Innovation:
A Compendium of Models and Frameworks

Version 1.4, May 10, 2012

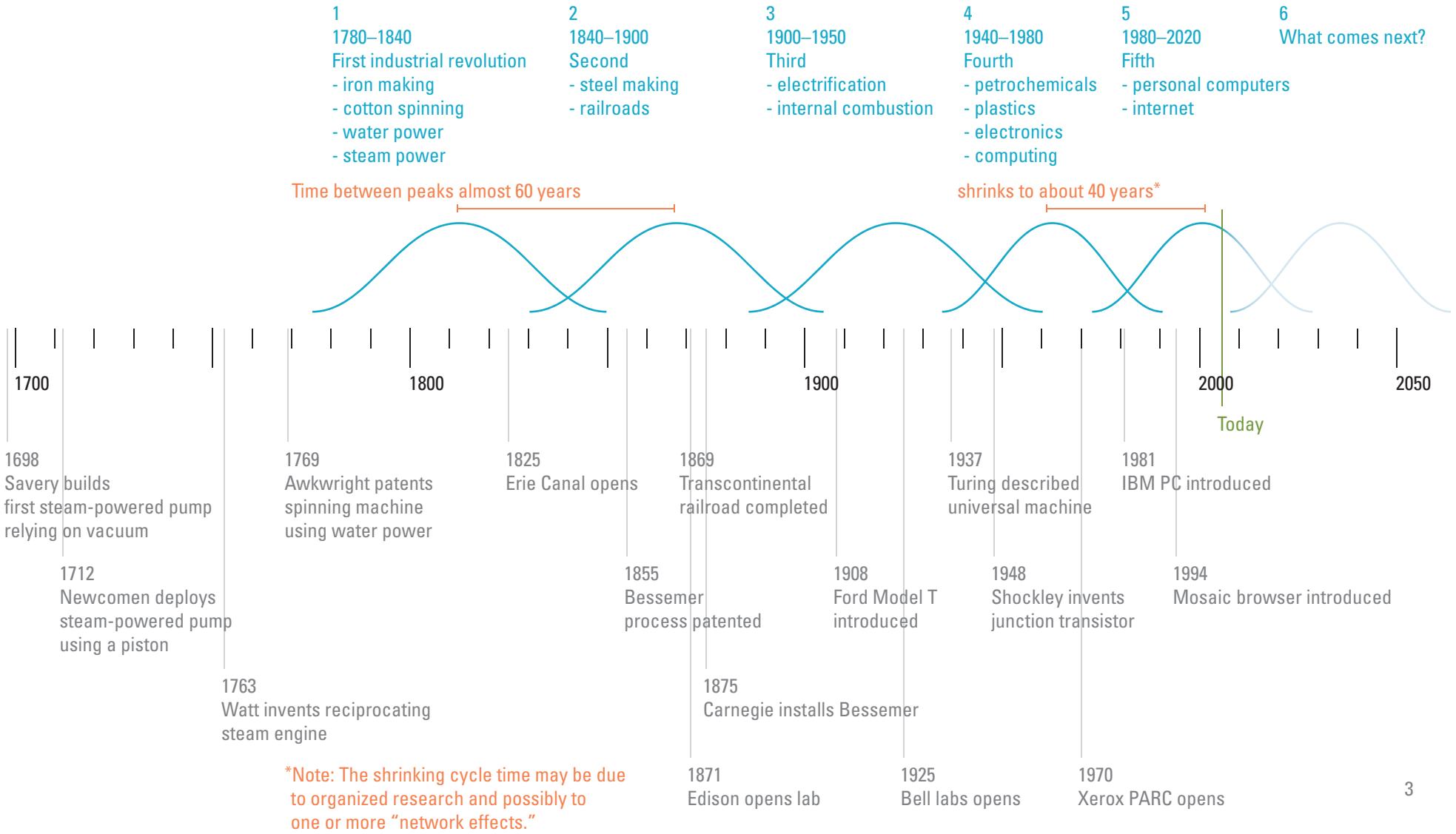
Prepared by
Dubberly Design Office
2501 Harrison Street, #7
San Francisco, CA 94110
415 648 9799

Contents

Technology Development Eras

after Joseph Schumpeter

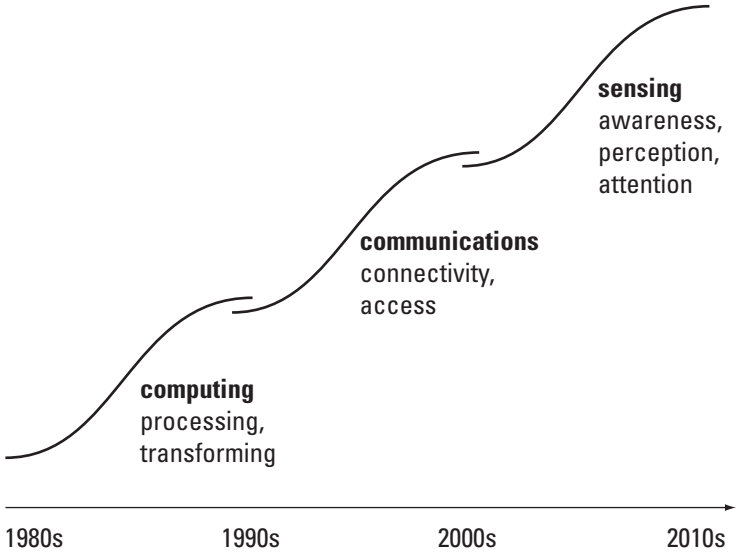
Austrian economist Joseph Schumpeter described technological developments in terms of "waves of innovation," where each wave brings the beginning and end of a new economy. The model suggests we consider the following: 1) how new technologies replace older ones and how we represent that phenomenon; 2) the large-scale technological trends that define social, business, and technology history; 3) what the next big trend might be, given that it has probably already begun even if we have not identified it; and 4) the time that passes between the invention of a technology and its widespread application.



Recent Eras of Technological Innovation

after Institute for the Future (2005)

The IFTF developed a framework relating innovations and the societal trends that result from them. The framework separates roughly the last 20 years into three eras of innovation, each of which occurs when "a technology begins to influence and change society in a fundamental way."



+ big data
+ social
+ convergence

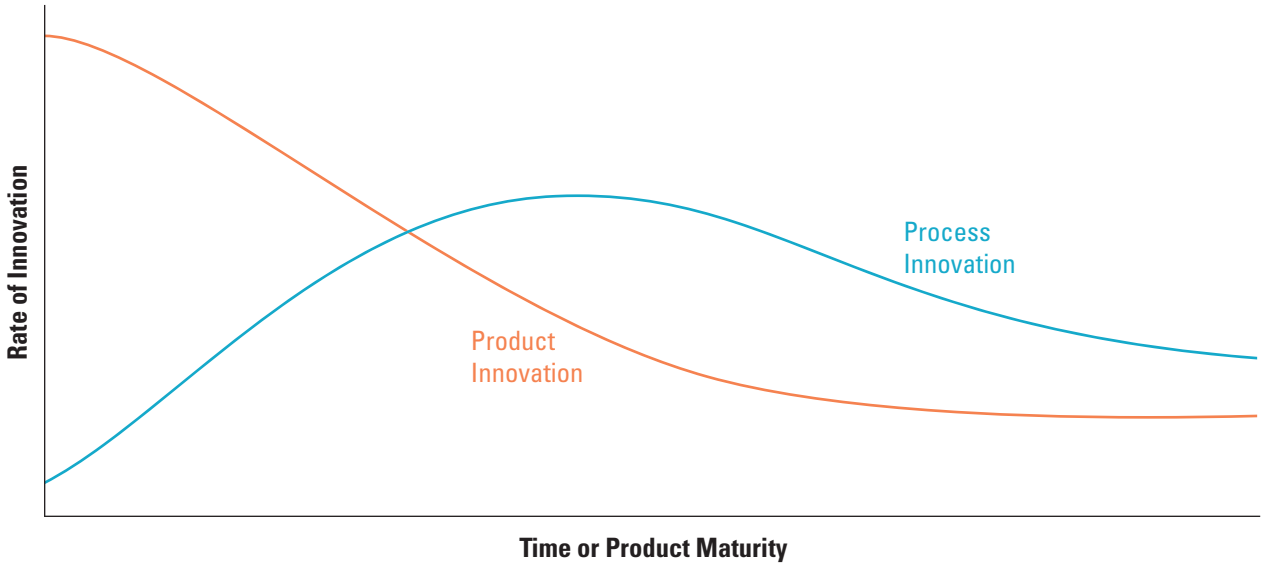
+ machine learning
pattern recognition
+ physical
internet of things

+ CRM
personalization
+ networked services
internet as OS
Xaas

Product-Process Focus Shift

after Abernathy and Utterback (1978)

William Abernathy and James Utterback proposed that successful organizations invest heavily in product R&D early in the product maturing period and shift investment to process technology as time passes. As the dominant design of a new product emerges, organizations focus on minimizing cost rather than varying product features. In their model the rate of innovation is high for product innovation in the beginning of product maturity and gradually declines, while the rate of process innovation increases midway into product maturity.

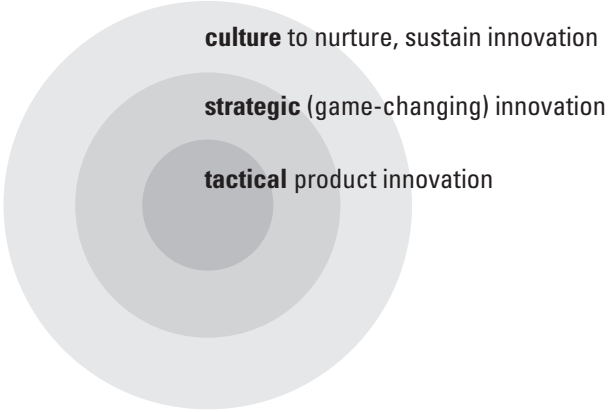


Competitive emphasis on	**Fluid pattern** Functional product performance	**Transitional pattern** Product variation	**Specific pattern** Cost reduction
Innovation stimulated by	Information on users' needs and users' technical inputs	Opportunities created by expanding internal technical capability	Pressure to reduce cost and improve quality
Predominant type of innovation	Frequent major changes in products	Major process changes required by raising volume	Incremental changes with cumulative improvement in productivity and quality

3 Levels of Innovation

after Parrish Hanna (2006)

A user experience designer who has worked for IBM and has consulted with Samsung, Parrish Hanna developed a tri-level model of innovation. He said that companies "achieve tactical product innovation, [foster] strategic (game-changing) innovation, and build a culture to nurture and sustain innovation." The model outlines the contexts in which organizations innovate.

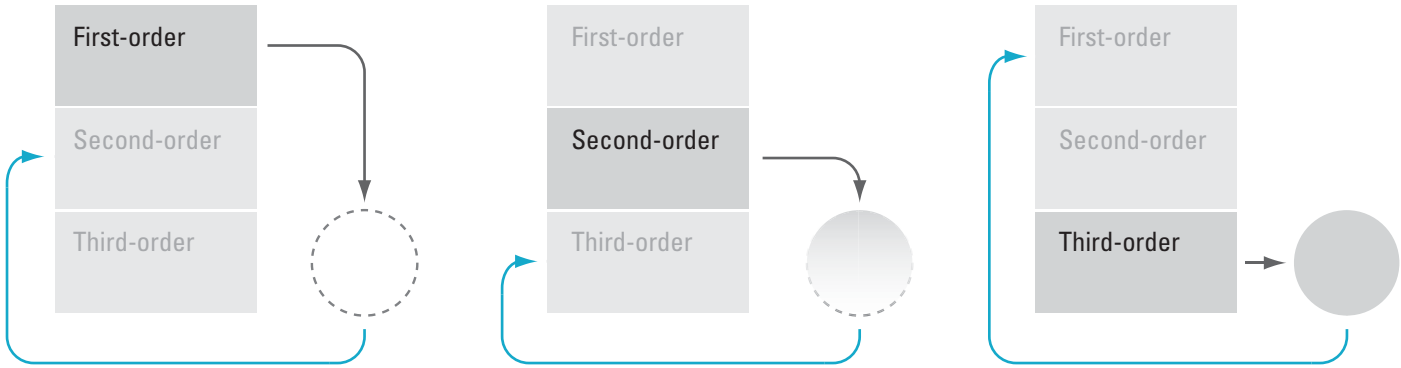


3 Orders of Change

after Michael Geoghegan (2002)

Geoghegan identified change as a way to define new elements, whether they be domains, systems, or efficiencies. Change, according to Geoghegan, takes place only in the context of what does not change.

These orders of change correlate with the orders of creativity (invention, discovery, and efficiency) and ultimately affect the efficiency of a system in a new domain.



First-order change creates new domains and new generative languages.

Second-order change affects system rules within a new domain.

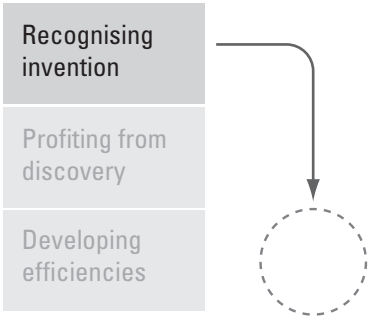
Third-order change seeks increased efficiency within that system.

Efficiency may lead to surplus, which makes it possible to support the discovery of new invention.

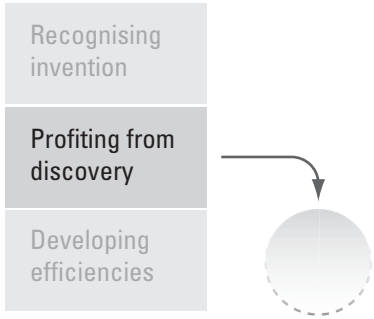
3 Orders of Creativity

after Michael Geoghegan (2002)

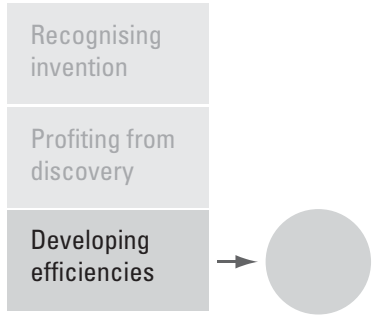
In his conversation with Paul Pangaro about language and the ability of organizations to change and regenerate, Michael Geoghegan delineated three orders of creativity: invention, discovery, and efficiency. In the invention phase, change arises out of new language and resources that are used to recognize invention. In the discovery phase, change results from finding new ways to create value in the form of products and services. In the efficiency phase, change comes from developing more efficient ways to make those new products and services.



They provide resources to recognize invention, which opens up new domains of language. In these new domains, profitable discoveries may be made.



They provide the necessary conditions for discovering and marketing products and services that emerge from these new domains.

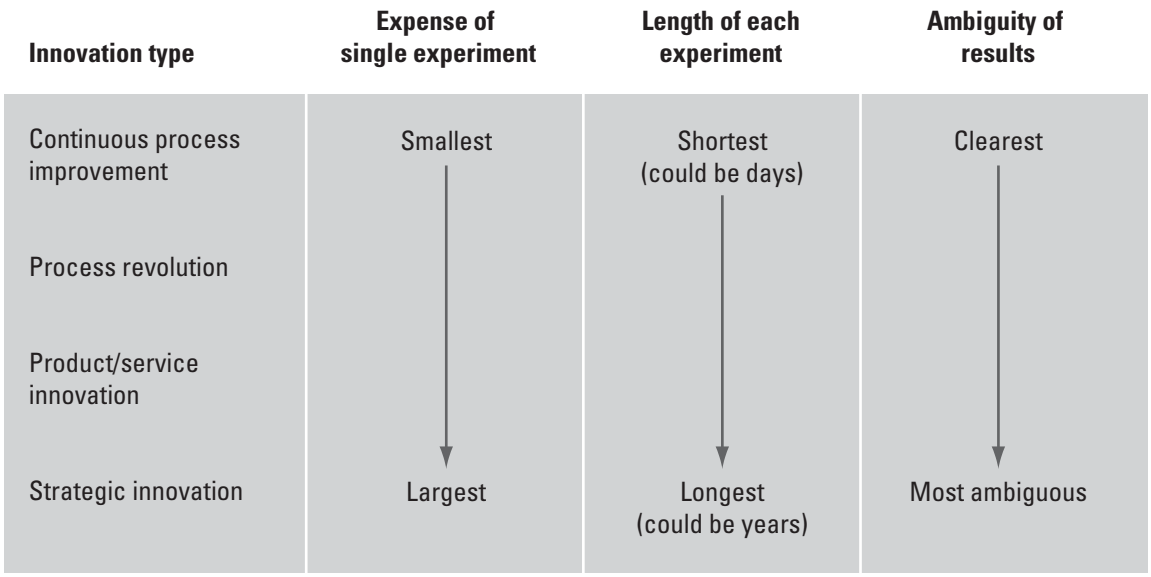


Then, they develop more cost-effective ways of producing and delivering these new products and services.

4 Innovation Types

after Govindarajan and Trimble (2005)

Govindarajan and Trimble define four types of innovation, all of which differ in the expense of a single experiment, the length of each experiment, and the ambiguity of results. The differences between the innovation types influence such issues as who should lead or participate in an innovation, how much resources to allocate, how to assess progress, and when to end the development process.



5 Innovation Patterns

after Goldenberg at al. (2003)

The innovation patterns of Goldenberg et al. manipulate existing components of a product and its immediate environment to come up with something ingenious and viable.

Similar to the way ideas can be recycled and reused, these innovation patterns add or subtract components of a product to create innovative objects.

1 **Attribute dependency**
The attribute dependency pattern alters or creates the dependent relationships between a product and its environment.

Examples
By creating a dependent relationship between lens color and external lighting conditions, eyeglass developers came up with a lens that changes color when exposed to sunlight.

2 **Division**
The division pattern divides an existing product into its component parts so that you can see something that was an integrated whole in an entirely different light.

The modern home stereo has modular speakers, tuners, and CD and tape players, which allow users to customize their sound systems.

3 **Multiplication**
The multiplication pattern makes one or more copies of an existing component, then alters those copies in some important way.

The Gillette double-bladed razor features a second blade that cuts whiskers at a slightly different angle.

4 **Subtraction**
The subtraction pattern works by removing product components, particularly those that seem desirable or indispensable.

A highchair attaches to a kitchen table as a legless incarnation of the original model.

5 **Task unification**
The task unification pattern assigns a new task to an existing product element or environmental attribute, thereby unifying two tasks in a single component.

The defrosting filament in an automobile windshield also serves as a radio antenna.

7 Sources of Innovation

after Peter F. Drucker (1985)

Peter F. Drucker, a writer and thinker on issues related to management and entrepreneurship, wrote that sources of innovation come from either within enterprises or industries or outside of them. He said that an enterprise can be a business or a public-service institution. Opportunities for innovation can come from events, needs, or changes in demographics and knowledge base.

Systematic innovation requires monitoring seven sources for innovative opportunity.

Sources within the enterprise, whether business or public-service institution, or within an industry or service sector:

1 **The unexpected**—the unexpected success, the unexpected failure, the unexpected outside event
2 **The incongruity**—between reality as it actually is and reality as it is assumed to be or as it "ought to be"
3 Innovation based on **process need**
4 Changes in **industry and market structures** that catch everyone unawares

Sources that involve changes outside the enterprise or industry:

5 **Demographics** (population changes)
6 **Changes in perception**, mood, and meaning
7 **New knowledge**, both scientific and nonscientific

10 Types of Innovation

after Vijay Kumar of Doblin Group

The Doblin Group established 10 types of innovation that each falls into one of four categories: finance, process, offering, and delivery. Each category focuses on a different aspect of the business: increasing revenue, supporting existing and new processes, designing offerings, and improving interactions with consumers.

Finance

1	Business model– How you make money	Dell revolutionized the personal computer business model by collecting money before the consumer's PC was even assembled and shipped (resulting in net positive working capital of seven to eight days).
2	Networks and alliances– How you join forces with other companies for mutual benefit	Consumer goods company Sara Lee realized that its core competencies were in consumer insight, brand management, marketing, and distribution. Thus it divested itself of a majority of its manufacturing operations and formed alliances with manufacturing and supply chain partners.

Process

3	Enabling process– How you support the company's core processes and workers	Starbucks can deliver its profitable store/coffee experience to customers because it offers better-than-market compensation and employment benefits to its store workers—usually part-time, educated, professional, and responsive people.
4	Core processes– How you create and add value to your offerings	Wal-Mart continues to grow profitably through core process innovations such as real-time inventory management systems, aggressive volume/pricing/delivery contracts with merchandise providers, and systems that give store managers the ability to identify changing buyer behaviors and respond quickly with new pricing and merchandising configurations.

10 Types of Innovation (continued)

Offerings

5	Product performance– How you design your core offerings	The VW Beetle (in both its original and its newest form) took the market by storm, combining multiple dimensions of product performance.
6	Product system– How you link and/or provide a platform for multiple products	Microsoft Office bundles a variety of specific products (Word, Excel, PowerPoint, etc.) into a system designed to deliver productivity in the workplace.
7	Service– How you provide value to customers and consumers beyond and around your products	An international flight on any airlines will get you to your intended designation. A flight on Singapore Airlines, however, nearly makes you forget that you are flying at all, with the most attentive, respectful, and pampering pre-flight, in-flight and post-flight services you can imagine.

Delivery

8	Channel– How you get your offerings to market	Legal problems aside, Martha Stewart has developed such a deep understanding of her customers that she knows just where to be (stores, TV shows, magazines, online, etc.) to drive huge sales volumes from a relatively small set of "home living" educational and product offerings.
9	Brand– How you communicate your offerings	Absolut conquered the vodka category on the strength of a brilliant "theme and variations" advertising concept, strong bottle and packaging design, and a whiff of Nordic authenticity.
10	Customer experience– How your customers feel when they interact with your company and its offerings	Harley Davidson has created a worldwide community of millions of customers, many of whom would describe "being a Harley Davidson owner" as a part of how they fundamentally see, think, and feel about themselves.

14 Types of Innovation

after Geoffrey A. Moore (2005)

While disruptive innovation is the most immediately recalled type of innovation, Moore argues that there are more types of innovation that occur along the category-maturity life cycle. He divides the category life cycle into four zones: product leadership zone, customer intimacy zone, operational excellence zone, and category renewal zone. Each zone offers opportunities for firms to innovate based on the maturity stage of their technology.

	Product leadership zone		
1	Disruptive	Creates new market categories based on a discontinuous technology change or a disruptive business model.	Oracle created a portable database that ran on many different computers and offered easy reporting.
2	Application	Develops new markets for existing products by finding unexploited uses for them, often by combining them in novel ways.	An entrepreneur took World War II synthetic rubber to market as a toy called Silly Putty.
3	Product	Focuses on existing markets for existing products, differentiating through features and function that current offers do not have.	Applied Materials introduced a multi-chamber semiconductor manufacturing device that integrated multiple steps of water fabrication within a single environment.
4	Platform	Interposes a simplifying layer to mask an underlying legacy of complexity and complication, thereby freeing a next generation of offers to focus on new value propositions.	Sony's video game machines provide a platform for independent developers.
	Customer intimacy		
5	Line-extension	Makes structural modifications to an established offer to create a distinctive subcategory.	Tylenol branched out from pain killers to products for allergy and sinus, cold, arthritis, and other ailments.
6	Enhancement	Continues the trajectory begun by line extensions, driving innovation into finer elements of detail, getting closer to the surface of the offer with less impact on the underlying infrastructure.	Kimberly Clark and Procter & Gamble have dominated the disposable diaper categories by adding to their products tape, Z fold, and elastic to increase convenience.
7	Marketing	Focuses on differentiating the interaction with a prospective customer during the purchase process.	Avon developed a sales channel with their "Avon calling" campaign in the 1950s.
8	Experiential	Bases value not on differentiating the functionality but rather the experience of the offering.	Cirque du Soleil redefined the notion of circus with its visual and philosophical productions.

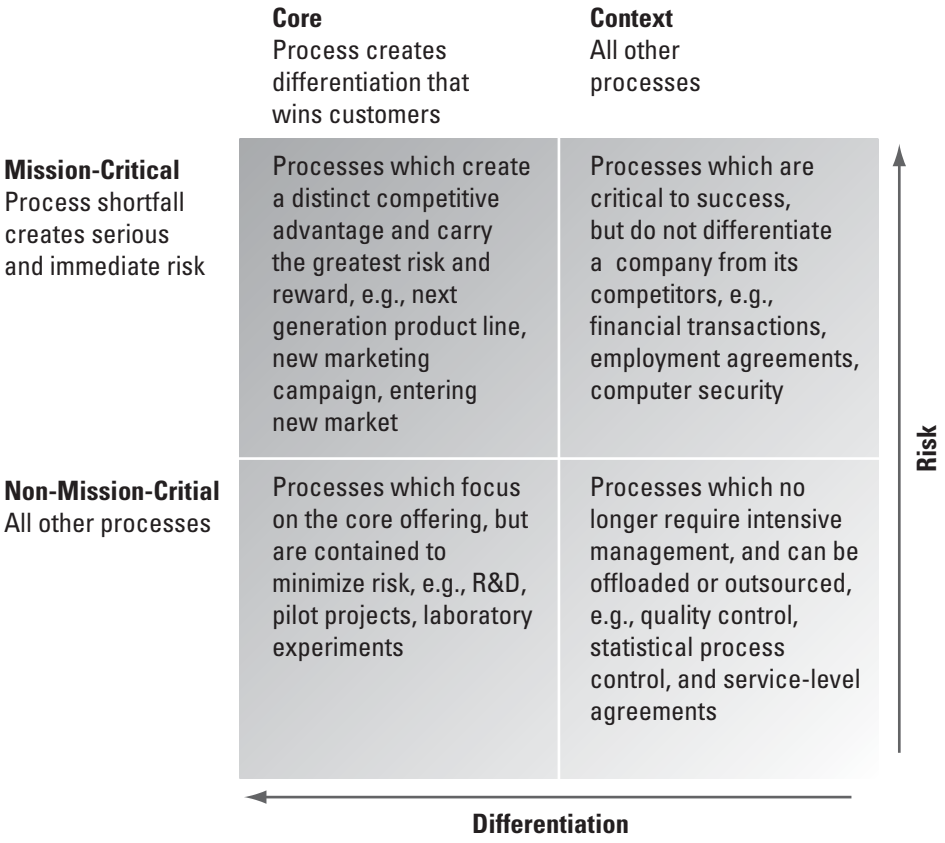
14 Types of Innovation (continued)

	Operational excellence		
9	Value-engineering	Extracts cost from the materials and manufacturing of an established offer without changing its external properties.	Southwest built a fleet with a single standard plane, simplified pricing and seat selection, and focused on point-to-point round-trip itineraries to reduce costs.
10	Integration	Reduces the customer's cost of maintaining a complex operation by integrating its many disparate elements into a single centrally managed system.	LEGOS sold its plastic bricks at a premium by marketing them in kits that integrated into toys.
11	Process	Focuses on improving profit margins by extracting waste not from the offer itself but from the enabling processes that produce it.	McDonald's engineers every process, from procuring and cooking to hiring, training, and terminating.
	Category renewal		
12	Value-migration	Redirects the business model away from a commoditizing element in the market's value chain toward one richer in margins.	Wal-Mart migrated power from branded consumer goods to high-volume discount retailer. It reduced costs with industry-standard bar codes and RFID-enabled inventory tracking.
13	Organic	Uses internal resources to reposition itself into a growth category.	Nokia, formerly of paper and pulp products, rubber manufacturing, and cable, entered the electronics sector with coaxial cable for computer networks.
14	Acquisition	Solves problem of category renewal externally through merger and acquisition.	Gateway acquired eMachines, the low-cost leader in retail PCs, and allowed their management to control the company and improve its operating efficiency.

Core-Context Analysis Framework

after Geoffrey A. Moore (2005)

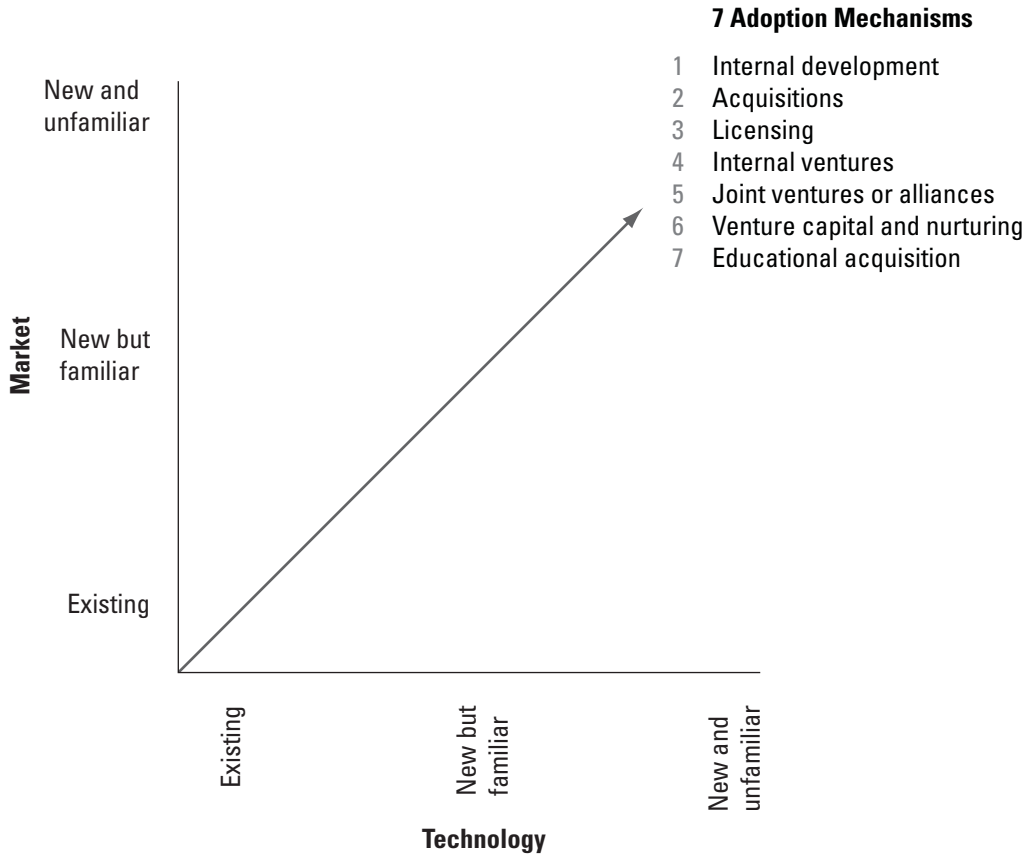
Moore's core-context analysis framework analyzes how resources should be allocated between core development and context development. While the core is the essence of a firm that helps it distinguish itself from its competitors, the context is the aspect that brings in revenue. Therefore funneling resources from context development to core development to create differentiation presents a risk for a firm. Moore believes that innovation is most likely to occur when resources are allocated to core development while still maintaining competitive differentiation.



Familiarity Matrix (Market-Technology) Model

after Roberts and Berry (1985)

The likelihood of a firm adopting an innovation successfully depends on how familiar the firm is with the technology that supports the innovation and the market that the innovation impacts. Roberts and Berry identified seven adoption mechanisms—internal development, acquisitions, licensing, internal ventures, joint ventures or alliances, venture capital and nurturing, and educational acquisition—that a firm can use to adopt the technology, depending on how radical the innovation is to the firm. The more unfamiliar the innovation, the more a firm should look outside its boundaries for assistance.



Market-Technology Model

after Abernathy and Clark (1985)

Abernathy and Clark stated that an innovation can either support or destroy two types of capabilities: technological capabilities and market capabilities. Their model defines four different types of innovation and suggests that market capabilities can be just as important as technological knowledge.

		Technological capabilities	
		Preserved	Destroyed
Market capabilities	Preserved	**Regular**	**Revolutionary** GE's market capabilities were instrumental during the transition from X-rays to CAT scans to MRI.
	Destroyed	**Niche**	**Architectural**

Component-Link (Architecture) Model

after Henderson and Clark (1990)

Henderson and Clark suggested that, since products are made up of components connected together, building them must require two kinds of knowledge: knowledge of the components, called component knowledge, and knowledge of the links between them, called architectural knowledge. Despite pioneering the xerography technology, Xerox spent many years developing a good, small plain-paper copier. RCA was never the leader in the portable transistor radio market despite its experience in the components of transistor radios. Since an innovation can enhance or destroy either one of those knowledge types, the Henderson-Clark model distinguished four possible types of innovation according to its effect on component and architectural knowledge.

Component knowledge	Architectural knowledge: Enhanced	Architectural knowledge: Destroyed
Enhanced	**Incremental**	**Architectural**
Destroyed	**Modular**	**Radical**

Incremental-Radical Dichotomy Model

after Tushman and Anderson (1986)

Incumbent firms and new entrants to a market can react differently to innovations. A radical innovation can render existing knowledge obsolete, while incremental innovation can build on existing knowledge. The incremental-radical dichotomy shows the advantages and disadvantages for each type of firm depending on the type of innovation that is affecting the firm.

	Incremental innovation (competence enhancing) Knowledge required to exploit the innovation builds on existing knowledge	**Radical innovation** (competence destroying) Knowledge required to exploit the innovation is very different from existing knowledge, rendering existing knowledge obsolete
Incumbent	- More willing to invest since such investments allow existing products to stay competitive in the market - Tend to dominate since required knowledge builds on what they already have	- May be reluctant to invest for fear of cannibalizing its existing products if, in doing so, it advances the date of introduction of the innovation - Existing capabilities may be useless and be a handicap to the introduction and development of the innovation
New entrant	- Would have to build knowledge from scratch	- Have less to lose, since they have no products to sell in that market - Do not have the burden of the old knowledge and can go on unencumbered to build capabilities for the innovation and exploit it

Motivation-Ability Framework

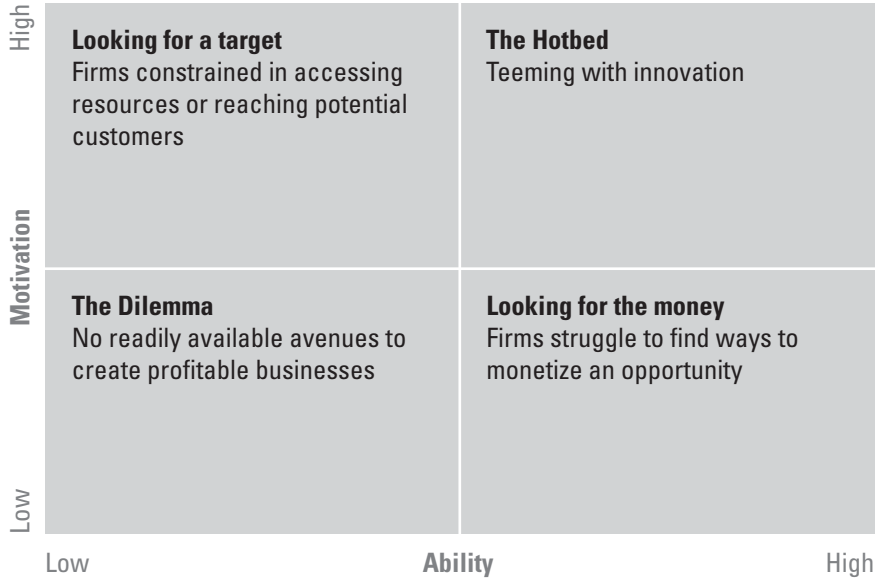
after Christiansen et al. (2004)

The Motivation/Ability Framework has two axes: Motivation, the "pot of gold waiting for the winners," and Ability, the "capability to obtain resources, craft them into a business model, and offer products and services to customers."

The axes have scales measuring each factor from low to high, and depending on the amount of each available in the market environment, indicates the likelihood of innovation in the market.

Generally determined by
- Market size/growth
- Competitive dynamics/ industry attractiveness
- Economics of opportunity/ business model attractiveness
- Competitive forces

Government levers
- Tax treatment (credit, subsidies, etc.)
- Antitrust policy
- Competitive policy
- Rate regulation
- Regulatory asymmetry
- Network element pricing



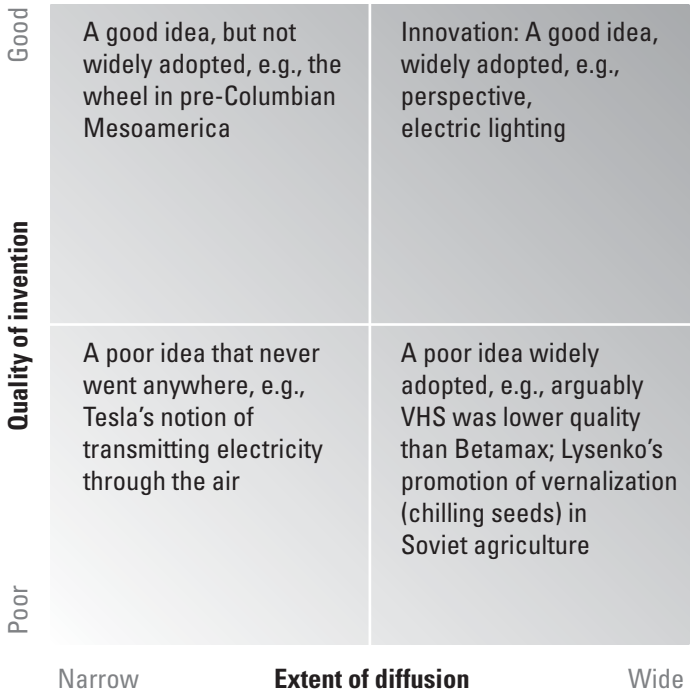
Generally determined by
- Resource availability
- Standards
- Market access
- Industry developments

Government levers
- Resource-related regulation
- Unbundling
- Standards

Innovation as Invention Widely Distributed

after Chris Conley (2006)

Chris Conley, Associate Professor at Illinois Institute of Technology's Institute of Design, laid out innovation in a matrix bordered by "Quality of invention" and "Extent of diffusion." Quality of invention and extent of diffusion are not necessarily measured in discrete units. In addition, there are inventions of poor quality that are widely adopted, as well as inventions of good quality that are not widely adopted. To be considered an innovation, an invention must be of good quality and have a wide extent of diffusion.

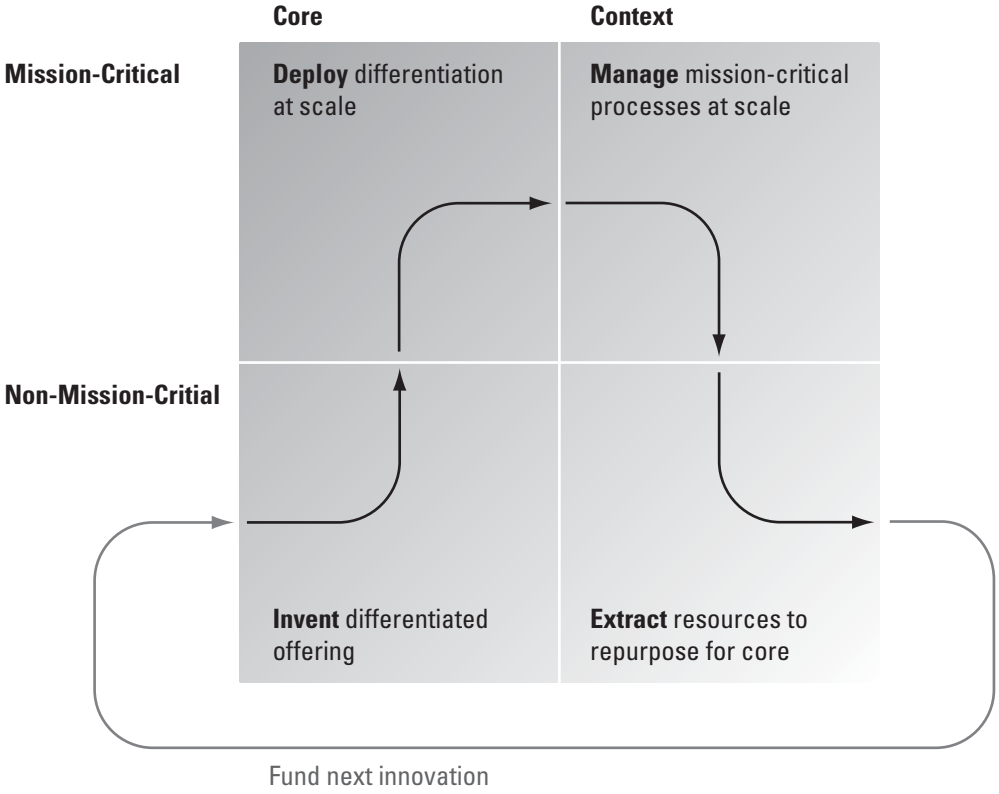


Cycle of Innovation

after Geoffrey A. Moore (2005)

The Cycle of Innovation follows the flow of resources from beginning and maturation to decline of an innovation. According to Moore, innovation begins in the non-mission-critical quadrant of the core development half of the framework. Once the innovation is ready for deployment, more resources are poured in to bring it to market.

As the innovation matures, resources shift to maintaining differentiation of the technology by improving the development process. The last phase of the cycle, before beginning anew, is that of repurposing resources for the generation of another innovation.



Foresight to Insight to Action Process

after Bob Johansen of Institute for the Future

The Institute for the Future, located in Palo Alto, California, researches the impact of technology on society. Its mantra is "Foresight to insight to action"—the idea of understanding knowledge about the future to brainstorm new possibilities and channel them to action. The purpose is not to predict the future, but rather to make a difference in the present through linear progression of thinking and understanding.

Situation	Conceived through…	Description
Verifiable present	Observation	What you have
Probable future	Foresight	What you are likely to get if things are left as they are
Possible future	Insight	What you might get by applying resources
Desireable future	Action	The best possible outcome, what you should work for

Simple Value Chain

after Geoffrey A. Moore (2005)

In his Simple Value Chain, Geoffrey A. Moore includes the steps of Research, Design, Source, Make, Market, Sell, and Service. These functions combine and link together to create a market.

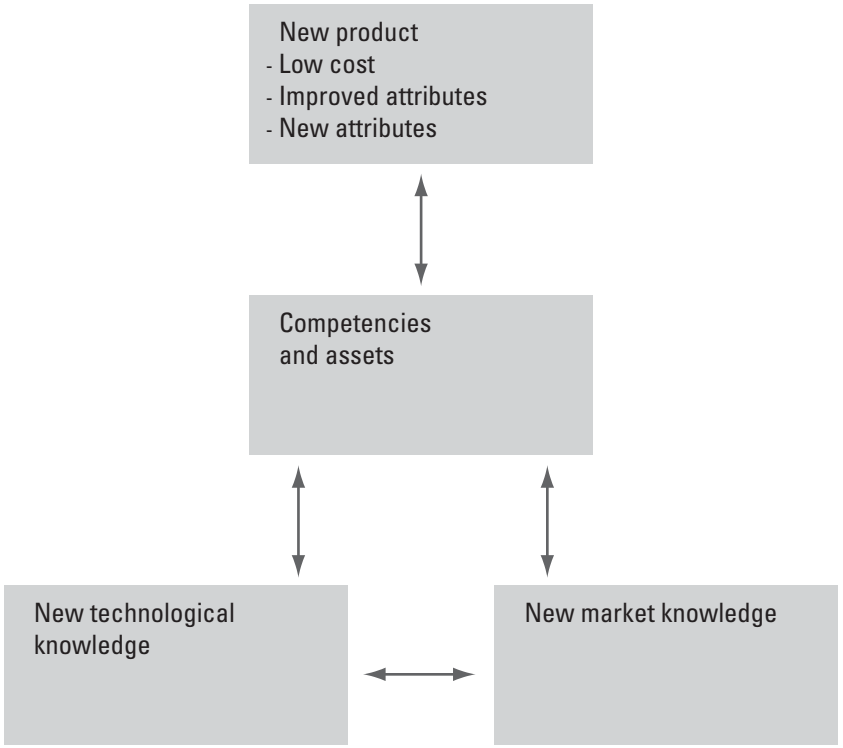
Moore proposes that even such a basic model differs in the way it applies to different business architectures.

Value chain elements	Complex systems	Volume operations
Research	Qualitative scenarios	Quantitative analytics
Design	Integration of modules	Modules that integrate
Source	At the margin	At the mean
Manufacture	Adaptive methodologies	Deterministic processes
Market	Value chain orchestration	Branding and promotion
Sell	High-touch persuasion	Low-touch distribution
Service	Open-ended consultations	Close-ended transactions

Innovation Factors

after Allan Afuah (2002)

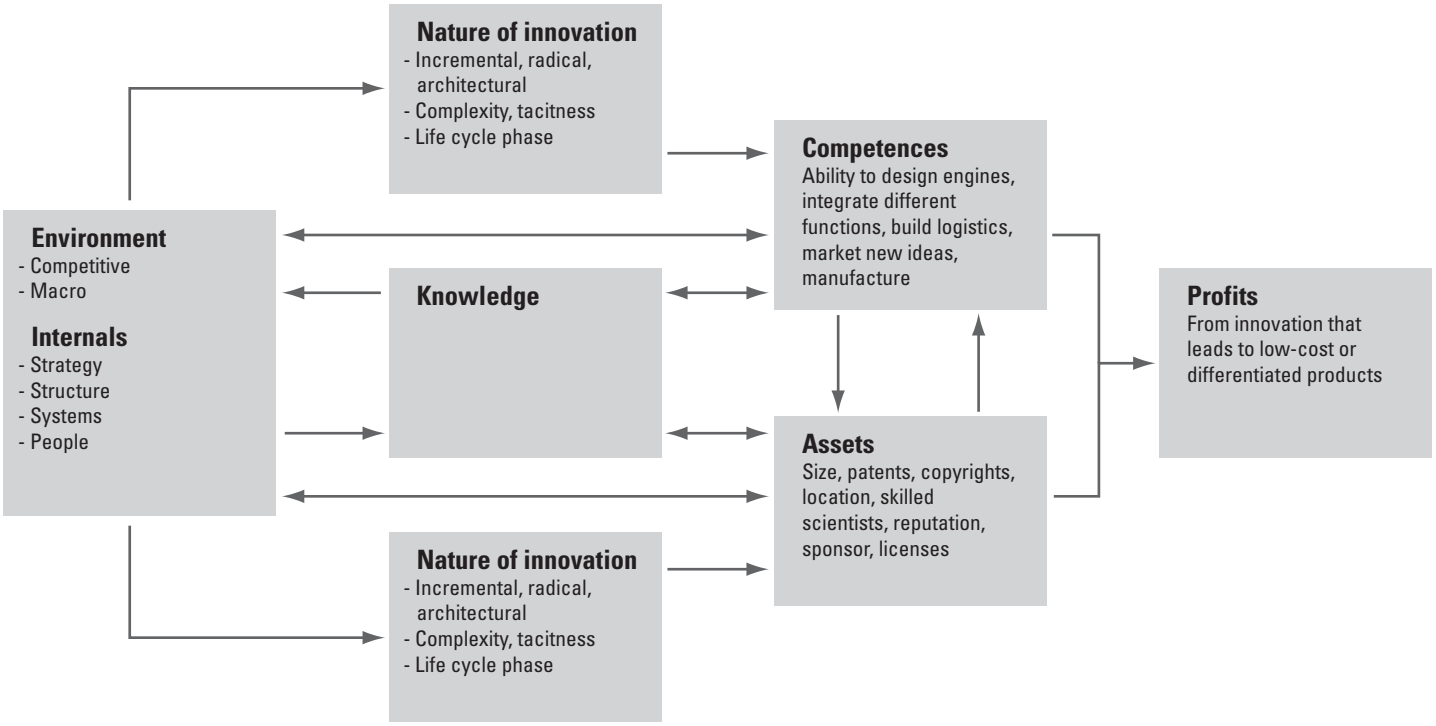
Allan Afuah, a professor in Corporate Strategy and International Business at the University of Michigan Business School, defines innovation as "the use of new technological and market knowledge to offer a new product or service that customers will want." New technological and market knowledge is used to create a product that costs less, has improved attributes, has new attributes, and has not previously existed in the market.



Profit Chain

after Allan Afuah (2002)

The profit chain model shows how a firm uses new knowledge to offer new products or services at a lower cost than its competitors, or to offer differentiated products at premium prices that more than compensate for the extra cost of differentiation. A firm relies on its capabilities to use the available knowledge for productive purposes.



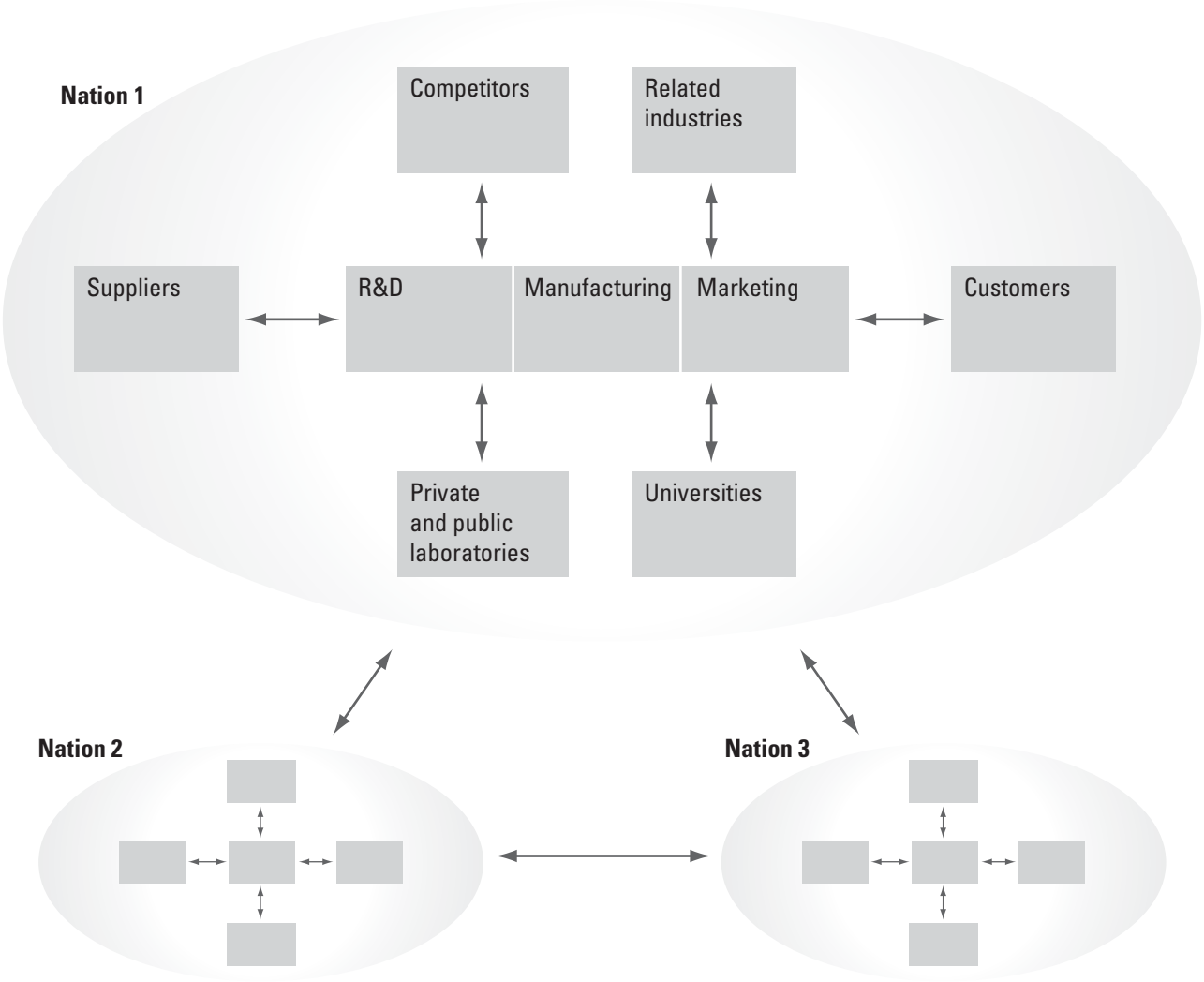
Functional Sources of Innovation

after Eric von Hippel (1988)

Functional sources answer the question of where innovations come from: Do they come from within the firm or from outside the firm? If from within, where exactly within the firm? Functional sources of innovation given by von Hippel include 1) a firm's own internal value chain functions; 2) its external value-added chain of suppliers, customers, and complementary innovators; 3) university, government, and private laboratories; 4) competitors and related industries; and 5) other nations or regions.

Environmental factors

Technological change
Regulation/deregulation
Customer expectations
Social/demographic
Political/legal
Globalization



Business Model Innovation

after Gary Hamel (2000)

According to Gary Hamel, founder of the consulting firm Strategos, the unit of analysis for innovation is a business concept. He emphasized the building of a business model around a new idea in order to yield measurable results. The model below shows the components of a business model, including core strategy and strategic resources. Hamel stated that, for an organization to be innovative, its members must set high expectations, be open to new ideas, and work for a cause that reaches beyond a simple business goal.

Business Concept / Model Components:

Customer Benefits		Configuration of Activities		Company Boundaries	
Customer Interface		*Core Strategy*		*Strategic Resources*	*Value Network*
Fulfillment & Support		Business Mission		Core Competencies	Suppliers
Information & Insight		Product / Market Scope		Strategic Assets	Partners
Relationship Dynamics		Basis for Differentiation		Core Processes	Coalitions
Pricing Structure					

Wealth Potential:

Efficient	*Unique*	*Fit*	*Profit Boosters*
			Increasing Returns
			- Network Effects
			- Positive Feedback Effects
			- Learning Effects
			Competitor Lock-out
			- Preemption
			- Choke Points
			- Customer Lock-in
			Strategic Economies
			- Scale
			- Focus
			- Scope
			Strategic Flexibility
			- Portfolio Breadth
			- Operating Agility
			- Lower Breakeven

Special thanks to

Sean Durham
Nathan Felde
Satoko Kakihara
Paul Pangaro

hugh@dubberly.com
415 648 9799

Presentation posted at
www.dubberly.com/presentations/innovation_compendium.pdf