

# **Commercializing New Technology Profitably and Quickly**

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## **EXECUTIVE SUMMARY**

The high-tech industry needs to get much better at commercializing new technology. This is particularly important during the current economic downturn, when companies cannot afford to waste funds and resources in low-value projects that will have no financial return. Therefore, these companies must significantly improve the effectiveness and efficiency of their investments in product development, sales, marketing, IT and so on. Oracle provides a Best Practices business process and a software system that lets companies optimally allocate the right assets (money and manpower) for the right purpose at the right time. Oracle does so by seamlessly linking all important business processes with the underlying databases.

## **PART 1: THE HIGH-TECH INDUSTRY CHALLENGE: COMMERCIALIZING NEW TECHNOLOGY**

The high-tech industry must get better at the difficult process of commercializing new technology, that is, of taking ideas or concepts into productization. In the typical high-tech company, 10-20% of the annual revenue is set aside for new development, and a significant percentage of the company's market value is based on the projected commercial success of new technologies. But analysis<sup>1</sup> shows no real correlation between new development spending and actual revenue growth.

Furthermore, as investment criteria have tightened during the current economic downturn, companies have shifted away from the pure research model represented by AT&T Bell Labs and Xerox PARC. However, even significant investment in new development (as opposed to pure research) has failed to provide reliable returns<sup>2</sup>

Clearly, high-tech companies must learn how to make investments in commercializing new technology more (a) effective, by selecting the right projects (products or platforms that best carry the technology to the market), and (b) efficient, by distributing resources optimally across the projects in the portfolio. This approach will maximize shareholder value and eliminate low-value projects early in the development cycle.

In addition, to survive in a down economy, companies must learn to adapt their product strategies quickly to rapid changes and evolve their offerings into new value propositions that sustain earnings growth. For example, some companies may have to transition their product-centric value proposition into a solutioncentric or service-centric one.

This paper focuses on solutions that make commercialization processes effective.

## Problem Overview

The figure below shows the high-tech product life cycle, from the creation of the original concept to the product's end of life (EOL). The typical high-tech company initiates too many projects that are not aligned with actual customers or customer needs. To minimize the loss of investment, these low-value project initiatives should be stopped as soon as the available data no longer justifies their continuation.

<sup>1</sup> Source: AMR Research study of 10 years of data for public U.S. manufacturers, using ordinary least squares regressions analysis

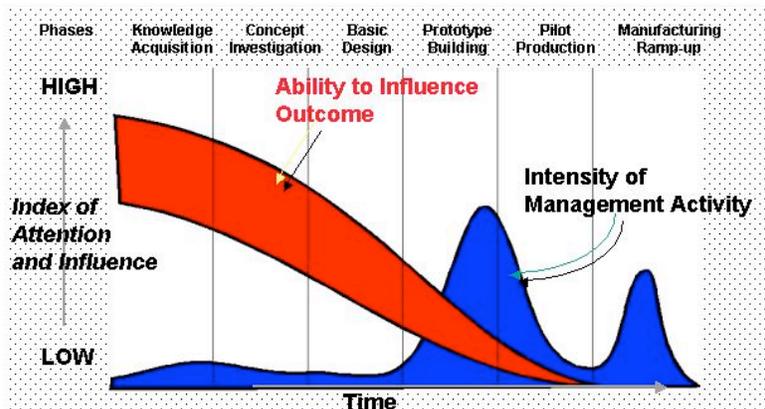
<sup>2</sup> Source: over 10 in-depth interviews conducted by Oracle with high-tech manufacturers.



As the next figure shows, management attention is most beneficial in the early stages of the product life cycle. Unfortunately, management is usually the least involved in these stages, and most involved later in the product life cycle, when the ability to affect the outcome is greatly reduced. Clearly this is not a scenario for success.

## Execution and Organizational Issues

*Management Attention is late, influence minimal*



Source: Hayes, R.H., Wheelwright, S.C., and Clark, K.B. (1988). *Dynamic Manufacturing*. New York: The Free Press, p. 273. See also Gluck and Foster, (1975, September-October). "Managing Technological Change: A Box of Cigars for Brad." *Harvard Business Review*, p. 141.

## Ineffective Investments

### Too many low-value development initiatives in the company

If a company has too many development initiatives, it is probably trying to develop too many projects that are of low value and/or outside the company's core strengths. This is an organizational problem in which management fails to prioritize projects

because it has no objective way to quantify the value and risks of each project, and because it cannot leverage the company's core strengths. Projects with a high noise level but relatively low value are greenlighted, while other higher-value projects are killed.

### **Resources over-allocated by 200-300%**

Resources are often over-allocated by up to 200-300%, frequently because the company lacks the ability to view the entire development portfolio all at once. This can mean too many projects per person (overloading), or the assignment of people to projects that are outside their actual skill sets, or both. Ineffective allocation of resources in turn leads to various inefficiencies in the productization processes. These inefficiencies are described below.

### **Inefficient Productization**

The key symptoms of inefficient productization include:

- Delays of up to 3x over the original schedule, resulting in loss of market opportunity (revenue and market share)
- Budget overruns by 5x caused by constantly changing requirements (moving targets), underestimation of the total cost and time needed to develop the product, and the near impossibility of anticipating product development technical problems and predicting how long it will take to solve them
- Manufacturing cost overruns caused by the unavailability of parts or by frequent retooling of manufacturing equipment due to changes in design

### **Products that don't fit the customer**

When new product development is inefficient, the final product often does not fit the customer. This means that (1) the product does not solve the customer's core problem, (2) the product is positioned incorrectly so that the wrong customers buy it, and/or (3) the wrong channel or support is provided for the product.

### **Low product quality and inadequate customer support**

When a high-tech company does not clearly define development modules during the design process, integration testing of the final product is painful. When the company pays too little attention to beta testing feedback from its customers, the product gets shipped prematurely. Either way, customers get a poor quality product. Consequently, the number of customer support calls goes up dramatically, leading to very high support costs, inadequate customer support, and ultimately a loss of business as customers desert the company in droves.

### **Industry Factors Unique to High-Tech Technology Commercialization**

Several industry factors contribute to the current lack of profitability in high-tech technology commercialization, including:

#### **Uncertainty**

All new high-tech products suffer from uncertainty due to constant changes in the forecasts of their cost, price, margins and volume. Forecasts of a product's market size and market share also change constantly due to the constantly changing dynamics of competitive forces and new technologies. Finally, there is uncertainty

around the technology maturation cycles and customer adoption of new technologies, so it is hard to predict customer receptivity to new products.

### **Complexity of technology and its many risk factors**

By its very complexity, high tech inevitably involves several risks, including:

- Technical risks: the technical viability of any initial product idea
- People risks: what are the right skills and the right level of staffing?
- Scheduling risks: delays and project management issues
- Shortages in capital
- Manufacturability issues
- Too many new product choices (too little differentiation) with no effective way to focus on core competencies in order to choose the best options

### **Platform versus product**

It is often necessary to carve a single new product development effort into two projects: a platform project and a specific product project which will use the platform. A platform strategy usually focuses on leveraging a company's key assets to develop sustainable differentiation over an extended period. This platform can manifest itself as a family of products; some products may fail but the overall portfolio based on the platform succeeds. However, when the development effort is not differentiated into platform and product, the company usually loses out on what could have been great future business.

### **Short product and market life cycles**

High-tech companies can no longer keep pace with today's super-short product and market cycles unless they can learn to accelerate their own idea-to-reality cycles.

### **Industry inflexibility**

High-tech companies are often out of touch with changes in the industry, particularly changes in the external technologies on which their own technology depends. Moreover, they cannot adapt quickly to these changes. For example:

- Customer needs are always changing. It is critical for a company to be able to respond fast to changes in demand.
- Technology gets commoditized quickly, eroding profit margins and revenue when multiple companies offer similar products to the same market. These companies should be able to change strategy fast, to develop new products and new value propositions quickly.
- New products always depend on the maturation of other infrastructure technologies. For example, a highly advanced CAD application may require a computer with a high-speed microprocessor; if the processor does not exist, the company that makes this CAD application may fail.

### **Global competition for top-level human capital**

Human capital drives new product development in high-tech companies. Unfortunately, there is a global shortage of people with skills in project management (the ability to deliver a project on time, on budget and

on resources) and product management (the ability to decide what products to make, what features these products should have, and most importantly, what features to leave out).

### **Increasing role of suppliers as development partners**

As companies become highly specialized and recognize their core competencies, they outsource more of the non-core work to other companies. Some of these design partners are suppliers. Thus companies now need to communicate and coordinate product development with their suppliers. If they cannot manage this communication effectively, inefficient product development is the result.

### **Increasing role of customers as development partners**

Like suppliers, customers are taking on a greater role in product development. This is because customers want increasingly customized products to fit their needs and more options tuned to their particular industry and company. *Leading users are often the best source of breakthrough new product ideas.*

### **Execution and organizational issues**

A company's leadership and/or organizational structure often prevents it from executing on new products well. There may be no clear leader to champion potentially viable new products, or the organizational structure may involve too many departments in new product development.

In addition, many companies have issues of autonomy versus control. A development team often needs a great deal of autonomy in order to develop a new product effectively. However, the company headquarters or central planning office, which is usually far removed from the problems this team is trying to solve, sometimes tries to exert too much control over the team. Decentralization maybe needed.

## **REVOLUTIONIZING THE COMMERCIALIZATION PROCESS**

### **Solution: A Business Process with a Software System**

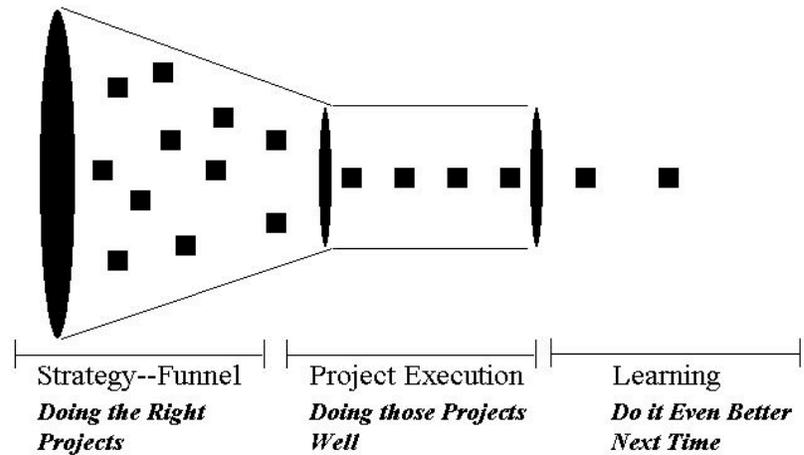
In the 1980's, high-tech manufacturing was notoriously inefficient. This prompted the development of such groundbreaking solutions as Total Quality Management (TQM) and Dr. W. Edwards Deming's manufacturing methodologies. Enterprise software vendors then automated these processes in software systems called MRP (Materials Resource Planning) or ERP (Enterprise Resource Planning).

Today, new technology commercialization (the idea-to-develop phase) is similarly very inefficient. It needs a solution that provides both a business process and a software system to support it.

The figure on next page illustrates the ideal commercialization process.

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# The Commercialization Process



From "Managing the Product Development Cycle" presentation by Gary Pisano, Harvard Business School

This ideal commercialization cycle leaves nothing to chance. It selects new initiatives based on financial metrics, and relies on factual data rather than hype throughout each phase of development, as described below.

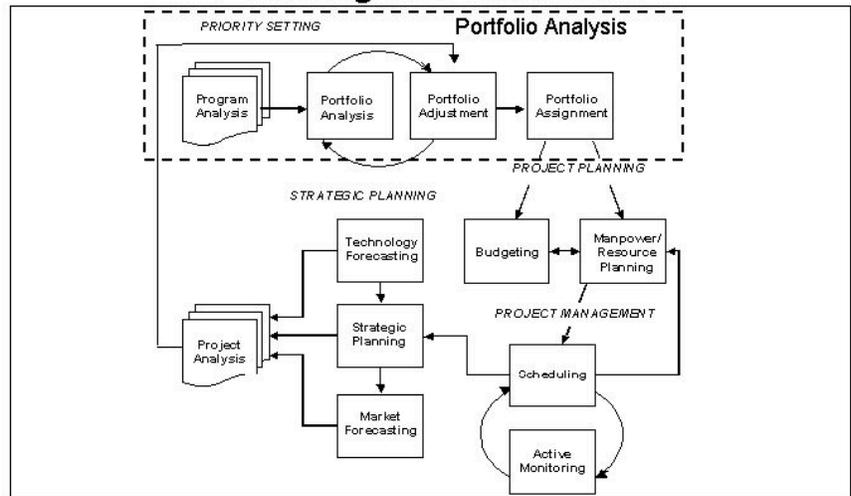
## **Doing the Right Projects** **Clear quantification via financial metrics**

The ideal solution will let companies incorporate efficient business processes. These processes will enable the creation of a portfolio plan. The company's overall portfolio plan will clearly quantify the following financial metrics:

- Return on investment
- Profitability and margins
- Cash flows
- Budget fit
- Risk profile

Therefore, the ideal solution will link strategy to execution as shown in the figure on the next page

## Linking Strategic Planning to Project Planning and Execution



Process adapted from "Third Generation R&D," by Roussel, Saad, and Erickson, Arthur D. Little, Inc., 1991

### **Portfolio analysis: intelligent selection or elimination of projects (strategic and project planning)**

The ideal solution must help with project selection by providing a strategic planning and portfolio analysis process. This process manages innovation by balancing creativity with rigor and pragmatism. For example, out of 20 concepts, it lets the company identify and expedite the 10 good ones, while rejecting the 10 bad ones earlier and faster. It prioritizes concepts by removing subjectivity from the decision-making and providing the relevant factual information from various data sources, including customers and existing metrics. Thus companies can identify the right concepts in which to invest. These concepts lead to profitable products that can be built, manufactured and sold, and for which there is an actual market.

The selection process can be triggered at any time for either periodic or ad-hoc reviews. As part of the strategic planning and decision-making process, the selection process captures the following parameters:

- Market forecast data regarding revenues, market share, demand, etc.
- Total risks associated with the entire investment, including:
  - Product, market and technology risks
  - Country, regional or customer-type (industry-type) risks
  - Strategy and competitive risks
- Execution risks (risks related to people, technology, schedules, sourcing, beta customers, operations, manufacturing and customer adoption)
- Total costs including resources (manpower, etc.)

This portfolio analysis process can also be applied during budget cuts. Since the process uses company specified criteria to identify lower-priority projects, the

company can make the right decisions when it is time to eliminate projects, as shown in the figure on the previous page.

### **Doing Those Projects Well: Project Execution** **Strategic execution**

The portfolio analysis process also enables strategic execution. For example, it reduces the cost of failure for new projects by doing the following:

- Budgeting and manpower/resource planning: Initial investment is restricted to lean resources until the technical and market risks are proven, regardless of the hype around an idea (many high-tech companies started large, poorly conceived and poorly justified e-commerce initiatives during the dot-com boom, only to see their investments wasted during the bust).
- Scheduling and active monitoring: Deliverables are reviewed by stage gates or mini-milestones during the development cycle; if the deliverables are not met, the process recommends *stopping projects or discontinuing funding*.

If early customer feedback is compelling (that is, if the initiative survives the "customer acid test" milestone), the process reduces the risk profile of the initiative, letting the company scale the investment with increased manufacturing, marketing and sales dollars.

### **Risk mitigation**

During execution, the portfolio analysis system accelerates workflows and approval cycles, and the company becomes more agile at handling exceptions. Risks are mitigated with early warning signals and corrective workflows. For example:

- If the development process triggers known constraints in the manufacturing or testing phases, the system automatically warns the product managers.
- If the prototype phase is behind schedule, the system sends alerts to ensure that corrective action can be taken to make up for delays in that phase, so that the final schedule remains unaffected.
- If a component selected during the design process is sourced from a low-quality supplier or the component's volume availability and/or pricing is uncertain, the system warns the engineering manager.
- If the design process is moved to the pilot stage or early-volume stage without mitigation of the known development-based risks (mainly technical and/or resource-related), the system generates a warning.
- If too few beta sites have been identified to ensure that the product design is adequately tested before production, the system generates a warning.

### **Do It Even Better Next Time: Learning and Deploying High-Quality Processes**

Another key aspect of the ideal solution is that it provides a learning (iterative) process by which a company can capture the data and processes of its previous projects. This lets the company make better decisions for subsequent projects and simultaneously fine-tune its own unique internal processes. As a result:

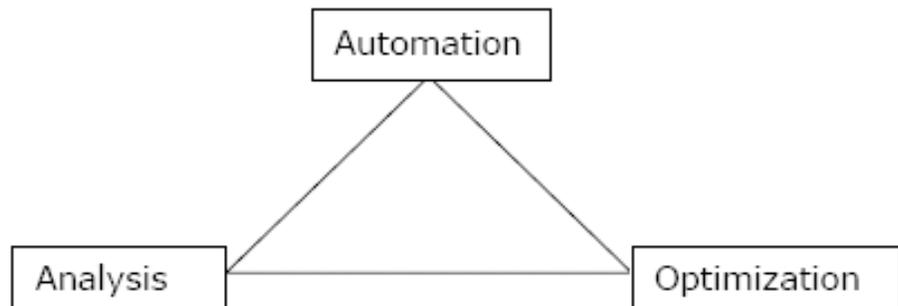
- Time and resource estimates are better.
- Certain types of work have lower failure rates.

- Support costs are lower and cost estimates are better.
- Execution risks are quantified more accurately based on past experience (risks related to people, technology, schedules, sourcing, beta customers, operations, manufacturing and customer adoption).

### **SOLUTION: BEST PRACTICES**

Today companies can achieve the benefits of the ideal solution described above by actively managing their portfolios of investments. An effective management strategy must incorporate three areas of efficiency:

- Automation
- Analysis
- Optimization



#### **Automation**

This refers to automating all manual processes. An effective system will let companies collect data effectively while also speeding up all processes. For example, many companies will be able to compare, for the first time ever, the actual data for people resource capacity versus the planned need for the resources to fund a new project concept. If a company is analyzing a portfolio of marketing expenditures, it can compare actual numbers to budgeted numbers by marketing categories: by market segment, product segment, geography or region, or vertical industry. This ability to compare data represents a huge gain in efficiency for companies managing portfolios of new projects.

Automating the portfolio planning cycle will incorporate many steps:

- Collection of business planning assumptions from disparate sources to better evaluate capital funding requests; this data may include:
  - Market forecasts (from product managers)
  - Resource requirements (from development managers)
  - Target costs and rates (from finance managers)
  - Data on existing projects (from product managers)
  - Planned campaigns (from product managers)
- Generation of a baseline portfolio
  - Evaluation of alternative portfolio scenarios

- Recommendation of an ideal scenario

Once a company automates its enterprise project and resource management process, it will be able to:

- Allocate resources at an enterprise level
- Re-allocate resources based on changing priorities for projects
- Trigger warnings due to delays at various stages of the development cycle
- Monitor the status of all projects at the portfolio level

Similarly, once a company automates its product data management system, it will be able to:

- Manage engineering changes (ECOs) quickly
- Increase reusability of components, sub-assemblies and designs
- Control documents (including CAD drawings) both internally and across design partners
- Link engineering items and BOMs with those of the manufacturing system
- Monitor costs

### **Analysis: Key Performance Indicators (KPIs) or Metrics**

Analysis gives insight into what has already happened. It provides a scorecard on how well a company has executed, by comparing the key indicators for the planned versus actual performance (schedules, resources used, funds expended, etc.). It analyzes historical data, monitors performance threshold levels and identifies where improvements can be made. It gives signals and warnings so the company can incorporate workflows to prevent future problems.

Analysis also lets the company analyze various “impact” scenarios. For example, the company can measure the revenue impact of a delayed product launch, or the profit impact due to a bad decision during the development cycle.

### **Optimization**

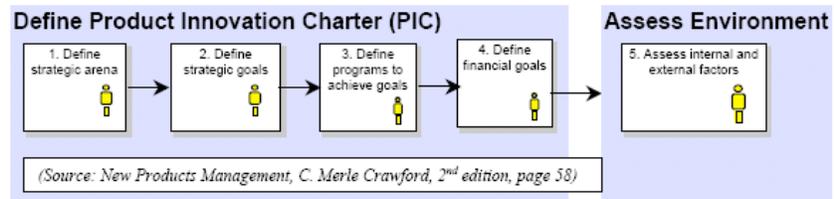
Optimization lets a company use predictive or forecasting data in addition to the historical data captured by analysis as described above. Optimization incorporates various types of uncertainties by measuring risks through probabilities and qualitative methods. During this stage, a company can simulate different business scenarios for its planned portfolio before making a decision.

A company can perform very sophisticated sensitivity analyses of the portfolio in varying degrees of detail, including:

- Analysis of groups of related projects at any organizational level (division, enterprise, etc.) for best/worst case scenario modeling
- Portfolio modeling in various dimensions, including:
  - Cash flow, margins, delay penalties, net present value (NPV), investment efficiency (ROI) and profit

A comprehensive portfolio optimization process incorporates all aspects of a company strategy. This is achieved through the Product Innovation Charter (PIC) as shown below.

### Strategy and the Product Innovation Charter (PIC)



#### Defining the strategic arena

The initial parameters of the PIC are defined according to corporate strategy. The strategic arena defines the perimeters of innovation activity. Such a rigorous exercise does not stifle creativity. Rather, it blocks ideas that should be blocked, saving companies valuable funds and resources. It directs the company's resources toward a designated arena that has plenty of opportunity for creativity. The key is to manage the process so that high-value ideas have a chance.

The perimeters are defined along the following dimensions:

- Product type: The most common dimension: computers, pharmaceuticals, banking services, etc.
- Application type: End use, such as computers for data processing
- Customer type: Includes demographics, behavioral variables, and even the distribution status
- Technology: Examples include Glass technology by Corning Glass and Xerography by Xerox

#### Defining goals

The PIC then defines goals that are in line with corporate goals, including:

- Growth type: Rapid growth, controlled growth, maintenance or controlled decline (harvest)
- Market share: Creating a new market opportunity, aggressively increasing market share, holding the current market share or yielding share

#### Determining programs to achieve the defined goals

The next step in the PIC is to identify programs in product innovation to achieve the goals defined above. These programs determine:

- Source of the key innovative element: This can be marketing (repositioning, brand names, sales force franchises, etc.), manufacturing/operations (process engineering, low-cost products such as Dell PCs, etc.), or the technical side (R&D, acquisition, etc.).
- Degree of innovation used: Innovation can be pioneering (invented within the company specifically for this product), adaptive (using adapted forms of

existing technologies to support the product), or imitative (imitating existing technologies to support the product).

- **Timing:** This can be first-to-market, quick reactive, or late reactive.

### Financial goals

The PIC defines targets for revenue, profits, costs, cash flows, etc.

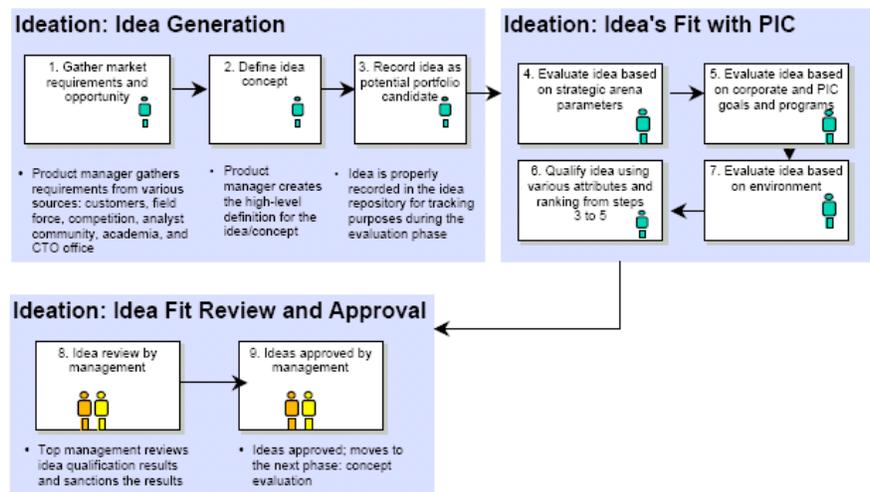
### Assessing the environment

Finally, the PIC assesses the elements that will affect product innovation, including:

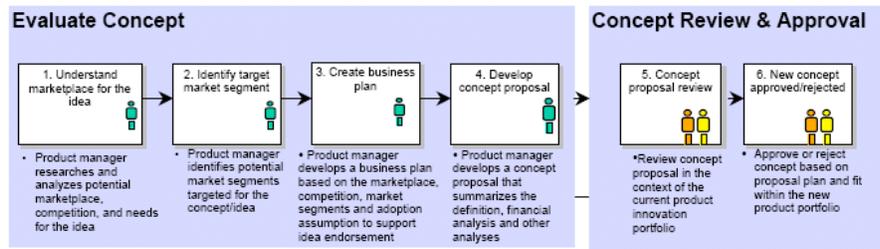
- Internal to the company: The company charter, core competence (technical, marketing), financial goals (revenue, profits)
- External to the company: New technology, market trends and competitors

### Idea-to-Concept Business Flow

Once the above variables are specified, the rest of the idea-to-concept business flow is as shown in the figure below. Ideation consists of three stages: (1) idea generation, (2) evaluation of whether the idea fits the PIC, and (3) idea fit review and approval. If the company has a clearly defined PIC, the rest of the corporation can be aligned with corporate goals. This eliminates waste and keeps the company executing profitably within its core competencies (or evolving competencies).

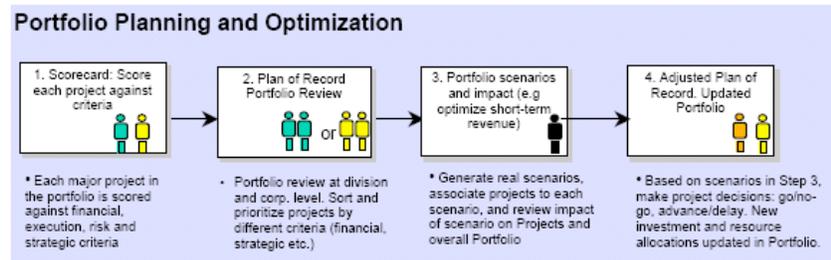


Once an idea is approved the concept is evaluated more rigorously. In the next step of the flow (concept review and approval) the process of selection or elimination is applied according to the company-specified criteria, as illustrated below. The crucial point is that the company now has a predictable framework within which its decision-makers can evaluate investment decisions based on factual data and customer input.



### Portfolio Planning and Optimization Business Flow

Aside from evaluating new concepts, a company may perform periodic reviews of the portfolio of all projects (marketing, product development, IT etc.). These reviews can also be ad-hoc based on critical business scenarios that arise from time to time. Examples include budget cuts, say by 20%, due to lack of demand, or focus on optimizing short-term revenue. Such a portfolio review and optimization exercise can be accomplished through four stages: (1) project scorecard, (2) current plan of record review, (3) creation of scenarios and impact, and (4) adjusted plan of record. Thus, this business flow optimizes the portfolio.



## PART 2: THE ORACLE SOLUTION

How can Oracle, the largest enterprise software vendor, support your technology commercialization process and enable Best Practices in your company?

### Oracle's Unique Approach

Oracle is the only vendor to offer a comprehensive ERP system that can plan and manage all of a company's resources, not just those at the manufacturing and supply chain levels as in traditional ERP. With Oracle, the project life cycle processes of a company become both fast and profitable, thanks to key tie-ins to all components of the Gartner ERP software system framework, including enterprise projects, financials, and business intelligence, as illustrated on the next page.

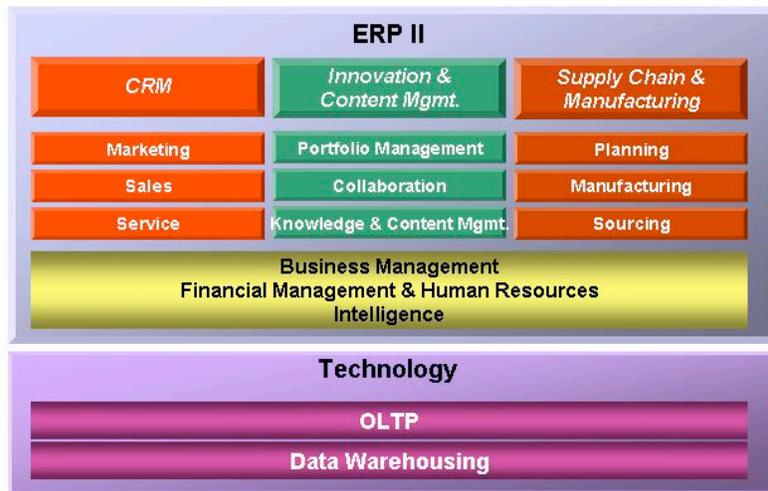
The Oracle solution also facilitates the use of best practices by offering business process efficiency at the three levels discussed earlier: automation, analysis and optimization. This solution lets companies seamlessly link all important business processes with the underlying databases, even if some of these business processes are not implemented in Oracle. An Oracle-enabled business process integration provides the following specific advantages:

**Business Process Integration Advantages with Oracle Workflows and business rules**

Rigorous event and exception management are built into the architecture of the Oracle solution. This makes it easy for a company to incorporate the risk mitigation and strategic methodologies described earlier.

With the Oracle solution, various types of scenario planning are triggered if the company's key performance parameters drop to predetermined threshold levels. For example, if the NPV of the overall portfolio falls below the minimal threshold, an alert or trigger is sent to the system to launch a reassessment planning cycle for the portfolio. This will include what-if scenario analyses on the reshuffling of resources to increase the portfolio's NPV.

**Gartner's Segmentation of ERP & Technology**



ORACLE

**Project items: Oracle's central data architectural element**

Just as the ERP software revolves around WIP/inventory as the key data item, Oracle bases its project life cycle management software on the project item as the central data architectural element. This is extremely critical in order to enable the business process integration required for companies to become highly efficient. It not only reduces the cost of integration among various disparate data sources and applications, but also minimizes the risks of implementing the Best Practices solution.

This means that when a new idea is about to enter the software system, a project management template is provided to start the process. As the idea is further developed during the life cycle, related data items such as cost estimates, revenue and risks are gradually added to the project item. If this data already exists in the enterprise system, Oracle's Analytics/Intelligence modules are leveraged to make the data mining easier.

### **Oracle's interface management**

Oracle is uniquely positioned to integrate data from other applications to enable the best functionality for life cycle management and portfolio analysis. Due to the inherent links between applications and database, only Oracle can offer the simplest, least expensive way to pull in various types of data, including:

- Industry-specific data: Data on the particular equipment type, research reports, costs, trends, etc.
- Historical data: Mainly data on resources (costs, time estimates, BOMs, etc.)
- Predictive data: Projections of revenue, market size, risks, etc.

### **Support by the ERP model**

Various building blocks of the Oracle Best Practices solution for life cycle management and portfolio analysis are already in place. At the foundation is the Oracle Enterprise Projects and Resource Management system (closely tied to the Human Resources system) and the Financial Intelligence system. At the top level is the Business Planning and Modeling software provided by a host of planning capabilities. And with the underlying application server and database platform, only Oracle offers the most comprehensive software system to enable the Best Practices solution.

*Note: The Oracle solution is not limited to Oracle modules. Oracle integrates with third parties such as SAP's financial and manufacturing systems.*

### **Oracle's successful internal business practices**

The best example of the Oracle Best Practices solution is Oracle's own internal deployment of this solution. Oracle applications, including the Human Resources, Projects, and Financial systems, are implemented internally through the widespread usage of self-service methodology as mandated by the management. As a result, Oracle has enjoyed significant gains in business efficiency. Specifically:

- One of Oracle's Best Practices in the areas of development and marketing is fast reaction to the market. New ideas are funded only with lean resources until risks are mitigated.
- As a corporation, Oracle is customer-driven as well as market-driven. As much as possible, Oracle builds products with leading customers who represent emerging needs of a broad market segment.
- Oracle focuses on its own core competencies for both the short term (six months to one year) and the long term (one to three years).
- Oracle tracks project progress closely. If a project schedule slips, making further investment a bigger loss, this is taken into account immediately.
- A project that was profitable in the previous planning cycle may be less appealing in the next cycle. Alternatively, newer, more attractive projects may have appeared. Oracle uses regular, frequent planning cycles to assess the current market versus the market when the product design was originally started.

## **SUMMARY AND ORACLE'S SOLUTION FACTORY**

With design-to-market cycles more compressed, industry leaders are struggling to find ways to survive the downturn and manage change. By enabling the adoption of Best Practices, Oracle helps companies improve the return and profitability of various investments such as technology commercialization, marketing, IT.

*At no cost* Oracle will demonstrate a solution around your line of business and share industry best practices. This industry-specific solution discussion offers the following benefits:

- Demonstrates the value of solving your business issues
- Mitigates the risk of investing in a solution
- Reduces overall systems costs. Improves your organization's ROI

For more information on Oracle's solution for commercializing new technology profitably and quickly, please visit [www.oracle.com/industries/high\\_tech](http://www.oracle.com/industries/high_tech) or call your Oracle representative at 1-800-ORACLE1.



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