Order out of chaos

A third-generation approach to developing winning products
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At least half of all product launches fail to live up to expectations. In general, companies have only themselves to blame. At most companies, new product design is still a rigid, linear staged process, in which customer input and preferences, potential production and design risks, technology, materials, and features are virtually locked in stone up front. The problem is, customer needs may have changed substantially by the time the product reaches its final manufacturing stages, or perhaps they weren’t fully grasped initially. Additionally, inflexible design, technology, and specifications often add so much complexity to the process that significant delays and greater-than-forecast costs are the inevitable outcome.

To mitigate some of these problems and the costs they drive, many companies have implemented lean product development techniques, a second-generation approach to design that chiefly focuses on minimizing waste and improving speed-to-market through more efficient information flow and task standardization. But the lean approach isn’t enough, because it, too, relies on unrealistically premature requirements stabilization, locking in customer preferences as well as design specifications and production budgets early in the process. In other words, lean does improve on the status quo, but it is not a catalyst for innovation or for developing products that more closely match unmet customer needs and derivative internal production forecasts.

Given these realities, a third-generation (3G) approach is necessary — a more agile product development system capable of addressing frequent iterations of multiple design options up front, based on continuous testing and highly sophisticated customer-driven design changes. This method, which both encourages flexibility and recognizes the unpredictability of the early stages of product development, ensures that the latter part of the cycle is much less uncertain, enabling companies to bring more popular products to market at lower cost with fewer delays.

Executive summary
**Key highlights**

- As many as half of all product launches fail to live up to expectations primarily because new product design tends to be a rigid, linear process, in which customer input and preferences, potential production and design risks, technology, materials, and features are virtually locked in stone up front.

- By the time many products reach final manufacturing stages, their customer focus has been lost, and design, technology, specification, and materials changes have added complexity and cost to the process.

- Lean product development techniques minimize waste and boost efficiency, but they are not a catalyst for innovation because they, too, rely on early stabilization of requirements.

- To radically improve the chances that product launches will succeed and to keep pace with competitors in rapidly shifting global markets, a third-generation approach should be embraced — an agile product development system capable of addressing frequent iterations of multiple design options up front, based on continuous testing and highly sophisticated customer-driven design changes.
Why new products fail

For every four projects that enter development, only one makes it to market, according to a recent study by two professors at Georgetown University’s McDonough School of Business. Moreover, Strategy& found in earlier research that 33 percent of new products fail to provide a satisfactory return; in fact, about 70 percent of the resources spent on new launches are allocated to products that are not successful in the market.

These figures are stunning enough, but perhaps even more surprising is the reason: For many companies, the process of product development is sometimes just too regimented. The typical gated model for new product design — in which decisions about continuing the effort are made at each stage along a linear time line — is a carefully choreographed approach that assumes almost perfect information and analysis at the front end to produce a successful product at the back end. When customer input gathered up front is not definitive or is ambiguous, the contours of the product and the ensuing product itself will almost certainly be merely functional, meeting some customer needs adequately but generally lacking in distinction. All too often, by the time the product is introduced, customer needs have evolved (or, more likely, they weren’t fully understood in the first place). Further, with designs and technology locked in early in the process, so much complexity and risk may be introduced that turning back and reworking aspects of the development effort triggers substantial cost overruns and delays in the final stages. Under these conditions, it’s extremely difficult to produce a “winning” product against competing alternatives.

In effect, the gated approach is akin to a waterfall (see Exhibit 1, next page). It assumes that customer requirements can be frozen at the beginning, risk can be adequately identified early on, and programs can be “baselined” prior to starting development — and that all of these elements can cascade down efficiently into the detailed design stage before downstream production begins. In reality, however, with decisions on functionality, features, and targets made and budgets crafted so early in the process, requests for quotes from suppliers are sent out without visibility into the true risks and needs of the
Exhibit 1
Traditional linear development: Frequent turning back and reworking

Rework loops impact time, cost, and effort to start of production

Source: Strategy&
development program or which types of suppliers match those needs best. Insufficient rigor in program and technical risk identification, unstable customer requirements, and a lack of due diligence about whether a product can be manufactured efficiently or whether a particular supplier can handle the work can conspire to ultimately drown the supposedly tidy development process at the bottom of the waterfall.

In short, the original plan is no longer valid. Now it becomes necessary to re-cycle, loop back, and change the product’s features and specifications. That’s the best-case scenario. The worst: Start over. This “hysteresis” loop, or rework cycle, frequently occurs throughout the development process, especially for complex or challenging new products where differentiation from the competition is key. The result can be devastating. With huge sunk cost investments, managers frequently decide to march on to product launch, even if this means taking significant value out of the product. They might opt to exclude high-risk features or functionality, which in turn results in poor customer acceptance. Remember the Apple Newton, an early 1990s iPad that originally had the ambitious goal of remaking personal computing and the way applications were programmed. Because of numerous design and production stutter steps, the Newton that finally saw the light of day was nothing but an overweight PDA with limited features; not surprisingly, it drew few fans.

We recently examined 50 projects utilizing traditional linear waterfall methods in the automotive, industrial, and aerospace sectors and found that 80 percent of the projects cost more than 20 percent above the forecast person-hours to launch. Four factors primarily accounted for this: marketing and customer requirements instability; failure to identify and manage inherent technology, integration, business, and market risks; making the wrong complexity versus manufacturability trade-offs; and supplier failure to deliver or conform to targets, specs, cost, and the like.
Lean is only part of the solution

Orderly but frequently ineffective, the gated approach has, not surprisingly, lost some of its luster in recent years. Many companies have replaced it with a second-generation methodology commonly called lean product development. Inspired by the success of lean production techniques, this method chiefly focuses on eliminating waste in gated processes and improving speed-to-market by better synchronizing information flow with decisions and standardizing repetitive tasks. In addition, this second-generation development strategy, if applied in the true spirit of lean thinking, captures the voice of the customer better than traditional gated approaches. Effort is spent to optimize product features and functionality based on extensive customer surveys and focus groups, as well as nontraditional consumer research such as intensive customer observation and trendspotting — all targeted at uncovering explicit opportunities and needs.

Clearly an improvement on the gated approach alone, lean product development has had success, especially in improving project execution efficiency, allowing companies to launch more projects and products within budgetary limits. The best lean-focused companies — Toyota, United Technologies, and General Electric, to name just a few — rely on lean techniques to streamline workflow and information sharing throughout the development process. They also add continuous “touch” points with customers to test product concepts, prototypes, and features along the development and launch cycle. In so doing, companies applying lean product development techniques have achieved as much as 30 percent declines in cycle time, up to 40 percent reductions in development costs, and dramatic gains in first-time quality over the traditional gated waterfall approach.

Where lean techniques fall short, though, is at the front end of the development process. Unable to offer a real alternative to the checklist approach to up-front product development or to provide a clear path to getting out of the waterfall/hysteresis vicious circle, lean models (like other traditional approaches) lock in what is known about customer preferences, budgetary and specification decisions, supplier requests for proposals (RFPs), and feature/functionality sets at the first stage,
before exploring a full set of alternatives that can lead to a truly distinctive product concept. The enhanced efficiency of lean product development is still highly dependent on early stabilization of requirements, rather than iterating, optimizing, and trading off requirements to get to the “winning” product design. As a result, innovation (such as it is in this scenario) is based on protecting what is decided initially within the confines of the “known” value chain — that is, based on safeguarding the status quo and not on being creative — leaving companies exposed to disruptive changes in the market later on.
Going agile

Given the shortcomings of the front end of lean product development — and the front to back problems with the gated model — we believe that a third-generation process is critical for success. We call it the agile/lean approach (see Exhibit 2, next page): It entails borrowing agile product development techniques from software companies and applying them to the front end of product development efforts. The goal is to achieve rapid and frequent iterations with multiple design options up front driven by continuous testing and granular customer analyses in order to optimize, balance, and prioritize requirements and identify risks earlier. This drives down uncertainty in the latter part of product development, making it less costly and more efficient. In short, with greater front-end rigor and stability, the application of lean techniques to the back end streamlines this part of the process, minimizing wasted effort and resources typically expended on product launches.

Especially now that globalization has created scores of new, more nimble competitors in every industry, the product development environment is too volatile for linear, standardized processes. In such a landscape, a 3G approach that embraces the value of flexibility and unpredictability is needed to generate more stable and successful outcomes. Paradoxically, while waterfall processes are focused on linearity and order, they often result in chaos. In contrast, the agile model, driven by chaos and uncertainty at the front end, yields greater order at the latter stages of product development.

Implementing agile

Software companies have been the earliest adopters of 3G product development because they must routinely iterate numerous versions of their programs and assess them against customer needs and preferences well before the software is ready for mass release. Without customer co-development, a deep knowledge of product integration risks, and extensive testing to eliminate bugs at the
Exhibit 2
Third-generation agile/lean product development

Agile front end

- Concept definition & requirements generation
- First prototype design
- Iterative customer inputs
- Sprint
  - Scrum cycle

Lean back end

- Mature, validated, risk-mitigated design from the agile front end feeds the lean back end
- Lean product development on the back end ensures efficient ramp-up and launch

- Detailed design/development
- Verify/ramp-up
- Launch & stabilize

Key enabling capabilities & behaviors

- Rapid iterative development model
- Modular architecture
- Early risk identification
- Intensive stakeholder and supplier involvement

Key enabling capabilities & behaviors

- Reusable platforms and modules
- Just-in-time information and resources
- Lean supplier integration
- Responsive change control system

Source: Strategy&
beginning of the development cycle, software companies are essentially operating blind, uncertain about the stability of their products or how they will be received. Given the prevalence of software in virtually every significant product — toys, jet planes, cars, elevators — software developers have become enthusiastic advocates for employing agile front-end development methods.

There are four primary facets to an agile front-end development process:

1. **Rapid iterative development model**
   
   Generate multiple concepts and in a period of weeks, not months, test product prototypes with customers. As the results come in, cross-functional product development teams — design, engineering, manufacturing, procurement, and sales and marketing, among others — work together in problem-solving sessions to produce a blueprint based on customer responses and the new ideas that these responses generated. Frequently, these development sessions are held in large rooms with plenty of drawing paper scribbled on and placed on the walls as new concepts gestate, rather than in more traditional and formal (and less conducive to creativity) Outlook-scheduled meetings. Toyota calls this approach *oobeya*, or “big room”; some software firms refer to these meetings by the rugby term “scrum,” a chance to “get the desks and partitions out of the way.” An effective approach for beginning the implementation of this step is to pick an upcoming market opportunity and conduct a “front-end” pilot, applying rapid iterations to generate and test multiple product options.

2. **Modular architecture**
   
   If companies have inflexible, non-modular product lines that are not easily upgraded or altered without a reengineering of the entire product, implementing an agile front end can prove to be a significant challenge, as there is no effective way to isolate the subsystems or modules for iterative development. By breaking a product concept into modules, sub-teams can be given the responsibility to work out the best set of solutions for the final design and manufacturing of their parts of the project, including interfaces, materials, and potential trouble spots. Armed with this input, design teams could then reunite the modules to set the plans for the next iteration of the product.

It is critical to designate a creative manager to orchestrate this part of the agile development process and make sure that all contingencies are being discussed and that the activity doesn't devolve into a wasteful and inefficient exercise. The most innovative
companies, such as Apple and Google, give this role to their most talented product managers and systems experts, asking them to weigh in firmly on how well customer preferences are reflected in the latest product iteration, the maturity of the product’s underlying technology, and the abilities of the development team and external suppliers and production partners to deliver the product as designed. The auto industry has made good use of modular architecture, allowing carmakers to refresh model lines and introduce new versions of their vehicles while reusing multiple parts, designs, and components from prior iterations. Conducting an “architecture” workout, which evaluates modularity shortcomings of current product offerings and generates ways to improve product modularity and flexibility, is a must.

3. Early risk identification

As cross-functional teams rapidly iterate and synthesize product ideas and concepts, more often than not the deep dive into the design process reveals potential development risks. With this knowledge, teams can prioritize potential risks and bake risk reduction plans — such as focused lead-customer research and early engineering assessments — into the development slate, while scheduling routine test events to verify that risks have been addressed.

A major medical device company mastered this approach particularly well recently by mandating that all development plans and contingency tests or “events” include rigorous risk management controls, rather than placing risk management activities on a schedule separate from product development. Using this program, the company reduced post-launch product quality and performance problems by more than 80 percent.

4. Intensive stakeholder and supplier involvement

Traditionally, companies hold suppliers and the manufacturing function at arm’s length until product requirements and concepts have matured. By contrast, the agile front end approach seeks to gain the input of all stakeholders — customers, partners, suppliers, and sales and manufacturing teams — to critique designs, offer insights, and broadly minimize risk and maximize efficiency up front so that fewer changes need to be made during production or product launch. The best way to do this is by appointing someone on each project team to be a “supplier integrator.” This person should bring suppliers into the development process at critical points while working to understand supplier perspectives and capabilities, thereby enhancing the likelihood that suppliers will meet cost, quality, and scheduling expectations.
Implementing the lean back end

The second component of 3G agile product development involves implementing robust lean techniques to manage detailed design, ramp-up, and launch. These phases should benefit from mature product definition and risk management implemented in the agile up-front stages of the project. Here, too, four aspects of product development are involved:

1. Reusable platforms and modules

   Using the lean approach gives teams the luxury of setting up a development plan that mitigates the need to redesign large parts of the product from scratch in every cycle and iteration. Some product features should be designated as necessary but not highly valued by customers; these can then be treated as common modules that can be reused over multiple product generations. This approach gives agile development teams the chance to apply most of their resources toward “intelligent customization” of product iterations, adding only new features and capabilities that customers value the most. This not only saves development effort and time, but also increases speed-to-market. In a classic example, Apple launched the initial iPod in just six months by reusing technology and components that had already been perfected by partners. And more recently, because of intelligent customization Apple was able to significantly upgrade its iPad tablet in only a year, adding a camera, faster processors, and improved battery life, among other things. This places Apple well ahead of competitors that are just beginning to launch first (and generally lesser) iterations of rival products. Many leading companies maximize reuse by developing common features, parts, and specifications libraries that are centerpieces of new developer training or, in some cases, are automated and fully integrated into product management systems and IT tools.

2. Just-in-time information and resources

   These are bedrocks of traditional lean systems and cannot be neglected when lean is implemented in product development because they increase development and production speed and reduce waste and total effort. In product development projects, these elements take a slightly different cast but ultimately achieve the same thing as they do in manufacturing. For example, several aerospace and industrial companies have begun to form “expert cells” of engineers that can do specialized design and development analytic work on an on-demand or just-in-time basis. Demand/pull lean planning techniques are utilized to ensure that work packages for development teams from these cells are accomplished on schedule, in turn allowing the core project teams to focus on risk mitigation.
and customer preferences. Implementation requires development of simple workload forecasts and demand planning tools that match project demand with available functional skills. This helps to avoid starving critical projects of necessary resources and unnecessarily deploying resources on less critical tasks.

3. **Lean supplier integration**

Just as suppliers must be intimately involved in the up-front agile aspects of the 3G product development approach, these partners should also collaborate in the detailed development and prelaunch phases. The goal is to identify the most critical product and process features, as well as risk mitigation parameters, while ensuring that supplier partners can produce to these benchmarks at a high level of quality. If these so-called critical-to-quality parameters are identified early enough in the process — in the agile stage, for example — they can be cascaded down the supply chain to avoid costly quality problems and delays in the lean phases. Creating critical-to-quality task teams made up of core development groups and leading suppliers, which apply state-of-the-art Design for Six Sigma tools, is one way to start developing this capability.

4. **Responsive change control system**

Even high-performing product development companies endure changes throughout the development life cycle. However, applying 3G principles should not only dramatically reduce the number of changes but also ensure that product alterations do not greatly slow down the overall product development process. This is accomplished by having a highly responsive change control approach in place, backed by the appropriate internal systems and technology. That’s a far cry from the norm in many companies, in which change management depends on outdated processes and systems and ineffective queues for sign-off and approval, a flurry of red tape that erodes speed-to-market. By applying lean analysis and principles to their change control system, some industrial companies have enjoyed dramatic results: reductions of as much as 75 percent in the time to process and approve changes. Change management bottlenecks are eliminated, and time-to-launch targets are maintained. Start by simply mapping the value chain of your current change management process. If the time between change initiation and change implementation is a month or more rather than weeks, an opportunity exists to eliminate information and approval bottlenecks.
Stellar results

Companies that implement the agile product development model enjoy significant returns, well beyond what they could expect with either the gated or lean approach (see Exhibit 3, next page). Indeed, embracing 3G product development is the most essential lever for permanently increasing product success rates and truly developing a much stronger, sustainable position in the marketplace.

However, it’s not an easy process. To become a 3G product development organization requires significant behavioral change for most companies; hence, rapid transformation is unlikely. Success with the agile front-end approach is dependent on a highly collaborative organizational culture, which reflects the idea that most disruptive innovations come from outside the organization. To embed this culture and outpace competitors, companies must continuously scout, filter, and channel global sources of technology, capabilities, and solutions as well as recommendations from suppliers, which should be treated as partners in the product development process. Put simply, a “not invented here” culture will not be able to achieve a 3G model.

And perhaps most important, 3G innovators understand that delivery of differentiated products requires a deep well of sophisticated customer knowledge that goes beyond basic analyses of consumer preferences and behaviors with existing products. Indeed, to identify latent or unmet consumer needs that could be the basis for new products and features, 3G companies use granular ethnographic and observational research, focusing on customer aspirations and motivations and the underlying factors that govern how people live and make product choices. In addition, product teams spend substantial time in the field, observing customers using their products in real-life situations.

An agile front end is a critical success factor in the conversion of an unmet need into a marketable product or feature. Third-generation companies are able to evaluate multiple potential product features and enabling technologies at the front end of the development process and refine them through rapid multiple iteration cycles with continuous customer input before making final development choices.
Exhibit 3
Performance gains of agile/lean product development

1 Share penetration or forecast realization.

2 Labor and capital resources required to launch.

3 Cycle time to launch.

Source: Strategy& analysis
Though many companies give lip service to open innovation models, more agile design approaches, up-front collaboration, and capturing deep customer insights, they often lack the skills, structures, metrics, and incentives to isolate market opportunities before they become obvious or to incubate and validate them before turning them over to a product development organization that can bring them to market effectively. The first step in overcoming these organizational weaknesses is to address decision rights and information flows with the goal of developing faster decision-making capabilities and mobilizing quickly to take advantage of new first-to-market opportunities.

Finally, companies must establish metrics and incentives to facilitate the breakdown of silos and open the organization to ideas from a greater number of internal and external sources, driving long-term accountability into the innovation process. High-level measures — for example, return on innovation, which measures the overall health of the product portfolio and pipeline — as well as project-level yardsticks that assess yield, value, and speed across the development life cycle should be adopted. Such carefully chosen metrics can improve transparency and accountability, enabling more educated decision making and trade-offs in the up-front agile iteration cycles.
Conclusion

Third-generation product development requires discipline and, for many companies, a complete transformation of how they design, develop, and launch products, which may include inefficient approaches deeply embedded in the organization. But in the end, the effort could pay off significantly. Just consider the returns that Apple has enjoyed from its rapid-fire sequence of products that began with the numerous variations of the iPod, then the iPhone, and finally the iPad — products updated virtually every 12 months or so, all of them built using many of the best 3G agile techniques.

On a larger industrial scale, there’s Oshkosh Defense. In late 2008, the Pentagon issued an RFP for a lightweight off-road vehicle that could protect a crew of four and a gunner from improvised explosive devices and other similar bombs directly beneath the truck. The catch was that the vehicles had to be ready for production within seven months. To meet the tight deadline, Oshkosh used modular parts from existing equipment; tested the design as it was being produced, generating new iterations frequently based on what was learned in the field in trial runs; and enforced daily meetings among the core team of about 60 members across numerous functions — design, engineering, manufacturing, procurement — aimed at ironing out problems, assessing risk, and fine-tuning the development plan. By diligently following this decidedly 3G agile program, Oshkosh handily overtook its competitors, winning a contract so far worth more than US$2 billion for about 4,000 M-ATVs, as these vehicles are now known.

Of course, Oshkosh’s successful experiences illustrate the very aspect of the 3G model that stymies many organizations: Though more flexible and potentially more profitable, this approach appears to be frighteningly chaotic up front. However, companies that have endeavored to adopt this system — perhaps inspired by the best software designers — learn quickly that what they give up in orderliness initially they gain in the ability to produce products more successfully, skillfully, and intelligently, outpacing even their most nimble rivals.

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