just another small-company startup that operates in a chaotic mode, so we also spent a great deal of time figuring out a parts-numbering system and documentation procedures that would help us avoid confusion. Those decisions paid off handsomely as we grew. Soon we were able to build prototype iterations quickly and have everything fully documented at each step.

We found modern CAD and simulation tools to be very cost effective. They speed up design time and also minimize costly, time-consuming mistakes. Better visualization can eliminate intervening steps, sometimes even eliminate the need to build some prototypes. Computers can also help you make the interfaces more seamless by providing communication tools such as e-mail to keep people informed. You want to take advantage of all the modern conveniences to expand your reach.

The outside world, too, can be helpful during the development stage of a new product. Consultants, for example, can help you solve specific problems quickly. Most universities are cooperative so long as what is produced in their laboratories does not get shipped to a customer. The new trend is for national laboratories and big companies to be cooperative as well. That trend allows you to focus your precious limited resources on developing internal capabilities you cannot reliably get from outside.

Moving into manufacturing

In the beginning, you're usually under the gun to get the first few products shipped. That often means you haven't worked out all the details, so the people who designed the products also have to assemble or tweak them. That process actually makes you feel good, because each shipment becomes a triumph. There's little incentive to document what you do because documentation is tedious and you can compensate for design oversights in real time. That's wonderful-until someone less knowledgeable has to crank the products out in volume. Some companies never quite develop the discipline to get out of this fire-fighting mode. That's unfortunate because making prototypes in volume still isn't production.

At New Focus, we couple product development with manufacturing from the start by not having a strong demarcation between them. All of our product-development engineers are deeply involved in manufacturing and vice versa. Some engineers in product development have taken classes in manufacturing at local colleges to learn documentation and materials management, and others have actually assumed manufacturing responsibilities. All engineers are involved in the early production phases, not so much to fight fires but to develop manufacturing processes. Over time, they learn to design products for manufacturability from the earliest stages in the development cycle.

Once we have shipped the product, the engineer who designed and developed it becomes the product line manager responsible for that aspect of the business, providing guidance to the people responsible for our advertisements and our catalog. When a problem occurs in the field, the engineer who designed the product usually winds up talking to the customer directly, refining the product as necessary on the basis of customer feedback. What the engineer learns this way will benefit future products as well.

A personal note

Most of what I have described here I learned at New Focus. We started with good people with a can-do attitude, and our mutual trust and confidence allowed us to move forward vigorously. By our fifth anniversary, we had developed enough off-the-shelf products to fill a 112-page catalog and had won numerous industry new-product awards. And yet the challenge is ongoing, to refine what we do as we grow.

The message is clear. For the product development team to be truly successful, its members must develop an intrinsic understanding of the business and participate in every aspect of the company. Given the close coupling between technology and business competitiveness, an even more efficient business model is to have engineers permeate the entire company and participate in making business decisions,

A logical extrapolation is that more people with a technical background will become business executives and start their own companies. That's happening now, but perhaps not fast enough. In managing a business, you'll find your research background tremendously helpful. You can apply technologies to give your business a competitive advantage. You can evaluate technology opportunities rationally without getting overly excited or rejecting them out of hand. You can also foster a culture that gives engineering the roles described in this article. That's going to make technology commercialization more efficient and ultimately make technology development more efficient as well. We all win in that process. □

FURTHER READING

- Robert Kelley and Janet Caplan, "How Bell Labs creates star performers," *Harvard Business Review*, July/Aug. (1993), p. 128.
- H. Kent Brown, Kim B. Clark, Charles A. Holloway, and Steven C. Wheelwright, "Development projects: the engine of renewal," *Harvard Business Review*, Sept./Oct. (1994), p. 110.