



Managing innovation dilemmas: The cube solution

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Abstract Innovation has become a universal feature of corporate life. Almost no company can survive without innovation. However, when it comes to developing innovation strategies, managers often are left alone to decide which innovation types to pursue, how to balance them in an overall portfolio, how to allocate resources, and how to implement them. In short, managers face a variety of innovation dilemmas. One of the most pertinent problems is how to distinguish innovation types in a meaningful way. In this article, we introduce the innovation cube, a tool that helps position innovation types in a managerially meaningful way. Once managers know how to relate and compare their innovation types to those of other companies, the cube helps them to better formulate their innovation strategy.

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1. The innovation jungle

The widespread agreement that innovation is important does not prevent the recognition that hardly anybody agrees on what innovation actually is. There is no unambiguous definition of innovation, and research provides inconclusive terms and overlapping classification systems (Crossan & Apaydin, 2010). One of the most common distinctions is that

between product and process innovation. Others distinguish between business model innovation (e.g., hub-and-spoke airline routes), operational innovation (e.g., business process reengineering), and services innovation (e.g., commercial pet sitting). If there are only small changes, we refer to incremental innovation (e.g., changed size of canned soft drinks) whereas huge modifications (e.g., the ballpoint pen) are named radical. If innovations create a new market segment by destroying an old one, we classify them as disruptive (e.g., the personal computer basically eliminated conventional typewriters). However, sometimes the distinctions are blurred. Take, for example, Apple's

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iTunes music store: It represents a radical change in the organization's business model (i.e., online music distribution). But MP3 players already existed and had been successfully introduced by competitors, so the introduction of the iPod was only an incremental innovation for the market. This terminological jungle in innovation literature could easily be extended with many other examples.

As a result, it is very difficult for managers to compare innovation types. Most research on innovation strategy is not particularly helpful because it classifies innovation types after the company has successfully or unsuccessfully implemented them. That is, looking for advice on how to launch an innovation project may not be successful because companies started out from a different vantage point than what is reported in research results. All this leads to problems in language, understanding, and operationalization which, in turn, impede other important decisions, such as how many and what kind of resources to allocate to different types of innovation or what risk profiles to accept.

In response, we aim to provide conceptual clarification and practical advice. Using insights from extant literature and several case vignettes, we develop an innovation cube, which positions the multitude of innovation types in a way that is meaningful for managers.

2. Classifications and typologies

Many disciplines have focused on innovation, ranging from economics, technology management, strategy, to organizational behavior (Daft & Becker, 1978; Rothwell, 1978; Teece et al., 1997; Utterback & Abernathy, 1975). It is not surprising that an equally large number of classification systems exist (e.g., Adams, Tranfield, & Denyer, 2011; Crossan & Apaydin, 2010; Rowley, Baregheh, & Sambrook, 2011). But to date, it has remained unclear what innovation really is and research provides little value to practitioners. A short excursion into attributes may help to locate the origin of the problem. Typically, a phenomenon can be described according to its primary or secondary attributes (Downs & Mohr, 1976). *Primary attributes* describe an organization independent of its context—it always remains the same. For example, innovations that are classified as new to the world will always be so—for every company that invents them—because the defining characteristic is their very first appearance on the market. However, most studies focus on *secondary attributes*: They focus on the context in which an innovation may differ. For example, internet service is a sustaining

innovation to catalog retailers, because it extends their existing markets by offering better value, but the same innovation is disruptive for department stores, challenging their very existence (Danneels, 2004).

These examples are reflected in existing classification systems and show some of the problems related to classifying innovations. Some classifications focus on the degree of required change in a corporation, the impact on the industry at large, or on organizational sources of innovation. However, the potential linkages across the different systems of classification are usually ignored. In addition, a classification that focuses on innovation intensity rarely includes the distinction between different areas of focus (e.g., product vs. process, product vs. technology, product vs. administration) (Adams et al., 2011). In a similar vein, a classification based on the impact of the innovation on the industry, such as sustaining vs. disruptive (Christensen, 1997), does not necessarily account for the strategic anchor of the innovation in which a particular business function drives innovation (e.g., marketing or logistics) as opposed to a corporate-level, system-wide innovation (e.g., value chain configuration). Without such links though, companies cannot identify the relevant capabilities and requirements for change or prepare fully to implement successful innovations. To address this problem, we propose an integrative framework that connects different innovation types and lends itself to the development of innovation strategies.

3. The innovation cube

Although innovation can refer to products, processes, systems, administrative procedures, or technologies, managers need to think holistically (Sawhney & Wocott, 2006). To adopt such a holistic perspective, we use three dimensions: change impact, strategic impact, and market impact.

All three dimensions are well established in academic literature and, in isolation, have served to classify innovations. Some other dimensions could permit comparisons too (there are 53 innovation attribute classifications) (Adams et al., 2011) but we selected these three because they have attained consistently high acceptance in interactions with managers during executive teaching and consulting projects worldwide (Salaman & Storey, 2002). Furthermore, these three dimensions support comparisons of existing classification systems that identify their similarities and differences. That

is, we position each innovation type in relation to these three dimensions and thereby unearth connections among the different approaches to classifying innovations.

To substantiate the three dimensions, we also draw on insights from literature on decision making and dynamic capabilities within strategic management (Grant, 2013); research into the levels, directions, and impetus for organizational change processes (Levy & Merry, 1986); and studies of innovation and market creation (Kim & Mauborgne, 2005). We complement these findings from prior literature with managerial insights and practitioner perceptions. We first distinguished between incremental and non-incremental innovation, which is the easiest distinction for managers to comprehend. Non-incremental innovations can take different forms, including disruptive innovations that have an impact on the market and industry, radical innovations that dramatically change user behavior, or strategic innovations that influence decision-making processes (García & Calantone, 2002).

3.1. Change impact

To develop innovations that depart from the status quo, a company often needs to reconfigure its internal procedures, resources, and capabilities. Thus, innovation types can be categorized in terms of their impact on the firm's established capabilities. When new capabilities are required, they may arise through what organizational change literature calls transitional or transformational change (Levy & Merry, 1986). These two variants facilitate different types of innovation. Transitional changes tend to involve minor modifications in the focus area of a firm's innovation (Adams et al., 2011), such as when a company changes focus from a product to a service or moves toward technological or administrative innovations. These smaller changes in turn can induce more substantial transformations in the firm. Transformational changes must overcome cognitive limitations and stir up deeply embedded customer or market-related competencies, which often limits companies from moving into new markets (Henderson, 2006). This constraint is salient when the firm must destroy existing competencies to create new ones or when the company's cognitive resource base needs to be shaken up to initiate path-breaking innovations. To identify innovation types along our first dimension, change impact as transformational or transitional change, we ask several questions (see Table 1).

3.2. Strategic impact

The nature of change provides information about the company's internal adaptation processes, but it does not reveal much about the complexity or underlying values of strategic decision making. Strategy research commonly differentiates between functional levels (Andrews, 1971). Innovations typically emerge from these various levels, including product development, human resources, or finance, because they deal with singular elements of strategic decision making. The success of the energy drink Red Bull can be ascribed to the company's ingenious marketing approach, for example. Questions on the business unit level pertain to the implementation of innovations, perhaps using a determined cost focus, as Easy Jet does, or according to the relevant scope in the markets in which the firm competes with its innovations, as exemplified by Unilever's bottom-of-the-pyramid approach to emerging markets (Prahalad, 2004). Decisions at the corporate level are typically systemic and involve the actual (and sometimes even future) positioning of the firm and they are generally of more fundamental strategic concern. National Geographic Ventures, a wholly owned subsidiary of National Geographic Society, created a new games division to publish and develop games for major gaming consoles and handhelds, online, and mobile platforms. This innovation was designed to extend its core mission and reach new generations of customers—that is, a strategic innovation with high impact (Markides, 1997). When identifying innovation types along our second dimension of strategic impact, the functional or corporate strategy level, we ask several questions (see Table 1).

3.3. Market impact

Market impact refers to the market sustaining vs. market disrupting impact of innovations. Traditional strategic management has long adopted a competitive orientation as companies attempt to become more effective in a given market (Grant, 2013). Christensen (1997) introduced an approach that complements this competitive orientation in a discussion on disruptive innovations. Initially, the author said that it is *disruptive technology* that drives the creation of new market segments; he later replaced it with *disruptive innovation* due to his recognition that few technologies are intrinsically disruptive or sustaining in character. Rather, it is the business model enabled by the technology that creates the disruptive impact.

Table 1. Evaluating the impact of the three dimensions

Cube Dimensions	Questions for Evaluation
Change Impact	<ul style="list-style-type: none"> ● Is there an incremental step-by-step movement, which is intended to do more of the same better or are new ways of perceiving, thinking, and behaving required? ● Is it a multi-level, qualitative, cultural, and radical change involving a paradigm shift or does change only affect a few dimensions? ● Which types of capabilities are affected by the change process? Does change involve a reconfiguration of dynamic capabilities or does it focus on replicating capabilities in different markets? ● Are capabilities internally developed and procedures gradually changed or are capabilities externally acquired and involve a radical change of absorptive capacity? ● How often is change initiated? Is this routine business or is change the exception?
Strategy Impact	<ul style="list-style-type: none"> ● Is it a strategic or a routine decision? Strategic decisions affect the corporate level of mission and scope; routine decisions affect daily activities. ● Is it a multidimensional or a unidimensional decision? Multidimensional decisions have an impact on the future of the company; unidimensional decisions have an implementation focus. ● Is it an internal or an external decision? Internal decisions are often operational or functional decisions; external decisions focus on what business the firm is in as well as defining long-term goals (i.e., more systemic decisions). ● Does strategic decision-making aim at decisions including diversification, vertical integration, acquisitions, new ventures, the allocation of resources between different businesses of the firm or divestments (corporate strategy level) or is it concerned with the improvement of functional operations, products, or the product portfolio?
Market Impact	<ul style="list-style-type: none"> ● Are innovations completely new to the world, or modifications and second moves into the market? ● Has the value proposition for one or more customer segments changed? ● Have customers used the product before and has experience learning taken place? Has customer perception of products or of the company changed? ● Do innovations affect competitors in the given market or do they lead to new market creation? ● Is the innovation largely built on a technology or on a business model?

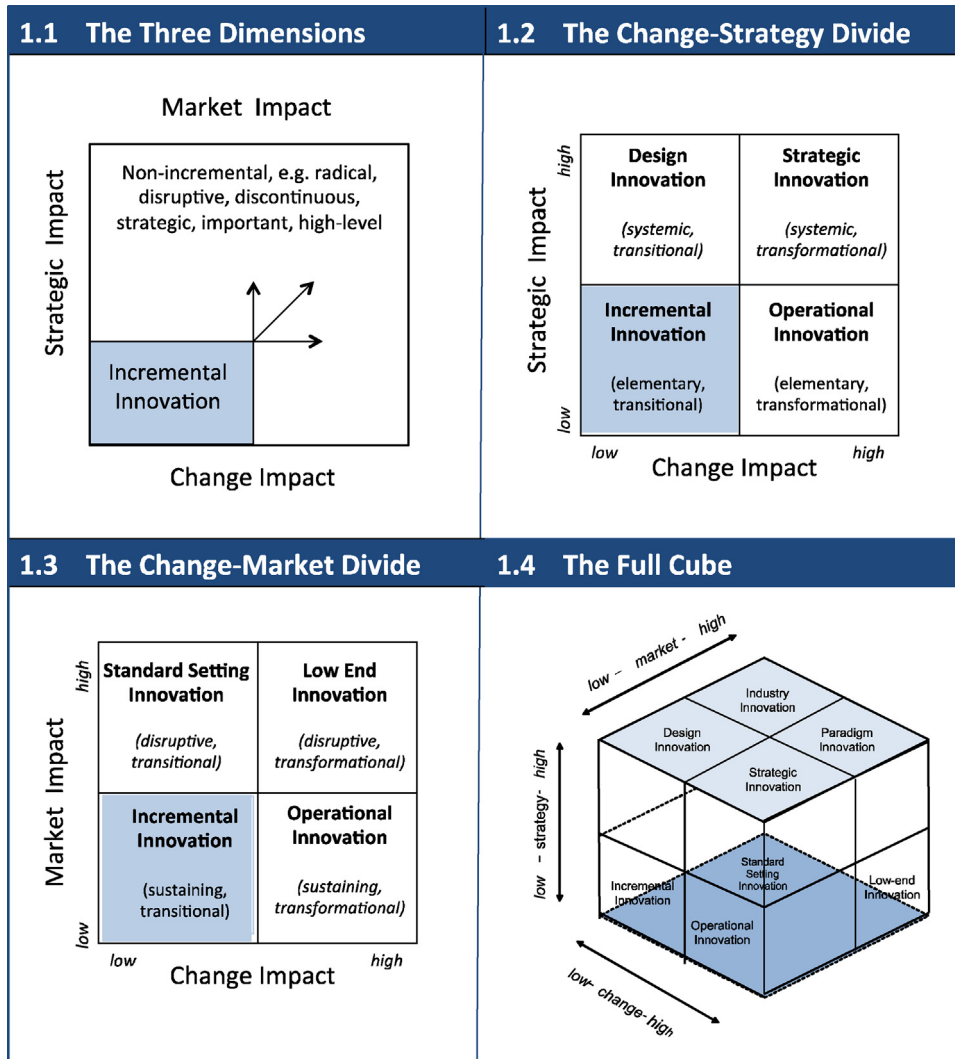
Many disruptive innovations are not based on sophisticated technologies. They emerge instead as novel combinations of existing, off-the-shelf components applied cleverly to a small, fledgling market niche before being scaled up to attract the mass market. A good example of a disruptive innovation is the launch of PCs and their ability to overtake mechanical typewriters in the market. Other products start at a rather low technological level, such as the first walkie-talkies. Often worse than existing products and services and also more expensive, these disruptive innovations appeal to new or less demanding customers. Such low-end disruptive innovations (Christensen, 1997) eventually turn into new market disruptions and target customers whose needs were previously not met by incumbents. Sometimes this strategy leads to the emergence of a new industry or industry segments, such as the netbook market. When identifying innovation types along our third dimension of market impact, that is, disruptive or sustaining market level, we ask several questions (Table 1).

Figure 1 takes a look at all three dimensions together. Step 1.1 illustrates the departure from incremental innovations along the three

dimensions. In Step 1.2, we contrast the dimensions of change and strategy impact, which helps identify three innovation types that differ from incremental innovation: operational innovation, standard-setting innovation, and industry innovation. In Step 1.3, the change dimension matches up with the market impact dimension, which facilitates a perspective on disruptive innovations such as standard-setting and low-end innovation. Step 1.4 uses all three dimensions to identify eight types of innovations: incremental, operational, design, strategic, low-end, paradigm, industry, and standard-setting. These innovation types can span different areas of focus; we could potentially construct different cubes with eight innovation types for technological, process, product, management, administrative, and other innovation foci.

The intersection of change, strategy, and market impact reveals a critical implication: Companies may be forced to develop competing resources and capabilities to succeed with different types of innovation. A further complication arises as some innovation types remain financially unattractive for a notable period because they need time to develop or open new market space, whereas others

Figure 1. The evolution of the innovation cube



provide quick returns. So how should a manager decide which innovation types to develop?

4. The eight innovation types: Case vignettes

To illustrate the cube, we first searched for existing company examples, then applied the questions to synthesize existing information and clarify the companies’ innovations along our three dimensions. We collected data from the press (e.g., *The Economist*, *Financial Times*, *The Wall Street Journal*), corporate websites, consulting reports, and various executive teaching audiences to identify companies. When we reached an agreement regarding the fit of a company, it was used to create a small illustrative case vignette. Our interpretation of the respective dimensions is included in the text (in brackets).

4.1. Incremental innovation: Beiersdorf’s Nivea skincare brand

The Nivea skincare brand is an innovation characterized by intersections of low change impact, low strategy impact, and low market impact—that is, a typical incremental innovation. After the company’s founding in March 28, 1882, the firm’s owner Oskar Troplowitz developed a water-in-oil emulsion as a skin cream with Eucerit, the first stable emulsion of its kind. It provided the basis for Eucerin and later Nivea. Over the years, the company has only marginally changed Nivea’s unique properties [*do more of the same better*], including its blue packing with a white logo. Today, the brand competes in 14 product categories and is available in more than 150 countries; the parent Nivea cream brand remains its core offering. The company gradually extended Nivea as an umbrella brand over other product categories [*sustaining*

innovation that builds on existing products]. In the context of our three dimensions, the Nivea example reveals:

1. The company did not have to change its internal procedures dramatically to bring the product to the market [*transitional changes*] because improving its existing product was the goal [*replication of capabilities*];
2. Major decision-making processes about product and design variants, extensions, and marketing campaigns made the company's overall business model very profitable [*unidimensional, functional focus*]; and
3. The market impact was clearly determined by sustaining and enlarging the market space [*continuous research and development but no radical, disruptive technology*].

Incremental innovation can arrive without any major impact on the three dimensions.

4.2. Operational innovation: Toyota Production System

The Toyota Production System (TPS) is characterized by the intersections among high change impact, low strategy impact, and low market impact, making it a typical operational innovation. With TPS, Toyota has repeatedly outperformed its competitors in terms of quality, reliability, productivity, and cost reduction. Implemented in the 1950s and 1960s by Taiichi Ohno, TPS has become the benchmark for manufacturing and product development in the automobile industry. Processes are constantly being challenged and pushed to higher levels, which enables the company to innovate and improve continually [*innovation takes place in a given market without challenging existing value propositions of the market*]. Interpreting the TPS example according to our three dimensions, we found:

1. The company started with transformational changes to initiate its exceptional production system, which then became deeply embedded in the culture. This made it impossible for others to copy the system on a one-to-one basis [*transformational change which involves an internal paradigm shift*], even after Toyota encouraged other companies to study its manufacturing process and allowed them access to its plants;
2. The procedures affect the operational or functional level of strategy; its competitive

advantages result from more focused activities [*continuous improvement of process elements*]; and

3. The market impact is sustaining, because the business domain has not changed [*internal process efficiency has not led to the creation of a new market*].

Operational innovation can have an important influence on the well-being of a firm, without any major strategic or market impacts.

4.3. Design innovation: Deutsche Post World Net

Deutsch Post World Net (DPWN) sits at the intersection of low change impact, high strategy impact, and low market impact, for a typical design innovation. The conglomerate that became DPWN has survived several upheavals, starting with the first postal reform in Germany in 1989 that separated telecommunications and postal banking from mail services. In 2002, DPWN obtained a majority stake in DHL, a pioneer and worldwide leader in global express shipping, then subsequently bundled all related activities under the single DHL brand. Although the appearance of the company changed due to its acquisition of DHL, that acquisition primarily allowed DPWN to increase its international network by improving the services that have long been at the core of the company's business [*no change in business model*]. Interpreting the DPWN example within our three dimensions, we assert:

1. DPWN has gone through innumerable changes while the essence of the business has remained fairly consistent [*transitional changes*], in that the company still delivers mail and operates a freight carrier system by gradually moving into new markets;
2. Decision making clearly affects the corporate level and thus the systemic core of the company. Through geographical expansion, definitions of the logistics business have been extended and the company has adopted a global player positioning [*new perception of the whole company*]; and
3. The company started with elementary logistics and has continued with them ever since [*sustaining business*]. There have been no recent efforts to disrupt existing markets through more fundamental strategic moves.

Design innovation can exist without any major change or market impacts.

4.4. Strategic innovation: Dell Computer Corporation's internet sales

As a typical strategic innovation, Dell's business model is characterized by the intersection of high change impact, high strategy impact, and low market impact. In its established industry, the company started to challenge its competitors by playing the game in a totally different way. It introduced new value propositions and new methods for purchasing, delivery, and service. The company was the first in the industry to embrace the internet and its role in the server and storage markets. From its inception, Dell has operated as a pioneer in the configure-to-order process, delivering individual PCs configured to customer specifications. This approach revolutionized the value chain, because Dell challenged conventional delivery times and demand supply imbalances. The company also had a clear focus on customer satisfaction and augmented its core product with a range of free services. Looking at the Dell example through our three dimensions reveals:

1. Compared with its competitors, Dell introduced a radically changed business model that depended on different internal procedures [*transformational change*], such that it bypassed traditional retail channels, built products to order, and sold directly through the internet; this led to huge cost savings and close customer integration into the product-building process;
2. Strategic decision making affected the whole company when it focused on internet sales and aligned its corporate decision-making with the resulting requirements [*strategic decisions affect mission and scope of the company*]; and
3. The business model was sustained [*complementing the offer of traditional computer sellers*]. Strategic innovation can exist with a major change and a strong strategy impact but a low market impact.

4.5. Low-end innovation: The Asus Eee PC

The Eee PC netbook by Asus is characterized by the intersection of high change impact, low strategy impact, and high market impact. This typical

low-end innovation caused a low-end disruption, because the performance of existing products overshoot the demand of certain customer segments. These consumers did not want to pay a premium for greater product functionality so they sought cheaper alternatives. In 2007, companies like Sony, Hewlett-Packard, and IBM were still focusing on increasing technological sophistication. Asus introduced its netbook, which was less powerful but addressed the requirements of a community of users searching for 'good enough' quality and low prices. Almost all competing companies followed this trend; by 2008, netbooks had begun to take market share away from notebooks. Interpreting the Asus example within our three dimensions, we note the following results:

1. The company offered a dramatically different value proposition to the market, including new sales and marketing strategies [*transformational change*];
2. Though Asus was a first mover, its initial objective was to complement its core business by enlarging the product portfolio so its decision making affected functional and business unit levels rather than the corporate strategy [*low strategy impact*]; and
3. The introduction of the netbook revolutionized the industry and created a new market segment that threatened the traditional PC industry [*disrupting existing markets*].

Microsoft and Intel even tried to cement netbooks in the low end of the market to protect mainstream notebook PC sales, because they earned lower margins on their own low-cost laptops. Low-end innovation can exist with high change and market impacts but low strategy impacts.

4.6. Paradigm innovation: Olympus's DNA computer for gene analysis

Olympus's introduction of the world's first DNA computer for gene analysis featured high change impact, high strategy impact, and high market impact—a typical paradigm innovation. Unlike a conventional microprocessor, which uses electrical impulses and processes information one step at a time, a DNA computer relies on chemical reactions between fragments of DNA. Because multiple reactions can take place inside a test tube simultaneously, the reaction is the equivalent of massive parallel processing. Since its founding in 1919, Olympus has led the industry in developing medical

innovations across multiple business lines [*innovation as strategy*]. It also has a reputation for pioneering many of the world's firsts, such as the first gastrocamera, the first DNA computer for gene analysis, and the first endoscope system featuring high-definition and Narrow Band Imaging technologies. When we interpreted this example within our three dimensions, we found the following:

1. To develop a completely new skill set in genome informatics, as is required to invent and commercialize the DNA computer, Olympus formed a joint venture—NovousGene—that enabled it to acquire external knowledge to merge it with its existing capabilities [*transformational change*];
2. Olympus had always been an innovative leader in the opto-digital solutions market and had deeply engrained innovation in its business model [*corporate strategy level*]; and
3. Olympus disrupted the existing sphere of digital computers, which alone were insufficient to offer quantitative gene expression profiling [*new market creation*].

Paradigm innovation can exist only when there is a major impact on all dimensions: change, strategy, and market.

4.7. Industry innovation: Napster's peer-to-peer network

In an *industry innovation*, Napster's peer-to-peer network idea involved the intersection of low change impact, high strategy impact, and high market impact. By facilitating direct file exchanges between peers, Napster threatened the established big players in the media industry. Its impact became manifest on May 17, 2002, when it was acquired by German media firm Bertelsmann for \$85 million. Originally founded as a pioneering peer-to-peer file sharing internet service, Napster also emphasized sharing audio files (typically music) encoded in MP3 formats. Although the original service was shut down in response to a copyright infringement lawsuit, it had a lasting impact on the traditional music industry. Rivals soon realized that Napster had fully integrated digital distribution into its sales concept, which made it easy for music enthusiasts to download copies of songs that were otherwise difficult to obtain. Interpreting the Napster example within our three dimensions, we suggest:

1. The required level of change to bring its product to market was transitional in that Napster used a

revolutionary technology but made few changes in operational procedures or market preparing activities [*transitional change*];

2. The creation of Napster involved a strategic decision to introduce a new business model that involved strategic company layers [*systems level*]; and
3. The company created an entirely new industry that radically changed existing value propositions [*market disruption*]. The threat associated with replacing existing industry rules explains the severe actions taken against Napster.

Industry innovations occur with high strategic and market impacts but imply only minor internal changes.

4.8. Standard-setting innovation: Procter & Gamble's wet-layering technology

Finally, Procter & Gamble's (P&G) idea is characterized by the intersection of low change impact, low strategy impact, and high market impact, which makes it a typical standard-setting innovation. The new technology provided a way to place wet paper onto a three-dimensional belt with a patterned honeycomb structure and then dry it with hot air. The resulting material featured a three-dimensional paper structure that was retained. P&G patented this innovation so that it could use it exclusively until 2018. It may even have a more far-reaching impact on the industry's players. The P&G example, according to our three dimensions, reveals the following:

1. The required level of change resulted from transitional moves to constantly improve manufacturing technologies to deliver higher quality, cost-effective products that require fewer raw materials [*change involves only a few dimensions*];
2. The innovation derived from improvements in manufacturing and affected production procedures and product positioning strategies [*functional level*]; and
3. The current paper manufacturing market has not yet been threatened by the innovation, but it should constitute a substantial threat to disrupt the whole industry after 2018, when its patent protection runs out. Thus, standard innovations may foreshadow future industry or paradigm innovations.

Standard-setting innovations can exist with low strategic impact and change impact but high market impact.

5. Managers' interpretations of the cube

Having established the dimensions and cells of our innovation cube, we used this information to interview 16 senior managers in organizations that must innovate (see Appendix). Our objective was to establish whether the three dimensions of our innovation cube (change, strategy, and market) and the resulting cells fit the thought worlds of practicing managers. The key issue is whether managers use the dimensions of the cube in practice and can meaningfully place their innovations in a particular cell.

We first asked managers to define innovation. Without giving them any further prompts, we

wanted to find out what they understood by the word. The results largely reflect the vast heterogeneity of academic research; respondents noted internal innovation (e.g., process of engaging in innovation, pushing limits, creativity), the extent of innovation (small, big, improvement, big idea), external client-focused innovation (value generation, benefit, relationship), innovation outputs (value, market demand, perception), and innovation actions (catch market share) (see Table 2).

After clarifying the managers' understanding of innovation, we asked these respondents whether the three dimensions of the cube made any sense. To establish the extent of their understanding, we asked for examples from their own companies that reflected the different dimensions of the cube. With regard to the change dimension, managers said:

"Any kind of innovation leads to internal change that could be organizational change, change of policies, compensation schemes, motivators, titles, change of power . . . I

Table 2. Managerial interpretations of innovation

Innovation	Examples
Internal process	<ul style="list-style-type: none"> ● Innovation is when you push the limits . . . innovation is at the frontiers . . . if you stay within your parameters, you will never experience innovation. Innovation is about trying to step outside. Either you will get killed, and if you don't, you get a step further. ● Innovation also means changing the processes to match the current reality. ● Innovation is essentially creativity, so advertising IS innovation. If you are not different or new, you don't catch attention.
Extent	<ul style="list-style-type: none"> ● Innovation is to create something completely new from scratch. ● Innovations are ideas about new things people do, create new things . . . ● Innovation is when you create something new or different which can be applied on a big scale or . . . maybe very small. The way you use something can be a small improvement. ● Innovation means to develop an idea how a demand can be better fulfilled through existing services or technologies. ● Innovation is doing new things, doing the same things in different combinations . . . ● Innovation is always bringing something new to existing products or services, doing something better, something that is different from the previous way of doing it.
Output	<ul style="list-style-type: none"> ● Innovation is when the customer believes in me, when he respects my competence and respects the relationship. ● Innovation is developing something new that is not there or the improvement of something existing . . . could be design or thoughts (e.g., philosophers' ideas about democracy), but it needs to bring a benefit. It can be major or minor. ● Innovation is creating a value that did not exist before; it is not a play toy. ● Innovation is when the customer sees the service, the value. ● Innovation is the idea and the implementation of what the market wants or accepts, if people are willing to give money for it . . . if there is something positive that is valuable, that can be used . . . then it is an innovation. ● Innovation is if a company introduces something new for the market. If services or products are introduced to the market that have not been there before . . . difficult to specify objectively, if the market perceives it as new, it is an innovation.
Action	<ul style="list-style-type: none"> ● We were not thinking much about innovation, we were just trying to catch the market. ● Innovation spans the whole organization . . . it is when people have a platform to bring in ideas and these do not get lost . . . where every idea is appreciated and people want to contribute . . .

experienced this with technology when people were doing web stuff . . . and over time that becomes a complete change of the company.”

“If you look at change in terms of impact, we would have different business units with their own processes . . . the influence could be contained within the business unit, it would then have a focused influence. But if this change is going to have an influence across business units (e.g., automated billing, which involves the finance department), by extension this is more profile change.”

With regard to strategic impact, managers said:

“The functional influence you mean, influence of change on the business strategy . . . if it is more profound, it has a corporate effect, then the company would be willing to invest. For instance, we had a project, temperature control containers . . . I think it was a great improvement to the process with strategic interests . . . honestly, but also political interests.”

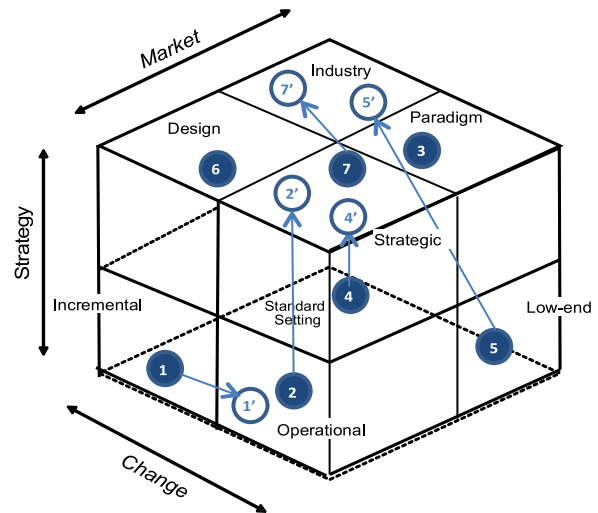
Finally, when asked about the dimension of market impact, managers said that:

“We were on the move toward disruptive markets. Image technology potentially destroys or enhances the radiologists’ competence. When disruptive technology is coming into play now, people do not immediately recognize it as disruptive; I don’t think we are really appreciating how disruptive it could be.”

“That is really creating something new. If you talk about paper-based to paperless systems . . . The electronic medical record changed not only a lot for patients, service providers, and health care provision in general—in terms of costs and benefits—but also affected other industries . . . especially when it came to compatibility . . . and there you had many firms like Siemens or Johnson & Johnson jumping on the new standards.”

In the next step, we focused on the cube’s ability to capture dynamic changes in innovation strategy. To this end, we used the questions developed earlier (see Table 1) to trace changes between innovation types over time (see Figure 2). The full circles represent a clear identification of one innovation type. When these full circles connect to empty circles, it indicates that the interviewees cited a change of innovation types over time. For example,

Figure 2. Innovation types and dynamics in the cube



circle 1 signifies an incremental innovation that, over time, became 1’—that is, an operational innovation accompanied by transformational change. By depicting these movements, the innovation cube reveals dynamic changes as perceived by managers. We report selected examples for each innovation type mentioned in the interviews.

- **Incremental innovation.** Interviewee 1, who worked for a healthcare company, emphasized incremental innovations resulting from constant quality improvements that involve reevaluations of existing procedures and products and benchmarking. These had the potential to turn into an operational innovation if they induced major changes to administrative procedures (see Figure 2, move from 1 to 1’). However, a basic dilemma arose when operational innovations with overly specialized and complex processes conflicted with customers’ need for more flexible solutions.
- **Operational innovation.** Interviewee 2, who had several years of experience in information technology, remarked that operational innovation reflected changes in the sales processes and underlying data access and communication. Eventually, this operational innovation led to a new business model relying on customer relationship management software (2 to 2’). A general problem identified with this operational innovation was the need for transformational changes, due to the loss of previous routines, while still preserving enough stability to act.
- **Paradigm innovation.** From Interviewee 3, a process expert and consultant working on

digitization in a large hospital, we obtained input about a paradigm innovation. The company introduced electronic medical records to enable storage, retrieval, and modification by different people located in different parts of the world—in itself a revolutionary process. One of the big challenges for the company was career related, because flexible access to data conflicted with the notion of expert status and confined knowledge.

- *Standard-setting innovation.* Interviewee 4 illustrated a standard-setting innovation involving the introduction of relational consulting and new revenue standards. This new approach had the potential to become a new business model or strategic innovation (4 to 4'). One of the resulting dilemmas the company faced was the lack of control over interpersonal success factors, which were inherent to this new model, unlike the clear performance parameters of the firm's former product sales consulting model.
- *Low-end innovation.* Interviewee 5, an international technology consultant, referred to low-end innovation in an example of 3-D printing, which could greatly endanger companies like FedEx as items that require physical transport today could be digitized and transferred through the internet. Thus, traditional delivery options would become obsolete and totally new industries may emerge (5 to 5'). Two major issues in the pursuit of low-end innovation for the firm were that the speed of industry change was difficult to gauge, and revenues were highly unpredictable. Thus, there was a need to decide between innovations with highly uncertain returns but eventually high impact or more predictable innovation outcomes with lower impact. Accordingly, the resource investments and return on investments differed widely.
- *Design innovation.* Interviewee 6, from the banking industry, provided an example of design innovation and the associated challenges. The company started to buy existing business models and players from the market. Under the umbrella of a service integrator, different services were included in its portfolio but, ultimately, these solutions did not pay off. The company talked about a pseudo-innovative strategy driven by the need to create networks of suppliers, increase complexity, and achieve end-to-end consulting. One of the big issues for this financial services company was how to balance attractive

innovation breadth through acquisitions with the focused approach required by its customers.

- *Strategic innovation.* Finally, Interviewee 7, a consultant, talked about strategic innovation in drastically changing a hospital's business model to embrace hotel services. This hotel hospital is a strategic innovation, but it also has the potential to turn into an industry innovation—an innovation type that we could not identify in isolation in our interviews (see Figure 2, B4 to B4'). The company did face a challenge in diversifying its services as its increased business scope forced it to go beyond its core competences. Thus, innovation breadth, despite its potential, was difficult to implement.

The feedback and real-life examples extracted from our interviews confirmed the relevance of our cube model with its three dimensions.

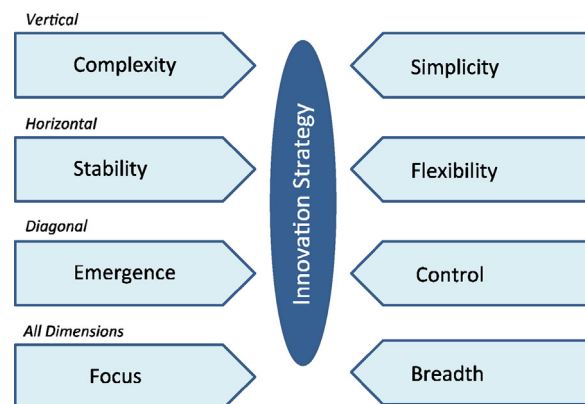
6. The cube in action

While many companies start out with one innovation type, once they grow they are more likely to orchestrate a portfolio of different innovations. Using our cube, we also identified what triggers change between innovation types and highlight the associated challenges and dilemmas managers have to solve (see Figure 3).

6.1. Complexity vs. simplicity

Within the cube, innovations vary in complexity, which may result from inside (higher specialization of employees) or outside of the organization (sophisticated consumer demand). Innovations become more complex if they cannot be understood entirely by one person within a specific domain of

Figure 3. Challenges in the innovation cube



expertise. For example, developing complex software solutions for specific industries often requires the interaction of information technologists, medical doctors, and process specialists. Preparing for these interaction processes can lead to a strategic innovation. Increasing complexity reflects the move to higher strategic impact (i.e., the vertical dimension of our cube). However, driving complex innovations in the firm also might come at the expense of developing simpler, more customer-oriented innovations. Managerial decisions to solve this dilemma should adopt the following practices:

- Compare innovation complexity with customer requirements (e.g., incremental vs. design innovation).
- Ensure that the move to a more strategic level of innovation is consistent with the company's strategy (e.g., operational vs. strategic innovation).
- Identify the potential of the innovation to exert an impact beyond the firm's boundaries (e.g., standard-setting vs. industry innovation).

6.2. Stability vs. flexibility

Within the cube, innovations can imply more stability or more flexibility. Transitions between innovation types are often driven by concrete needs for higher efficiency (e.g., operational innovation) or new solutions (e.g., strategic or paradigm innovation). At the same time, every change process potentially dismantles existing organizational practices, control structures, and cultures. This change often conflicts with the basic human need for continuity and stability. For example, continuous process improvement in the healthcare example implied greater reliability for all those involved while also moving toward operational innovation with more transformational changes and administrative juxtapositions, which created uncertainty. Along the horizontal dimension of the cube, we find that higher levels of change tend to increase flexibility but also increase psychological uncertainty—both on the employee and the consumer side. Managers should therefore rely on the following guidelines:

- Make sure the move toward more flexibility is backed by a safe psychological environment (e.g., incremental vs. operational innovation).
- Reappraise whether visible stability should be preserved rather than interrupted by business

model change (e.g., design innovation vs. strategic innovation).

- Validate the time span for industry shifts and subsequent diffusion throughout a broader target audience (e.g., industry innovation vs. paradigm innovation).

6.3. Emergence vs. control

Within the cube, innovations can have an emergent or a controlled character (i.e., triggered by control and planning vs. experimentation and play). Sometimes, innovations emerge as a pattern of action that develops in an organization in the absence of a specific mission and goals, or even despite a mission and goals. This is not to say that innovations are the result of pure luck but their output cannot always be fully controlled, which is typically the case for more disruptive innovations for which precise planning is difficult. The dominant but not exclusive path in the cube that reflects transitions between emergence and control is along the diagonal dimension, where control decreases the higher the transition to more disruptive innovations (e.g. paradigm, industry innovation but also, to a lesser extent, standard-setting or low-end innovation). Managers can follow these guidelines:

- Check the willingness to take the risks involved in a move toward the back of the cube (emergent disruptive innovations; e.g., from operational to industry innovation).
- Validate the backdrop of increased control that comes along with moves toward the front of the cube (sustaining innovations and more control; e.g., move from standard-setting to strategic innovation).

6.4. Focus vs. breadth

Finally, companies must decide whether to focus on single types of innovations or adopt a variety of them. No firm can adopt the full range of potentially viable innovations in its portfolio but the combination of innovations, accumulated over time, suggests that the composition of a firm's prior innovation activity may influence later innovations. For instance, industry innovations are typically preceded by other innovations, whereas low-end innovations are almost never the end state of innovation development. Knowing about potential trajectories, a firm may choose to focus on innovation types that are closely related, such as cells along one dimension in the cube, or else spread its

(financial) efforts more evenly across all three dimensions. Managerial decisions to solve this dilemma can follow these guidelines:

- Ensure that there is no danger of competence erosion (when sticking to one innovation type).
- Verify ongoing processes of core dynamic capability development (when broadening the innovation scope).
- Identify the relatedness between innovation types and restrict deviation among all dimensions (when broadening the innovation scope).

Following these simple guidelines helps to discuss the feasibility of an organization to follow different patterns of innovation development. While the above refers to general guidelines, certain industries may favor particular trajectories, such as high-reliability organizations (transportation, hospitals, construction) sitting at the forefront of the cube to sustain established practices while only carefully exploring market-disrupting innovations. On the other hand, research-driven organizations (smaller IT-companies, biotechnology) are more likely to move along the vertical paths of the cube (for example starting from low-end innovation) to develop both high strategic and high market impact innovations (see again the Napster example). While many companies strive for innovation types with higher impact, the potential of incremental innovation should not be underestimated, especially in subscription-based business models in industries where functionality improvement is key (e.g., online learning, gaming, software).

7. Summary

The innovation cube presents an approach to master the major challenges associated with categorizing and selecting innovation types. These challenges are pervasive in literature on innovation. Managing innovation has always been a difficult business, not least because of its fuzziness. We have explored how innovation types can better be classified along three dimensions. The resulting innovation cube offers a tool for diagnosis that provides managers with a simple, well-arranged instrument to identify, compare, optimize, and redesign innovation strategies. It also helps identify valuable combinations of innovation types by balancing underlying dilemmas, which leads to intelligible, practical managerial implications.

The results, from both our illustrative case vignettes and our managerial interviews, showed that the theoretically developed dimensions match practical business activities; the eight cells with ideal types of innovation are of high practical relevance. If managers place their innovation types in the cube, they will gain a tool that facilitates competitive benchmarks and improvements.

Appendix. About the research

The ideas put forward in this article were developed from different sources. First, we drew on several years of conducting executive seminars and MBA-programs on innovation and innovative approaches to strategy and marketing. Thus, in partnership with several companies and managers, we identified pressing demands and problems. We were also fortunate to discuss ideas for this article with a large group of participants in workshops and training seminars. Second, we interviewed 16 managers spanning different industries (e.g., financial services, solar energy, advertising, pharmaceuticals, television, automotive, IT, healthcare, consulting), countries (e.g., Germany, France, the U.S., Syria, India, the U.K., Turkey, Africa, China), and functions (e.g., functional experts in business development, marketing, IT consulting; business unit leaders; CEOs).

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