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Design and the Economy of Choice

Abstract This article argues that we are in a transition from an economy of scale to an economy of choice. It presents the historical context of how design relates to the economy of scale, and why underlying forces of that economy reduced the relevance of user experience and focused design practice on appearance. It discusses why manufacturers now meet the desire for more consumer choice through over-production. It explains how this leads to an "innovation gap" in which companies know how to make anything without knowing what to make.

This article presents a model of the core capabilities of design, showing how they relate to economically viable ways of providing choice. The model involves a closer fit with emerging production processes related to platforms, the maker movement, and open innovation. In this model, such capabilities provide more exploratory and responsive ways to create innovation than a reliance on the predictive methods inherent in the economy of scale. This leads to a "whole view" model of innovation.

The model proposes a way of "sketching" innovation initiatives that involves fundamental questions: What is the offering? Who is it for? Why will it create value? How will organizations make it a reality?

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Value Creation
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Billion-Dollar Bets

During the mid-1990s, executives at GM and Toyota each made a billion-dollar bet. Eiji Toyoda, Toyota's chairman in Nagoya, Japan, and the patriarch of its ruling family, was worried about the future of the automobile. In response, Yoshiro Kimbara, then head of R&D, set out to develop a new car that could be sold globally. He had two goals: create new ways of producing the car, and achieve dramatic improvement in fuel economy. Takeshi Uchiyamada, a senior engineer and an expert in noise and vibration control, was selected to lead the project. Toyota gave him four years and 200 million yen to develop an engine that was three times cleaner and twice as efficient as the current engines.

Uchiyamada had no idea how he was going to do this. Even if he achieved this goal, it seemed like a road to nowhere: marketing research said people would want larger cars for the foreseeable future. One only needed to look on American streets to see the obvious preference for large vehicles and the clear lack of concern for fuel efficiency. Creating an unwanted engine, no matter how sophisticated, seemed like an assignment to end a career.[1]

Meanwhile, executives at GM headquarters in Detroit had the same view of American streets being increasingly populated with ever-larger SUVs. They also saw the numbers predicting an increase in sales of large vehicles, and with full confidence and optimism, they bought Hummer.[2]

In hindsight, with Toyota's Prius becoming an icon of sustainability and with GM's divestiture of Hummer and eventual bankruptcy, it seems that Toyota's bet was obviously right, and that GM's investment was dubious. But exactly the opposite was true. The management methods created in the twentieth century to help companies predict markets gave GM executives the confidence to follow numbers and make a safe bet. In this context, Toyota's decision was high-risk.

The problem was that GM was looking at conventional data that they were able to gather, while ignoring the public's nascent yet unspoken and unmeasured concerns about sustainability and its emerging desire to spend less on fuel. Analysts could count the number of people saying they wanted larger cars, but they had no way to measure daily actions indicating a burgeoning sense of environmental responsibility. Consumers were not lying when they said they wanted larger cars. What is an executive to do when increasingly sophisticated consumers do not clearly know what it is they truly want? Bob Lutz, then vice chairman of GM, said that hybrid engines were an "interesting curiosity."[3]

At that time Toyota was recognized as the industry leader in manufacturing, but thought of as a follower in design and technology – albeit a fast one.[4] How could Toyota create multiple technical innovations and design an iconic car in so little time? How could GM executives be off course by 180 degrees when they could see the growing interest in environmental responsibility and sustainability – and actually lived in what would become the primary market for the Prius? With all the resources available to GM's many intelligent executives, who have degrees from the best schools of engineering and business, why was it so difficult to predict what cars to make?

The Quest for Certainty

During the 1950s and 1960s, the US auto industry was at its height. All of the companies had adopted the platform-creating theories and processes first deployed on a large scale by Alfred Sloan while he was CEO of GM.[5]

Before Sloan developed this approach, it was standard practice for the development of a new model to require that all parts and components be new. This meant teams would work on a new engine, new transmission, new chassis, and other expensive components. With platforms, however, the most expensive

1 For the history of the Prius, see Adrian J. Slywotzky and Karl Weber, *The Upside: The 7 Strategies for Turning Big Threats into Growth Breakthroughs* (New York: Crown Business, 2007). See also Hideshi Itazaki, *The Prius that Shook the World: How Toyota Developed the World's First Mass-Production Hybrid Vehicle* (Tokyo: Nikkan Kogyo Shimbun Ltd., 1999).

2 Gregory L. White, "GM Buys Hummer Brand Name, May Offer Broader Range of SUVs," *The Wall Street Journal*, last modified July 1, 1999, http://www.wsj.com/articles/SB93078398275940304.

3 Chris Isidore, "GM Executive Lutz Argues Critically Acclaimed Hybrid Compacts Like Toyota Prius Are Bad Business," CNN/Money, last modified January 6, 2004, http://money.cnn.com/2004/01/06/pf/autos/detroit_gm_hybrids/.

4 For information on Toyota's capacity as a manufacturing firm, see Jeffrey Liker, *The Toyota Way: 14 Principles from the World's Greatest Manufacturer* (New York: McGraw Hill, 2004). See also Toyoda, Eiji. *Toyota: Fifty Years in Motion* (Tokyo: Kodansha International, 1987); James P. Womack, Daniel T. Jones, and Daniel Roos, *The Machine that Changed the World* (New York: Simon and Schuster, 1990). The crucial differences here are not automobiles or platforms, but the culture of the automobile companies that create innovative automobiles and manufacture them. See also David Halberstam, *The Reckoning* (New York: Avon Books, 1986).

5 Alfred P. Sloan, *My Years with General Motors* (New York: Doubleday Currency, 1990 [1963]). See also: David Farber, *Sloan Rules: Alfred P. Sloan and the Triumph of General Motors* (Chicago: University of Chicago Press, 2002); and Peter F. Drucker, *The Concept of the Corporation* (Rutgers, New Jersey: Transaction Publishers, 1993 [1946]).

components in a car are shared among a few models. Instead of a company needing 15 different engines for 15 different models, five engines could cover the 15 models. The standardized use of expensive components across a number of automobiles proved very successful.

Indeed, this was one of the key methods that enabled GM to pass Ford in the market and become the largest company in the world.[6] Despite this advantage, platforms also made cars much more alike. American consumers had the choice between different brands and styles; they could choose among degrees of sporty cars versus family-oriented cars, and among basic versus luxury makes. Even so, they had essentially no choice regarding the size and fuel efficiency of the vehicles.

GM had several brands, including Chevrolet, Pontiac, Oldsmobile, Buick, and Cadillac. The company promoted many models of each brand as meaningfully different one from the next. In reality, several models shared a few platforms. The result was that they were more or less the same. Within this limited range of choices, market researchers could trust the answers consumers gave to their questions. When the automobile market was stable, without disruptive technologies or disruptive business models, executives could accurately predict what their consumers would buy. They could therefore decide what their factories should make. They had achieved the quest for certainty.[7]

But a long-term quest for certainty carries major risks. History shows the continual and generally disruptive development of new inventions, new methods, and new frameworks. When a major shift in technology, economics, or the daily life of human beings occurs, they need new ways of seeing and new ways of acting.

In the middle of the 1800s, for example, it became evident that the transcontinental railway systems of North America could not function with reliable schedules if every town remained on local time. In response, the leaders of the major railroads in Canada and the United States met in Chicago in October of 1883 to adopt standard time zones for the continental US and Canada. Europe also experienced this problem. British Railways had adopted London time in the 1840s, and a changing world saw the need for coordinated time; the ever-increasing global sea trade between and among maritime empires raised questions that could only be settled by establishing a common prime meridian. Soon after the Chicago meeting, experts from around the world met in Washington, DC, to determine a prime meridian and global time.[8]

Until those conferences, local time meant that noon occurred when the sun stood over the church steeple at the center of town or the town hall clock tower. But noon shifted minute by minute, inch by inch as the sun passed from dawn till dusk around the planet. Trains lefts Chicago at one time and got to Denver at another – and people who set their clocks by the church steeple sometimes missed trains, while trains might not connect. A key element of the modern world had been set in place.

As organizations shifted to the large scale of the twentieth century, they needed new frameworks and methods to ensure expected returns on the increasingly large investments in huge production facilities. In the era after World War II, factories, warehouses, delivery channels, and media grew to unprecedented scale. To mitigate the risk of huge investments in production capabilities, executives needed new tools to predict various dimensions of their businesses. These tools included ways to manage money, predict markets, identify competition, and operations.

An example of such a tool is the use of a company budget for planning the upcoming year, rather than simply analyzing the past year. In 1922, James O. McKinsey, an assistant professor of accounting at the University of Chicago, published the landmark book *Budgetary Control*.[9] In this book, McKinsey outlined a three-part framework for the use of budgets:

6 Kuhn, Arthur, *GM Passes Ford, 1918–1938: Designing the General Motors Performance Control System* (University Park, Pennsylvania: Pennsylvania University Press, 1986).

7 See for example "Roger Martin on Validity vs. Reliability in Business Strategy, Institute of Design Strategy Conference, May 2007," vimeo video, posted by IIT Institute of Design, May 2007, https://vimeo.com/5080081. Martin provides the foundation for this argument.

8 For a more detailed account, read Clark Blaise, *Time Lord: Sir Sandford Fleming and the Creation of Standard Time* (New York: Vintage Books, 2002). See also David Landes, *Revolution in Time: Clocks and the Making of the Modern World* (Cambridge, Massachusetts: Belknap Press of Harvard University Press, 1983).

9 James O. McKinsey, *Budgetary Control* (New York: The Ronald Press Company, 1922).

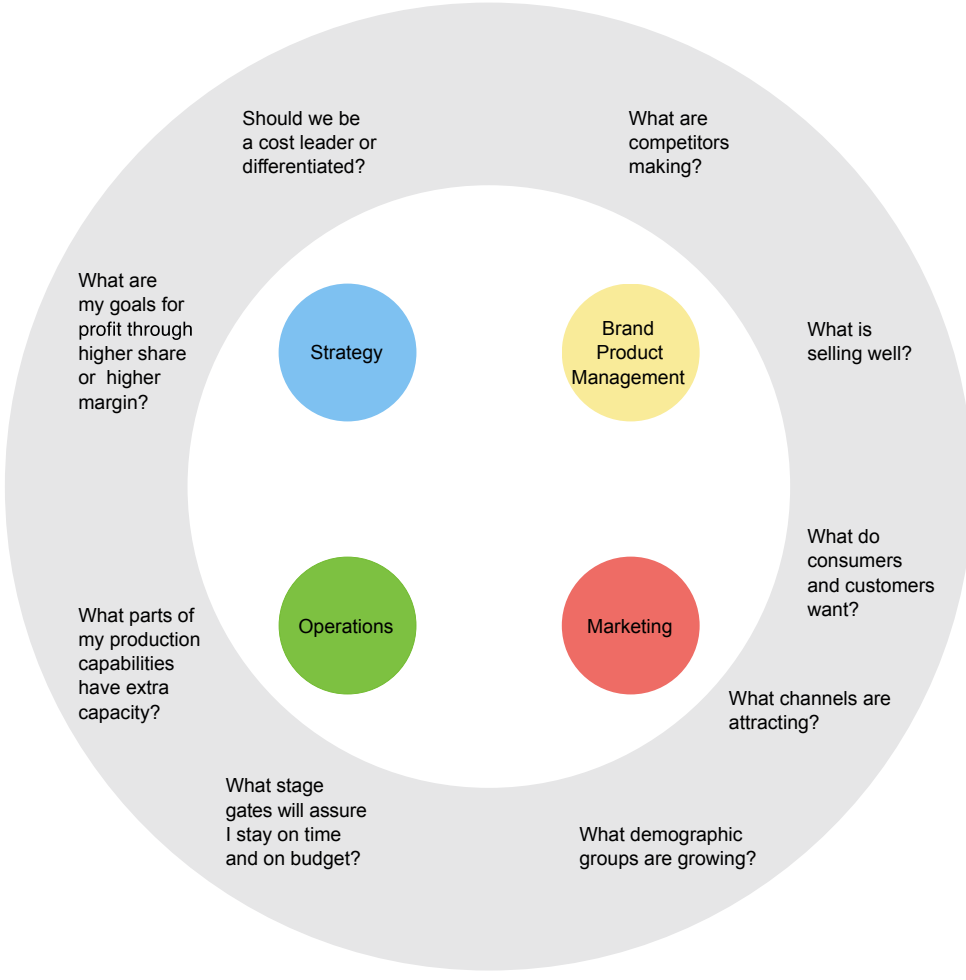

Figure 1 A set of standard questions has evolved, shown on the perimeter of the adjacent diagram, that is readily recognized by any manager who works for any mid- to large-sized company. Notice how the questions are very good if the goal is innovation based on what exists today.

1. *Monitor the operations of separate departments such as sales and production.*
2. *Coordinate the operations of departments into a whole business.*
3. *Note future conditions and business cycles and shape plans to meet these conditions he called "forecasting" or "business predicting."*

McKinsey recognized that these activities were related; various organizations already practiced them in informal ways. He noticed the patterns underlying these informal practices, developing a general framework to explain those patterns. In doing so, he made it easier for executives to lead organizations, easier for students to learn new processes, and easier for researchers to build on prior work. The idea of using the budget for "business predicting" captured the attention of executives. The demand for McKinsey's services led to the creation of McKinsey & Company.

The attraction of executives to frameworks that allowed them to understand and plan for the future was understandable. Organizations were increasingly required to make large, long-term bets that were an intrinsic part of the substantial and expensive production facilities at the core of their operations.

There are numerous examples of academics and others defining new frameworks for managing twentieth century economies of scale. These include Robert Merton, a Columbia University professor who invented the process of gathering potential customers to discuss concepts for a new product in the 1940s, as opposed to relying solely on the guesses of company managers. Another was Harvard University professor Michael Porter's theory of corporate strategy, developed in the 1970s.

The economy of scale changed how companies were organized and how they competed. It caused managers to ask new questions and create new frameworks and methods to answer them (fig. 1). More than this, it required the creation of entirely new fields; public relations, advertising, merchandising, mass media, and the design field called styling were invented to get people to consume the output of the hugely efficient factories.

Inventing new methods and even new fields was a costly investment for industry. This investment was warranted. Millions of people bought things that were fundamentally the same in this new economy of scale, an economy that powered a new form of industrial revolution.

Running Forward, Looking Backward

It is impossible to predict the outcome of adopting new transformative technologies. We can nevertheless be sure that initial attempts to create products and services based on emerging technologies will mostly fail. While companies can envision the tangible benefits that a new technology will bring to people and companies, they see these in terms of the existing ways people live, and the current ways companies make money. They typically do not see how the new benefits create new dimensions in daily life and ways to create value. Companies try to use frameworks from the past to understand the people and companies of the future. As a result, they often invest in products and services that fail.[10]

Eventually, new frameworks emerge to explain how users, businesses, and technology adapt, and find a mutually acceptable level of fitness. This was visible in the second industrial revolution. Driven by such technology breakthroughs as the Bessemer steel process, electrification, mass production, the assembly line, and telephone and radio broadcasting, we created production facilities, companies, and markets of unprecedented scale; yet many failures occurred before industry found fitness and balance. An early idea for using the telephone involved enabling people to hear concerts from neighboring cities. Reframed as a tool for talking, another idea involved placing one telephone on every city block. The persistence of old frameworks obtains: we still call such tools "telephones," although they are largely used to transmit electronic data in one form (or format) or another.

Similarly, the "horseless carriage" began its life at the center of technological experimentation as an expensive toy for wealthy hobbyists. Ford developed a new assembly process, convinced that the emerging middle class would buy standardized cars. With such business innovations as a dealer network, a savings bank for employees, and a vertically integrated supply chain, Ford reorganized great parts of modern life around the automobiles that he manufactured at the River Rouge plant. At the same time, he gave a new name to a form of industrial economy: Fordism.

The latest iterations of the Industrial Revolution have enabled hundreds of millions of people in the twentieth century to live a middle-class life. While the meaning of the term "middle class" has many nuances, depending on nation, income level, assets, and habits, 13% of the world's population is now in the middle-income tier, with an additional 9% in the upper middle-income tier.[11] At the same time, a massive number of people internationally have risen out of poverty to attain low-income status. With a total world population of 7.3 billion,[12] that means a global middle class of more than 1.6 billion people, along with a massive low-income group including more than 4 billion people emerging from poverty.

In the shift from a world where poverty was the general condition to the world in which we live today, the Industrial Revolution created a consumer-driven society. This, in turn, enabled companies to grow, creating and distributing new wealth while creating jobs and opportunities for the world's industrial societies. At the same time, this has created unintended consequences, with

10 For examples from the Middle Ages to modern times, see Jean Gimpel, *The Medieval Machine. The Industrial Revolution of the Middle Ages* (London: Pimlico, 1992); Arnold Pacey, *The Maze of Ingenuity: Ideas and Idealism in the Development of Technology* (Cambridge, Massachusetts: MIT Press, 1992); Henry Petroski, *The Evolution of Useful Things* (New York: Vintage Books, 1994); Patrice Flichy, *Dynamics of Modern Communication: The Shaping and Impact of New Communication Technologies* (London: Sage Publications, 1995); Carolyn Marvin, *When Old Technologies Were New: Thinking About Electronic Communication in the Late Nineteenth Century* (New York: Oxford University Press, 1988); Scott Berkun, *The Myths of Innovation* (Sebastopol, California: O'Reilly Media, 2007).

11 Rakesh Kochar, "From 2001 to 2011, Nearly 700 Million Step Out of Poverty, but Most Only Barely," *Pewglobal.org*, last modified on August 13, 2015, http://www.pewglobal.org/2015/07/08/a-global-middle-class-is-more-promise-than-reality/#who-is-middle-income, p. 6.

12 United Nations Department of Economic and Social Affairs Population Division, *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables* (United Nations, 2015), http://esa.un.org/unpd/wpp/Publications/Files/Key_Findings_WPP_2015.pdf.

problems that were first identified in the 1970s.[13] It is only now, however, that the magnitude of these problems is becoming clear. A consumption-based economy leads to the unsustainable use of natural resources, as well as creating anthropogenic climate change. While corporate growth creates wealth, unchecked corporate growth can lead to impoverished citizens, even while such growth may be good for the GNP.

Twentieth-century innovations were driven by cheap oil, fixed production, and economic standards ignoring difficult-to-measure, intangible values: what is the value of clean air? What is the cost to society of poor schools? In contrast, future innovations will often be driven by cheap information and flexible production systems, and the organizations that produce them will track both tangible and intangible values. Many of these organizations will also be in the not-for-profit and public sectors.

But we are only just beginning to understand the nature of how our lives fit into this future. We urgently need frameworks that let us face forward to get a clearer view of the social and economic dimensions of our future world, and especially how they might interact with emerging technologies.

The transformations taking place today seem as profound and consequential as the changes that took place when the industrial age turned the world upside down one hundred years ago. This time, however, transformation is characterized by a shift from an economy of scale to an economy of choice: driven by flexible production and new business models, consumers have more options for everything — how they live, how they work, how they learn, and how they play.

With unlimited permutations of choice and behavior among consumers, it has become increasingly difficult for companies to predict what consumers want.[14] Lenses that were reliable in the relatively stable twentieth century are not strong enough to focus on the blurring world of changing technologies, business models, and consumers' daily lives. Though still important, such issues as defining market segments, optimizing operations, and the other management processes invented in the last century are part of the price of market entry, rather than a way to succeed within it.

Design, however, does offer companies a way to win in this time of extraordinary choice. Considering holistic systems, recognizing intangible value, and reframing problems are among the ways that design creates value for business today.

Reframing Design

The next time you are in New York, visit the constructivist collection at the Museum of Modern Art. Look at two small paintings by László Moholy-Nagy, *Construction in Enamel 2* and *Construction in Enamel 3*. Moholy-Nagy created these in April 1923, shortly after he joined the Bauhaus faculty in Weimar.

The paintings are beautiful, but we are looking at them for a special reason. How Moholy-Nagy made them is what interests us: the artist did not himself apply the paint to these works. Instead, he gave precise specifications for production by telephone to fabricators at a local enamel factory.

Moholy-Nagy's approach to these works differed radically from the typical artistic process of the twentieth century in which a single person conceives, sketches, and makes the artifact in a single stream of activities leading from one to the next. In earlier centuries, when art was among the artisan craft guild traditions, some masters created sketches or engaged in some tasks related to an artwork while assigning other tasks to apprentices. This was also the case in studios, where the same master might undertake works of art, useful artifacts, architecture, jewelry, and other projects. Moholy-Nagy was probably the first artist to

13 With respect to resources and sustainability, the authors of the 1972 Club of Rome report "Limits to Growth" have studied these issues in a comprehensive series of reports for over four decades. See Donnella H. Meadows et al., *The Limits to Growth. A Report for the Club of Rome's Project on the Predicament of Mankind* (New York: Universe Books, 1972); Donnella H. Meadows, Jørgen Randers, and Dennis Meadows, *The Limits to Growth: The 30-Year Update* (White River Junction, Vermont: Chelsea Green Publishing, 2004); Jørgen Randers, *2052: A Global Forecast for the Next Forty Years* (White River Junction, Vermont: Chelsea Green Publishing, 2012). See also Daniel Bell, *The Coming of Post-Industrial Society: A Venture in Social Forecasting* (New York: Basic Books, 1999 [1973]). From the viewpoint of a larger social perspective, this landmark 1973 study remains a benchmark. Peter Drucker has appraised these issues from the perspective of managerial innovation and economics, updating his thinking regularly since the appearance of his first major book in 1939. Three books are particularly relevant to this article: Peter F. Drucker, *The New Realities* (Milton Park, UK: Routledge, 2011 [1989]); Peter F. Drucker, *Post-Capitalist Society* (Milton Park, UK: Routledge, 2011 [1993]); and Peter F. Drucker, *Managing in the Next Society* (New York: St. Martin's Press, 2002).

14 Barry Schwartz, *The Paradox of Choice: Why More Is Less* (New York: Harper Perennial, 2004).

give a verbal description to workers who used industrial processes to translate and execute an artwork, when the workers themselves did not aspire to becoming artists or artisans. Moholy-Nagy had unbundled the activities of conception and specification from the activity of fabrication.

Taking a process that once seemed a single continuous flow, breaking it into steps, and using the steps in new ways is one of the issues that Moholy and other Bauhaus masters explored. In creating these two enamel paintings, Moholy seemed to ask a question: "If mass production overtakes hand-fabrication, how does this change the nature of conception and specification?" This question was core to the emergence of design as a field distinct from art and craft.

Several key changes took place in the context of how products and information were made and used in the industrial economy that grew over the different phases of the Industrial Revolution. In manufacturing, production capacity changed as waterpower gave way to coal and finally to electricity. Where small factories formerly often had little more capacity than was needed for local or regional markets, the massive capacity of mass production led to national markets. Large-scale department stores, catalogue stores, and national chains emerged to meet the needs of an urban middle class. In many ways, such fields as marketing and design answered the need for new type of specialists in a new economy.

As manufacturers began to serve dispersed markets that were distant to them and less familiar, these new specialists helped to bridge the growing gap between makers and users. Marketing and design explained the needs and desires of consumers to manufacturers who made things to meet the needs of as many people as possible.

The Bauhaus and the Deutscher Werkbund are examples of the kinds of institutions that catalyzed the emergence of design as a separate field. Architects, craftsmen, and artists joined together to explore how the mass production of objects would influence social patterns, cultural values, economics, and other aspects of daily life, often asking how technology, mass media, and information systems would play a role in the process. They also explored new ways of working in which they would conceive and specify artifacts when others would use industrial processes to fabricate the final product.

Throughout history, craftsmen have had a deep and holistic understanding of the relationship between what should be made for local users, why it would be of value, and how slowly evolving traditional technology would shape the artifacts they made. They had a sense of the comfortable fit that created a seemingly natural bond connecting an object's function and aesthetics, the people who would use it, why it would make economic sense, and how material and processes would make it real.[15]

Their informal sense of these key issues can be stated more formally as four fundamental questions (see fig. 2):

What should I make?
Who is it for?
Why will it create value?
How should I make it?

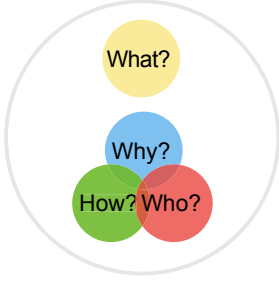

Figure 2 The four key questions.

These questions were core issues in crafts long before industrialization. Today, they are central to the thinking of entrepreneurs who start new ventures, and entrepreneurs within large organizations who seek innovations leading to higher than average profits. These questions may seem simple, but they are often forgotten in the quest to answer the questions shown in fig. 1.

The increased speed and scale that Moholy-Nagy and his contemporaries witnessed in the world around them made it clear that they would have to expand their knowledge and methods beyond their traditional craft.

15 The nature of craft and craftsmanship has once again emerged as a field of inquiry in the contemporary context. Sociologist Richard Sennett explores these issues in two books: Richard Sennett, *The Craftsman* (New Haven, Connecticut: Yale University Press, 2008); and *Together: The Rituals, Pleasures, and Politics of Cooperation* (London: Penguin, 2012). Philosopher and craftsman Matthew B. Crawford has also explored these issues from another perspective. See Matthew B. Crawford, *Shop Class as Soulcraft: An Inquiry into the Value of Work* (New York: The Penguin Press, 2009); and Matthew B. Crawford, *The Case for Working with Your Hands: Or Why Office Work is Bad for Us and Fixing Things Feels Good* (London: Viking, 2011).

When craftsmen tried to work in the new context, the consequences of their decisions occurred at an unprecedented speed and scale. The nature of their problems changed as they designed new types of things to be made by machines rather than with their hands, products to be sold in far-flung and distant mass markets rather than to the individuals who were their neighbors. The context of making, using, and creating value had changed.

New Challenges Lead to New Applications

A cursory glance at the history of design practice in the last half of the twentieth century shows how changes in the contexts of business, use, or production would lead to new design applications.

Growth in mergers & acquisitions led to corporate identity

By the 1960s, it was clear that being the largest company in an industry had competitive advantage. Local companies became national, and national companies became international. In some instances, corporate strategy meant dominating a single industry. In others it meant occupying multiple industries with different financial cycles. The desire to be as large as possible, as soon as possible, led executives to grow through merger and acquisition rather than organically. While newly merged companies – frequently operating in different industries and varied geographies – may have fit together from a financial perspective, they often made for odd couplings in terms of culture and capability.

Leaders of huge companies increasingly focused on stock price rather than on products and services.[16] Business theorists claimed that the purpose of business was to create shareholder value. Corporate presidents and CEOs talked to analysts on Wall Street more than they talked with the people who used their products.

In this context, companies called on designers to create new names and identity systems. The appearance of products became merely the entry cost of doing business rather than a differentiator. Massimo Vignelli, Jay Doblin, Ralph Ekerstrom, and others at Unimark International; Wim Crouwel at Total Design in the Netherlands; Ivan Chermayef and Tom Geismar; and Gordon Lippincott at Lippincott & Margolies set new standards for creating systems that designed products, communications, buildings, and nomenclature systems for everything from products and services to the name of the company itself.[17]

Emphasis on marketing and finance while ignoring quality led to design for manufacturing

In the 1980s, business challenges in the United States began to shift again. Companies had become primarily focused on product appearance. At the same time, their main focus turned to the financial and accounting activities enabling mergers and acquisitions,[18] such that they neglected the technical quality of their products.[19]

In the meantime, Toyota and Sony were proving to American consumers that small, low-cost products from innovative companies could function as well as their high-end counterparts. In response, industry turned to design. They engaged designers to work more closely with manufacturing engineers. The goal was improving the technical quality of products, whether basic offerings or luxury goods.

Embedding computers in media and things led to interaction design

At the same time, computing technology was being directly integrated into products and media. While working on the GRiD Compass in the early 1980s, Bill Moggridge and Bill Verplank at ID2 realized that the most important design aspect

16 Devra L. Golbe and Lawrence J. White, "A Time-Series Analysis of Mergers and Acquisitions," in *Corporate Takeovers: Causes and Consequences* (Chicago: University of Chicago Press, 1988), 265–310.

17 Philip B. Meggs and Alston W. Purvis, *Meggs' History of Graphic Design* (Hoboken, New Jersey: John Wiley & Sons, 2011).

18 See Bryan Burrough and John Hellyer, *Barbarians at the Gate: The Fall of RJR Nabisco* (New York: Harper Business, 2009 [1990]). This classic story involved the attempted leveraged buyout of biscuit maker RJR Nabisco by CEO Ross Johnson. See Michael Lewis, *Liar's Poker: Rising Through the Wreckage on Wall Street,* 25th Anniversary Edition (New York: W. W. Norton, 2014 [1989]) for another classical account about the financial gyrations of the 1980s.

19 This problem also lies at the heart of the collapse of the American automobile industry in Halberstam, *The Reckoning*.

of their product was its software interface, not its physical form. It was at this time that they coined the term "interaction design."[20]

To streamline the performance of what had traditionally been the domain of "print" offerings, Hugh Dubberly, Doris Mitsch, and Clement Mok from Apple Computers were among the first to create interactive media offerings. It soon seemed normal for designers to set the parameters that defined the way that people would interact with information and products. The end user made the final design choices by selecting the particular functions and features that met immediate personal needs.

Too many choices and features led to user research

In addition to information and products beginning to react and be complicated, consumers and users were faced with an unprecedented number of choices. Together, these changes caused an underlying power shift from individual producers to consumers. It became key for organizations to understand people's needs and aspirations more deeply than people understood about themselves. To find that depth, innovators turned to ethnography, a set of methods created by anthropologists to understand unfamiliar cultures in foreign lands.[21] Companies now had consumers with so many choices and such increased variety in their patterns of daily life that they were essentially members of a foreign culture.

John Seeley Brown, Chief Scientist at Xerox Corporation and Director of its Palo Alto Research Center (PARC), was the first business leader to bring ethnography into the corporate world in a significant way. In the early 1980s he was leader of the Cognitive Systems Laboratory at PARC. Lab scientists were exploring the nature of collaborative work, different styles of human interaction with information, and other fundamentals of human-computer interaction. These factors had become important; computing was increasingly embedded in products and systems used by people without any technical knowledge. To meet this challenge, Brown hired Lucy Suchman, then an anthropology professor at the University of Michigan. Her assignment was to bring ethnographic methods to a lab staffed by scientists. Suchman's work at PARC added to the body of knowledge of ethnographic methods, setting the stage for user observation in companies. It led to her 1987 book *Plans and Situated Actions*, one of the key foundations of the emerging field of Human-Computer Interaction.[22]

Suchman's work at PARC demonstrated the value of anthropology to the design field, while design and innovation realized the value of ethnography and ethnographic methods; a significant illustration of this was practiced at Rick Robinson and John Cain's consulting firm E-Lab, which used applied ethnography to help companies understand their users.

Donald Norman, experimental psychologist and cognitive scientist at the University of California, was and remains a seminal figure in design and user research. First published in 1988, Norman's *The Design of Everyday Things* provides many of the concepts and frameworks used in the fields of design and computer-human interaction today.[23]

The ability to make anything led to strategic design

The 1980s and 1990s saw the rise of flexible manufacturing and global supply networks. These enabled companies to meet the varying needs and desires of consumers and customers; previously governed by the rules inherent in the economy of scale, companies began adapting to a world governed by different rules in the new economy of choice.[24]

This capacity came at a price: it led to an overabundance of offerings. As executives began to realize that they could make anything, they also came to understand that they were unsure about what to make. They turned to strategic design to help them define new offerings and new businesses. Larry Keeley and Jay Doblin at

20 This is based upon a conversation between Bill Mogreridge and me in January 1983.

21 See, for example, Susan E. Squires and Bryan Byrne, eds., *Creating Breakthrough Ideas: The Collaboration of Anthropologists and Designers in the Product Development Industry* (Westport, Conn.: Bergin and Garvey, 2002); Wendy Gunn, Ton Otto, and Rachel Charlotte Smith, eds., *Design Anthropology: Theory and Practice* (London: Bloomsbury Academic, 2013).

22 Lucy A. Suchman, *Plans and Situated Actions: The Problem of Human-Machine Communication* (Cambridge: Cambridge University Press, 1987).

23 Donald A. Norman, *The Design of Everyday Things: Revised and Expanded Edition* (New York: Basic Books, 2013 [1988]).

24 Patrick Whitney, "People, Not Markets," *American Center for Design Journal* 6, no. 1 (1992); Whitney, "End of Mass Innovation," *IDSA* 5, no. 2 (Spring 1986).

Doblin Group, and Keith Yamashita at Stone Yamashita formed high-profile firms that focused exclusively on strategic design to help companies plan their futures.

Each new application depended upon designers who worked differently from the norm – and an executive who believed design would help his company, even if there was no proof. Raymond Loewy could not have designed the company-saving 1939 Studebaker Challenger without the trust of CEO Harold Vance. Recognizing that the nature of the workplace had changed, Steelcase leader Rob Pew used Larry Keeley's advice to influence strategy. Steve Jobs accorded Dubberly, Mitsch, and Mok the latitude they needed to develop iconic interactive media projects that served a purpose for years to come. Even though there was no proof that design would benefit their companies, executives who have collaborated with designers did so because they believed it was the best way to not only get ahead, but also serve their customer base.

While both business leaders and designers would work in new ways with the emergence of new challenges and applications, the types of core capabilities at the center of design remained the same.

The Core Capabilities of Design

The capabilities of design were, at first, invisible and informal. They became increasingly evident as designers worked on a variety business challenges. As in most emerging fields, a few thought leaders began to discuss their informal work in focused reflection and writing. This led in turn to more refined capabilities that improved future applications, which were also easier to teach.[25]

A good example is Jay Doblin's notes about a scale of abstraction. Before helping co-found Unimark, he had been Raymond Loewy's lead designer in New York and then Director of the IIT Institute of Design from 1955 to 1969. Doblin had a remarkable ability to uncover the essential need underlying a challenge, a capability called "abstracting the problem". He taught this method at the Institute of Design and demonstrated it to clients. This expanded the boundaries within which they could explore options while remaining focused on the central intent of the project they were addressing.

In her post dated April 26, 2012, Helen Walters describes Doblin's thoughts on abstraction using the redesign of a gas pump as an example:

> "LEVEL 1: The designer accepts the pump's performance but shortens and cleans up its form.
> LEVEL 2: Performance improvements are made. Either money, gallonage, or fillip can be punched directly. Inserted credit card automatically bills the customer.
> LEVEL 3: Changes the basic mechanism. The station is like a parking lot where hoses are pulled from trap doors below ground. All the controls are on the nozzle.
> LEVEL 4: Involves products that are outside the company's control. No liquid fuel is pumped; pressurized cartridges are inserted into the car. One cartridge fits all cars (like sealed beam headlamps), a one-price sale.
> LEVEL 5: The service performed is changed; there are no more gas stations. Fuel cartridges are bought anywhere, like beer.
> LEVEL 6: The service is eliminated; cars never need refueling, they run indefinitely on atomic power.
> LEVEL 7: Transportation is eliminated; all human contact is by telecommunications."

Walters also observes that "It means that 35 years ago, designers were [already] thinking about increasing their scope from object to system, about how to elevate

25 The evolving literature of design and business begins with reflective commentary centuries in the past. See Sabine Junginger and Jurgen Faust, eds., *Designing Business and Management* (Oxford: Berg Publishers, forthcoming). See especially the examples in Ken Friedman, "Three Thousand Years of Designing Business and Organizations," in Faust & Junginger, *Designing Business and Management*, 67–80.

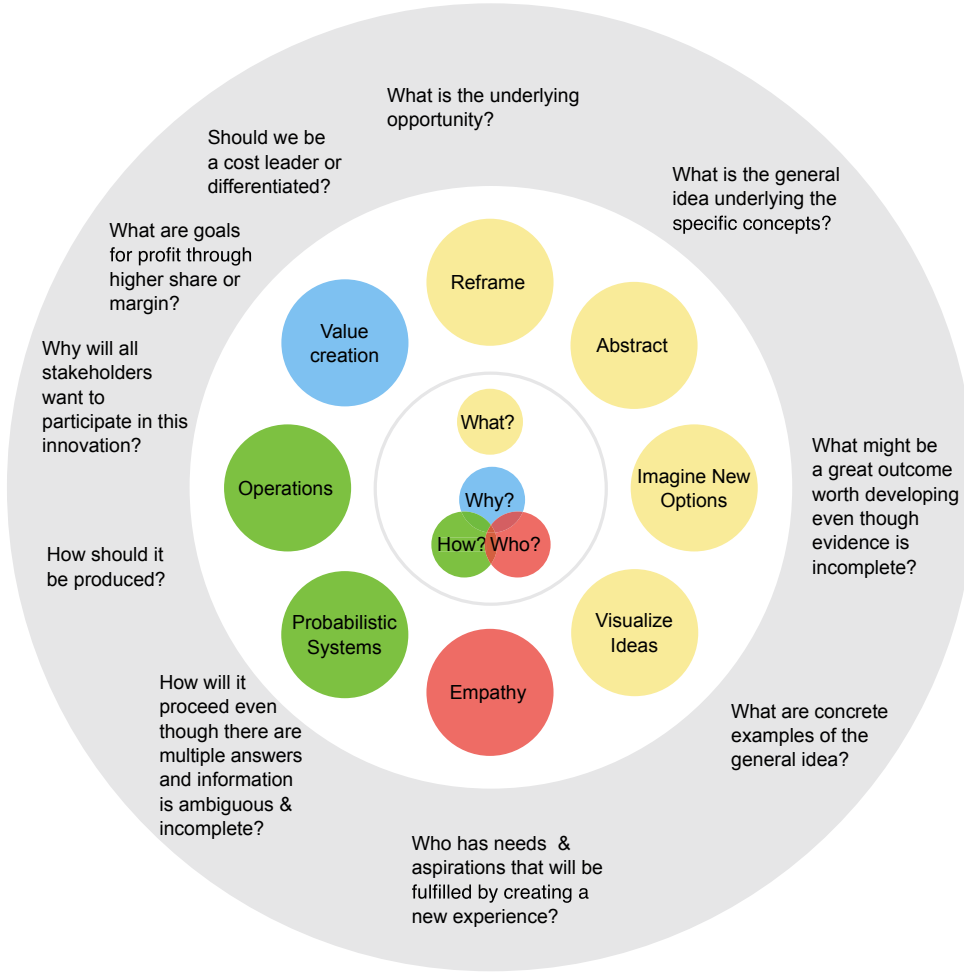

Figure 3 Eight core capabilities form the foundation for a range of questions relevant to innovation capacity today.

themselves from beyond providing the superficial aesthetic appeal of a product to considering its strategic consequences, even its point of existence."[26]

Fig. 3 illustrates the eight core capabilities of design, including abstraction. It indicates their relationships to the fundamental questions of design, and to a more expansive set of concerns that are vital to innovation.

Reframe: Realize that the initial definition of a challenge may not be accurate. Create a new frame for understanding what is needed

Reframing describes a new direction for a project. It depends heavily on *abstraction* and new insights gained through *empathy*. In the case of Apple music, music industry executives thought they were creating value by manufacturing CDs, while Apple reframed the challenge as "helping people enjoy music." This led them to create a phenomenal new retail experience. They reformatted the music offering by focusing on songs rather than albums. They wrote a new contract for digital rights management that would make the downloading transaction legal, creating more balanced benefits for listeners, musicians, and publishers, all the while generating other innovations.[27]

Abstraction: Discover the core value that can be created or enhanced

Projects often begin with an answer in mind. Continuing to ask "Why?" to discover the core value that can be created leads to meaningful, novel solutions. A good example is the way Steve Jobs abstracted the concept of the "MP3 player and

26 Helen Walters, "Jay Doblin's Seven Levels of Design," (blog) April 6, 2012, http://www.thoughtyoushouldseethis.com/post/21860352429/jay-doblins-seven-levels-of-design.

27 Owen Linzmayer, *Apple Confidential 2.0: The Definitive History of the World's Most Colorful Company* (San Francisco: No Starch Press, 2004).

software to organize music" to "enjoying music," directly competing with Napster and other software used to steal music.

Imagine New Options: Create new ideas that make sense even when evidence is limited

In the late 1800s the American scientist and logician Charles Sanders Pierce wrote about a third type of logic that could be used to make logical conjectures with relatively little evidence. Called abductive logic, other ways to describe it include 'hypothesis formation' and 'argument to best inference'. An abductive inference reasons backward from a likely outcome, to ask, "If this is the result, what could be the most likely cause?" Physicians often use abduction in making diagnoses based on observation. Designers use abduction to propose options based on user observations. Both use incomplete information, yet each has a sound reason to believe in value of a proposal.[28] As we shift to an era filled with uncertainty, organizations need a wider variety of plausible options. The type of intelligent creativity that characterizes design achieves this.

Visualize Ideas: Turn abstract ideas into concrete examples

Projects are frequently launched with an abstract verbal description that each project team member may interpret differently. By visualizing and prototyping early ideas, design enables all involved to see the alternative ramifications of different options.[29]

Empathy: Know users better than they know themselves

Companies normally think of users in terms of market segments. These are normally a cross between a range of demographic characteristics and a propensity to buy things within the categories of interest to the company. By observing what people do rather than asking questions about purchasing preferences, the design process can discover patterns that can lead companies to create offerings that people do not know to request. A simple example is Oxo Good Grips.

Sam Farber, the founder, worked with Smart Design to design potato peelers and other household tools with large rubber handles that looked good. He had observed that people with arthritis could not hold the small handles on existing products. He also knew that a much larger group was buying elegant kitchen products. By expanding his customer base among this second group, Farber was able to sell the product for much less than the dull looking products that had been designed exclusively for people with arthritic hands.

By empathizing with both groups, Farber created a product that millions of people love but none had asked for. Had Farber done traditional market research, he would have discovered no segment for relatively expensive, specialized kitchen gadgets, other than the market for people with arthritis. Just because a market segment does not exist does not mean that a need or aspiration does not exist.[30]

Probabilistic Systems: See relationships among things that do not seem related

Designers are comfortable making decisions with information that is logical and supported by evidence, yet still incomplete and unproven. Complex deterministic systems – like building a bridge – have known factors and specifiable results. Working on ways to reduce morning traffic congestion on the bridge has incomplete and unreliable information in fuzzy areas, like how people make decisions about the route they take to get to work in the morning.[31]

Operations: Know the general options for production and the social context for gaining acceptance in the organization

Since the shift of design from making things to specifying them, the operational aspect of design knowledge has taken on a more important role. This role ranges

28 Abduction is often misunderstood. It is not a secure logic, as Peirce warned. Rather, it is a useful starting point, particularly in such professional practices as medicine, law, or design. For a comprehensive overview of abduction, see Igor Douven, "Abduction," *The Stanford Encyclopedia of Philosophy* (Spring 2011 Edition), Edward N. Zalta, ed., http://plato.stanford.edu/archives/spr2011/entries/abduction/. See also Douglas Walton, *Abductive Reasoning* (Tuscaloosa, Alabama: University of Alabama Press, 2005). For Peirce's view of abduction, see K.T. Fann, *Peirce's Theory of Abduction* (The Hague: Martinus Nijhoff, 1970).

29 See Bill Buxton, *Sketching User Experiences: Getting the Design Right and Getting the Right Design* (San Francisco: Morgan Kaufmann, 2007) for many good examples.

30 My knowledge about Oxo is derived from numerous conversations with Sam and Betsey Farber, who were both involved in founding the company.

31 Charles L. Owen, "Evaluation of complex systems," *Design Studies* 28, no. 1 (2007): 73–101; Keiichi Sato, "Context-sensitive approach for interactive systems design: modular scenario-based methods for context representation," *New York Journal of Physiological Anthropology and Applied Human Science* 23, no. 6 (2004): 277–81.There are many good examples of these kinds of projects, but the literature tends to be scattered, with few careful and well-organized case descriptions. One good source of freely accessible books and case studies is the archived web site of the former Helsinki Design Lab http://helsinkidesignlab.org.

from gaining approval for an idea to knowing which manufacturing processes to consider.

Value Creation: Recognize unusual opportunities to create value, particularly intangible value

Companies that were first adopters of quality assurance programs had a competitive edge over other firms – until quality control programs became standard. The intangible value that design creates is today's competitive edge. Consider Apple's balance sheet: design appears as a cost, but it remains invisible on the revenue side. Individual consumers cannot buy design, but we can buy the offerings of outstanding companies who deploy design as a competitive resource.

From an Economy of Scale to an Economy of Choice

There are many historical precursors to the "age of mass production." The British industrial revolution in textile production was one. Another was the creation of interchangeable parts in the "American system of manufactures," first visible in producing firearms. The American Civil War was a major catalyst, with its innovations in the mass production of arms, clothing, and food.[32] Even so, it was not until he saw the moving carcasses of slaughtered animals on the "disassembly lines" of Chicago's meatpacking district that Ford conceived of assembling cars by moving parts to stationary workers rather than the prior practice of moving workers to the parts.[33]

Ford's massive River Rouge plant was at the confluence of these elements, enabled him to create low-priced automobiles and highly-paid workers who could afford the cars he manufactured. This set the stage for continuous growth in efficiency across a range of industries, and within 50 years, created a society in which most people lived a comfortable life – working in and buying from companies that could predict the future to a reasonable degree.

Nevertheless, the advantages of mass production and mass markets contained the seeds of their own destruction. Companies have to be large in order to take advantage of standardization and economies of scale. Similar offerings mean simpler and cheaper operations, yet even as companies succeeded at fulfilling customers' basic needs, they had to create greater variation in offerings to attract and retain them.

Providing more variety allows companies to come closer to meeting the particular needs of each consumer. But this development leads to overly complicated production systems and an excessive number of stock keeping units. Inventories grow difficult to store, and difficult to manage. In addition to executives who face the chaos of increased complexity, consumers also become confused by too many choices and confounded by too many functions and features.

Depending on the industry, the advantages of classic mass production and marketing are reaching their limit. Most companies that became leaders during the age of mass production are now embracing transformation – or they are in decline.[34]

The questions in the outer ring of fig. 3 help leaders and designers in understanding what to make next when extending currently successful products and services. However, these particular approaches work against creating the far-reaching innovations that can lead to higher than average profits.

What would have happened if the Prius, the Walkman, Starbuck's, Facebook, or any other major innovation had been subjected to these kinds of questions at an early stage? None of these products and services was requested and none had a market. These kinds of questions would have killed them all. Even though

32 For a thorough account of this transition, see David Hounshell, *From the American System to Mass Production, 1800–1932: The Development of Manufacturing Technology in the United States* (Baltimore: Johns Hopkins University Press, 1984).

33 Henry Ford, Samuel Crowther, and William A. Levinson, *The Expanded and Annotated My Life and Work: Henry Ford's Universal Code for World-Class Success* (Boca Raton, Florida: CRC Press, 2013).

34 Matt Mason, *The Pirates Dilemma: How Youth Culture is Reinventing Capitalism* (New York: Free Press, 2008); Clay Shirky, *Cognitive Surplus: Creativity and Generosity In A Connected Age* (Penguin Press, 2010); Daniel Bell, *The Cultural Contradictions of Capitalism* (New York: Basic Books, 1976).

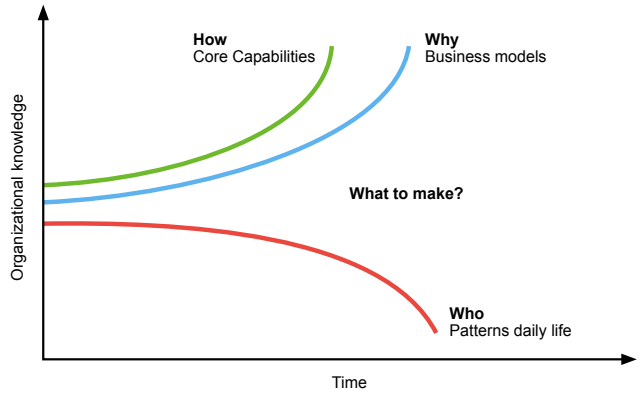

Figure 4 The innovation gap.

production processes and business models enable greater variety, these questions limit the view of what to make. This sets the limit at modest extensions of what currently exists. This leads to a dilemma called the innovation gap.

The Innovation Gap

Over the last half-century, companies have dramatically increased their knowledge of how to make things and how to use new business models. This causes an increased variety of products for users. It results in users having more choices, which in turn causes companies to be less certain about what to make (see fig. 4).

Corporate decision makers have been dragged away from a relatively secure world in which competition centered on optimizing known production processes and reducing known costs. Executives now live in a world where technology and new business models enable them to make almost anything. People are able to live more varied lives as companies fulfill ever more refined choices. But this new overabundance of consumer choice creates a new risk: it has become increasingly difficult for producers to know what consumers want and need.

This divergence between greater knowledge of how to produce almost anything and less knowledge of the patterns in users' daily lives is called the innovation gap. Awareness of this gap is one of the main reasons that companies are increasingly adopting design principles. The goal is to reframe what they once thought of as the original problem in a way that is more likely to lead to offerings that are different to and better than the offerings currently available.

The Risk of Trying to Avoid Risk

Executives must respond rapidly to the fast-changing lives of their consumers, and the rapid changes of the world in which they live. Executives and their customers both face ambiguous, even volatile, problems sometimes described as "wicked problems."[35]

For example, many companies are finding that factories, once major assets in the economy of scale, have become liabilities in the economy of choice. A lack of flexibility has become a source of risk rather than stability. This risk is exacerbated when competitors use the world as a factory, choosing the most appropriate production facilities for products designed to fit users' needs and aspirations.[36] However, as companies outsource their manufacturing and supply chain to enable more flexible production, they still face the prerequisite question: What to make? Welcome to the uncertain world of "foggy problems." These problems come in many forms and sizes, and often seem to have more than one answer that is obviously right. They always have a level of ambiguity caused by multiple variables. Information is incomplete and changes quickly. Outcomes

35 The fundamental account of the concept of wicked problems appears in Horst W.J. Rittel and Melvin M. Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences* 4, no. 2 (1973): 155–169. In the design field, two key articles address this: Richard Buchanan, "Wicked problems in design thinking," *Design Issues* 8, no. 2 (Spring 1992): 5–21; and Richard Buchanan, "Design Research and the New Learning," *Design Issues* 17, no. 4 (Autumn 2001): 3–23.

36 See R. H. Coase, "The Nature of the Firm," *The Firm, The Market, and the Law* (Chicago, Illinois: University of Chicago Press, 1990 [1937]): 33–55. Coase's theory of the firm essentially asks what we should do within a company to reduce the risk created by seeking the same services in the open market.

rely upon such "soft" factors as values, beliefs, and the activities of daily life. It is not possible to address foggy problems using the methods that worked in the economy of scale.

It is impossible to meet these challenges by conducting deeper user research for more insightful predictions. What companies need is a way to engage in the fast exploration of possibilities without limiting that exploration to the possibilities of new offerings. What happens when exploring possibilities includes different models of value creation, different models of operations, and different models of user experience that permit a whole view of the challenge?

Sketching The Whole View

Designers sketch rapidly and casually. Sketches, drawings, and diagrams are particularly valuable early in the design process as a way of thinking about the project rather than illustrating the right answer.

Because it is common in business to define a solution at the outset of a project, sketches normally focus on defining the look and feel of what users will experience. This process involves optimizing current knowledge to improve usability and appearance. This "direct design" approach moves directly from analyzing current reality to creating a predictable extension of current reality.

Direct design is less effective when uncertainty increases. For example, direct design may not be the best approach to creating a new offering for an unfamiliar market. Direct design is far from the best approach when the problems that face organizations involve new production processes or new business models. The greater the uncertainty, the greater the need for an approach that lets organizations explore several options before committing to one solution.

What if it were possible to do more than sketch the character of offerings based on seemingly unchangeable models and processes? What if we had ways to sketch value creation, use, and production?

Despite the uncertainties inherent in the economy of choice today, we know that there are many different ways to address questions related to creating value, understanding users, and managing operations. When an organization consciously begins to work on foggy projects, it requires a tool kit to "sketch" an initiative, which of course means more than simply sketching product ideas.

As Roger Martin eloquently describes, design is able to deal with today's problems because it is based on a third type of logic, called *abduction*.[37] First described by Charles Sanders Peirce, abduction is particularly useful for dealing with problems when one does not have enough information to form a sound hypothesis, and what might constitute a successful solution is not entirely obvious. The design process often uses an abductive, exploratory approach by not accepting a problem as originally stated, which makes it particularly well-suited to the kind of problems that do not lend themselves to standard methods of analysis and optimization.

The model in fig. 5 gives a whole view of innovation frameworks and methods that enable fast, informal sketches that work descriptively and prescriptively.

What to make?

Three Levels of Innovation

This framework helps assess the proximity of a potential project to what is currently available. It describes innovation projects by fitting them into one of three levels: *steps* are incremental modifications to existing offerings

37 **Roger Martin, *The Design of Business: Why Design Thinking is the Next Competitive Advantage* (Boston: Harvard Business Press, 2009): 57–78.**

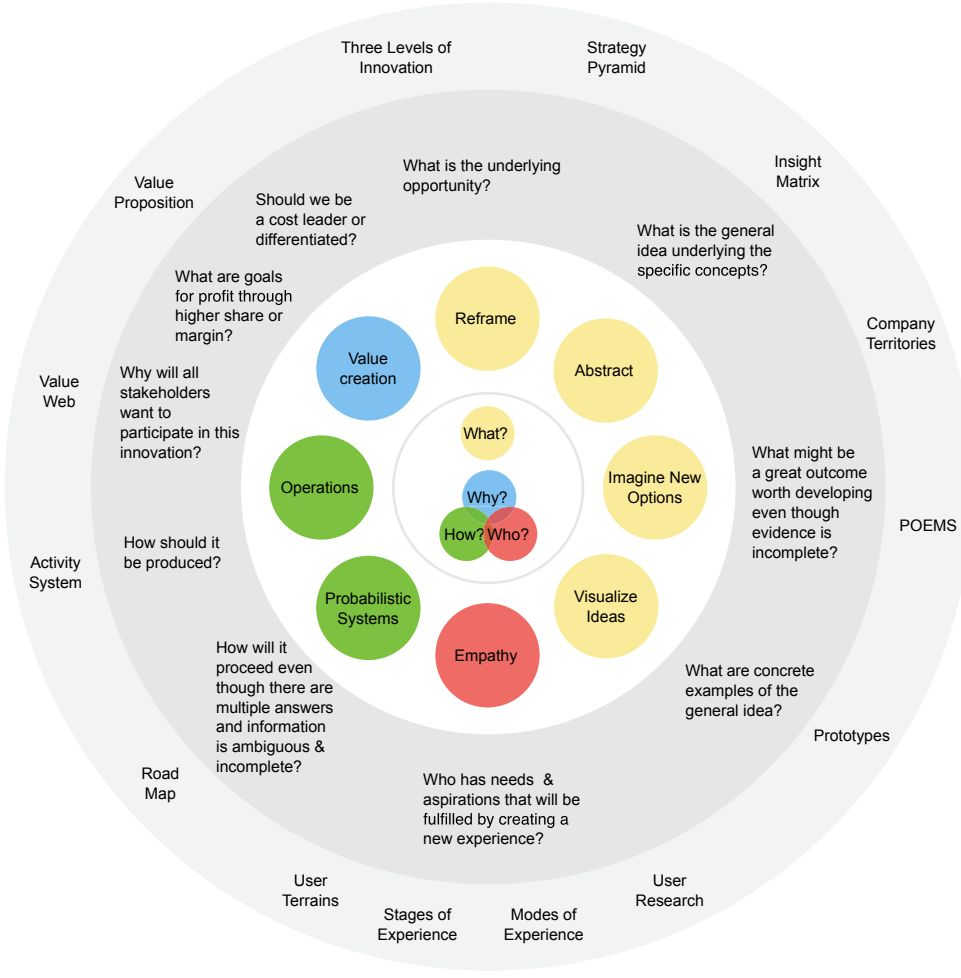

Figure 5 The methods and frameworks in the outer circle can work in concert to sketch options for novel business models, operations, use cases, and offerings.

whose practicalities remain within the known; *jumps* are similar to steps, but a little more uncertain as they involve new elements, for example new technology; and *leaps* are based on compelling ideas involving new tools and methods, which open up new worlds of opportunity worth the risks they imply.

Strategy Pyramid

This framework helps the team to determine whether a project is about changing offerings, the systems and platforms used for making new offerings, or the design of organization itself. During the 20th century design was viewed as a process for shaping objects, environments and messages. Now many of the core capabilities of design are inherent to the planning of the systems that underlie the final offering and extend to the design of the organization.[38]

Insight Matrix

The insight matrix tool, developed by Vijay Kumar,[39] can lead designers to discovering patterns not visible through conventional forms of questioning and analysis. This tool, based on comparing scores of *user observations*, is useful in *abstracting* and *reframing* a problem.

Company Territories

Together with *user terrains*, company territories map the relationship between customers and users and the products and services they buy. Terrains describe aspects of users' lives independent of what the company makes, like "enjoying

38 Charles Owen, "Structured Planning in Design: Information-Age Tools for Product Development," *Design Issues* 17, no. 1 (Winter 2001): 27–43; Roger Martin, *The Design of Business: Why Design Thinking is the Next Competitive Advantage*, 3rd ed. (Harvard Business Review Press, 2009); Matt Mayfield et al., "Battling the Demons of Complexity: Design Thinking in a Business Context," *Design Management Review* 23, no. 2 (May 2012): 18–26; Matt Mayfield and Stan Ruecker, "Strategy Simulation in Design: The Role of Simulation in Exploring Both Business & Design Decisions," in *Proceedings of the International Association of Societies of Design Research* (IASDR) (Tokyo, Aug 26–30, 2013).

39 Vijay Kumar, *101 Design Methods* (Hoboken, New Jersey: John Wiley & Sons, 2012): sections 4.10–4.13.

social, family time." Territories are areas of opportunity that companies carve out inside or astride such user terrains, for example "a service dedicated to Saturday evening family events."

POEMS

This framework recognizes that designers commonly create entire systems of offerings, which can include *People*, *Objects*, *Environments*, *Media/Messages*, and *Services*. Examples of this include the behavioral characteristics of the staff at Starbucks or Nordstrom's (People); the new generation of dentist chairs, or the retractable belt stanchions used to control crowds (Objects); the interior of the Apple Store or the business class seats and seating sections of major airlines (Environments); and the caller guidance systems of successful customer support centers (Media/Messages).

Prototypes

Used early in the development process, two kinds of prototypes are relevant to the exploratory work needed in the economy of choice.

Concept prototypes help team members explain early ideas to each other by creating rough approximations (low fidelity, low resolution) models. As project development moves forward, concept prototypes become increasingly accurate in representing what the concept will be (high fidelity) and become more detailed and refined with respect to final product appearance (high resolution).

Behavior prototypes, effective after user observation, help teams discover aspects of user activities. They are designed to elicit visible activities, and may look nothing like the finished offering.

Who is it for?

User Terrains

Terrains are identified by people's aspirations and needs: the high-level goals people have for themselves and those close to them. These can be identified by how people spend their time, attention, and money. Aspirations include having a happy and inviting home; succeeding at a sport or hobby; providing enriching life experiences for one's children; and achieving high social status.

Terrains are different from the market segments that classify people based on demographic factors and their propensity to buy what a company offers. In contrast, establishing territories inside existing terrains, or carving out new territories between terrains allows companies to focus on goals. Separating terrains and territories helps companies avoid myopically positioning people in the context of the company rather than in their own human context. While this may not have been important when people had few choices, it is essential now.[40]

Observing Users

Observing users is one of the design capabilities undergoing the greatest change. On one hand, *user observation* developed in parallel with the specialties of user-centered design and interaction design to the extent that many equate user research with design research. This is problematic, as many other theories, methods, tools, and practices form areas of design knowledge that require investigation and development.

It can also be argued that the importance of user observation has led to the widespread acceptance of trivial and often incorrect assumptions. This includes believing that tiny sample sizes can uncover what users *will do* rather than realizing that small samples can enable a design team to reframe their ideas about

40 The distinction was always clear to companies that catered to the upper class. Private banks and luxury restaurants understand the wants and needs of their clientele in terms of what they expect. Retail banks focus on convenience, often using business models that restrict banking services to demographic sectors with relatively common needs. Mass production restaurants serve the same products to everyone, competing on price and convenience. This is the formula for McDonald's and most fast food chains. Some firms pursue both strategies; for example, certain banks offer standard credit cards on basic terms for the majority of customers while offering exclusive platinum and even more exclusive black credit cards to high wealth clients.

what users *might do.* Another incorrect assumption involves the belief that inventing a user scenario based on one's own personal experience has any use at all. So, too, is the practice of inventing so-called "personas" that simply reflect the ideas of the designer, and testing user scenarios of personas that are merely ideas in the mind of the designer. Such practices raise a crucial question: Are we working in a "design bubble" in which the claims about design are outpacing the substance of the field?

The growing economy of choice will increase the need for understanding users using rigorous methods that increase the depth and speed of observation. This need is partly being met by using the same technologies that are enabling the new economy. A few interesting examples are emerging. John Cain, TJ McLeish, and Rick Robinson at Iota are using sensors embedded in user environments. Kim Erwin at the IIT Institute of Design is taking advantage of the ubiquity of the web and new protocols for engaging groups in defining problems. Tom MacTavish, also at the IIT Institute of Design, is using mobile telephones and principles of the emerging field of persuasive communication to let users record and reflect upon their own activities.[41]

Modes of Experience

Like user observation, the relationship between design and user experience is often thought of in curious ways. There is no widely agreed upon approach other than the injunction to "be like Apple." A more useful framework describes user experience as having five modes: physical, cognitive, social, cultural and emotional. Of course, users do not separate their experiences into these modes, but the distinction is useful for designers considering how people will experience their design.

Some of the examples that follow are wide-ranging, but to illustrate how these facets of experience act together, an example from the health care sector is also provided.

1. Physical. Considering the physical mode of experience focuses designers on the abilities and limitations of the body. The classic example of this is tableware for the disabled by Maria Benktzon and Sven-Erik Juhlin of Ergonomi Design in Sweden. Both the split keyboard and the Leap chair from Steelcase also benefited from designers' concerns for this mode. Examples from health care include childproof caps on medicine bottles that require users to have hands stronger than those of a child, or the system of levers that enables a nurse to raise a patient bed.[42]

2. Cognitive. Focusing on the cognitive mode helps make designs more understandable. It includes the design of products, product interfaces, software, and instructions to make them easy to use. It is also central to simplifying complex information management tasks such as generating financial statements and completing tax forms. The Apple OS interface and the instructions for IKEA products are good examples. The medical field is full of examples, including the time-saving tools used by staff to learn how to operate new equipment, and the tools that facilitate self-care after a hospital visit.[43]

3. Social. Often the "user" is better thought of as a group rather than as a set of individuals. Team spaces at work, temporary workspaces at hotels, airport lounges, control rooms for power stations, and war rooms for the army all work better when designed with group dynamics in mind. Nursing stations and operating rooms are

41 Kim Erwin and Theodore Pollari, "Small Packages for Big (qualitative) Data," in *Ethnographic Praxis in Industry Conference Proceedings* (London: EPIC Board of Directors, 2013): 44–61. Several white papers about the work at Iota can be found at http://www.iota-partners.com/.

42 Maria Benktzon and Sven-Erik Juhlin, "The Development of Eating and Drinking Implements," *Social Design*, ed. Nils H. Edlund (1989); Maria Benktzon and Sven-Erik Juhlin, "What Can Design Contribute to Human Society in the Near Future?" *Design Quarterly* (Tokyo), no. 2 (1984); Ken Friedman, "Benktzon and Juhlin: Tablewares for the Disabled," *Contemporary Masterworks* (Chicago and London: St. James Press, 1991), 736–737.

43 Norman, *Design of Everyday Things*.

examples of hospital environments that require groups to share a large amount of fast-changing information.[44]

4. Cultural. Thinking about the cultural mode helps design for populations that do not know each other, but may share beliefs, habits, values, and activities. It is typically one of the aspects of experience, along with the emotional, to which designers pay the most attention. Styling and quality are normally decided upon with the values of a large segment of the population in mind. This is noticeable when comparing Starbucks to Dunkin' Donuts: they both sell above average coffee, but Starbucks is much more culturally engaging, while Dunkin' Donuts is more transactional. In a hospital environment, the value that the culture of the nursing profession places on "caring" could lead to designing nursing stations that provide direct line-of-sight contact with patients.[45]

5. Emotional. Raymond Loewy, and other design stars of the 1930s through 1950s, created streamlined shapes for fast trains which they transferred to staplers, pens, radios, toasters and other stationary objects to express a feeling of modernity to a population that was tired of the dreary terror of the Depression and WWII. Similarly, Apple borrows the purist forms of Braun in their attempt to make people feel that their complex machines are simpler and more uplifting than the complex products of other computer manufactures. In the health care industry, advanced children's health care centers are conducting many experiments with designers in an attempt to make patients feel less anxious.

Stages of Experience

Similar frameworks developed at Doblin and at Conifer Research use a 5-phase structure similar to the order users travel through an experience. Like the modes described above, users do not think of their experiences in these stages. However, it is useful for design teams to think of these stages.

- initial attraction
- entering and orientation
- being engaged and participating
- exit
- extending the experience through photographs and conversations and other ways.

How to make it?

Road Maps

Road maps are plans describing how an innovation will launch, and its subsequent stages of growth. They require the determination of "success criteria" for the user and for the business. These criteria govern the integrity of the offering both when it is launched and as it grows, which helps to counteract the common trend toward normalization.[46]

Activity Systems

Professor Michael Porter of Harvard created the activity systems framework to help executives see the interdependencies among the key activities needed to bring an innovation to life. Taking these interdependencies into account while the project is still at an early phase allows executives to ascertain where an important activity lacks

44 Joyce Bromberg et al., "Planning and Designing Highly Functional Nurses' Stations," *Healthcare Design Magazine* 11 (2006): 80–88.

45 Phred Dvorak, "Businesses Take a Page From Design Firms," *wsj.com*, last modified November 10, 2008, http://www.wsj.com/articles/SB122608904288009265.

46 This directly relates to the concept of "backcasting." The core idea is to know the principles of what you want to achieve and use them as an anchor to pull the initiative towards the desired future. By far, most work and publications relate to environmental sustainability. However, the idea easily translates other applications. See PJ Dortmans, "Forecasting, Backcasting, Migration Landscapes and Strategic Planning Maps," *Futures* 37, no. 4 (2005): 273–285; John Holmberg and K.H. Robèrt, "Backcasting from Non-overlapping Sustainability Principles: A Framework for Strategic Planning," *International Journal of Sustainable Development and World Ecology* 7, no. 4: 291–308.

a necessary prerequisite activity. Without this early view, it is likely that executives will not discover missing capabilities until after the innovation is launched.[47]

Why will it create value?

Value Proposition

Geoffrey Moore, a thought leader for the high tech industry in Silicon Valley has developed a value proposition framework described in his book *Crossing the Chasm.*[48] The framework gives a structure for brief statements that describe the breadth of a new offering and its competition.

Value Web

Value webs are sketches of business models that enable a team to explore where value can be created or lost. Exploring options for offerings is often artificially constrained by assuming the business model is unchangeable. Value webs identify the people and organizations that give and receive value. The value can be of any type: products, services, money, brand, or any other entity that makes it worthwhile for each stakeholder to be a participant in the web.

Fitting the Economy of Choice

It is difficult to see the benefits of new frameworks until they have been tried and tested. Because they do not fit the context that is being left, and the emerging context is not wholly visible, they are often seen as eccentric.

However, maintaining the status quo can cause anxiety: no longer fitting with a well understood past while not having a complete view of the future that may already be here can cause a serious dilemma. This is illustrated by a conversation I had with a senior executive at a major consumer products company, who said: "I know the new methods will give me better insights about what the company should make; but if we use them, we will not be able to benchmark against last year."

A historical perspective may ease the anxiety. The first example is about changing a liability into a resource and developing ways of counting what formerly seemed uncountable. The second example is about knowing a concept is in the right direction even though 100% of the data says is wrong. It is also a testament to being able to reverse cultural values that seemed so unchangeable that they must be universal truths.

From Cost to Asset

In 1959, Jay Doblin stepped into a new factory in the Shimomaruko district of Tokyo where Canon was manufacturing its recently developed single-lens reflex cameras. Doblin was the Director of the IIT Institute of Design and former chief designer of Raymond Loewy's New York office. He had a particular interest in planning processes in large companies. Doblin was in Tokyo to advise the Japanese Ministry of International Trade and Industry, and to tour Japan.

As Doblin walked by the long lines of workers wearing white uniforms and seated at benches making parts, he noticed a small number of machines making some of the smallest components. What surprised him is that these machines were self-operating. They made parts without direct human control.

Doblin knew of similar machines at work in factories in the United States. Companies were using these in the continuous drive to reduce costs. Doblin had heard that labor costs in Japan had been rising in recent years and he asked his hosts about the savings brought by these precursors to robotic production.

47 This kind of insight is a typical discovery in robust prototyping ventures of the kind that typify the Design Factory model in use at the Aalto Design Factory in Helsinki, The Aalto-Tongji Design Factory in Shanghai, The Swinburne Design Factory in Melbourne, or the ME310 projects at Stanford University. One reason that companies engage in these projects is that they can learn about missing capacities in an early stage at the relatively low cost of sponsoring a project. Companies can then take promising projects forward, either by creating necessary capacities within the firm, or by shifting the focus to a project for which the firm does have necessary capacity.

48 Geoffrey A. Moore, *Crossing the Chasm, 3rd Edition: Marketing and Selling Disruptive Products to Mainstream Customers* (New York: Harper Collins, 2014 [1991]).

The Japanese executives paused, and then replied: "Mr. Doblin, we do not know if they save money or not. The reason we built these machines is that they make detailed parts at higher level of quality than people can make by hand."

This was a shock. Doblin was used to seeing the quality control function at the end of the assembly line where people would identify sub-standard products and send them back for rework. Canon had a different point of view. This company saw quality improvement as an integral factor in the production process.

Doblin had witnessed an early step in Japan's effort to revitalize Japanese industry. This drive would ultimately change the connotation of "Made in Japan" from "low quality, cheap copies" to "high-quality, modern, reasonably priced products."[49]

Canon was not alone in the quest for products of higher quality and value. W. Edwards Deming had brought his remarkable ideas about quality to Japan in 1950 when the Japanese Union of Scientists and Engineers invited him to speak. Aware that his ideas would have no impact, he agreed to speak on the condition that leaders in business and industry would join the scientists and engineers for his talks and workshops. These presentations launched a manufacturing revolution in Japan. Eventually, the Prime Minister of Japan created the Deming Prize to be awarded to the Japanese company that best exemplified Deming's principles. These principles showed how to increase quality and profit at the same time. Deming himself would become one of the few foreigners to be honored with Japan's Order of the Sacred Treasure, while Deming's fourteen points became a central tool in leading Japanese industry. Quality control in North America meant inspection at the end of the manufacturing process as Doblin realized. Quality control in Japan meant manufacturing products the right way through effective management a robust manufacturing process.

Among Deming's fourteen points were three crucial processes addressing quality while bringing design to the entire manufacturing process: "9. Break down barriers between departments. People in research, design, sales, and production must work as a team, to foresee problems of production and problems in use that may be encountered with the product or service. 10. Eliminate slogans, exhortations and targets for the work force asking for lower defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low performance belong to the system and thus lie beyond the power of the work force. 11. Eliminate work standards and quotas on the factory floor. Substitute leadership. Eliminate management by objective. Eliminate management by numbers and numerical goals. Substitute leadership."[50]

Doblin's visit continued this process. His meetings with MITI helped to alter public policy. One result was a law that required companies to demonstrate high quality as the basis of an export permit. Before gaining the permit, companies were required to show that their products had the same quality as the domestic products in the importing country – or higher quality. Working together, scientists and engineers, academics and government, business leaders and factory workers succeeded in turning quality from a cost to an asset.

They made this change by choice. They chose to look at a broader set of factors that had been considered intangible prior to Deming's work.

From Bigger Is Better to Smaller Is Cooler

At the same time, Masaru Ibuka and Akio Morita, the founders of a young electronics company called Tokyo Tsushin Kogyo launched the TR-63 transistor radio. They had made previous models, but this was the smallest (112 mm × 71 mm × 32 mm). It was their first worldwide hit. The following year, to

49 The information about Doblin visiting the Canon factory and MITI, and his reactions, come from direct conversation with him between 1977 and 1996.

50 William Edwards Deming, *Out of the Crisis* (Cambridge: Cambridge University Press, 1986): 23–24. See also William Edwards Deming, *The New Economics for Industry, Government, Education* (Cambridge, Massachusetts: MIT Press, 2000); Mary Walton, *The Deming Management Method* (New York: Perigee, 1986). Halberstam gives an elegant description of Deming's work and influence in *The Reckoning*.

prepare for the further expansion of exports, they changed the name of their company to Sony.

A few years after Doblin's visit and the success of the TR-63, consumers in North America and Europe would notice Sony stereo components. While the cases of these brushed aluminum products looked unusual to the Western eye, they sounded great. And they cost less than the hi-fi audio equipment that consumers were used to, products in decorative wooden cabinets from such consumer electronics giants as RCA and Telefunken. The Sony products were machines for listening. They were small enough to keep on open shelves in the home rather than camouflaging them as furniture on the floor.

Treating quality as an asset meant building quality into the production process. It also involved seeing an opportunity that would shift consumer values from "bigger is better" to "smaller is cooler." These are examples of people looking at businesses differently.

A major cross section of Japanese industry saw a dramatically different way to make products. Ibuka and Morita saw that consumers had new needs and aspirations that were others did not notice.

Japanese manufacturers began making choices that ran counter to industry conventions. But these choices were logical for those that looked at the broader context of how things were made and used.

Choices We Face Today

Visiting Shenzhen or Bangalore, it is astonishing to see the evidence of tens of millions of people escaping poverty and entering the middle class.

Visitors to major European industrial cities during the second half of the 19th century were equally amazed, as were visitors to the great American cities of the early 20th century. Then, as now, the world saw millions of people leaving farms and villages to work in new urban jobs. Families chose to disrupt the traditional patterns of daily life in the farming communities and move to cities to increase their opportunity to have enough to eat and send their children to school. Societies accepted environmental degradation as a small price for this progress. The promise of moving from a life of scarcity to a life of relative comfort was a trade-off worth making.

The current transformation in Asia was ignited by the low-cost production of products and services in China and India. It is taking place at a scale and speed that the world has never seen before.

In the last twenty-five years, hundreds of millions of people have achieved better lives. Every day, we learn more about this growth as we try to comprehend the staggeringly high numbers. Whether we are counting in terms of new apartments and houses, newly graduated engineers and scientists, first-time savings accounts, office buildings, new car sales, or hours spent in traffic jams, the scale of change is unprecedented.

But this transition also represents problems never before seen in human history, involving the carrying capacity of the planet itself. The expectation for greater material well-being has increased several times over, while the world's resources have remained the same or decreased. The Stockholm Resilience Center has developed a model showing the limits and boundaries of nine planetary systems affected by human activity. We have already overstepped the safe boundaries for three of those systems.[51] A trade-off between improvements in material well-being and environmental degradation will no longer work.

The environmental impact of innovation threatens to become catastrophic as global economic power shifts to the large populations and large-scale conditions of China and India combined with the resource constraints these nations face.

51 Johan Rockström et al., "A Safe Operating Space for Humanity," *Nature* 461, no. 24 (September 2009); for more information, visit http://www.stockholmresilience.org.

China and India are becoming global centers of innovation – and of environmental degradation; they will be ground zero for the coming conflict between innovation and sustainability. Yet this is but one of the conundrums of our time.[52] Other challenges include having enough food and clean water, creating better schools that focus on learning rather than testing, and having health care systems that can accommodate large and aging populations. Such problems operate on a daunting level of complexity, scale and scope. There are no single correct answers, and any information we do have is neither reliable nor complete.

The answers are not obvious. Neither are the questions. The likelihood of our asking the right questions and being open to answers that are not obvious will increase if we go beyond the standard reductive processes invented for a more predictable world. We need to see beyond symptoms to the underlying challenges, visualize abstract data to discover unexpected patterns, reframe orthodoxies about what is valuable, recognize the aspirations and needs of all stakeholders, and understand the new flexibility in organizations and technologies that change how ideas are realized.

Gaining a whole view of the context in the economy of choice will not only enable organizations offer choices without excess production, it will also help us choose the world in which we want to live.

52 See David Owen, *The Conundrum: How Scientific Innovation, Increased Efficiency, and Good Intentions Can Make Our Energy and Climate Problems Worse* (New York: Riverhead Books, 2012); see also Stephen Emmott, *Ten Billion* (New York: Vintage Books, 2013).