Supply Chain Management

New Product Development

EMBRACING AN ADAPTABLE PROCESS

APQC®

CASE STUDY

Case Study
EXFO

ORGANIZATION OVERVIEW

EXFO is the No. 1 provider of optical testing solutions in the world, No. 2 in wireless protocol analyzers and network simulators, and No. 2 in portable test sets in the telecommunications industry. Since its 1985 founding in Quebec City, Canada, the organization has grown to more than 1,700 employees and has increased its market share every year, launching an average of 30 new products annually to 2,000 customers in 100 countries. EXFO is known for its usable, modular testing platforms and high-quality fiber optic equipment.

With a focus on innovative and scalable service solutions for fixed and mobile telecommunications networks, 44 percent of EXFO's work force is in research and development (R&D). Since 2000, EXFO has expanded the reach and diversity of R&D with development teams dispersed in Quebec City, Montreal, Toronto, Boston, Sweden, and two sites in India. EXFO has a working presence in 25 countries with manufacturing facilities in Quebec and China and sales and support offices all over the world. (For the purpose of this case study, the EXFO NetHawk activities are not considered, which includes 250 R&D resources in Finland and one of the India centers.)

The cultural differences between R&D team members in Quebec City and Montreal alone were challenging for EXFO. The addition of three more global locations strengthened the organization's commitment to bridge cultural and time barriers in order to develop cohesive global teams that leverage the expertise of many worldwide members.

R&D is a central component of EXFO. The organization's revenue is based on its ability to provide cutting-edge products that meet pertinent market needs. Therefore, bringing ideas to fruition is critical to the organization's future. The percentage of the work force dedicated to R&D and the fact that 20 percent of revenue is invested in R&D demonstrates EXFO's focus on product development and innovation.

NEW PRODUCT DEVELOPMENT GOVERNANCE

EXFO's organizational structure reflects its emphasis on R&D. Under the CEO, EXFO employs nine vice presidents, with one devoted entirely to R&D. Six locations support R&D: Quebec City, Montreal, Boston, Toronto, Pune (India), and Gothenburg (Sweden). R&D employs directors for its business units and product centers. R&D project teams are composed of members from multiple sites, depending on each individual's expertise.

At EXFO, strategy developed at the executive level trickles down into portfolio decisions, which shape the processes that employees follow when developing new products. Activities at the new product development process level link to executive goals and objectives, which focuses the entire organization on developing products that will give EXFO an advantageous position in the marketplace.

EXFO has established a global project management office (PMO) to manage the projects at all of its diverse sites. The PMO ensures that processes that prove successful at one location are replicated across all sites as appropriate. The PMO is led by the PMO director, who communicates the organization's strategic vision throughout all projects and locations to ensure that efforts align with business objectives.

The ultimate business process owner of new product development is the R&D vice president, who oversees stage-gate meetings, plays a large role in portfolio prioritization, and takes ultimate responsibility for the performance of new product development in the organization. The business process manager of new product development is the PMO director, who manages the way business is practiced across sites and ensures that best practices are transferred and that all locations support the organization's strategic vision.

Project managers are always assigned to projects within different units to apply processes that have been successful. When a project incorporates resources from multiple business units, the business unit directors are usually directly involved in the project. Their participation increases the visibility of successes across the organization. Because the directors regularly work together, the business unit processes are becoming more aligned as they share the best practices.

Gate Meetings

Every stage of the process includes a gate meeting to determine the state and readiness of the project for the next stage of development. At the meetings, the project manager and the product line manager present the state of the project along with any other pertinent information or topics for discussion.

A weekly set time for gate meetings facilitates the attendance of team members located in North America and India. Each meeting lasts 30 minutes, a time frame respected by all attendees and generally sufficient for addressing the issues at each gate. The PMO director coordinates and schedules the meetings and sends invitations to all required participants.

EXFO transmits each meeting to all remote attendees using an internal video system or tool such as WebEx. If someone is traveling, then he or she calls in to participate. A standard PowerPoint template serves as the basis for the gate presentation. The slides are sent in advance to meeting participants, who are encouraged to send any questions to the group before the meeting. This reduces the meeting time considerably. After the meeting, the PMO sends highlights, action items, and the gate verdict to all participants and relevant stakeholders.

During the gate meeting, the gatekeepers assess the project against a set of standard criteria for that gate, which address the technical specifications, manufacturability, launch plans, and serviceability of the product. If a certain criterion does not apply to a given project, then it will not be included in the assessment. If one or more criteria are not met, then the gatekeepers will not approve the project, and the PM will have to present the fulfilled criteria at the next gate review meeting. Occasionally, a project will pass a gate conditionally if missing criteria can be fulfilled within a week.

Each project has its individual quirks and requirements, but the standard template and design of the gate assessment allow for speedier and more consistent reviews. Having standard criteria and procedures in place also helps the employees working on the projects know what to expect as they present their projects and anticipate promotion to the next stage. The gatekeepers make comments and assess risk levels at each gate, which helps the team make decisions as the project progresses.

Process maturity is not equal across all product development centers, so some sites are still working to determine which activities will work best for them. Every product development center has the flexibility to apply processes as needed. This can prove difficult when multiple centers or units have to work together, but EXFO believes that some autonomy ultimately benefits the process.

At gates 0 through 2, the portfolio review committee acts as corporate gatekeeper by attending the gate meetings and evaluating the presented material. This team consists of:

- the president of EXFO,
- the vice president of marketing,
- the vice president of service assurance,
- the vice president of R&D, and
- the vice president of sales (both U.S. and international).

After Gate 2, the mandatory corporate gatekeepers include:

- the vice president of R&D (new product development's business process owner),
- the vice president of manufacturing operations and customer service,
- the vice president of the wireline division and corporate marketing,
- the vice president of service assurance, and
- the director of manufacturing engineering.

In addition to the mandatory gatekeepers and the project manager and product line manager, the marketing and R&D directors for the product center or business unit appropriate to the project are invited, along with a record keeper. Depending on the

project, its current stage, and the risks involved, additional participants may attend. At Gate 4.1, marketing and R&D play a diminished role, with manufacturing and service personnel taking over as they finalize preparations for full-scale manufacturing.

CULTURE AND PEOPLE

EXFO's culture is based on a combination of rigorously applied processes and flexibility to adapt those processes as needed. This balance of structure and openness to change is reflected throughout the new product development environment.

Project Teams

R&D at EXFO is organized around projects. Once a proposed product is approved for development at Gate 2, it becomes a project and is prioritized and granted project resources accordingly. Projects and the project teams, which change in composition based on the expertise and availability required, are an essential element of EXFO R&D culture.

A product line manager (PLM) is typically the person who first presents the idea to the organization. The PLM remains technically involved in the project, oversees the development of a full product definition, and determines any changes that may need to be made. The project manager (PM) leads the logistics of the project and typically stays out of the more technical elements of the project so that he or she can manage the team objectively and make decisions that are best for the project and its ability to support business objectives.

Teams in charge of developing new projects are led by a project manager (PM), an important strategic position at EXFO. EXFO employees in R&D typically take either a technical or managerial track. The PM position is fairly high on the management track; individuals holding the role typically have a technical background but do not specialize in a particular technology at the time they reach the PM level. The PM must provide objective guidance and maintain a disciplined distance from technical details during each stage of the project so that he/she can keep the project moving efficiently. He or she helps determine which deliverables are appropriate and how to apply process rules. A PM usually manages approximately five projects at a time.

In addition to the PLM and PM, the core new product development team consists of a:

- system engineer—who translates the PLM's product definition into specific technical requirements,
- R&D technical coordinator—who manages a subset of tasks according to his/her expertise,

- technical team—who reports to the R&D technical coordinator and is made up of specialists in different facets of the new product, and
- manufacturing engineering leader—who coordinates the activities required of manufacturing and will prepare processes for when the product moves from concept to the manufacturing/operations floor.

Members of the core new product development team devote a substantial amount of time to the project and will stay on the project for the majority if not all of its life. They reach out to extended team members for additional support only when necessary. Extended team members could include a:

- purchaser—who procures materials for the project and negotiates with subcontractors as needed;
- support and service center leader—who defines and coordinates the activities that will be required of the service center and product support groups;
- R&D contributors—experts that are contacted for short-term tasks within the projects; and
- manufacturing and engineering contributors—who assemble prototypes, set up manufacturing systems, and contribute industrial engineering expertise.

Even if new product development teams are dispersed across several sites, they respond to a single R&D management authority—typically the PMO or the R&D vice president. EXFO sees R&D as a single entity and allocates resources across all locations, without limiting the pool to a single site. By approaching projects from a multisite perspective, EXFO can use the same rules and similar processes organizationwide.

New product development projects not only run across multiple sites but also operate independently of the organizational structure (Figure 1). New product projects are not owned by a specific product center (product centers focus on a particular type of EXFO product such as wireline protocols, enterprise applications, and platforms) and may use resources from multiple centers, depending on the expertise and technology required.

EXFO Product Center Structure and Projects

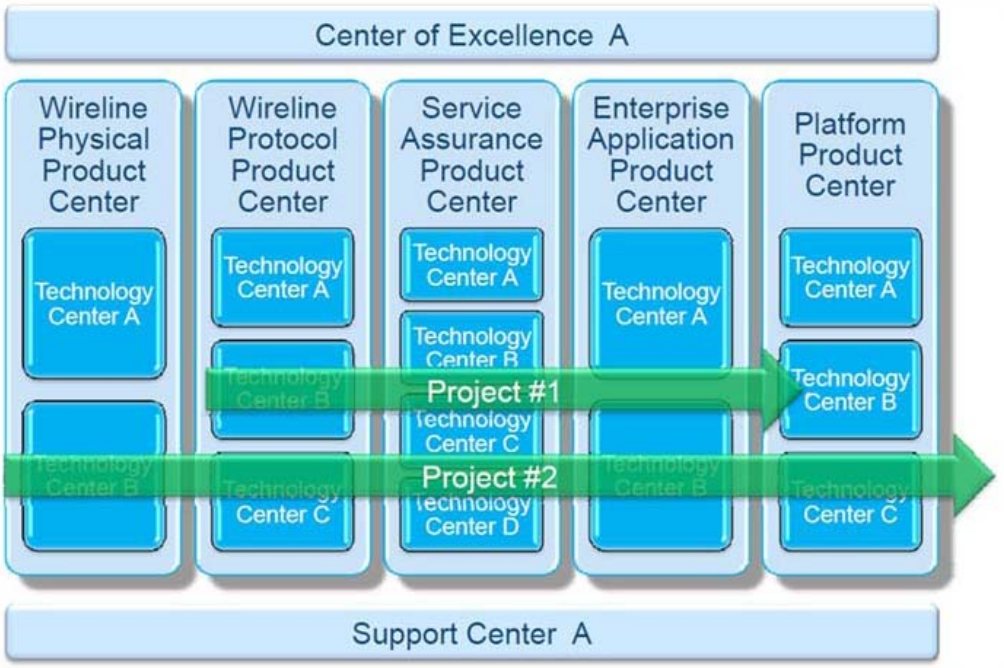

Figure 1

Multisite Challenges

Having team members located among five disparate locations presents special challenges, but EXFO has adapted several of its practices to accommodate differences among sites. For instance, stage-gate or other major meetings are now held early in the morning to accommodate the time difference for team members in India. The organization has also installed video systems in all sites to facilitate more direct and personal relationships among team members. EXFO gives training to all sites that explain the cultural differences between one location and another. Although teams often never meet in-person as an entire group, EXFO sends employees to visit different sites as much as possible within budgetary constraints.

Training

EXFO introduces all new employees to new product development processes within the first week of hire and explains the supporting tools and methodologies involved. If EXFO hires a new employee specifically to support new product development, then he or she is assigned to a project team. The technical leader of that project team will guide the new hire through the new product development processes during the course of the project. The new employee can also ask the project manager or group manager for guidance if needed.

Each employee has a development plan that focuses on honing competencies and increasing knowledge in areas that will benefit his or her group and support the career track the employee is interested in (technical or managerial). The development plan links directly to the corporate-level strategic objectives of the organization. Typically, the group manager is responsible for creating and administering the development plan, along with the employee.

As changes are made to product development processes (e.g., new deliverables or product criteria alterations), PMs and technical leaders communicate the impact and new requirements to their team members. If major changes are implemented, such as new sets of documentation requirements, then the organization gives formal presentations in which leaders describe and explain the changes to all R&D employees.

To increase employee buy-in for any alterations to processes or practices, most major changes are piloted in a project where a select number of people affected by the change receive training in the new procedures and then try the new way of doing things. They can recommend adjustments and get an idea of how the changes will affect work on a small scale. The stakeholders involved in the project then serve as trainers and leaders when broader scale deployment begins.

Turnover

EXFO looks to grow employees with the organization. Its turnover rate is relatively low, and EXFO wants to keep it that way. Because of its policy to load 100 percent of its work force into projects, losing an employee at any point during a project presents a major challenge.

EXFO leaders believe that they have built such a strong, committed work force because they have provided training and experience to people who needed it. However, EXFO does set limits. Stephen Bull, vice president of R&D, says that he will not tolerate two specific employee actions: the hiding of mistakes or failures and continued missteps after repeated mistakes, education, and warnings.

Group managers are responsible for developing resources and identifying key people whose loss would pose a risk to the organization. If such a situation exists, then the group manager develops other resources to have the same knowledge or expertise so that valuable information and skill will not reside within only one individual.

EXFO also maintains a knowledge base of product development information to ease knowledge transfer and retain important content related to processes and projects of value. It is currently working to grow this repository and increase its accessibility.

Acquisitions

When EXFO acquires a new business, gatekeepers concern themselves less with process details and focus more attention on shepherding new employees through

the process. The goal is for new units to integrate progressively into EXFO systems and culture; therefore, patience is applied liberally in the early stages. Thus far, EXFO's rigorous processes have enabled faster and more complete integration. Expectations are clear, and the regular meetings keep everyone, especially those new to the process, on track.

NEW PRODUCT DEVELOPMENT PROCESSES

EXFO employs a standard new product development process, but that process has been modified to create other official processes for projects that must adhere to shorter timeframes (XPRESS projects), projects with multiple releases, and software-specific projects. EXFO has designated a specialized group to perform nonstandard processes for projects with special customer requirements and customizations.

EXFO currently has one official product development stage-gate process. But in parallel with the operational stage-gating, there is a strategic planning process. EXFO decouples strategic and operational activities so that employees involved in strategic decision-making processes do not get mired in the operational product development flow and so that those on the operational or technical side can concentrate on completing their work rather than feeling sudden pressure to also assist with strategic preparations. Marketing, R&D, and operations all participate in the operational product development flow. Executives and directors are typically the most involved in the strategic process. Project managers and product management leads have multiple responsibilities within both process flows.

All projects go through the gating process, including incremental and product improvement projects. In EXFO's funnel-to-tunnel approach, gates 0 through 2 funnel the pool of potential product ideas into a streamlined tunnel that takes a much smaller group of selected projects through to marketing and production. Typically, a project will be in the funnel for about eight months and will take nine to 12 months to go through the rest of the process.

Figure 2 illustrates all of the gates along with the focus and activities associated with every stage-gate period.

EXFO's Stage-Gate Activities

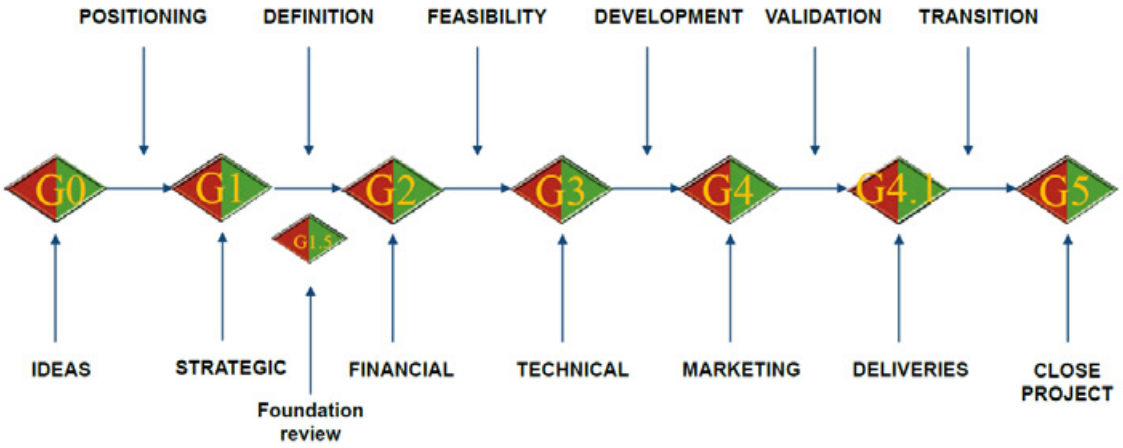

Figure 2

The product line manager (PLM) presents potential product ideas to the portfolio committee at Gate 0. Beginning there, a team of technical managers and the prospective project manager evaluate the product and make preliminary plans. The project team is officially constituted at Gate 2, when the project is approved by the portfolio committee. At that point, the project manager leads the team through Gate 5, when R&D hands the product over to manufacturing and the support group.

The PLM is responsible for engaging the customer and understanding how a product could or should be oriented in the market. From Gate 0 to Gate 5, the PLM collects voice-of-customer information from multiple sources including:

- the sales force,
- distributors,
- lead customers (customers identified with a need or interest in a particular product),
- external market analysis/research providers,
- an internal research group, and
- R&D specialists.

The entire enterprise uses the same high-level process, but the particulars can vary as required at each EXFO site. The high-level milestones for each project stage remain consistent, but every site and project team has the flexibility to use their own documents and other processes to respond to the requirements.

Each gate consists of four parts.

1. Technical review—Technical leaders with applicable expertise review all the material related to the product and provide a recommendation that states whether or not the technical team believes the product is ready for the next stage or what actions need to be taken. The gatekeepers review the recommendation and take it into consideration, but they have the authority to agree or disagree with the technical team's suggestions.

2. Project planning—The PM and PLM prepare a presentation for the gatekeepers. If they receive feedback from the technical review committee, then the PM and PLM may incorporate the suggestions and explain any issues or resolve conflicts before the gate meeting.

3. Gate meeting—The PM and PLM present the current state of the product/project and alterations to the business case or project plan to the gatekeepers and others in attendance. The gatekeepers make a final approval decision. If they approve the project, then it passes through to the next stage. If required deliverables are not prepared or if the gatekeepers do not feel the project is at the level necessary to pass the gate, then a new gate meeting will be scheduled, which gives the project team time to address issues and go through another technical review and planning session.

4. Next steps—Once a project passes a gate, the PM must transition the team to the new stage. Some team members may need to take a larger or smaller role, and the focus of the team will shift to new requirements and deliverables. In some cases, passage into a new gate requires that certain project resources be activated from departments with little former involvement. Marketing, for instance, asserts a greater presence after Gate 4.

Ideas are not considered projects until they pass Gate 2. After that point, few projects are ever killed (i.e., removed from the portfolio), although it has occurred. EXFO believes in rigorously stage-gating ideas until they meet the requirements to become a project, have an appropriate and compelling business case, and have a reasonable plan to support its development. This ensures the success of approved projects. Also, PMs do not have the authority to kill a project; their responsibility is to provide creative solutions to keep a project on-track.

Gate 0—Positioning

Gate 0 occurs primarily within marketing, the department tasked with determining which ideas fit with current corporate, product, or technology strategies. If the idea seems to fit, then the PLM performs competitive and market appreciation analyses to identify a unique selling position, differentiation, and the size of the market for the product.

Some products never make it out of Gate 0. At a minimum, the product needs to fit with corporate strategy and have a positive competitive analysis and high-level market analysis. At this stage, it does not matter if EXFO has the technology to develop the product.

Gate 1—Definition

To make it through Gate 1, the product must fit with corporate strategy. If the portfolio committee approves this initial definition, then the PLM refines it based on any feedback given and conducts a detailed market analysis using the refined definition. Simultaneously, R&D managers begin developing technical solutions to meet the product definition.

Gate 1.5—Foundation Review

Eight weeks before Gate 2, a Gate 1.5 (review) meeting occurs. This step ensures proper preparation of the business case before Gate 2, when the product idea will be submitted to the gatekeepers as a potential project. Without Gate 1.5, employees tended to wait until immediately before Gate 2 before refining a business case, which often resulted in a Gate 2 meeting mired in details that slowed the process. This gate ensures that technical issues are discussed and considered in conjunction with market conditions. A PM joins the PLM at this stage, and they must agree on the product definition.

Gate 2—Feasibility

The portfolio team again acts as the gatekeepers at this gate. Gate 2 requires a secure financial business case and technical preliminary feasibility. The technical review committee's feedback is taken into consideration, and the PM / PLM must present an acceptable:

- target cost,
- target sales price,
- development cost, and
- time to market.

If Gate 2 is passed, then the PM officially joins the team and asks for appropriate specialists to be assigned to the project. Once the full team is assembled, they prepare for Gate 3. The PM creates a feasibility plan based on the allocated budget.

To accurately determine feasibility, the team may build a preliminary prototype at minimal cost, which may be presented to certain core customers if they are the

primary market for the product. Those customers sign confidentiality agreements and provide feedback that can be used in later gate meetings.

All of this information ultimately forms the detailed feasibility plan and a high-level plan for the remainder of the project. The costs of the feasibility planning process vary widely but average approximately 15 percent of total project costs (typically related to intensely technical work).

Gate 3—Conception

Armed with a detailed feasibility plan and a map for the rest of the project, the PM and PLM approach the mandatory team of gatekeepers at Gate 3. At this stage, the gatekeepers require:

- final product definition,
- validated product designs,
- preliminary prototypes,
- an assurance of market acceptance, and
- project plan.

If technical analysis, market analysis, and the business case prove acceptable and compelling, then the project team passes the gate and is given permission to develop the product. All gatekeepers must agree on the decision. The project cannot pass Gate 3 unless the team has everything it needs to begin producing a finished product.

Thus, upon passing the gate, the team develops the first complete iteration of the product (a complete prototype, as opposed to the preliminary version constructed during feasibility phase). This prototype must meet all functional specifications, as well as the additional specifications required to differentiate it from the competition. Although the product may not be finished during this stage, the team works more heavily with marketing to ensure that it stands out from the competition. Without a competitive advantage, the product will never go to market.

This work is accomplished in EXFO's "emerging cell" environment, where products are manufactured in their final forms before hitting the main production floor in either China or Quebec. The emerging cell allows EXFO to try different ways of manufacturing and servicing a product by establishing the most complete and efficient methods to create and maintain the product prior to rolling out major new work flows within a larger production environment. By bringing in key members of operations, the project team can identify the best ways to accomplish tasks and introduce new concepts at an early stage.

At the end of the feasibility stage, the product definition should remain stable. Gatekeepers must approve any changes to the concept or definition after this point.

Gate 4—Validation

Gate 4 is crucial for any new product. Gatekeepers at this stage determine if the product is ready to be launched in the market. Any bugs found in the emerging cell need to be addressed, and gatekeepers must believe that it can be successfully marketed.

Between Gates 4 and 4.1, marketing begins generating sales, and the organization offers the product to customers and may provide demonstrations. All gatekeepers and functional leaders must commit to the launch schedule and stay on track. This is a high-intensity stage.

Gate 4.1—Transition

Gate 4.1 was added to signify the point at which a product leaves the hands of R&D and enters the control of manufacturing. The R&D team fine-tunes the product, increases efficiencies, and helps optimize the production cycle if needed; but manufacturing has ultimate responsibility for the product's creation at this point. If a product will be manufactured in China, then it is sent directly from the emerging cell to the Chinese production floor, which operates virtually identically to the Quebec manufacturing site.

The R&D team remains on-call to monitor any product returns, especially ones that are dead or defective when the customer receives it. Such returns must be examined to increase the quality and sustainability of the product.

This phase lasts approximately three months, with the goal of optimizing the product and the manufacturing cycle so that the product can move fully out of R&D and into long-term production.

Gate 5—Close Project

At Gate 5, the PM presents an optimized manufacturing cycle to the gatekeepers along with customer feedback and actions taken to address it. Team members perform an end-of-project postmortem before the project is officially closed.

Until 2002, the postmortems were presented to the portfolio committee as well as the Gate 5 gatekeepers, but this proved problematic once the portfolio grew and did not leave time for such reviews. Now, the PM presents any postmortem recommendations only to the gatekeepers. Those recommendations should be related to three things:

1. team dynamics (how the team worked together and coordinated the project),
2. process (how processes were adhered to, any changes made or suggested), and
3. management (how well the vision for the project was defined, how decisions were made, and any recommendations for more effective management or special issues).

XPRESS Gating Process

EXFO always intended that its standard stage-gate process be scalable and flexible. Sometimes, activities can be omitted for the sake of greater efficiency and customer satisfaction. Although some employees shifted activities to accommodate shorter schedules, many individuals did not feel comfortable skipping certain steps or activities.

To accommodate and encourage faster development when appropriate, EXFO introduced the XPRESS process (Figure 3), a truncated version of the standard stage-gate process. Having an officially shortened version made people more comfortable with requesting changes to the work flow when necessary, based on appropriate conditions. Four or five projects per year use the XPRESS gating system.

EXFO's XPRESS Gating Process

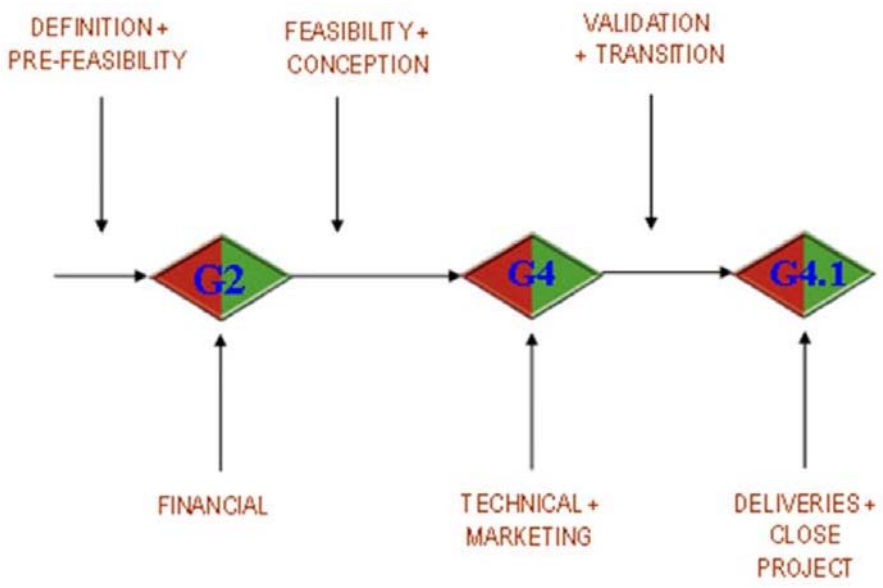

Figure 3

Process for Software Programs

EXFO differentiates between conventional product development and software program development. The path is similar, but Gate 3 is replaced with extra iterations of the Gate 4 to Gate 4.1 feasibility activities. EXFO typically divides the features that will be included in a finished software program into packs. The project team works on the features packs (FPs) one at a time and often releases them to customers as they are completed. For this reason, the project team repeats Gates 4 and 4.1 for each features pack. Figure 4 illustrates how the software program development process works.

EXFO's Software Program Gating Process

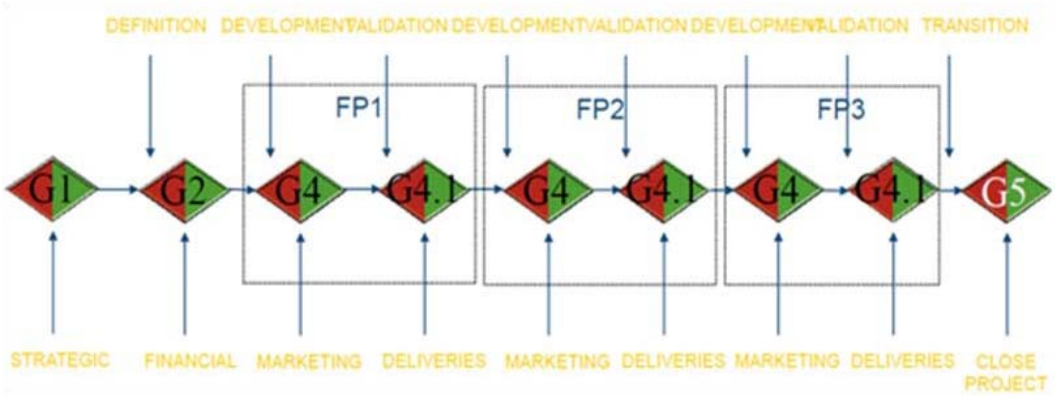

Figure 4

The team presents the program road map with all of the anticipated feature packs at Gate 2. If approved, software engineering and development for the first features pack begins, and the team works through the delivery of all planned features packs. The process allows for flexibility according to the specifics of the program and the particular features packs included.

Managing Changes to the Project Plan

Innovation could not be done by robots.

—Stephen Bull, EXFO's vice president of R&D

Although EXFO largely adheres to its processes, flexibility is necessary to allow for the kind of innovation crucial to the organization's success. If an issue occurs or

there is some reason why a project manager needs to deviate from the original project plan, then he or she can pursue three different avenues for a change.

1. If the project will not be ready to pass the gate at the time of the gate meeting, then the PM lets the gatekeepers know, and the gate meeting instead becomes an update meeting. During this meeting, participants offer solutions on how to correct the situation and assess the impact of delays and how those impacts can be mitigated. Then, a new date is scheduled for the gate meeting.

2. If a PM wants to create or provide market or customer deliverables prior to a scheduled milestone, then he or she requests a risk meeting. During this meeting, gatekeepers and other stakeholders (e.g., marketing and manufacturing) determine if the opportunity is worth the risk being taken to provide deliverables early. They also assess what the impacts of the new plan would be on quality, schedules, cost, and other project elements.

3. For all other changes after the project has received Gate 3 approval, the PM can submit a project change request. He or she fills out the project change request form and asks the gatekeepers to hold a project change request meeting. During the meeting, participants add, modify, or remove functionalities from the Gate 3 requirements, evaluate the impact of the changes on the project (e.g., to time, budget, costs, and the business case), and get a final consensus and approval from the gatekeepers.

Global Regulatory Requirements

Meeting regulatory requirements in the more-than 100 countries where EXFO sells its products can be challenging. To reduce the time project teams spend on ensuring compliance with global regulations, EXFO formed a centralized certification group to handle the complexities associated with compliance. The responsibilities of the certification group include:

- reducing the complexity of standards and requirements and applying it to daily work,
- determining where in EXFO different standards apply, and
- bringing compliance expertise to projects teams so that project team members can focus on innovation rather than regulations.

The certification group identifies compliance issues early in the development of a product. In particularly complex cases, a certification specialist may work directly on the project team so that they can analyze and apply standards appropriately.

Internal Standards
EXFO has developed internal standards that define mandatory requirements and compliance-specific requirements. The internal standards cover more than 90 percent of project issues and questions and help the different sites project teams in the reuse of internal designs or development on existing EXFO platforms.

Portfolio Management
Managing the portfolio is critical to guiding projects through the appropriate processes and ensuring that EXFO releases products that give the organization an advantage in the marketplace.

The periodic review process to prioritize EXFO's projects (every four months) takes five days. The first four days include the:

1. strategy review;
2. technology review;
3. project management office (PMO) results from the previous four months;
4. review of strategic products; and
5. strategic business unit presentations, which cover the unit's current product strategy, ongoing projects, Gate 1 presentations, and Gate 2 presentations.

The final day encompasses the:

1. prioritization of marketing plans,
2. final project prioritization rankings, and
3. loading resources to each project.

Once the final ranking, priority, and committee comments are complete, along with an approved allocation of resources, the R&D vice president holds a general meeting with the organization's cross-functional management team and project management office to communicate the results. The individual R&D directors then host general meetings with their business units to explain the new rankings.

EXFO does publish the rankings publicly but in a blinded format. Only individuals who know the code for their specific project(s) can discern where their projects fall in the list of priorities.

Strategic Review
The strategic review assesses how well a product/project:

- aligns with strategic objectives,
- differentiates EXFO's offering from the competition,
- addresses a worthwhile market,
- promises revenue generation,
- offers an acceptable return on investment,
- stretches current technology levels,
- mitigates risk,
- adheres to an acceptable budget, and
- projects an appropriate and market-advantageous timeline.

Software programs in development have different requirements. Software is often released in stages and goes through different processes from hardware products. At the strategic review, programs must have a:

- road map—a list of projected total features with estimated release dates for each program update;
- first feature pack release—the complete list of features for the base model and what will be included in its first update (this should cover 50 percent of all the features that will eventually be released);
- financial prospectus (e.g., sales or sales projection and fixed and variable margins);
- overall budget and how resources are currently being used; and
- metric results (e.g., return on investment, net present value, and hit rate).

The portfolio review committee tracks the information, reviews details, and notes in a standard portfolio project review form.

Project Prioritization

- The prioritization of the project portfolio is critical to the gatekeepers' decision-making process as a project moves through the stage-gates. After the strategic review, the portfolio review committee ranks the top projects in the organization. The committee designates each project with a priority level.
- Priority 1—highest priority projects that may take resources from other projects (priority 3) if necessary
- Priority 2—important projects that are fully staffed, cannot lose resources to priority 1 projects, but also cannot pull more resources from other projects

- Priority 3—lower priority projects that may lose resources to priority 1 projects, resulting in occasional schedule slips
- Priority 4—projects on hold until the next review

Then the committee ranks the projects in prioritized order from the highest to the lowest. The committee votes to establish the final ranking order.

Ranks are determined according to each project's:

- strategic fit,
- expected increased revenue as a result of the project,
- planned market share,
- product differentiation in the marketplace,
- technology advancement, and
- risk levels.

In some cases, a project can change priority levels between portfolio reviews. This depends on the marketplace, technology advancements, and resource availability. As a project moves through the stage-gate process, gatekeepers review the project and may make new recommendations between review periods.

Resource Allocation
Based on the rankings, a team of all the R&D directors divides available resources (funds and staff) among the business units and their assigned projects and then presents its recommendations to the portfolio review committee for deliberation.

New product development projects at EXFO are not given a buffer in terms of resources. Leaders fully load each project with the amount of resources they determine necessary for that project. Instead of saving a pool of resources as emergency or alternate staff or funds, EXFO prioritizes projects and fully staffs and funds each one individually, using all available resources.

It is difficult to staff priority 3 projects, and resource reallocation can slow a priority 3 project manager's anticipated progress. Low-priority projects have to wait for the next portfolio planning session to receive a higher ranking.

It can be discouraging to work on a priority 3 project because of the insecure timeline and resource pool, but priority 3 projects are often also some of the most innovative and radical. Thus, employees can be attracted to projects with various levels of priority depending on their interests and tolerance for project lag times.

Ultimately, employees work on many different types of projects, and any given project can rise from priority 4 to priority 1 as time passes. During the period between portfolio reviews, some projects may end, the team could develop a more

compelling business case, new technologies could come to the forefront, or market demand may increase for a given product.

EXFO executes resource planning and monitoring through an internally developed tool based on Microsoft Excel. High-level staffing is done at the corporate or business unit level; the individual sites complete the detailed loading of staff to different projects.

PERFORMANCE EVALUATION

Metrics play a key role in managing risk and encouraging performance excellence at EXFO. On a monthly basis, R&D directors review the following key measures to evaluate the progression of the multiple projects under their purview:

- dynamic time to market,
- time to market,
- project cost, and
- hit rate (for software programs).

Every month, metrics can be viewed for each individual project, and individual metrics roll up to reports that show the performance of all the projects in a given product center, as well as the overall performance of all projects organization-wide. Project metrics are accessible via a project dashboard (Figure 5).

At the beginning of each project, the PM and PLM identify targets for the:

- project budget,
- project schedule (time to market),
- return on investment,
- cost of good (for hardware development), and
- list of features.

These targets are tracked with dedicated metrics (e.g., drifts in budget, schedule, or cost of good; actual vs. projected ROI, and completion of product features), and the project teams are accountable for those metrics. The metric results are part of employees' annual performance appraisals. Outstanding performance on a project will affect salary decisions.

EXFO has a variable compensation structure for its employees. The variable percentage of an individual's salary increases the higher that person's position falls on EXFO's organizational chart. The opportunity for performance rewards depends on metrics like ROI for a given business unit. EXFO continuously refines its

metrics so that leaders can make objective decisions about issues like compensation, and the organization is trying to orient itself around measures employees feel that they can control through more effective work.

EXFO's Project Management Dashboard

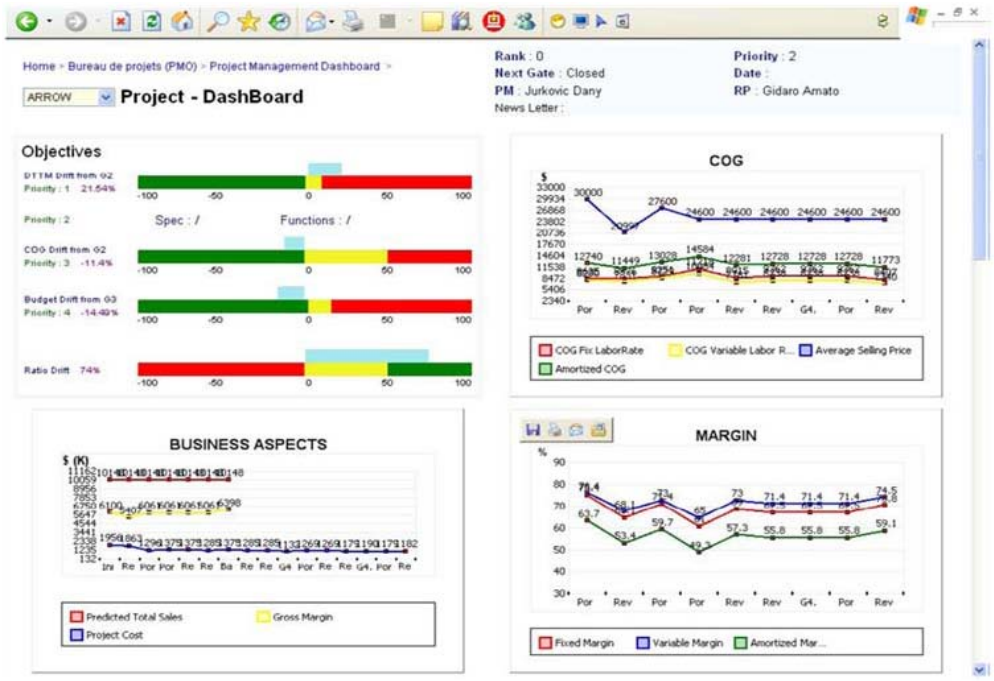

Figure 5

Compensation is tied to project team or business unit performance rather than individual outcomes. Teams are rewarded for their performance as a group, which encourages contributions that benefit the team rather than work that serves simply to increase a particular employee's numbers.

EXFO is pushing for more project managers to focus on tracking dynamic time to market. This metric tracks the forecasted schedule against current conditions. If PMs see that they will miss a deadline or not be ready for a gate, then they are charged to get the project back onto the original schedule. If this is not possible, then PMs should do their best to mitigate the amount of timeline creep that occurs.

At the corporate level, EXFO tracks the performance of each of the product centers (e.g., optical, protocol, and access) in a number of metrics such as ROI and budget. For example, Figure 6 displays a hypothetical comparison of the ROI of EXFO's product centers to the overall average. (The thick line across 3.0 is the target return.)

Tracking Return on Investment (ROI) by Product Center

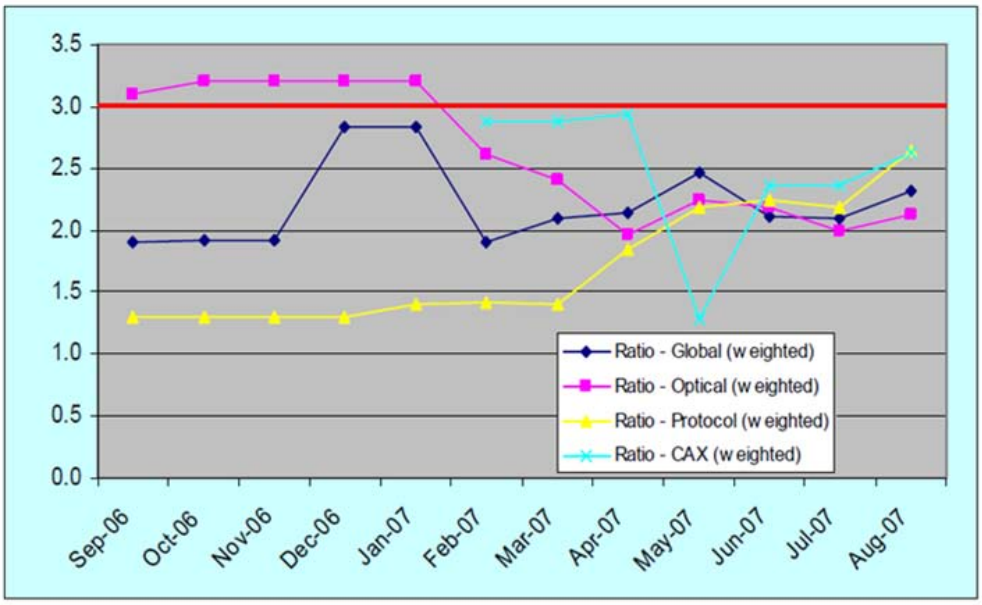

Figure 6

Product center directors view such tracked metrics and comparisons each month in order to make decisions that will drive better performance. They conduct root-cause analysis based on each month's results, take action, and view the new results the following month. Metric shifts can indicate the impact of changes made or can alert managers to take other actions.

Capturing Lessons Learned

Before the final Gate 5 meeting for a project, the PM must conduct a postmortem evaluation of the project and present recommendations to the gatekeepers at the meeting. Management can then choose to incorporate those suggestions to improve processes or spread best practices.

EXFO does not have a formal approach to capturing lessons learned and currently relies on its employees to learn from each project to make future projects better. This has worked thus far, largely due to EXFO's hands-on and activity-oriented culture. The organization has a learn-by-doing approach. And because employees are constantly working on a shifting portfolio of projects, they can immediately apply lessons to new development activities and teams.

Nonetheless, EXFO is actively improving its documentation capabilities (with software developed by its group in India) and investigating more formal ways to transfer lessons learned throughout its multiple sites. It wants to ensure that best

practices are translated into the different cultures and that, as the organization grows, it can improve as one organization rather than only in small units. Because the organization is growing, lessons need to be communicated beyond the reach of the groups that individual employees interact with.

TOOLS AND SYSTEMS SUPPORTING NEW PRODUCT DEVELOPMENT

EXFO is trying to leverage technology more effectively throughout all of its locations by creating a cohesive system to manage product development and facilitate better communication. As the organization grows, it needs more highly structured systems.

Even with growth, EXFO intends to keep tools simple. As of 2010, it is the PM's responsibility to build a project plan and determine what kinds of tools and technology will be required to accomplish the work. The organization values this type of autonomy. Giving employees the opportunity to make wise decisions and request the tools they need is essential to growing innovation. As Andre Richard, PMO director, said, "The success of EXFO isn't built on complex managing tools."

The main tools EXFO uses are:

- Microsoft Project (for initial project planning);
- TimeControl (timesheet application that monitors organizationwide efforts and statistics);
- Microsoft SharePoint (document repository and team member collaboration);
- many kinds of sprint planning tools for agile software development;
- SAP (an enterprise resource planning system for purchasing and manufacturing);
- JIRA (a product by Atlassian for tracking product bugs);
- Apache Subversion (for enterprise version control);
- SolidWorks 3D CAD Design Software;
- Mentor Graphics CAD system (for design);
- GWD (an internally developed tool for communication, reporting, integrated documentation and other project needs); and
- several internally-developed applications such as the project measurement dashboard, an application for material specification, and a document repository.

Each project team funds the development of new technology meant to support its efforts. IT offers support but it has its own prioritized IT project portfolio determined at the vice president level. The IT and new product development portfolios are not connected, but they are coordinated as needed by the vice

presidents. The IT function develops many of EXFO's in-house tools, but the PM is accountable for any project-specific technology requests.

Many of the in-house applications used for budget tracking, resource allocation, metrics, and project collaboration are based on Microsoft Excel and other Microsoft applications such as SharePoint. In general, external applications are customized very little. Although all the systems that EXFO uses are not fully integrated, portions of the applications are. And EXFO is working toward a more completely integrated system.

CRITICAL SUCCESS FACTORS AND NEXT STEPS

EXFO attributes its product development success to three main factors:

1. senior management sponsorship,

2. the rigorous application of processes and practices, and

3. a commitment to continuous improvement.

EXFO's president is devoted to the efficient creation of innovative new products. His passion drives EXFO's vice presidents and directors. They are committed to developing the best work processes and modifying them as circumstances change and new best practices are discovered.

EXFO applies its processes with rigor and consistency. However, directors are quick to note that rigor is not synonymous with rigidity. The processes are flexible and encourage employees to think intelligently and make the best choices for their particular projects. Methods to change course, apply different practices, or provide alternate deliverables are built into the process. Change request forms facilitate this as well as the fluid nature of processes at EXFO.

This flexibility also stems from a recognition that the world, the marketplace, and technology constantly change. Therefore, EXFO must change. Leaders want the organization to grow and adapt as external and internal transformation occurs. EXFO's marketing and product development departments monitor the technological and customer climate. Adjusting according to market needs and EXFO's own technological capabilities has enabled the organization to gain market share every year since its inception. EXFO's goal is to sustain and grow that position by adhering to its core values of rigor, flexibility, and continuous improvement.

EXFO is reviewing its product development processes and streamlining the flows for conventional hardware products and software products. As software development increases in significance at EXFO, clear distinctions have arisen between hardware and software processes. Changes to the processes will take into account where the work is being performed and the different deliverables and release requirements of each type of product.

EXFO also wants to solidify processes for original equipment manufacturer products that are manufactured by EXFO but require the integration of a third-party product. A few details of this process need refinement.

EXFO is intensifying its focus on a unified R&D model, with full integration of all its product development centers. As EXFO makes changes and broadens its global scope, the organization will continue to rely on the objectives set forth by senior leaders, its structured processes, and openness to improvement.

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