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Signposts of Innovation

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Towards Better Innovation Metrics for Business—A Primer

RESEARCH REPORT R-1626-KBI

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For More Details on the *Signposts for Innovation*

A more exhaustive review of innovation metrics is provided in a separate white paper entitled *Signposts of Innovation: A Review of Innovation Measures*. The Conference Board is compiling a metadatabase of innovation metrics by country, sector, and company level which will be available soon to our members.

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Key Business Issue: *Signposts of Innovation*

This year, The Conference Board will explore the key issue of how companies can successfully measure and improve their innovation efforts. This report is part of an ongoing research initiative to identify and define the *Signposts of Innovation*. To achieve this, we have incorporated input from leaders in innovation among the member companies of The Conference Board through events and interviews (see page 29 for a list these forums). The project continues. In 2017, The Conference Board will:

- Identify new metrics of innovation (beyond existing metrics which are already in the public domain) by leveraging knowledge about innovation and the practical experience of business executives;
- Conduct a business survey on selecting top innovation metrics across signposts;
- Conduct surveys to collect new innovation metrics through partnerships with other research organizations;
- Research a variety of metrics for their strength and reliability to identify facets of innovation and their impact on financial and business performance;
- Analyze which innovation metrics provide the best insights in the future of innovation success; and
- Investigate the possibility to further develop a series of metrics that can be collected on a continuous basis that companies may use as a basis for benchmarking against other companies as well as against the aggregate performance of sectors, innovation systems, or even macro-levels such as countries or regions.

For more information on the *Signposts of Innovation*, please visit:
https://www.conference-board.org/future-of-innovation/

About This Report

This report provides a high-level overview of various approaches to measurement of innovation activities and dives more deeply into the key characteristics of innovation metrics which can help business to track, monitor, and assess innovation performance to improve management and decision making. The *Signpost of Innovation* framework presented in the report identifies six key areas (technology, digitization, customer experience and branding, environmental and social sustainability, internal innovation network, and external innovation ecosystem) and provides guidance on the kind of innovation metrics that may be developed to populate each of those signposts.

Executive Summary

Despite the importance of innovation, companies often lack a comprehensive innovation measurement framework. This report reviews the diverse approaches to measure innovation at the country and company levels and develops a comprehensive framework resulting in a holistic view of innovation measurement that will give business leaders clearer direction for identifying strategies and taking action.

We propose a framework of six innovation "signposts," designed to help executives better track different aspects and activities of innovation, communicate effectively on innovation, improve innovation outcomes, and enhance competitiveness and overall performance.

The six signposts are:

- Technology;
- Digitization;
- Environmental and Social Sustainability;
- Customer Experience and Branding;
- Internal Innovation Network; and
- External Innovation Ecosystem.

The *Signposts of Innovation* framework seeks to capture the scope of the innovation life cycle across industries and within an organization, ranging from idea generation to full scale commercialization. The framework is designed to:

- **Reflect** the complexity of new generations of innovation models;
- **Measure** innovation in business activities along the value delivery chain by examining inputs, outputs, and throughputs; and
- **Provide** a system for companies to organize their innovation metrics.

On the basis of this framework, companies can begin identifying the innovation signposts and underlying metrics that are key to their innovation strategies and activities, and present them in, for example, a scorecard or dashboard. This can serve as the starting point for a systematic measurement and tracking tool but can also be used in a conversation on what dimensions of innovation are key for the business. Ultimately, these metrics could help improve resource and investment allocation decisions, identify bottlenecks, and allow for better management of innovative activities.

The Need for Innovation Metrics for Business

In today's business environment characterized by disruptive innovations, changing customer needs, and a slowing trend of global growth and trade, innovation is one of the most important engines of business growth for companies across industries and all over the world. Strong innovators drive productivity, and therefore make their companies more agile and resilient against shocks, disruptions, and the uncertainties that come with them. Indeed, for many years, successive editions of ***The Conference Board CEO Challenge®*** survey have found innovation activities ranked among the most important strategies by CEOs, presidents, and chairmen to face the challenges in their business environment.[1]

Over the past few decades, traditional ways of doing business, serving customer needs, and producing goods and services have changed dramatically with the advent and widespread use of information and communications technologies. While in today's business world, innovation is not limited to digital technologies, digital transformation of modern economies is creating a significant disruption for companies.[2] These disruptions highlight that businesses either have to become disruptors by becoming leaders in innovation or will be disrupted by those who innovate faster. In fact, becoming an innovation leader may be the only way for companies to address disruptions and turn themselves into agile competitors in their own and adjacent sectors.

Understanding and measuring innovation

Although innovation is critical to companies, they often struggle with how to evaluate, manage, and promote it. In many companies, adequate measurement of innovation is at best partial, often narrowly focused or not operationalized from a business perspective (McKinsey, 2008).[3] Innovation results are sometimes tracked with key performance indicators or financial metrics, but those metrics are often not helpful to track or monitor activity during the innovation process itself. Moreover, most innovation activities count as current expenses, and, therefore, weigh on a company's bottom line in the current year, whereas the payoff is usually over multiple years. There can also be internal cross-currents among organizational teams and business units, who are measured on different and sometimes contradictory scorecards.

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1 Bart van Ark, Chuck Mitchell, and Rebecca Ray "*The Conference Board CEO Challenge*® 2016: Building Capability – Seeking Alignment, Agility, and Talent to Innovate and Grow," The Conference Board, January 2016 and Bart van Ark, Chuck Mitchell, and Rebecca Ray "*The Conference Board CEO Challenge*® 2017: Leading Through Risk, Opportunity, Disruption, and Transformation," The Conference Board, January 2017.

2 For definitions of digitization and digital transformation see below and also Bart van Ark, Abdul Erumban, Carol Corrado, and Gad Levanon, "Navigating the New Digital Economy: Driving Digital Growth and Productivity from Installation to Deployment," The Conference Board, May 2016 and Mary Young, "Digital Transformation: What Is It and What Does It Mean for Human Capital?" The Conference Board, July 2016.

3 "McKinsey Global Survey Results: Assessing Innovation Metrics," McKinsey Quarterly, 2008. The survey shows a lack of measurement—out of the 1075 respondents, 51 percent of them indicate that their organizations pursue business model innovations, but only 28 percent of them say that their organizations formally assess the innovation. The patterns are similar for process innovation (61 percent vs. 37 percent), service innovation (65 percent vs. 37 percent), and production innovation (71 percent vs. 54 percent). Moreover, in the companies that carry out innovations, 16 percent of them do not formally assess them.

DEFINING INNOVATION

Definitions of innovation abound. (One consultant, Jeff Dance, offers over thirty of them.[a]) For the purposes of this report, the definition of innovation is a relatively simple but broad one, based on an earlier study at The Conference Board[b]:

> Innovation is broadly defined as a process that results in the creation and use of a new or significantly improved product or service; production or operating process; way of attracting customers by enhancing their experience; and organizational practice, work design, human capital competency, or use of resources that creates value.

a Jeff Dance, *What Is Innovation? 30+ Definitions Lead to One Fresh Summary*, Fresh Consulting, May 2008.

b Joseph McCann and Michelle Kan, *Designing Global Businesses for Innovation and Growth*, The Conference Board, August 2014.

Innovative activities often compete for resources against routine work, making it critical that executives working on innovation at all levels in a company communicate with the top management about the resource requirements, barriers, progress, portfolios, and estimated return of innovations.

Organizations need to bridge the gap between quantitative measures of innovation (such as revenue, spending, or number of patents or technical staff) and qualitative measures of innovation which are related to subjective assessments of innovation capacity and effectiveness (such as the internal environment or a company-wide cultural orientation for launching large innovation projects with success). Making a connection between these types of measurements will give business leaders clearer direction for identifying strategies and taking action.

To complicate the measurement of innovation activities even further, innovation models have evolved from R&D-driven innovations into a more complex system of multiple types of innovations happening at the same time within and across organizations. Innovation activity now involves participants both inside and outside of a company which can be seen as operating as part of an innovation ecosystem. These developments call for different types of metrics than in the past.

This report provides a high-level overview of various approaches to measurement of innovation activities and examines the key characteristics of innovation metrics which can help business to track, monitor, and assess innovation capabilities and link them to performance. The *Signposts of Innovation* framework presented identifies six key areas (technology, digitization, customer experience and branding, environmental and social sustainability, internal innovation network, and external innovation ecosystems) and provides guidance on the kind of innovation metrics that may be developed to populate each of those signposts. For a more detailed review of the innovation models and existing publicly available metrics, see *Signposts of Innovation: A Review of Innovation Measures*.[4]

4 For a more detailed explanation of the structure of our preferred innovation model, see *Signposts of Innovation: A Review of Innovation Measures*.

What Innovation Model Does Your Company Follow?

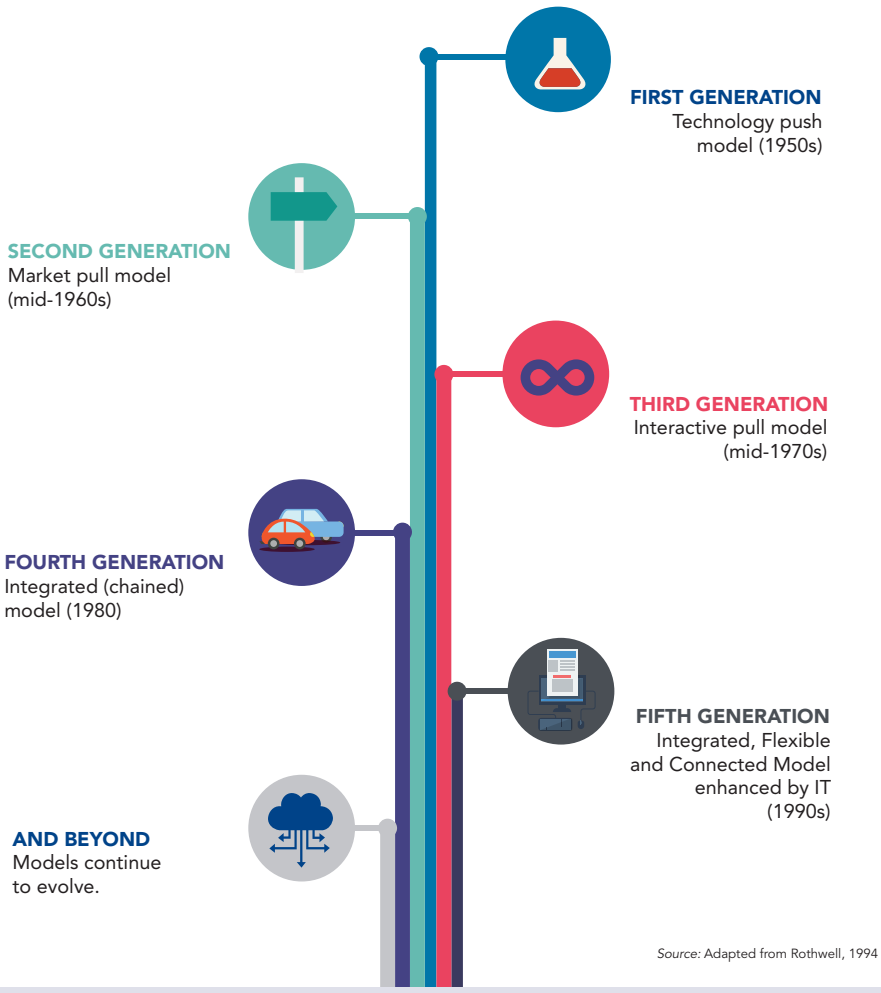
Paradigms of Innovation Have Evolved to Become More Dynamic and Complex

The way companies approach innovation is complex and constantly evolving. It is driven by an increasingly competitive environment, new capabilities (such as digitization), and changing customer demands. Over the past seven decades, the common view of innovation has changed from a mainly static and scientific activity of research and development to a dynamic and complex system of interactions between various participants both inside and outside of a firm, sometimes with the assistance of advanced IT systems.[a] One way to view these evolving approaches is is to take five distinct categories or generations (see infographic below).

(Text continues on next page.)

THE EVOLUTION OF INNOVATION MODELS

Understanding the innovation models at work in your company is an important first step to creating a robust measurement framework. Each of the five generations of innovation models below co-exist in today's economy and continue to evolve. Within one company, different generations of innovation processes may coexist and function concurrently.



Source: Adapted from Rothwell, 1994

What Innovation Model Does Your Company Follow? (continued)

First generation: Technology push model (1950s) New technology leads to commercialization of new products in a linear sequence: from basic research, to design and engineering, manufacturing, and finally marketing and sales.

Second generation: Market pull model (mid-1960s) Customer demand creates a pull on the company. The market is the starting point for ideas and innovations, but the process still flows in a linear sequence from market (demand) that informs R&D and design, to engineering, manufacturing, and sales.

Third generation: Interactive pull model (mid-1970s) The company is connected to the market and new technology in a feedback loop, leading to innovations. The process flow is nonlinear.

Fourth generation: Integrated (chained) model (1980s) Different business functions and external resources are integrated and work in parallel instead of sequentially, thus shortening the time span of innovations.

Fifth generation: Integrated, Flexible and Connected Model (1990s) The feedback loop of the integrated model is enhanced with IT technology allowing suppliers, customers, and alliances to participate in the innovation process to enable new forms of innovation (such as crowd sourcing).

And beyond: Models continue to evolve. The 2000s saw the rise of the Internet platform business. In the 2010s, innovators began to incorporate big data and predictive analytics into their processes.

When measuring innovation, it is helpful to identify which generation(s) of the innovation model is/are being used by the company because different generations will require different measurement systems. Most companies use a mix of elements from several generations. In some cases, models based on one or more generations may even operate side by side within a firm. The internal capabilities of a company and the demands of their industries and customers determine the specific approach they follow. For example, some companies still use the "gate" system, which corresponds to linear innovation models (first and second generations) to track innovation because only linear models will allow innovation activities to flow linearly from one gate to the next. The fourth and fifth generations are likely to involve different participants along the value delivery chain including customers, suppliers, peer companies, universities, and the general public (for crowd sourcing), and thus need multidimensional measurement frameworks.

Innovation models continue to evolve in the 21st century. The rise of the internet-platform business in the 2000s and the use of big data/predictive analytics in the 2010s, for example, are important landmarks of new forms of innovation.

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[a] Roy Rothwell, "Towards The Fifth-Generation Innovation Process," *International Marketing Review* 11, no. 7, pp. 7-31.

Toward a Flexible and Comprehensive Innovation Measurement System

To develop the *Signposts of Innovation* framework introduced in this report, we took as our starting point a firm that operates within a set of institutions and infrastructures, responds to market demand, and reacts to other firms' behaviors as well as to government policies and the education and public research systems. At the same time, within the firm, its culture, innovation strategy, organizational structure, and its ties to the innovation ecosystem influence how the firm uses its innovation resources, manages projects and portfolios, and reaches satisfactory innovation outcomes.

A good way to capture both the innovation environment outside a company and innovation inputs and processes within a company is to combine the external innovation model provided by the *Oslo Manual* of the OECD (2005)[5] and a firm-level model provided by Eric Dulkeith and Steven Schepurek (2012)[6] (Figure 1). This adapted approach effectively demonstrates the policy and business environment of innovations, while capturing the innovation strategy, culture, idea management, and the innovation process of inputs, throughputs (intermediates), and outputs at the firm level. It is this innovation process of inputs, throughputs, and outputs that is at the basis of the innovation metrics in each of our six signposts.

A key observation from Figure 1 is that there are several complex interactions and feedback loops among the different dimensions of innovation activity. The *Signposts of Innovation* measurement framework is flexible enough to cover firms operating under different models of innovation. For instance, the literature identifies generations of innovation models ranging from a linear model of an R&D-driven process (first generation) to a complex model of open innovation (fifth generation). (For more, see box on pages 7–8)

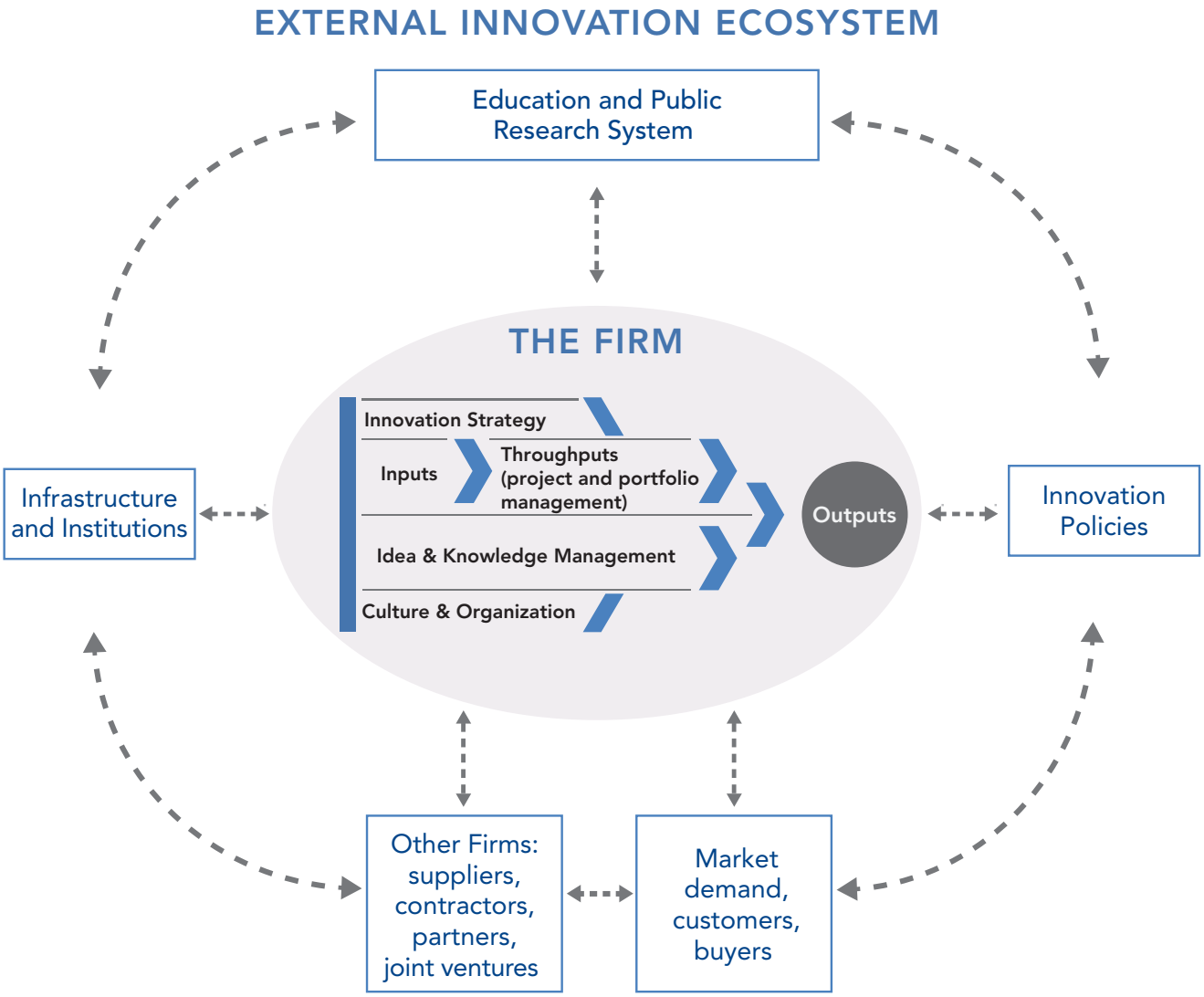
5 *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, 3rd Edition, OECD, 2005.

6 Eric Dulkeith and Steven Schepurek, *Innovation Performance Measurement: Assessing and Driving the Innovation Performance of Companies*, Detecon Consulting, 2013.

FIGURE 1: AN INTERACTIVE MODEL OF INNOVATION

A successful measurement framework captures the full scope of internal and external innovation interactions in a quantifiable way. A firm operates within a set of external forces which interact with each other and create a vibrant and complex innovation ecosystem. Within the firm, its culture, innovation strategy, organizational structure, and ties to the innovation ecosystem influence how it uses its innovation resources to create value. These internal factors may be roughly categorized as inputs, throughputs, and outputs.

OUR MODEL OF INNOVATION



Sources: Adapted from the Oslo Manual, OECD (2005) and Dulkeith and Schepurek (2013), The Conference Board.

The *Signposts of Innovation* Framework

The *Signposts of Innovation* framework is designed to capture and organize innovation metrics holistically. The signposts relate to six separate dimensions of innovation activity. The purpose of the framework is to help executives who are involved with innovation better track different aspects and activities of innovation to make better business decisions about the allocation of resources among innovation projects and between innovation and other projects. (Figure 2).

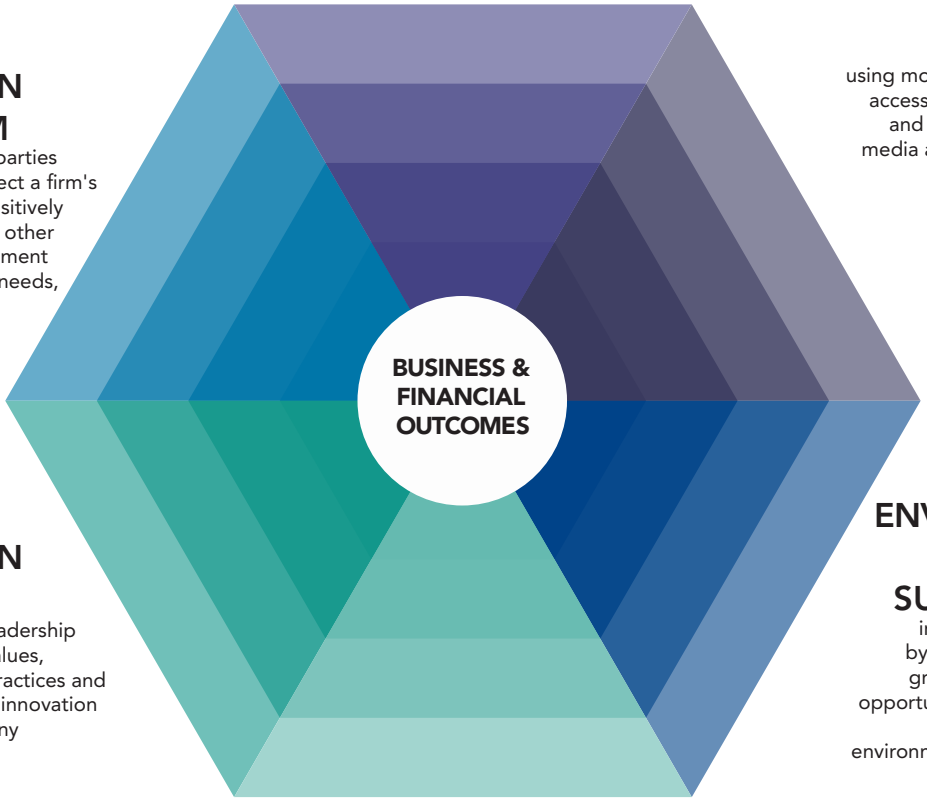
The pragmatic and somewhat eclectic approach we follow encompasses a broad range of possible theories and allows for organizations to put more emphasis on those signposts that matter the most for their purpose.

Since the complexity of innovation models have increased from the traditional linear R&D model to much more sophisticated and collaborative models, the *Signposts of Innovation* framework is designed so that businesses can develop metrics that:

- **Monitor** multiple sources of innovation within and outside the firm which may relate to technology opportunities (for example, biotech or digitization), trends in customer demand, or strategic objectives from governments (for example, sustainability objectives).
- **Recognize** the role of innovators along the value delivery chain and amongst multiple business functions. Those innovators may include customers, present suppliers, peer companies, or universities, and come from the general public through crowd sourcing or household innovation.
- **Position** metrics across the entire life cycle of innovation, including innovation inputs (such as R&D spending), throughputs (such as innovation projects in place), and outputs (such as profit from new products). (See "Track All Resources Devoted to Innovation" on page 14.)
- **Track** the innovation ecosystem in today's collaborative innovation environment inside and outside the firm.
- **Measure** an organization's level of innovative culture and internal innovation networks which are critical in generating innovative activity and harnessing its value.
- **Adapt and adjust** with a flexible structure to differences between or evolutions in innovation strategies by organizations.

Figure 2

The Conference Board Signposts of Innovation



Defining the Six Signposts of Innovation

1 **Technology** is the use of science to solve a problem, often through engineering and applied sciences. Economists also define technology as the state of knowledge on the methodologies for converting resources or inputs into outputs. Thus, a broader definition of technology would encompass the use of machinery and equipment (as well as business processes) and even software and databases to achieve end results for the business.

2 **Digitization** is driven by adoption of mobile technology, ubiquitous access to the internet, adoption of cloud services, use of big data and analytics as well as social media and enterprise platforms, artificial intelligence, and cognitive computing. It can include use of additive manufacturing or 3D printing.

3 **Environmental and social sustainability** involves innovation in the pursuit of a business growth strategy that creates long-term shareholder value by seizing opportunities and managing risks related to the company's environmental and social impacts. These impacts include elements of corporate citizenship, corporate governance, environmental stewardship, labor and workplace conditions, supply chain and procurement, community involvement, and philanthropy.

4 **Customer experience and branding** are two strongly related areas reflecting the importance of how consumers experience, value, and even contribute to innovation. These two aspects of innovation are strongly connected as customer relationships are built through experiences with the brand over time. Conversely, an innovative brand has a significant impact on the perception of brands and the anticipated customer experience.

5 **Internal innovation networks** are at the core of a business's innovation process. An internal innovation system requires a careful look into a company's innovation capabilities through its leadership & organization, processes & tools, people & skills, and culture & values.[7] Innovation success is critical to a business being agile and resilient where the agility and resilience arises through establishing and maintaining an inclusive, collaborative, and networked culture.

6 **External innovation ecosystem** refers to factors related to the firms' ability to carry out innovations in relation to their external environment. These factors include the dynamics of market demand, innovations in other firms (including competitors, collaborators, customers, and suppliers), the interactions with the education and public research system, the impact of government innovation policy, access to capital and infrastructure, and institutional frameworks.

7 George Chen and Michel van Hove, *Identifying and Removing Barriers to Innovation*, American Management Association, September 2011.

Track All Resources Devoted to Innovation

Measure throughout the Value Delivery Chain and Stages of Activity

Innovation metrics should be positioned along the full spectrum of innovation stages and the value delivery chain of each signpost, using an input, throughput, and output structure (see table). In this way, we can track both the resources devoted to innovation activity and the implementation of innovation initiatives along the lines of the six signposts which capture the different business functions along the value delivery chain. As an example of the input-throughput-output structure, in the *technology* signpost, R&D spending leads to patents and licenses which in turn can lead to license revenues. Another example is that spending on market research increases the duration of customer relationships and leads to an increased share of sales from new customers. As an example of innovation in different business functions along the value delivery chain, support from top managers on innovation initiatives may increase R&D spending, and that may create new services which expand market size.

Examples of Metrics Across Signposts and the Innovation Life Cycle

	Input	Throughput	Output
Technology	R&D	Patents	Receipts of license fees
Digitization	ICT spending	New digital technology adopted	ICT and business model creation
Environmental and social sustainability	Investment in operational sustainability	Number of ISO 14001 environmental certificates	Revenues from sustainability-advantaged products
Customer experience and branding	Spending on advertising	Relationship duration	Customer satisfaction
External innovation ecosystem	Venture capital access	University/industry collaboration	Revenues from collaborative innovation projects
Internal innovation network	Spending on innovation projects	Number of new ideas created internally	Number of new products developed from new ideas

Source: The Conference Board

At the Center of the Signpost Framework: Business and Financial Performance

Companies innovate to ultimately increase revenues, raise profits, create shareholder value, or to achieve some other financial or business goals. While the innovation goals of many companies are broader than merely maximizing some financial metric, financial and business performance is still often the primary goal for for-profit companies, and such metrics are therefore still among the most common output measures for innovation.[8] Examples of such measures are:

- Percent sales from new products/services in a given time period;
- Percent of new products or services launched;
- Return on investment (ROI) of new products or services;
- Potential of entire new product/service portfolio to meet growth targets; and
- Net present value of entire new product/service portfolio.

But, business leaders are also often in search of other non-financial output measures. Some innovation goals include attracting new customers/market share, creating new markets, becoming an industry leader, accelerating the share of digital products, rating the effectiveness of organizational learning (or knowledge generation) and dissemination of services, or decreasing the firm's environmental footprint. Sometimes, the reputation of being an innovative company can be a business goal related to the long-run survival and market and brand leadership of the firm. Overall, having a culture of innovation and a talented and skilled workforce may serve as even more compelling innovation output measures, as they help assure both current and future success.

Nonfinancial business performance goals can help to complement business evaluation with a deeper reflection on innovation activities. The *Signposts of Innovation* framework includes those non-financial "output" aspects of innovation as part of the input-throughput-output perspective within each signpost, all the while recognizing that financial and business performance measures are still the ultimate outcomes needed (see "Measurements for Countries and Sectors Can Also Be Used at the Company Level" on page 16).

8 For example, the KPMG Technology Innovation Survey (2013) finds that the top three measures of the value of an innovation are revenue growth, ROI, and market share. According to McKinsey (2008), the most important outcome metric is revenue growth due to new products or services.

Measurements for Countries and Sectors Can Also Be Used at the Company Level

In this report, the focus is largely on innovation metrics that can be used at the company level, and which therefore mostly reflect innovations within the company. However, national statistical offices and international organizations carry out surveys and evaluate innovation performances of countries, resulting in aggregate measures at country or sector level. Such measures can be useful for businesses too. For example, they can compare differences in innovation climate across regions (be it countries, groups of countries, or regions within a country) or sectors in which companies are active. They can also compare their own performance relative to the aggregate. A detailed overview of publicly available macro-, sector-, and firm-level metrics is available in *Signposts of Innovation: A Review of Innovation Measures*, The Conference Board (2017).

When using aggregate innovation measures at the company level, one should keep in mind these three caveats.

1 **Use R&D-based innovation indexes when technology prevails over other innovation dimensions** In the 1950s and 1960s, the major types of innovations were R&D based; in the 1980s, the model of user innovation became important where consumers/users shaped new innovations; and in the 1990s the model of open innovations in which companies needed to rely heavily on external sources of knowledge emerged. In today's innovation environment, R&D metrics cannot sufficiently capture the rapidly changing innovation models.[a] Another downside of public R&D spending measures is that they tend to lag a few years and therefore make it hard for practitioners to formulate timely operational decisions.

2 **Leverage the information underlying innovation indexes** Many public measurements are a simple average or weighted average of a list of macro variables related to innovation. Examples are the Global Innovation Index, the European Innovation Scoreboard, the Global Creativity Index, and the Global Entrepreneurship Index. These metrics can make a complex situation easier to understand, potentially motivate the country/company to improve on its ranking, or provide a direction for action. But simple ranking of innovation capabilities often masks the complexity of innovation activities, and may be too simplistic in describing the heterogeneous process of innovation at the level of the organization. When using such indexes it is therefore important to take a deeper dive into the rankings and relationships between the metrics. The composite index ignores those dimensions and that may lead to biased policies for government and a biased assessment of a company's innovation environment.[b]

3 **Look for metrics across the innovation life cycle** Whereas business measures of innovation often focus on outcomes, macro-level indexes tend to focus on input metrics due to the data maturity and abundance of input metrics. When using macro-level measures, companies should therefore also seek output measures, such as the percentage of sales of new products or services, high-tech exports, royalty and license fees, ICTs, and the predominant business model in a given country.

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a Hugo Hollanders and Adriana van Cruysen, *Rethinking the European Innovation Scoreboard: A New Methodology for 2008-2010*, Pro Inno Europe, September 2008.

b Micheala Saisana, "Composite Indicators—A Review: Second Workshop on Composite Indicators of Country Performance," presentation to the OECD, Paris, February 26-27 2004.

The Six Signposts in More Detail

Indicators for several of the signposts at the country level are abundant (see box on page 16). Such measures are often readily available from national and international organizations, such as Eurostat, OECD, the United Nations, or the World Bank.[9] But they are harder to find at the company level, on which we focus here.

As mentioned before, the importance of each signpost varies by company or even by innovation project within a certain company. Hence our approach has been to provide a flexible data structure to allow the different innovation approaches and models that companies apply.

1: Technology

Despite the evolution of innovation beyond technology, technology-related metrics are still among the most widely accepted measures of innovation capability at the firm and economy-wide levels. R&D spending and the number of scientists, for example, are innovation measures widely used by governments that show up in news headlines regularly.

The importance of technology for the economy cannot be overstated, but its incorporation into business processes and its impact vary across industries. For example, the pharmaceutical and automobile industries tend to spend heavily on research and development, and this can be directly measured. However, unlike manufacturing industries which rely on their R&D departments, service industries tend to use new ideas collected from other business functions as well and are less likely to report R&D as a stand-alone business expense in company annual reports.

Important metrics at the company level include:

- R&D spending as a percentage of sales from company financial statements;
- Number of patents from national patent offices; and
- Other variables, such as the number of ideas or concepts in the pipeline.

Some measures, such as the number of ideas or concepts in the pipeline, are mostly collected internally in a company, and while they may be collected through government and private surveys, they are rarely made public on a company-by-company basis.

Some technology-related metrics throughout the innovation life cycle are easy to categorize as inputs, throughputs, and outputs. For example, R&D spending or the number of salaried researchers are clearly inputs in most industries. Other measures are not so clear cut. Executives in different industries might view similar metrics in a different light. For instance, a large pharmaceutical company may treat the number of patents as an input. In contrast, a research start-up may identify the number of patents as an output because it can charge for the licenses associated with them.

9 See "Measurements for Countries and Sectors Can Also Be Used at the Company Level" and Janet Hao et. al., *Signposts of Innovation: A Review of Innovation Measures*, The Conference Board, 2017.

2: Digitization

Information and communications technology (ICT), the Internet, and other digital technology/equipment are changing the economy, the business world, and society in many ways—from consumer trends to the production of goods and services and the social sphere.[10] The rise of the New Digital Economy, which refers to the combination of mobile devices, ubiquitous access to the internet, and cloud services, will continue to transform the business world.[11] Digital innovations such as artificial intelligence and the Internet of Things are only in their beginning stages. All of these are sources and enablers of innovations.

Digitization differs from the broader concept of digital transformation, which concerns the use of digital technologies and the data they produce to connect organizations, people, physical assets, processes, etc. for the purpose of rapidly developing new products, services, markets, and business models to capitalize on emerging customer needs.[12] In this way, digital transformation spans several signposts, of which digitization is only one, and connects them in a complex web of business interactions.

Digitization can be measured both through the dimension of products/services and according to the way outcomes are achieved. For example, the DigiWorld Yearbook (2015) defines six types of products and services related to digitization—network equipment, IT services and software, telecom services, TV and video services, Internet services, and devices. Digitization measures at the country level are plentiful and are available from public and private sources such as ZookNIC, Google, Wikimedia Foundation, ITU World Telecommunication/ICT Indicators Database of the International Telecommunication Union, and the Executive Opinion Survey of the World Economic Forum.

Data on digitization at the company-level are rarely available for comparison across companies. Digitization measures at the company level include:

- Percentage of documents digitally archived;
- IT spending per employee;
- Ratio between IT staff and all non-IT staff ;
- Percentage IT budget of total revenues;
- Number of *product* innovations that are digital;
- Number of *process* innovations that are digital;
- Metrics related to digital usage, readiness, and adoption; and
- Metrics related to the digital component of innovation strategy.

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10 Louise Keely, Brian Anderson, and Ben Cheng, "Introducing the Connected Spender: The Digital Consumer of the Future," The Demand Institute, February 2017.

11 van Ark, *Navigating the New Digital Economy.*

12 Mary Young, *Digital Transformation: What Is It and What Does It Mean for Human Capital?* The Conference Board, July 2016.

However, several of these measures are becoming less useful for companies operating in the New Digital Economy. For example, in the latest digitization wave, the importance of IT staff is declining as the skills of non-IT staff and the expectations that they be tech-savvy and able to understand and apply digital tools increase. Also digitization often occurs as part of other business processes, including sales and marketing, so the spending on digitization within the company take place outside of the IT department's budget. Going forward, we therefore need to move toward a new set of metrics for the New Digital Economy, which will be an important goal for follow up during this research project.

3: Customer Experience and Branding

Customer experience and branding are two strongly related areas reflecting the importance of how consumers experience, value, and even contribute to innovation. These two aspects of innovation are strongly connected as customer relationships are often built through experiences with the brand over time. Conversely, an innovative brand can have a significant impact on the perception of brands and the anticipated customer experience.

In innovation leaders' minds, customer experience is the closest one can get to an output measure of innovation, and it could replace or at least supplement common financial revenue metrics. For example, in businesses that are driven by subscriptions, customer satisfaction is often more important than one-time revenues because customer satisfaction creates recurring revenues in the coming years.[13] Incorporating customer experience into the signposts framework stresses the user-centric approach toward innovation.

In today's world of rapid innovation, many companies have become even more focused on delivering a relevant and differentiated customer experience through taking a more holistic approach to innovation and leveraging their brand assets. Branding is the sum total of what a company does to communicate and deliver a brand promise, and innovation adds an additional enhancement to that promise. For instance, when a new product is launched by a respected brand, that product has an eager prospective group of customers, predisposed to trying it and buying it. And, when a brand is refreshed through a successful innovation, that innovation makes the brand and customer relationships even stronger.[14] If a company nurtures a culture of innovation, customer experience is expected to be higher than without it.

13 See for example, Tyler Zloat, An Introduction to Subscription Finance: Strategies for Understanding and Growing Your Recurring Revenue, Zuora.

14 Clayton and Turner (2000) examined the consumer sector and found that branded producers introduce new products faster than unbranded ones.

Customers are also no longer just passive recipients of a company's innovations. Co-creation of products and services through continuous feedback loops between producers and users are becoming critical elements of the innovation process. And household innovation outside the business sector is becoming increasingly important, involving as many as 3 to 6 percent of households in mature economies, such as Canada, the UK, and the United States.[15] This new source of innovation can be an important competitor to established businesses or a driver of subsequent business innovation.

Examples of measures related to brand and customer experience used at the company level in the context of innovation measurement include:

- Advertising spending provided by company financial statements;
- Customer satisfaction ratings;
- Conversion rates of digital marketing provided by the marketing department of a company;
- Net promoter scores;
- Metrics related to customization, co-creation with customers, social media, and big-data analytics to understand customer needs; and
- Data on brands, such as familiarity with a corporate brand, reputation, or brand power.

4: Environmental and Social Sustainability

Environmental and social sustainability is often a key target of many high-performing organizations. Some companies view sustainability goals either being an "add-on" to innovation targets, while others see them as an "integral" part of the innovation process. To address these challenges, a growing number of companies are looking for best practices to embed sustainability practices into their innovation processes and ways to develop portfolios of sustainability-advantaged products, services, and solutions.

Several companies are investing significantly in sustainability R&D and generating sizeable revenues from these innovations. General Electric, for example, allocated over half of the company's R&D budget to its initiative in 2015. Similarly, Siemens' Environmental Portfolio accounted for 43 percent of the company's overall revenue in 2015.[16] Sustainability initiatives seek to address problems of climate change and resource scarcity as well as significantly contribute to the bottom line by dramatically increasing percentage of revenue, exceeding strategic goals, and attracting the attention of the financial sector.

15 Eric von Hippel, *Free Innovation*, The MIT Press, November 2016.

16 Thomas Singer, *Driving Revenue Growth through Sustainable Products and Services*, The Conference Board, July 2015.

The measures for environmental and social sustainability at the company level include:

- Atmospheric emissions;
- Energy and electricity consumption;
- Water consumption;
- Waste reduction;
- Biodiversity policies;
- Expenditure on illness and accident prevention; and
- Expenditure on employee training.

Some of this raw data can currently be found in company annual reports and/or sustainability reports and also in *The Conference Board Sustainability Practices Dashboard*.[17] Many companies are seeking best practices and comparable data as well as looking ahead for the next big innovation story in the sustainability space.

5: Internal Innovation Network

The internal innovation network is at the core of a business's innovation process and reflects a company's innovation capabilities through its leadership & organization, processes & tools, people & skills, and culture & values.[18] Responses to the 2017 edition of ***The Conference Board CEO Challenge***® show a clear recognition that for an organization to achieve innovation success, counter the emergence of new and more nimble competitors, and get ahead of evolving customer demands and needs, it must have a culture that is inclusive, collaborative, and networked. The top four strategies to address the challenge of innovation are all related to internal innovation networks:[19]

1. **Engage** in strategic alliances with customers, suppliers, and/or other business partners.
2. **Develop** managers and leaders to promote idea sharing in teams.
3. **Establish** a strong collaborative culture that encourages cooperation across functions and business units.
4. **Emphasize** creativity and/or innovation as a corporate value or principle.

17 *The Conference Board Sustainability Practices Dashboard*, November 2016.

18 Chen and van Hove, 2011.

19 *The Conference Board CEO Challenge® 2017*.

Identifying the Internal Innovation Network

As to company-level measures, Dobni and Nelson (2012) measure the internal innovation environment within four major categories (below) with nineteen detailed types of metrics:[a]

- Innovation intent (context), including "innovation propensity," "employee connectivity," and "strategic infrastructure;"
- Innovation infrastructure (resources), including "employee skills & creativity," "organizational learning," and "technical & financial support;"
- Innovation influence (knowledge management), including "business environment enactment," "industry/competition/client knowledge dissemination," and "industry/competition/client knowledge generation;"
- Innovation implementation (execution), including "alignment," "new venture management," and "employee empowerment."

a Brooke Dobni and W. Thomas Nelson, Jr, *Innovation Nation? Innovation Health Inside the Fortune 1000*, Strategian and Lodestar, 2012.

As to specific metrics that can be collected by internal company surveys, some examples include:

- Sufficient funding for innovations;
- Talent mix;
- Access to information;
- Incentives for innovation success;
- Organizational structures (hierarchical vs. flat);
- Individual vs. collective decision making;
- Cooperative teams and levels of diversity and degree of inclusion on those teams; and
- Leadership involvement in the innovation process.

6: External Innovation Ecosystem

Firms do not carry out their innovation activity in a vacuum, and increasingly collaborations beyond the firm boundaries are becoming important. Many external factors determine whether firms are able to carry out innovations, how they innovate, and what innovations will be operational or come to market. Factors related to the innovation ecosystem include market demand, innovations in other firms, educational and public research systems, government innovation policy, access to capital, collaborative arrangements with other large and small companies, and infrastructure and institutional frameworks.

Indeed recent competition has started to shift from taking place between firms within the same ecosystem to occurring between innovation ecosystems, where firms may become more competitive than before by accelerating their pace of innovation in an open and collaborative environment, thanks to globalization, changes in industry boundaries, and advances in technologies.[20] This means building and nourishing strategic external alliances with customers, suppliers, and business partners while fostering internal, cross functional, and cross business unit collaboration.

External innovation systems are often geographically determined. Silicon Valley is one of the most well-known examples of an innovation ecosystem. Access to top technology companies, universities, venture capital, and a culture of risk tolerance all contribute to making Silicon Valley a cradle of many successful and highly valuable innovations. But there are many other examples of such geographical innovation systems, including the Research Triangle in North Carolina, Amsterdam's ArenA Innovation Center in the Netherlands, and Singapore's Research, Innovation, and Enterprise (RIEC) council.

In some ways, the measurement of the relationships between a company and an external innovation ecosystem will encompass the previous five signposts. For example, open innovation relies heavily on an external innovation ecosystem while drawing from different types of resources or "signposts." In the fourth and fifth generations of innovation models, multiple types of innovations tend to happen simultaneously along different segments of the value delivery chain both inside and outside a firm.[21]

Data on external innovation ecosystems are relatively abundant. Data sets include the World Bank's rankings on the ease of starting a business in regions of the world, the World Economic Forum's Executive Opinion Survey which provides information on the intensity of local competition, and Eurostat's public R&D expenditures.

At the company level, external innovation ecosystems could be characterized by:

- Number of innovation projects with third parties;
- Joint funding of innovation ventures with other organizations; and
- Amount spent on basic research or participation in innovation platforms.

20 Chander Velu, Michael Barrett, Rajiv Kohli, Torsten Oliver Salge, "Thriving in Open Innovation Ecosystems: Toward a Collaborative Market Orientation," Cambridge Judge Business School, April 2010.

21 Larry Keeley, Helen Walters, Ryan Pikkel, and Brian Quinn, *Ten Types of Innovation: The Discipline of Building Breakthroughs* (Wiley, 2010).

Missing Metrics as a Barrier to Innovation

In June 2016, attendees at the fourth Innovation Masterclass of The Conference Board participated in an open-ended exercise to identify what measures they thought were missing for innovation.[a] The participants were instructed to name measures that, if adopted by a company, could "move the needle" on innovation performance. Some interpreted the question as asking about measures that are missing at their company even if they existed elsewhere. Others focused on measures not yet used anywhere. There were nearly 150 submissions, which were arranged into eight different categories. The participants then voted on the most important categories of metrics. Out of 150 submissions, the top categories that emerged were:

- Capturing and communicating "learning" to help future efforts (35 votes);
- Value of failure (34 votes);
- Customer resonance and adoption (31); and
- Progress towards a culture of innovation (31 votes).

Most of the suggested metrics require measurement of the opinions, perceptions, or sentiments of employees/leaders. The ensuing discussion among participants indicated that an organization would find significant value in an ability to compare its measures with other companies, particularly those in its industry and/or those most admired as innovators.

Four learnings from this exercise were:

1. The value of failure and capturing/communicating learning may be an organization's biggest opportunity to improve innovation performance.
2. Improving on the measurement of an open innovation culture may be the most productive move in achieving better innovation measurement.
3. Improvement is needed in understanding how well a potential innovation meets customer needs and how willing they are to adopt it. This point seems to be related to user-centric product or service design (e.g., co-creating with customers, using more sophisticated tools than focus groups, etc.). Many respondents think organizations need to improve capture and use of customers' and potential customers' ideas as inputs for innovations.
4. Customers aren't the only important entity external to the company that participants of this exercise identify as needing metrics. Other external entities include competitors and potential external partners.

[a] We are grateful to Anne Greer and Rita Shor for conducting the exercise and sharing their insights with us.

How to Overcome the Challenges of Innovation Measurement at the Firm Level

Widen your range of innovation measures

The increased complexity of the innovation process requires the use of a mix of measures which are unique to a given innovation process and reflect its various dimensions.

Track the entire life cycle of innovation

Currently, companies are more likely to use measures of innovation outputs than inputs.[a] But output measures usually lag and cannot provide timely information about ongoing innovation projects. As such they could be useful for evaluation or assessment of past innovation efforts but are silent on the effects of current innovation activities, nor do they provide a forward-looking perspective of a company's future ability to innovate. Research also shows that firms measure resources (for example, R&D spending) and outputs (for example, market share of new products) but tend to ignore the intermediates in the process.[b] Companies should therefore expand their focus to include more input and throughput (or intermediate) measures.

Don't kill the innovation process with measurement

Measuring innovation in too strict a manner can impede the process of innovation, especially if the focus is on output measures. Given the uncertainties of the innovation process, measuring the wrong things at the wrong time can hurt learning, discovery, and risk taking in the innovation process. For example, rate of return or return on investment (ROI) works better for short-term innovations but tends to exclude long-term innovations and breakthroughs.[c] At an early stage, a company likely does not know the potential market value of a particular innovation and projects may be abandoned prematurely if only short-term measures of success are used. Hence, indicators should be linked to the way a company defines and understands its innovation progress and fit with its innovation culture.[d]

(Continued on next page)

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a McKinsey, McKinsey Global Survey Results: Assessing Innovation Metrics.

b Rene Cordero, "The Measurement of Innovation Performance in the Firm: An Overview," *Research Policy* 19, issue 2, 1990, pp. 185-192.

c Langdon Morris, *Innovation Metrics: The Innovation Process and How to Measure It*, Innovation Labs LLC, November 2008.

d Sue Jefferson, "The Cultural Barrier," *Chief Innovation Officer,* Issue 6.

Accept that failure is a critical part of the innovation process

In the 2017 edition of ***The Conference Board CEO Challenge®*** survey, the strategy defined as *ensure that the performance appraisal system acknowledges that failure and iteration are often necessary aspects of innovation success* was ranked tenth out of 25 innovation strategies.[e] An exercise conducted with the participants of the fourth Innovation Master Class in June 2016 showed that capturing and communicating the "value of failure" and its learnings are closely related and, if measured, may be an organization's biggest opportunity to improve innovation performance (see "Missing Metrics as a Barrier to Innovation" on page 24).

Use a common language about innovation throughout the company

Vocabulary is an important part of making collaboration work. This is somewhat inherent to the process of innovation which is evolving continuously. Hence, new inventions, incremental improvements, and applications lead to new vocabulary and easily cause confusion among the players. The development of innovation metrics will increase clarity for definitions, reporting of results, and agreements on the goals of innovation projects.

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[e] *The Conference Board CEO Challenge® 2017*.

Toward Implementing the *Signposts of Innovation* Framework

The *Signposts of Innovation* framework is based on the notion that a fixed set of innovation metrics will fail to satisfy the needs of companies in different industries or with different innovation goals. Measurement initiatives for innovation need to recognize the multiple dimensions in the innovation process (over different time frames and across different segments of the value delivery chain).

On the basis of this framework, companies can begin identifying the innovation signposts and underlying metrics that are key to their innovation strategies and activities and present them in, for example, a scorecard or dashboard. This can serve as the starting point for a systematic measurement and tracking tool which can be used in conversations on what dimensions of innovation are key for the business. Ultimately, these metrics could help improve resource and investment allocation decisions, identify bottlenecks, and allow for better management of innovative activities.

With this framework in hand, The Conference Board is undertaking a series of new activities in the coming year:

- Identify new metrics of innovation (beyond existing metrics which are already in the public domain) by leveraging knowledge about innovation and the practical experience of business executives
- Conduct a business survey on selecting top innovation metrics across signposts
- Conduct surveys to collect new innovation metrics through partnerships with other research organizations
- Research a variety of metrics for their strength and reliability to identify facets of innovation and their impact on financial and business performance
- Analyze which innovation metrics provide the best insights for the future of innovation success
- Investigate the possibility to further develop a series of metrics that can be collected on a continuous basis that companies may use as a basis for benchmarking against other companies as well as against the aggregate performance of sectors, innovation systems, or even macro-levels such as countries or regions.

Finally, most innovation metrics tell stories about past and present innovation efforts, from which lessons can be learned for future innovation activities. However, some innovation indicators give more insight into the future of innovation success. Strong examples of such indicators are indexes related to innovative cultures which create environments where the continuous searching for new innovation opportunities is in the DNA of the organization. In follow-up research we aim to provide more insights on these forward-looking characteristics of innovation metrics.

About the Authors

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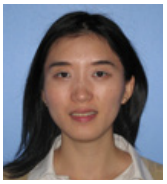
Van Ark has been extensively published in national and international academic journals and is frequently featured in major international business media, including Bloomberg, CNBC, *Financial Times*, and the *Wall Street Journal*.



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Prior to joining The Conference Board, Hao earned her PhD in economics in 2007 from the University of Maryland, College Park. Her dissertation examined how highways promote trade and development in US metropolitan areas.

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Engagements with innovation leaders on developing the signposts of innovation framework

	Description	Events and activities
Councils	Councils of The Conference Board, composed of senior innovation executives from member companies, provide insights on signposts for assessing and predicting innovation	Council meetings of various innovation councils: • Innovation Council • Applied Innovation Council • Innovation Leadership Council • European Innovation Council • Products & Services Development Council
Seminars and workshops	To obtain feedback from a wide range of innovation leaders and practitioners regarding the predictive signposts of innovation and how they might work at the company level	• Transforming Innovation Through Collective Disruption Seminar (December 1, 2015) • 4th Annual Innovation Master Class (June 8, 2016) • The Future of Digital Transformation and Innovation unConference (October 6, 2016)
Panels and other discussions	Panel and roundtable discussions with researchers and senior innovation executives to address the goals, challenges, and opportunities in innovation measurement	• Fireside Chat hosted by 3M, Saint Paul, MN (October 19, 2015) • Cologne Institute for Economic Research Roundtable (August 29, 2016) • Dallas Chamber of Commerce Innovation Panel (October 3, 2016) • One-on-one briefings with individual companies
Research collaborations	Partnerships with academics and subject matter experts in the areas of innovation research and measurement to collect data and quantify innovation at the company level	• Innovation surveys of members of The Conference Board

Innovation-related Research at The Conference Board

Over the past two decades, The Conference Board has researched multiple aspects of innovation at the company and country levels. Areas of research have spanned from intangible assets to technology, digital transformation, productivity, branding and marketing, sustainability, the culture of innovation, diversity and inclusion, and profits and revenues. The *Signposts of Innovation* project draws insights from experts in those research fields. Examples of The Conference Board research related to innovation include:

INNOVATION

Innovation Viewed from Within the Corporation, Economics Program Working Paper Series, 2008.

Exploring Innovation with Firm Level Data, Economics Program Working Paper Series, 2008.

Speed: Linking Innovation, Process and Time to Market, Research Report, 2000.

Living Open Innovation: Not New, but New for You, Webcast, 2016.

TECHNOLOGY

Historical Foundations of American Technology, Report, 2008.

The Structure of Business R&D: Recent Trends and Measurement Implications, Economics Program Working Paper Series, 2004.

DIGITAL TRANSFORMATION

Navigating the New Digital Economy: Perspective on the US, KnowlEdge Series, 2016.

E-Business Strategies in the Global Marketplace: E-Procurement and Other Challenges, Research Report, 2001.

Collaborative Innovation Accelerates IoT Product Development, Webcast, 2016.

INTANGIBLE ASSETS

Innovation, Intangibles and Economic Growth: Towards A Comprehensive Accounting of the Knowledge Economy, Economics Program Working Paper Series, 2007.

Intangible Capital and the Market to Book Value Puzzle, Economics Program Working Paper Series, 2008.

PRODUCTIVITY

Entrepreneurs, Inventors and the Growth of the Economy, Research Report, 2008.

Computers and Productivity: Are Aggregation Effects Important? Economics Program Working Paper Series, 2000.

BRANDING AND MARKETING

Exploring the Link between Customer Care and Brand Reputation in the Age of Social Media, Executive Summary, 2016.

Brand Efficiency: Measuring Brand Communications Effectiveness, Webcast, 2008.

The Fortune 500 and Social Media: A Longitudinal Study of Blogging and Twitter Usage by America's Largest Companies, Research Report, 2016.

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Innovation-related Research at The Conference Board (continued)

SUSTAINABILITY

Measuring the Effectiveness of Global Ethics and Compliance Programs: Trends and Challenges, Book, 2005.

CULTURE OF INNOVATION

HR's Role in Building a Culture of Innovation, Executive Action Report, 2005.

Recognition and Reward Systems for Innovation, Webcast, 2008.

Innovation and Leadership: Generating the 'Love of Learning' Culture, Webcast, 2016.

DIVERSITY & INCLUSION

Inclusion + Innovation: Leveraging Diversity of Thought to Generate Business Growth, Research Report, 2016.

Why Inclusive Companies Are Better at Innovation, Webcast, 2016.

PROFIT AND REVENUES

Measuring the ROI of Online Press Releases, Research Report, 2016.

New Activities in 2017

As part of the *Signposts of Innovation* framework, The Conference Board is working with various research partners to identify and collect data on new metrics of innovation. For example, in early 2017 The Conference Board launched the Global State of Innovation Survey together with InnovationOne, LLC, (www.innovationone.io), an independent research and consulting firm that scientifically collects and analyzes information on innovation success, obstacles, and issues. This survey will help identify metrics currently used and/or needed to assess innovation culture and capability at the company and country level.

The "customer experience and brands" signpost is another area for collecting new data to improve our understanding of how brands interact with innovation at companies. Tenet Partners, a brand research company that has published the CoreBrand Index since the early 1990s, has introduced a new survey question related to the perception of companies having a culture of innovation. The analysis of this new data source is expected to shed light on the relationship between innovation and brands.

The Conference Board will continue to conduct surveys to collect new innovation metrics through partnerships with other research organizations as well as bring together new data sources and analysis on the *Signposts of Innovation*.

If you would like to inquire about research collaboration please email us at ipc@conference-board.org and visit our website at https://www.conference-board.org/future-of-innovation/.

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