Stage-Gate® New Product Development System:
A Game Plan from Idea to Launch
Robert G. Cooper


Introduction

Facing increased pressure to reduce the cycle time yet improve their new product success rates, companies look to new product processes, or Stage-Gate® systems¹, to manage, direct and accelerate their product innovation efforts [1]. This chapter outlines what the Stage-Gate or phase-gate process is, why it is important, and how it has been modified to handle different types of development projects. The chapter concludes with some steps on how to design and implement this process in the company.

What Is a Stage Gate Process?

A Stage-Gate® process is a conceptual and operational roadmap for moving a new product project from idea to launch – a blueprint for managing the new product process to improve effectiveness and efficiency [2,3]. Stage-Gate breaks the innovation process into a predetermined set of stages. Each stage defines a set of prescribed, cross-functional and parallel activities to be undertaken by the project team, much the way a playbook defines the actions to be taken by a football team (see Figure 1). Management then builds into these stages best practices and critical success factors.

The entrance to each stage is a gate: these gates are analogous to huddles in a football game. Gates are meetings that control the process and serve as the quality control and Go/Kill

---

¹ Stage-Gate™ is a trademark of R.G. Cooper and Associates Consultants Inc. in many countries.
check points. At these gate meetings, the project is scrutinized by senior management: they review the progress of the project, determine whether the criteria necessary to move forward have been met, and either approve the task and resources for the next stage (Go), ask for more information (Recycle), or stop the project (Kill or Hold).

This stage-and-gate format leads to the name “Stage-Gate process”. Other names include phase-gate and phase review processes.

**What the Stage-Gate® Process or Playbook Looks Like**

**The Stages**

The *Stage-Gate* process breaks the new product project into discrete and identifiable stages, typically four, five, or six in number, as in Figure 1. These stages are the *plays* – where players execute prescribed actions. Each stage is designed to gather information and undertake tasks needed to progress the project to the next gate or decision point. Some key points:

- Each stage is cross-functional: There is no “R&D stage” or “Marketing stage”; rather, every stage is Marketing, R&D, Production, Engineering, etc.

- Each stage consists of a set of parallel activities undertaken by people from different functional areas within the firm – that is, tasks within a stage are done concurrently and in parallel, much like a team of football or rugby players executing a play.

- The activities within a stage are designed to gather critical information and to reduce the project’s unknowns and uncertainties. Each stage costs more than the preceding one: the process is an incremental commitment one. But with each step increase in project cost, the unknowns and uncertainties are driven down, so that risk is effectively managed.

The flow of the typical *Stage-Gate* process is shown pictorially in Figure 1. Here the stages are:

**Discovery**: pre-work designed to uncover opportunities and generate NP ideas

**Scoping**: a quick, preliminary investigation and scoping of the project – largely desk research

**Build the Business Case**: a much more detailed investigation involving primary research – both market and technical – leading to a *business case*, including product and project definition, project justification, and a project plan

**Development**: the actual detailed design and development of the new product, and the design of the operations or production process

**Testing and Validation**: tests or trials in the marketplace, lab, and plant to verify and validate the proposed new product, and its marketing and production/operations

**Launch**: commercialization – beginning of full operations or production, marketing, and selling.

There is one additional stage: *strategy formulation*, an essential activity. This strategy formulation stage is left out of the Figure 1 flow diagram, not because it is unimportant, but because it is macro and all encompassing in nature – strategically oriented as opposed to process or tactics. Thus, strategy
formulation is best superimposed over (or atop) the model in Figure 1; it is a prerequisite to an effective *Stage-Gate* process.

**The Gates**

Preceding each stage is a gate or a Go/Kill decision point. The gates are the *scrums* or *huddles* on the rugby or football field. They are the points during the game where the team converges and where all new information is brought together. Gates serve as quality-control check points, as Go/Kill and prioritization decisions points, and as points where the path forward for the next play or stage of the project is decided.

The structure of each gate is similar. Gates consist of:

1. A set of required *deliverables*: what the project leader and team must bring to the decision point (e.g., the results of a set of completed activities). These deliverables are visible, are based on a standard menu for each gate, and are decided at the output of the previous gate. Management’s expectations for project teams are thus made very clear.

2. *Criteria* against which the project is judged: these can include Must Meet or knock out questions (a checklist) designed to weed out misfit projects quickly, for example:
   - Does the proposed project fit our business’s strategy?
   - Does it meet our EH&S policies (environmental, health and safety)?

   There are also Should Meet criteria or desirable factors, which are scored and added (a point count system), which are used to prioritize projects, for example:
   - the strength of the value proposition or product’s competitive advantage
   - ability to leverage core competencies
   - relative market attractiveness, and
   - size of the financial return vs. the risk.

3. Defined *outputs*: for example, a decision (*Go/Kill/Hold/Recycle*), an approved action plan for the next stage (complete with people required, money and person-days committed, and an agreed timeline), and a list of deliverables and date for the next gate.

Gates are usually tended by senior managers from different functions, who own the resources required by the project leader and team for the next stage. They are called the *gatekeepers*, and are a pre-defined group for each of the five gates. For example, for larger projects, Gates 3, 4 and 5 are often staffed by the leadership team of the business – the head of the business and the heads of Marketing/Sales, Technology, Operations and Finance.

**A Walkthrough the *Stage-Gate®* Process**

Now, let’s have a high level look at the *Stage-Gate®* process – an overview of what’s involved at each stage and gate – that you can follow stage-by-stage in Figure 1.

**Begin Stage: Discovery**
Ideas are the feedstock or trigger to the process, and they make or break the process. Don’t expect a superb new product process to overcome a deficiency in good new product ideas. The need for great ideas coupled with high attrition rate of ideas means that the idea generation stage is pivotal: you need great ideas and lots of them.

Many companies consider ideation so important that they handle this as a formal stage in the process, often called “Discovery”. They build in a defined, proactive idea generation and capture system. Activities in the Discovery stage include:

- undertaking directed but fundamental technical research, seeking new technological possibilities
- working with lead users (innovative customers) to uncover unarticulated needs
- using creativity methods (such as brainstorming)
- strategic planning exercises to uncover disruptions in the marketplace leading to identification of gaps and significant opportunities
- and even idea suggestion schemes to encourage ordinary employees to submit NP ideas.

A good summary of many ideation methods is provided in [7].

**Gate 1: Idea Screen**

Idea screening is the first decision to commit resources to the project: the project is born at this point. Gate 1 is a “gentle screen” and amounts to subjecting the project to a handful of qualitative criteria such as strategic alignment, project feasibility, magnitude of opportunity and market attractiveness, product advantage, ability to leverage the firm’s resources, and fit with company policies. Financial criteria are typically not part of this first screen.

**Stage 1: Scoping**

This first and inexpensive homework stage has the objective of determining the project’s technical and marketplace merits. Stage 1 is a quick scoping of the project, involving desk research or detective work – little or no primary research is done here. Stage 1 is often done in less than one calendar month’s elapsed time, and 10-20 person-days’ work effort. It includes activities such as:

- a preliminary market assessment
- a preliminary technical assessment
- a preliminary business assessment.

**Gate 2: Second Screen**

The project is subjected to a second and somewhat more rigorous screen at Gate 2. This gate is essentially a repeat of Gate 1: the project is re-evaluated in the light of the new information obtained in Stage 1. If the decision is Go at this point, the project moves into a heavier spending stage. Besides the qualitative criteria used at Gate 1, the financial return is assessed at Gate 2, but only by a quick and simple financial calculation (for example, the payback period).

**Stage 2: Build the Business Case**

The business case opens the door to product development. Stage 2 is where the business case is constructed: this stage is a detailed investigation stage, which clearly defines the product and verifies the attractiveness of the project prior to heavy spending. It is also the critical homework stage – the one found to be so often weakly handled. Key activities include:

- Market research studies, including voice-of-customer research, to determine the customer’s needs, wants, and preferences to help define the “winning” new product.
- Competitive analysis
- Concept testing to validate the product concept.
- Detailed technical appraisal focuses on the technical feasibility of the project
- A manufacturing (operations or source of supply) appraisal
- Definition of the winning new product including target market definition, product concept, positioning strategy, benefits to be delivered, the value proposition, and product attributes, requirements and high-level specifications.
- A detailed business and financial analysis involving a discounted cash flow approach (NPV and IRR), complete with sensitivity analysis to look at possible downside risks.

The result of Stage 2 is a business case for the project: the product definition – a key to success – is agreed to; and a thorough project justification and detailed project plan are developed.

Stage 2 involves considerably more effort than Stage 1, and is best handled by a team consisting of cross-functional members – the core group of the eventual project team.

**Gate 3: Go to Development**

This is the final gate prior to the Development stage, the last point at which the project can be killed before entering heavy spending. Once past Gate 3, financial commitments are substantial. In effect, Gate 3 means “go to a heavy spend.” Gate 3 also yields a “sign off” of the product and project definition.

The qualitative side of this evaluation involves a review of each of the activities in Stage 2, and checking that the activities were undertaken, the quality of execution was sound, and the results were positive. Next, Gate 3 subjects the project once again to the set of Must Meet and Should Meet criteria used at Gate 2, but this time with much more rigor and with benefit of more solid data. Finally, because a heavy spending commitment is the result of a Go decision at Gate 3, the results of the financial analysis are an important part of this screen.

If the decision is Go, Gate 3 sees commitment to the product definition and agreement on the project plan that charts the path forward: the development plan and the preliminary operations and marketing plans are reviewed and approved at this gate. The full project team – an empowered, cross-functional team headed by a leader with authority – is designated.

**Stage 3: Development**

Stage 3 witnesses the implementation of the development plan and the physical development of the product. Lab tests, in-house tests or alpha tests ensure that the product meets requirements under controlled conditions. For lengthy projects, numerous milestones and periodic project reviews are built into the development plan. These are not gates per se: Go/Kill decisions are not made here; rather these milestone check points provide for project control and management. Extensive in-house testing, alpha tests or lab testing usually occurs in this stage as well. The “deliverable” at the end of Stage 3 is an internally-tested prototype of the product.

The emphasis in Stage 3 is on technical work. But marketing and operations activities also proceed in parallel. For example, market-analysis and customer-feedback work continue concurrently with the technical development, with constant customer opinion sought on the product as it takes shape during development. These activities are back-and-forth or iterative, with each development result – for example, rapid prototype, working model, first prototype, etc. – taken to the customer for assessment and feedback. Some experts call this iterative process “spiral development”. Meanwhile, detailed test plans, market launch plans, and production or operations plans, including production facilities
requirements, are developed. An updated financial analysis is prepared, while regulatory, and intellectual property issues are resolved.

**Gate 4: Go to Testing**
This post-development review is a check on the progress and the continued attractiveness of the product and project. Development work is reviewed and checked, ensuring that the work has been completed in a quality fashion, and that the developed product is indeed consistent with the original definition specified at Gate 3.

This gate also revisits the project’s economics via a revised financial analysis based on new and more accurate data. The test or validation plans for the next stage are approved for immediate implementation, and the detailed marketing and operations plans are reviewed for probable future execution.

**Stage 4: Testing and Validation**
This stage tests and validates the entire viability of the project: the product itself, the production process, customer acceptance, and the economics of the project. It also begin extensive external validation of the product and project. A number activities are undertaken at Stage 4:

- **In-house product tests**: extended lab tests or alpha tests to check on product quality and product performance under controlled or lab conditions.

- **User or field trials of the product**: to verify that the product functions under actual use conditions, and also to gauge potential customers’ reactions to the product – to establish purchase intent.

- **Trial, limited, or pilot production**: to test, debug, and prove the production or operations process, and to determine more precise production/operations costs and throughputs (often production equipment is acquired and tested here).

- **Pre-test market, simulated test market, full test market, or trial sell**: to gauge customer reaction, measure the effectiveness of the launch plan, and determine expected market share and revenues.

- **Revised business and financial analysis**: to check on the continued business and economic viability of the project, based on new and more accurate revenue and cost data.

Sometimes Stage 4 yields negative results, so it’s back to Stage 3. Iterations back and forth through the Stage-Gate process are quite possible.

**Gate 5: Go to Launch**
This final gate opens the door to full commercialization – market launch and full production or operations start up. It is the final point at which the project can still be killed. This gate focuses on the quality of the activities in the Testing and Validation Stage and their results. Criteria for passing the gate focus largely on expected financial return and appropriateness of the launch and operations start-up plans. The operations and marketing plans are
reviewed and approved for implementation in Stage 5.

**Stage 5: Launch**
This final stage involves implementation of both the marketing launch plan and the production or operations plan. Given a well thought-out plan of action and backed by appropriate resources, and of course, barring any unforeseen events, it should be clear sailing for the new product ... another new product success!

**Post-Launch Review**
At some point following commercialization (often 6-18 months), the new product project must be terminated. The team is disbanded, and the product becomes a “regular product” in the firm’s product line. This is also the point where the project and product’s performance is reviewed. The latest data on revenues, costs, expenditures, profits, and timing are compared to Gates 3 and 5 projections to gauge performance. Finally a post-audit – a critical assessment of the project’s strengths and weaknesses, what can be learned from this project, and how the next one can be done better – is carried out. This review marks the end of the project. Note that the project team and leader remain responsible for the success of the project through this post-launch period, right up to the point of the post-launch review.

**Built-in Success Factors**

The logic of a well-designed new product process, such as *Stage-Gate* in Figure 1, is appealing because it incorporates many of the critical success factors – the drivers of success and speed – that were highlighted earlier in this chapter. For example:

1. The process places much more emphasis on the homework or pre-development activities. Stages 1 and 2 – the Scoping and Build Business Case stages – are the essential homework steps before the door to Development is opened at Gate 3.

2. The process is multi-disciplinary and cross-functional. It is built around an empowered, cross-functional team. Each stage consists of technical, marketing, operations/production and even financial activities, necessitating the active involvement of people from all of these areas. The gates are cross-functional too: gates are tended by gatekeepers from different functions or departments in the firm – the senior managers who own the resources needed for the next stage.

3. Parallel and spiral processing speeds up the process. Activities in each stage are undertaken concurrently, rather than sequentially, with much interaction between players and actions within each stage. And there are constant checks of the product with the customer as it takes shape.

4. A strong market and VoC orientation is a feature of the process. Marketing inputs begin at the Discovery stage, and remain an important facet of every stage from beginning to end of the project. Projects cannot pass the gates until the marketing actions have been completed in a quality way. And this extensive VoC emphasis often leads to the unique, superior product with a compelling value proposition, yet another key to success.
5. A product-definition step is built into the process at Stage 2, Build the Business Case, so that the project scope and product specs remain stable from Gate 3 onward. This product definition is a key deliverable to Gate 3; without it, the project cannot proceed to Development.

6. There is more focus. The process builds in decision points in the form of gates, with a clear locus of decision-making and visible Go/Kill criteria. These gates weed out poor projects early, and help focus scarce resources on the truly deserving projects. The gatekeepers are the decision-makers at each gate: at earlier gates (1 and 2), often the gatekeepers are mid-level management; but for Gate 3 and on, gatekeepers are typically the leadership team of the business.

7. There is a strong emphasis on quality of execution throughout. The stages and recommended activities within each stage lay out an “activity plan” for the project leader and team: there is less chance of critical errors of omission. The gates provide the critical quality-control checks in the process: unless the project meets certain quality standards, its fails to pass the gate.

What Types of Projects Does Stage-Gate® Apply To

The specific model described above and in Figure 1 has been designed for new product projects. Here, a new product project is defined as one where technical development work is applied to a market need to deliver a new or improved product or service that is visibly different from previous products. The result can be a radical innovation, a significant product improvement, or merely a line extension – all these types of new product projects are handled by the Stage-Gate approach outlined above.

Stage-Gate is used by producers of physical products – both consumer goods (such as Procter & Gamble and Pillsbury-General Mills) and industrial goods (such as DuPont, ITT and Nortel Networks) – and also service providers (such as banks or telephone companies).

Some companies have extended the use of the Stage-Gate approach – the concept of stages with defined tasks and resulting deliverables together with gates, defined gatekeepers, and visible Go/Kill criteria – to a wide variety of investment decisions. Besides new product projects, these other applications of Stage-Gate include:

- new business developments – outside the current market and technological boundaries of the firm
- alliance and partnership projects
- new process developments – where the “deliverable” is a new or improved manufacturing process
- fundamental research or science projects
- platform developments.

Stage-Gate Express for Smaller Projects

Some companies have developed abbreviated versions of the five-stage model in Figure 1 to cope with smaller, lower risk projects. The Stage-Gate process is not a hard-and-fast set of rules. Rather, each project can be routed through the process according to its specific risk level and needs. Stages can be omitted and gates combined, provided the decision is made consciously, at gates, and with a full understanding of the risks involved. The new product process is essentially a risk-management process, and thus the risk level, the uncertainty, and the need for information dictate what steps and stages need to be done, and which can be left out.
The result is a shortened version of Stage-Gate, such as the three-stage, three-gate process in Figure 3. But this shortcut process should be reserved for low risk projects only – extensions, fixes, improvements and product renewals; the routing decision is made at the previous gate, often as early as Gate 1.

An illustration: At one of North America’s largest banks, a five-stage, five-gate new product process is used, very similar to the process in Figure 1. But senior management uses a triage approach and has defined three categories of projects, based on project scope, investment, and risk level. These are:

- **system change requests**, which are relatively minor product changes and improvements, often in response to a request from a major corporate client. These go through a two-stage, two-gate version of the model.
- **fast track projects**, which are medium cost projects and feature some risk (less than $500,000 development cost, but impact multiple customers). These moderate risk projects are tracked through a four stage version of the model, which collapses the two homework stages into a single stage.
- **major projects**, over $500,000, are considered higher risk, and pass through the full five stage model.

**What About Fundamental Research Projects or Platform Developments?**
Stage-Gate systems, in modified format, also apply to less well-defined development projects such as fundamental research and platform developments. First, here are some definitions:

- **Platform projects** build a capability. The analogy is that of building a oil-well drilling platform in the ocean, at great cost [9]. Once in place, many holes can be drilled from the one platform, each at much less cost. In new products, the platform establishes the capability; and this capability spawns many new product projects – much more quickly and cost effectively than starting from the beginning each time. Examples are: a deposit software platform in a bank, from which many different end-user deposit products can be developed; a new engine-transmission-frame assembly for an auto company, from which many new car models can developed; and a new catalyst in the chemical industry, which might spawn an entire new family of polymers.

- **Fundamental research projects** are those where the deliverable is new knowledge. When the project begins, there may be no specific new product (or new manufacturing process) defined or even in mind. Rather, the scientist initiates some experiments with the hope of finding some technical possibilities
and discoveries, that might yield ideas for commercial products or processes. These are also called “science projects” and “technology developments”.

The main difference between these and a new product project – for which Stage-Gate in Figure 1 was designed – is that science projects and platform developments are often more loosely defined at the outset than is the typical new product project. For example, in a fundamental research project, it may take months of technical research before it’s even clear what might be technically possible. So undertaking market analysis in Stage 1 in Figure 1 and detailed market studies in Stage 2 is difficult when one cannot even define the resulting products! And the criteria for project selection are clearly different than for a very tangible, well-defined new product project.

Similarly, platform projects are often visionary in scope, with little concrete defined in the way of tangible products. Rather, management is building a capability that they hope will lead to multiple new product projects. Again it is difficult to undertake detailed market analyses and full financial projections when only the first or second product from the platform is even envisioned – the rest are “yet to be defined”. And so, the decision to move ahead must be largely a strategic one that looks at what this platform might yield in terms of multiple new products, most of which are unknown.

Some companies have adapted and adjusted Stage-Gate to handle these types of projects. The stage-and-gate approach seems to work, but clearly the spirit of the stages and the specific criteria used at gates are quite different than those described above and in Figure 1. Some examples:

- Rohm and Haas, the chemical company, has expanded their Stage-Gate process to accommodate science or exploratory research projects
- Exxon Chemical has published a synopsis of its Stage-Gate process to handle fundamental research projects [10]
- DuPont has modified its new product process to handle business developments – that is, projects that are beyond the typical new product project in the sense that they involve both new markets and new technologies to the company [11].
- The Japanese company, Dai Nippon Industries, has adapted its regular five-stage process for new products to handle fundamental research projects.

The nature of a Stage-Gate process for technology developments or science projects is quite different from a standard product-oriented process outlined earlier in this chapter, with much more experimentation allowed [12]. We call the process StageGate-TD, for technology developments:
projects where the immediate deliverable is not a new product or new manufacturing process, but is new knowledge or a capability that may spawn new products or processes. The model in Figure 4 is a composite example of a technology development process for science projects (taken from a number of leading firms). Note that there are only two stages and three gates. And Gate 3 – the Application Path gate – may be combined with Gates 1 or 2 in the standard new product process of Figure 1. In effect, the two processes are merged or overlapped.

The gate criteria in *StageGate-TD* are much less financial and more strategic in nature than for the standard new product model. For example, Toray Chemical in Japan (developers of breakthroughs such as micro-fiber and ultra-suede fabrics) uses the following rating criteria for judging their *technology development* projects:

- degree of strategic fit and strategic importance to the corporation
- ability to achieve strategic leverage (e.g., platform for growth; impact on multiple business units)
- potential for reward (value to the company, if successful)
- likelihood of technical feasibility
- likelihood of commercial success (e.g., competitive advantage; existence of in-house competencies).

**Doing It Right**

NPD is one of the most important endeavors of the modern corporation. The message from both Wall Street and Main Street is “innovate or die!”. Customers as well as shareholders seek a steady stream of innovative new products: customers want innovative products because they demand value for money; and shareholders seek the organic and profitable growth that innovations provide. Without a systematic new product process, however, often the NPD effort is a shambles – a chaotic, hit-and-miss affair. Stage-Gate processes act as an enabler or guide, building in best practices and ensuring that key activities and decisions are done better and faster. But a Stage-Gate process is considerably more complex than the simple diagram in Figure 1 suggests; there are many intricacies in the details – both the “what’s” and the “how to’s”. And implementing the process is also a major challenge. Many leading companies, however, have taken the necessary step, and designed and implemented a world-class NPD process, such as Stage-Gate, and the results have been positive: better, faster and more profitable new product developments!


Available at www.stage-gate.com
References:


2 “Stage-Gate” is a term coined by and trademarked by the author – see endnote 1, *JMM* 1988. Second generation processes are what many companies began to implement toward the end of the 80s; the third generation processes of the late 90s have improved time efficiencies – see endnote 1, *Winning at New Products*; also endnote 3.


7 Cooper, *Winning at New Products*, endnote 1, Ch 5.


The Author:

**Dr. Robert G. Cooper** is Professor of Marketing at the De Groote School of Business, McMaster University, Canada, and President of the Product Development Institute. He has published over 100 articles and six books on the topic of new product management. Cooper is the father of the Stage-Gate® process. He may be reached at robertcooper@cogeco.ca or +1 905 304 8797