

## **Report Card on US Corporate Innovation**

*Report for Survey Project*

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## **Introduction**

Due to its significant impact on economic growth and human development, innovation has drawn increasing attention from scholars in various disciplines (e.g. business, economics, science, engineering, sociology) (Tellis, Prabhu and Chandy 2009; OECD 2005).

Although innovation is widely recognized as critical to business success, it is a subject that has been difficult to analyze in a rigorous yet practical manner. In large part, this is because quality data on corporate innovation is generally lacking. In turn, this is because many aspects of innovation are hard to define, much less quantify. Despite the evolution of innovation theories in recent decades, consensus on how best to define or deconstruct innovation has yet to emerge.

Economist Joseph A. Schumpeter (1939) first distinguished innovation from invention, identifying three critical characteristics of innovation: 1) constructing new plants and equipment, 2) introducing new firms, and 3) developing new leadership (Robertson 1967).

Rothwell and Gardiner (1985) suggest that innovation refers to both the commercialization of major advances and the utilization of small changes in technology. Henderson and Clark (1990) define innovation as a process by which companies introduce new methodologies, workflows, services, products, and ideas. Albury (2005) and Hartley (2006) agree that innovation involves the creation, development and implementation of new products, processes, services, methods of delivery, and organizational forms that result in significant improvements in outcomes.

In general accord with Albury (2005), Hartley (2006), the EPRS briefing (Rellon, 2016), and the Oslo Manual (OECD 2018), we loosely define innovation as the creation and adoption of new products, processes, marketing approaches, or organizational approaches that produce value-creating outcomes to the innovator (i.e., firms), consumers, the economy, and society as a whole. Although other categorizations of innovation have been developed (e.g., Henderson and Clark

(1990), Satell (2017)<sup>1</sup>), because we chose to use a definition of innovation consistent with the one used in the Oslo Manual (OECD 2018), we also used their categorization of innovation into four types: product innovation, process innovation, marketing innovation, and organizational innovation (OECD 2005, 2018; Table 1).

**Table 1** Definitions for the Four Types of Innovation (OECD 2005)

<p><b>A Product Innovation</b> is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.</p>	<p><b>A Marketing Innovation</b> is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.</p>
<p><b>A Process Innovation</b> is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.</p>	<p>An <b>Organizational Innovation</b> is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations.</p>

As a multi-faceted concept, innovation has been said to exist along three key dimensions. The first dimension, *novelty*, states that an innovation should be different from previous and current alternatives, wherein the difference created by an innovation can range from incremental (on the low end) to radical or disruptive (at the upper end). The second dimension, *adoption*, indicates the degree to which an innovation is utilized by some broader set of parties beyond the innovator. The third dimension, *value*, assesses the extent that an innovation changes the world by affecting the innovating firm, consumers, the marketplace, the industry (including competitors of the innovator), and society at large. (Reillon 2016; OECD 2018).

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<sup>1</sup> Henderson and Clark (1990) categorizes innovation into incremental innovation, architectural innovation, modular innovation and radical innovation; Satell (2017) categorizes innovation into breakthrough innovations, sustaining innovations, basic research and disruptive innovation.

Despite substantial academic research on innovation, insights from C-level managers on corporate innovation are relatively scarce. In this research, we develop a self-administrated survey for C-level executives in US-based Fortune 500 firms, with the objective of gaining their perspectives on how well their firms performed during the past three years on the four types of innovation, along the three dimensions of innovation.

The survey we develop serves two primary purposes. First, it facilitates the gathering of baseline data to better understand the recent innovation activity of US-based Fortune 500 firms. Second, it serves as a foundation from which a *Report Card on US Corporate Innovation* can be developed annually, which would generate longitudinal data on US corporate innovation to enable subsequent directions of research on corporate innovation. If the survey is well-designed and well-received, the resulting annual *Report Card* (and underlying data) could be of significant value to both industry and the academia.

### Sampling

The target population of this survey is C-level executives in US-based Fortune 500 firms. For this research, we intend to purchase curated information from *RSA List Services*, which offers data on 5,000 CXO executives from Fortune 500 companies, including names, titles, telephone numbers, physical addresses, and email addresses. A sample of this list is shown in Figure 1.

**Figure 1** Sample from *RSA List Services* Data on CXO Executives in Fortune 500 Firms

Rank	2011 Company	Rank 2011	Ticker	File	Contact Name	Title	First Name	Last Name	Web Add	Address	Address2	City	State	ZIP Codes	Country	Phone	Nu	FAX	Numt	Employee	Revenue	SIC Code	Industry	Email	Status
1	Walmart	1	WMT	CEO	C. Douglas	President	Douglas	McMillion	www.sto	702 SW 8th St		Bentonvil	AR	72716-62	USA	+1-501-2	+1-302-6	2300000	514405	5940	General M	douglas.r	Verified		
6	UnitedHealth Group	5	UNH	CEO	David S. V	Chairman	David	Wichman	www.uni	9900 Bren Rd E		Hopkins	MN	55343-96	USA	+1-952-93	+1-302-6	230000	226247	6324	Health C	dalid.v@uhg	Verified		
7	McKesson	6	MCK	CEO	Brian Tyle	Chief Exec	Brian	Tyler	www.mci	1 Post St		San Franc	CA	94104-52	USA	+1-415-98	+1-302-6	68000	208357	5122	Wholesale	brian.tyle@mc	Verified		
9	AT&T	9	T	CEO	Randall L.	Chairman	Randall	Stephens	www.att.c	208 S Akard St		Dallas	TX	75202-42	USA	+1-210-8	+1-302-6	268540	170756	4813	Telecomm	randall.st@att	Verified		
10	AmerisourceBergen	12	ABC	CEO	Steven H.	Chairman	Steven	Collis	www.amc	1300 Morris Dr		Chesterbr	PA	19087-55	USA	+1-610-7	+1-610-6	18500	167940	5122	Wholesale	scollis@a	Verified		

In theory, this list should align perfectly with the desired sampling frame, including all (and only) C-level executives for all US-based Fortune 500 companies. However, if the above-noted list is not as complete as advertised, we will face a non-coverage issue – in which case, the actual sampling frame of the survey would be all executives included in the *RSA List Services* list.

As described further below, many of the questions in the survey are measured on a 7-point Likert scale. Since this survey is the first of its kind, there is no prior knowledge about the true extent of variation in the response data we will receive. Accordingly, for each of the Likert scale questions, we assume that responses will be distributed normally, with a mean of 4 and a variance of 1, implying that 95% of all responses will fall within the range [2,6] – consistent with the notion that respondents to Likert-scale questions tend to avoid responding at either extreme of the scale.

Furthermore, even though the sample could plausibly be stratified (e.g., by different C-level roles), there is no theoretical basis for supposing that variance would be different for different strata, thus negating a primary reason for undertaking sample stratification in the first place. While the findings from this research could provide justification for sample stratification in subsequent iterations, for this survey, we will undertake a simple random sampling approach.

Given the target population of 5000 CXO executives from Fortune 500 companies ( $N = 5000$ )<sup>2</sup>, assuming a response variance of 1 ( $\sigma^2 = 1$ ) and a tolerance level equal to 10% of the variance ( $e = 0.1$ ), and using a 95% confidence interval ( $\alpha = 0.05$ ) for statistical analysis, the minimum sample size of completed surveys required for the dataset is 357 (Appendix D).

To achieve this minimum sample size, we will assume a non-response rate of 80%, reflecting the fact that Fortune 500 C-level executives are very busy, and most will not have the time or interest to invest the time in completing the questionnaire. Accordingly, to obtain a minimum sample size of 357, we will email the questionnaire – under a cover note designed to stimulate commitment to complete the survey – to 1,785 (= 357 / 0.2) individuals randomly selected (without replacement) from the *RSA List Services* list of 5,000 executive contacts.

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<sup>2</sup> The estimate of population size is based on 5000 CXO records that *RSA List Services* provides.

If responses received from the initial batch of 1,785 survey emails turn out to be less than the minimum sample requirement of 357, another set of surveys will be emailed to a random sampling of the previously unselected 3,215 ( $= 5,000 - 1,785$ ) individuals on the CXO list from *RSA List Services*, this time using the non-response rate found to be associated with the first batch of survey emails, until the minimum sample size is reached.

### **Draft Questionnaire**

An initial draft web-based questionnaire (Appendix A) was developed in Qualtrics to gather opinions from respondents on the following three topics: 1) the extent to which their company is engaged in each of the four types of innovation described above, 2) how well their company performs on the three dimensions of innovation: novelty, adoption and value and 3) the impact that the company's innovation activities have had on the market and on the organization.

Accordingly, the questionnaire was developed around a core section comprised of three main blocks of questions (Blocks A, B and C) corresponding to the three areas of inquiry. This core was preceded by an introductory section and followed by a concluding section.

### **Introductory Section**

To provide context, the introductory section of the survey consisted of an opening statement, along with two questions to gain basic information on the respondent's firm.

The opening statement notably included references to:

- The topic (corporate innovation), and objective (assessing whether an annual report card for corporate innovation would be valuable) for the research
- The organization (the Pamplin College of Business at Virginia Tech) sending the survey, to establish the credibility and non-competitive nature of the research
- The expected duration of time (15 minutes) for the respondent to complete the survey

- The names and email addresses of the two researchers responsible for conducting the survey, in the event of any questions or concerns
- Assurances that the respondent's (and their employer's) identity will remain anonymous and responses will remain confidential

After this opening statement, the respondent was asked to provide the name of company, and to identify the type of company by using a standard industrial classification (SIC) typology.

### **Block A**

Block A opened with a general statement that “Corporate innovation is a multi-faceted topic” and then introduced the four types of innovation that would be investigated by subsequent questions.

After this set-up, Block A was structured to proceed through each of the four types of innovation using an identical template involving the following six screens:

1. A statement defining the type of innovation, also providing some illustrative examples.
2. A question asking respondents to answer “to what extent” – on a Likert scale from 1 (“not at all”) to 7 (“to a great extent”) – that type of innovation had been pursued by their company over the past three years.
3. An open-ended question asking respondents to identify the competitor that they believed to be “best-in-class” on this type of innovation.
4. Another Likert scale question asking respondents to rate the extent of their company’s innovation activities over the past three years relative to the just-identified best-in-class competitor – from 1 (“nowhere near as much”) to 7 (“to the same degree”).
5. An open-ended question asking respondents to identify the most successful example of this type of innovation at their firm during the past three years.

6. An open-ended question asking respondents to elaborate why the just-identified example of innovation was successful.

In structuring Block A in this manner, involving the respondent running through six screens four different times, we recognized the possible negative implications on overall survey length and the potential sense of repetition that the respondent might experience. However, we could not identify a superior approach that would provide the degree of desired insight on each type of innovation without imposing a need on the respondent to continually shift thinking between different types of innovation, potentially causing blurring or confusion in responses.

Since the “extent” of innovation is unquantifiable and difficult for a respondent to assess objectively, we asked two similar questions for each type of innovation, thereby requiring respondents to think about the issue with greater care. The first question (#2 above) was intended to be an assessment of the extent of innovation by the respondent’s firm on an absolute basis (despite the lack of tangible quantitative scale for the innovation construct), whereas the second question (#4 above) was aimed to assess the extent of innovation by their firm relative to a competitor judged immediately before to be very active in that type of innovation.

The two open-ended questions at the end of the section of questions for each type of innovation (#5 and #6) were not intended to elicit responses about the “extent” of innovation, but rather what innovation activities succeeded and for what reasons. Thoughtful answers to these questions should provide further insight into the true nature of the company’s innovation activities.

## **Block B**

Block B was intended to elicit responses on the three identified key characteristics of innovation: novelty, adoption and value. Because we determined that findings on the value of innovation were to be covered directly in Block C, we therefore focused Block B on gaining

perspectives on the degrees of novelty and adoption associated with the innovation activities taken by the respondent's firm over the past three years. Moreover, we wanted to maintain separate responses for each of the four types of innovation, as explored in Block A.

Therefore, Block B consisted of two similar questions – one for novelty and one for adoption – each of which asked the respondent to respond on a 7-point Likert scale about their firm's activities along each of the four types of innovation.

The first question asked about the degree of significance of each of the four types of innovations pursued by the firm, with 1 representing “incremental” innovation and 7 representing “radical” innovation. To assist the respondent, the terms “incremental” and “radical” – as commonly used in management literature pertaining to innovation – were defined in the question.

The second question asked about the extent to which each of the four types of innovations pursued by the firm were adopted, with 1 representing “not at all” and 7 representing “to a great extent”. Adoption was defined to include both internal (i.e., “within the firm”) adoption or “external” (i.e., by customers, suppliers, competitors, etc.) adoption.

### **Block C**

Block C consisted of nine similarly phrased questions to elicit perspectives on various possible constructs of value-creation – both within the company and in the marketplace – associated with innovation undertaken in the past three years by the firm employing the respondent.

The basic phrasing of the question was “To what extent have your firm's innovation activities during the past three years resulted in...”, and all questions were posed on a 7-point Likert scale (1 = not at all, 7 = to a great extent).

The nine innovation value constructs investigated in Block C were: 1) increased value for established customers, 2) increased market share, 3) new products and services, 4) entry to new

markets, 5) increased competitive strength, 6) improved financial results, 7) increased organizational effectiveness, 8) improvements for employees and 9) improvements to society.

With nine very similar questions in a row, Block C ran the risk of being somewhat long and possibly repetitive for the respondent. Nevertheless, we decided that these various measures of the value generated from innovation were sufficiently worthy to merit independent investigation.

### **Concluding Section**

The concluding section of the questionnaire consisted of three sub-sections:

1. Two questions that aimed to generate synthesized perspectives from respondents, taking into account all the innovation topics covered in the survey. The first question asked about the perceived degree of satisfaction within the firm – on a Likert scale from 1 (“unsatisfied”) to 7 (“satisfied”) – about the success of its innovation activities. The second question was open-ended, asking the respondent to identify the biggest impediment to innovation success within the company.
2. Five demographic questions (introduced by a brief statement indicating that the survey was soon coming to an end) to gain basic information about the respondent’s role and tenure within the company, as well as the respondent’s age and gender.
3. A concluding statement thanking the respondent for completing the survey.

### **Pilot Test**

On July 31, 2020, two experienced senior executives (George Head and Tom Steding, bios in Appendix C) separately completed our draft questionnaire by connecting to the survey on Qualtrics per instructions. As long-time professional colleagues of one of the researchers (Stuebi), the two executives were solicited to participate with the understanding that the request was to pilot test a survey instrument. Otherwise, the executives were given essentially no further context or

introductory explanation other than what the survey itself provided to the respondent. Both executives completed the questionnaire in approximately 15 minutes.

Debriefing conversations with each executive were undertaken immediately after their completion of the questionnaire, resulting in the following findings:

***The distinctions between the four types of innovation were difficult to keep clear.*** Both executives had difficulty with the definition of process innovation – one of the executives struggled in distinguishing it from marketing innovation, while the other struggled in distinguishing it from organizational innovation. It was proposed that the four definitions be succinctly defined in a small image visible during all questions involving the four types of innovation, and that the respondent should have the ability to revise previously entered answers if necessary as deeper understanding about the topic is gained during the process of completing the survey. The potential concern about response contamination associated with a “go back” option is not relevant to our survey, since casual inferences will not be drawn and thus question order is not critical.

***There was concern about the questionnaire being too long.*** One executive indicated that he began to get impatient towards the end due to a sense of repetitiveness and suggested adding some kind of indicator (a “progress meter”) to inform the respondent of how much of the survey remains to be completed. Meanwhile, the other executive commented that the two types of questions (absolute and relative) about the extent of innovation undertaken were very difficult to keep straight, and recommended combining them into one question, which also resulted in eliminating the open-ended question about identifying the “best-in-class” competitor.

***Certain other interesting questions were unposed.*** One of the executives thought it would be interesting to know how respondents weighted the relative importance of each type of innovation. In relation to the question about the biggest impediment to innovation, the other

executive noted that it would be interesting to inquire what the respondent's employer could have done differently to alleviate that impediment. In general, this executive commented that questions should be designed to explore/test specific hypotheses, rather than merely collecting information.

***The age and gender questions were off-putting.*** Notwithstanding typical academic practice of asking respondents their age and gender, both executives doubted whether it was appropriate to such questions ask senior executives – especially in a corporate context, where age and sex discrimination is a very sensitive topic. Because this research is intended to result in a report card for industry use (rather than for an academic paper), we elected to remove these two demographic questions from the final questionnaire.

***All questions should have an “out”.*** One of the executives suggested that “I don’t know” be a potential answer to the Likert scale questions, otherwise a respondent may be inclined to provide a random answer when in doubt. Unfortunately, the web-based survey software used in this research (Qualtrics) does not accommodate such a solution. Accordingly, we changed the opening statement to make clear that – while discouraged – the respondent can skip an answer if absolutely necessary. Although this creates the possibility that a respondent will submit a survey with some questions left unanswered, we do not anticipate any skewing of findings to result, as missing data should be randomly distributed (across respondents and across questions), and thus will not affect estimated means of response scores associated with any question. Although there are techniques to impute the values of missing data, during analysis of this survey, we plan to drop any questions that generate high degrees of non-response, with the intention of replacing them with alternatively-phrased questions in future surveys.

***The introduction is critical for securing commitment to complete the survey.*** Since busy executives need to know “what’s in it for me?” before deciding to invest 15 minutes of time for a

survey, they should be offered findings from the survey in exchange for their agreement to complete the questionnaire. Respondents also need rock-solid assurances that answers ascribed to their firm won't end up in the hands of competitors or the public (especially if a publicly traded company, which most Fortune 500 companies are).

### **Final Questionnaire**

Based on the findings from the pilot tests of the draft questionnaire, the draft questionnaire was revised into final form (Appendix B) by implementing the following changes.

#### **Entire Questionnaire**

- Added a “progress bar” showing approximate percentage completion of the survey to reduce respondent fatigue/anxiety and thereby improve response quality
- Added ability on each screen to go back to prior screen to increase response accuracy

#### **Introductory Section**

- Added (and highlighted) text indicating researchers’ commitment to share findings in exchange for survey completion, in order to promote respondent’s motivation
- Added (and highlighted) text to allow respondents to skip questions if necessary to avoid forced answers with high error variances

#### **Block A**

- Eliminated slides defining and providing examples of each of the four types of innovation
- Added “two-by-two” tabular image to define all four types of innovation, to be visible when answering all questions to aid respondent in keeping distinctions clear
- Added new question asking respondents to indicate how they would proportionally weigh the importance (summing to 100%) of each of the four types of innovation

- Consolidated the “absolute” and “relative” questions about the extent of innovation activities into one question, beginning with the preamble “Relative to best practices,...” in order to mitigate a potential source of confusion and to shorten the survey
- Eliminated open-ended questions asking respondents to identify best-in-class competitor in each type of innovation

## **Block B**

- Consolidated both questions onto one page to reduce transition steps
- Added “two-by-two” tabular image to define all four types of innovation
- Clarified intention of the term “externally” in reference to the adoption of innovation, in order to minimize interpretation nuances

## **Block C**

No changes

## **Concluding Section**

- Deleted questions about respondent’s year of birth and gender
- Added question: “What might your firm have done differently to address this impediment?”
- Added question: “How many years of business experience do you have?” (proxy in lieu of deleted question asking for respondent’s year of birth)

## **Caveats**

While great care was taken in developing the survey questionnaire to promote clarity and consistency of responses, care must also be taken in interpreting those responses. The following caveats are most notable.

To begin with, survey responses are likely to be positively biased simply because of self-reporting: respondents are likely to evaluate their firms more positively than would be the case if corporate innovation could be somehow measured objectively. Note that C-level executives tend to have strong self-firm connection, either because they have been employed at their firm for years or because they have a critical role at their firm. In turn, this self-firm connection will lead respondents to better remember favorable recollections (and to forget or overlook unfavorable recollections) on past innovation activity and performance, thus leading to an overestimation of the innovation truly undertaken by their firm. Also, respondents will be sensitive to their (and by extension, their firm's) reputation. As a result, despite the assurances of anonymity and confidentiality emphasized in the opening statement of the survey, a respondent may still be concerned that their response can somehow be identified, which will increase reluctance to report anything negative.

Second, self-selection bias could be a concern. C-level executives who are willing to invest their scarce and precious time to complete this survey are likely to be more interested in and more enthusiastic about innovation (either as a general topic, or in regard to their firm's performance) than those who do not respond. Similarly, executives from innovation-intensive firms or/and industries are more likely to self-select into the sample. For both reasons, the degree of corporate innovation indicated by the sample data could be biased upwards relative to true population means.

Third, since the questionnaire is fundamentally constructed around four types of innovation, responses to the survey depend upon the respondent's interpretation of how these four types are distinguished. Although the survey explicitly references definitions for each of the innovation types that have been developed from prior research, these definitions remain somewhat subjective. Feedback gained from pilot testing of the survey questionnaire (confusion between the types of

innovation by both test respondents) indicated that there is likely to be variance in how respondents understand and interpret survey questions, which in turn will be a source of response error that reduces the confidence levels of statistical findings.

Fourth, many of the survey questions involve 7-point Likert scales that transform responses about inherently qualitative concepts concerning innovation into quantitative data. This provides ordinal information (where a higher score is unambiguously better) but not necessarily cardinal information: the perceived difference between responses of 5 vs. 4 may not necessarily be the same as the perceived difference between responses of 4 vs. 3. Moreover, without explicit calibration of each increment on the Likert scale, equal responses from different respondents may not represent the same degree of perceived innovation. Theoretically, these sources of error could be mitigated by using a Likert scale of greater numerical granularity (e.g., 1 to 100), but this is impractical to achieve in a workable survey instrument. Because respondents only have seven somewhat vaguely defined choices, analytic results from the sample data (e.g., means, differences in means) must be construed with caution.

Lastly, as with other online self-administrated surveys, response quality is a potential concern. Especially given the time pressures they face, combined with the intrinsically vague benefit from completing the survey at all (much less completing it thoughtfully), C-level executives may not give enough consideration to each question and may instead respond carelessly, thus introducing another source of error in the data collected.

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## Appendix A

### *Draft Questionnaire*

#### **Introductory Section**



#### **GENERAL INSTRUCTIONS**

Thank you very much for agreeing to participate in this opinion survey of Fortune 500 senior executives concerning the extent and effectiveness of their firm's corporate innovation activities.

This survey serves as a pilot to determine the potential value of an annual "report card" of corporate innovation practices across industries.

In this survey, you will be asked to indicate your opinions on multiple questions regarding innovation.

You will also be asked to briefly elaborate your answers on a few questions.

The survey will take around 15 minutes to complete.

This research is being conducted by Pamplin College of Business at Virginia Tech. You must be 18 or older to participate.

Your identity and responses will remain anonymous and confidential. Your participation is voluntary, and your consent is implied by submission of the survey.

Should you have any questions or concerns about the study, you may contact the researchers: Richard Stuebi at [richardts@vt.edu](mailto:richardts@vt.edu) or Jinyan Xiang at [jxiang5@vt.edu](mailto:jxiang5@vt.edu).

Thank you again for your participation!

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**Please click the arrow button below to advance the screen and enter the survey.**



## Corporate demographics

What is the name of your firm?  
If you prefer not to identify your firm, please respond "NA".



What category of economic activity best describes your firm?

- |   |  |
|---|--|
| <input type="radio"/> Mining and quarrying  | <input type="radio"/> Motor vehicles   |
| <input type="radio"/> Food products and beverages   | <input type="radio"/> Other transport equipment  |
| <input type="radio"/> Tobacco products  | <input type="radio"/> Furniture, other manufacturing n.e.c.                                  |
| <input type="radio"/> Textiles  | <input type="radio"/> Recycling  |
| <input type="radio"/> Wearing apparel and fur   | <input type="radio"/> Electricity, gas and water supply                                      |
| <input type="radio"/> Leather products and footwear   | <input type="radio"/> Construction   |
| <input type="radio"/> Wood and cork (not furniture)   | <input type="radio"/> Marketed Service   |
| <input type="radio"/> Pulp, paper and paper products  | <input type="radio"/> Sale, retail, maintenance and repair of motor vehicles and motorcycles |
| <input type="radio"/> Publishing, printing and reproduction of recorded media                   | <input type="radio"/> Other wholesale trade  |
| <input type="radio"/> Coke, refined petroleum products and nuclear fuel                         | <input type="radio"/> Hotels and restaurants   |
| <input type="radio"/> Chemicals and chemical products   | <input type="radio"/> Land transport and via pipelines                                       |
| <input type="radio"/> Chemical products less pharmaceuticals - Pharmaceuticals                  | <input type="radio"/> Water transport  |
| <input type="radio"/> Chemical products less pharmaceuticals -Rubber and plastic products       | <input type="radio"/> Air transport  |
| <input type="radio"/> Non-metallic mineral products   | <input type="radio"/> Supporting and auxiliary transport activities, travel agencies         |
| <input type="radio"/> Basic metals  | <input type="radio"/> Post and telecommunications  |
| <input type="radio"/> Fabricated metal products (except machinery and equipment)                | <input type="radio"/> Financial intermediation   |
| <input type="radio"/> Machinery n.e.c.  | <input type="radio"/> Real estate, renting   |
| <input type="radio"/> Office, accounting and computing machinery                                | <input type="radio"/> Computer and related activities  |
| <input type="radio"/> Electrical machinery  | <input type="radio"/> Research and development   |
| <input type="radio"/> Electronic equipment (radio, TV and communications)                       | <input type="radio"/> Other business activities  |
| <input type="radio"/> Medical, precision and optical instruments, watches, clocks (instruments) |  |

Please describe your firm's business activity.

→

(if *Other Business Activities* is selected)

## Block A: Innovation engagement in four types of innovation

**Corporate innovation is a multi-faceted topic.** In this survey, we will ask your opinions about **your firm's performance in four types of innovation:**

- **Product Innovation**
- **Process Innovation**
- **Marketing Innovation**
- **Organizational Innovation**

Before asking for your opinions, we will first define each of these types of innovation.

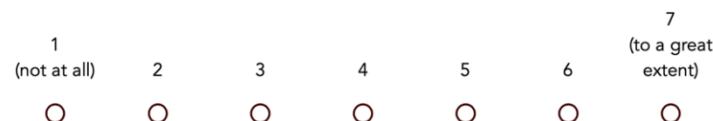


A **Product Innovation** is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.

**Here are some examples of product innovation:**

- 1) Global positioning systems (GPS) in transport equipment
- 2) Cameras in mobile telephones
- 3) Video on demand via broadband Internet
- 4) A new, self-service bank office

To what extent has your firm engaged in **product innovation** during the past three years (1 = not at all, 7 = to a great extent)?

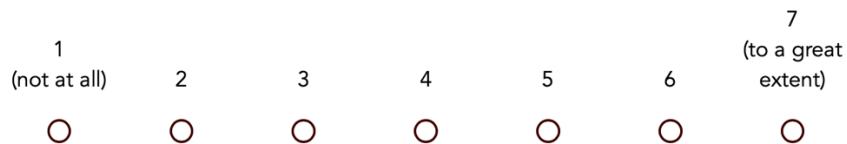


A **Product Innovation** is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.

**Here are some examples of product innovation:**

- 1) Global positioning systems (GPS) in transport equipment
- 2) Cameras in mobile telephones
- 3) Video on demand via broadband Internet
- 4) A new, self-service bank office

To what extent has your firm engaged in **product innovation** during the past three years (1 = not at all, 7 = to a great extent)?



What has been the **most successful product innovation** undertaken by your firm during the past three years?

Please briefly elaborate **why you think this product innovation was most successful?**

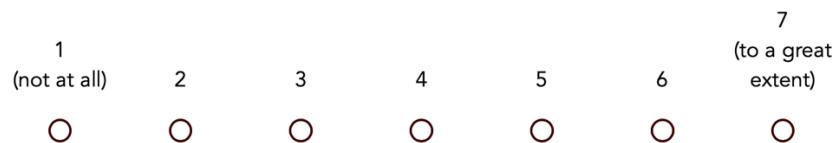


A **Process Innovation** is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.

**Here are some examples of process innovation:**

- 1) Laser cutting tools
- 2) Automated packaging
- 3) GPS tracking systems for transporting equipment
- 4) Introduction of automated voice-response system

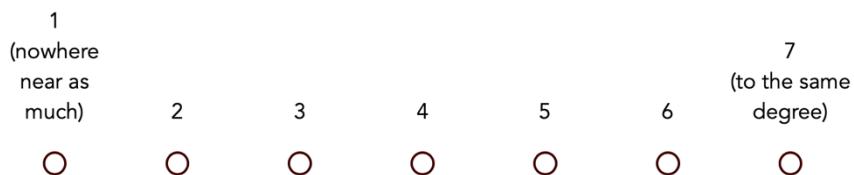
To what extent has your firm engaged in **process innovation** during the past three years (1 = not at all, 7 = to a great extent)?



In your opinion, which competitor of your firm is best-in-class for **process innovation**?

Please enter the competitor's name in the box.

Relative to the competitor you just entered, to what extent has your engaged in **process innovation** during the last three years (1 = nowhere near as much, 7 = to the same degree)?



What has been the **most successful process innovation** undertaken by your firm during the past three years?

Please briefly elaborate **why you think this process innovation was most successful?**

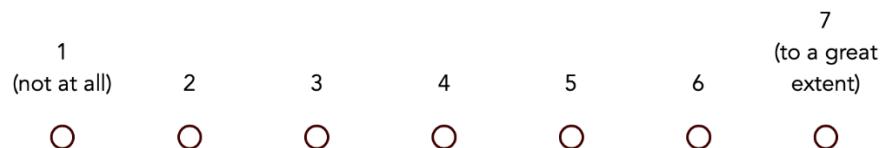


A **Marketing Innovation** is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.

**Here are some examples of marketing innovation:**

- 1) Implementation of a significant change in the design of a furniture line to give it a new look and widen its appeal
- 2) First-time introduction of direct selling or exclusive retailing
- 3) First-time use of a method for varying the price of a good or service according to demand for it
- 4) First-time use of trademarks

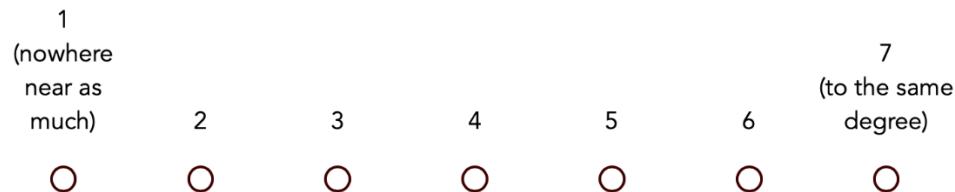
To what extent has your firm engaged in **marketing innovation** during the past three years (1 = not at all, 7 = to a great extent)?



In your opinion, which competitor of your firm is best-in-class for **marketing innovation**?

Please enter the competitor's name in the box.

Relative to the competitor you just entered, to what extent has your firm engaged in **marketing innovation** during the last three years (1 = nowhere near as much, 7 = to the same degree)?



What has been the **most successful marketing innovation** undertaken by your firm during the past three years?

Please briefly elaborate **why you think this marketing innovation was most successful**?

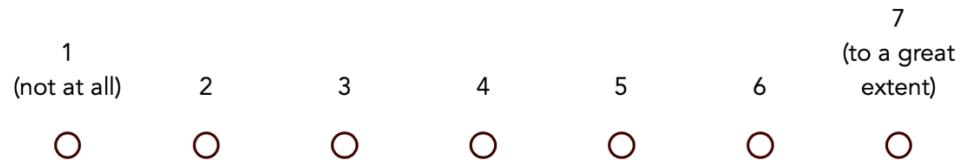


An **Organizational Innovation** is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations.

**Here are some examples of organizational innovation:**

- 1) Establishing of a new database of best practices, lessons and other knowledge so that they are more easily accessible to others
- 2) First-time implementation of an anonymous incident reporting system to encourage the reporting of errors or hazards in order to identify their causes and reduce their frequency
- 3) First-time introduction of quality control standards for suppliers and subcontractors
- 4) First-time use of outsourcing of research or production

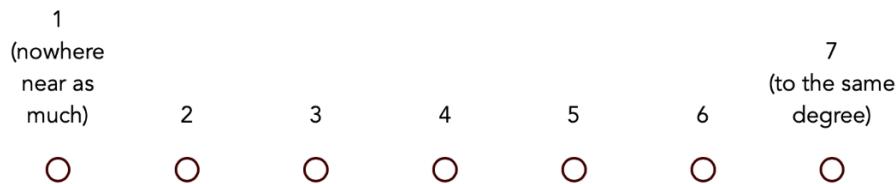
To what extent has your firm engaged in **organizational innovation** during the past three years (1 = not at all, 7 = to a great extent)?



In your opinion, which competitor of your firm is best-in-class  
for **organizational innovation**?

Please enter the competitor's name in the box.

Relative to the competitor you just entered, to what extent has your engaged  
in **organizational innovation** during the last three years (1 = nowhere near as  
much, 7 = to the same degree)?



What has been the **most successful organizational innovation** undertaken by  
your firm during the past three years?

Please briefly elaborate **why you think this organizational innovation was most  
successful?**



## Block B: Innovation performance on three dimensions

How **significant** was each of the four types of innovation achieved by your firm (1 = incremental, 7 = radical)?

Incremental innovations: innovations that continuously advance the process of change

Radical innovations: innovations that create major disruptive changes.

	(incremental)						(radical)
	1	2	3	4	5	6	7
Product Innovation	○	○	○	○	○	○	○
Process Innovation	○	○	○	○	○	○	○
Marketing Innovation	○	○	○	○	○	○	○
Organizational Innovation	○	○	○	○	○	○	○



To what extent has each of the four types of innovations achieved by your firm been **widely adopted, either within the firm or externally** (1 = not at all, 7 = to a great extent)?

	(not at all)						(to a great extent)
	1	2	3	4	5	6	7
Product Innovation	○	○	○	○	○	○	○
Process Innovation	○	○	○	○	○	○	○
Marketing Innovation	○	○	○	○	○	○	○
Organizational Innovation	○	○	○	○	○	○	○



## Block C: Innovation impacts on the market and the organization

To what extent have your firm's innovation activities during the past three years resulted in **increased value for your established customers** (1 = not at all, 7 = to a great extent)?

1 (not at all)	2	3	4	5	6	7 (to a great extent)
<input type="radio"/>						

To what extent have your firm's innovation activities during the past three years resulted in **increased market share** (1 = not at all, 7 = to a great extent)?

1 (not at all)	2	3	4	5	6	7 (to a great extent)
<input type="radio"/>						



To what extent have your firm's innovation activities during the past three years resulted in **new product and services** (1 = not at all, 7 = to a great extent)?

1 (not at all)	2	3	4	5	6	7 (to a great extent)
<input type="radio"/>						

To what extent have your firm's innovation activities during the past three years resulted in **entry to new markets** (1 = not at all, 7 = to a great extent)?

1 (not at all)	2	3	4	5	6	7 (to a great extent)
<input type="radio"/>						



To what extent have your firm's innovation activities during the past three years resulted in **increased competitive strength** (1 = not at all, 7 = to a great extent)?

1 (not at all)	2	3	4	5	6	7 (to a great extent)
<input type="radio"/>						

To what extent have your firm's innovation activities during the past three years resulted in **improved financial results** (1 = not at all, 7 = to a great extent)?

1 (not at all)	2	3	4	5	6	7 (to a great extent)
<input type="radio"/>						



To what extent have your firm's innovation activities during the past three years resulted in **increased organizational effectiveness** (1 = not at all, 7 = to a great extent)?

1 (not at all)	2	3	4	5	6	7 (to a great extent)
<input type="radio"/>						

To what extent have your firm's innovation activities during the past three years resulted in **improvements for employees** (1 = not at all, 7 = to a great extent)?

1 (not at all)	2	3	4	5	6	7 (to a great extent)
<input type="radio"/>						

To what extent have your firm's innovation activities during the past three years resulted in **improvements to society** (1 = not at all, 7 = to a great extent)?

1 (not at all)	2	3	4	5	6	7 (to a great extent)
<input type="radio"/>						



## Concluding Section

### *Integrated questions*

In your opinion, how satisfied is your firm with its innovation activities over the past three years (1 = unsatisfied, 7 = satisfied)?

1 (unsatisfied)	2	3	4	5	6	7 (satisfied)
<input type="radio"/>						

In your opinion, what has been **the biggest impediment** to successful innovation at your firm?

### *Respondent demographics*

Thank you for your opinions on your firm's innovation activities. We very much appreciate your valuable contribution of time and perspectives to our research.

Now, just five remaining questions to collect some demographic information.

What is **your title** within your firm?

What is **your functional responsibility** within your firm?

How many years have you been employed by your firm?



What is your year of birth?

What is your gender?

Female

Male

→

Thanks again for participating in our survey. Your response has been recorded. We assure your anonymity and confidentiality. We appreciate your contribution of valuable time and perspectives to our research effort.

## Appendix B

### *Final Questionnaire*

#### Introductory Section

**Progress Bar**

**VIRGINIA TECH.**

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**GENERAL INSTRUCTIONS**

Thank you very much for agreeing to participate in this opinion survey of Fortune 500 senior executives concerning the extent and effectiveness of their firm's corporate innovation activities.

This research is being conducted by Pamplin College of Business at Virginia Tech. Your identity will remain anonymous and your responses will remain confidential.

This survey serves as a pilot to determine the potential value of an annual "report card" of corporate innovation practices across industries.

In this survey, you will be asked to indicate your opinions on multiple questions regarding corporate innovation at your firm. You will also be asked to briefly elaborate your answers on a few questions.

The survey will take around 10 to 15 minutes to complete. **In appreciation for your time to complete the survey, we would be pleased to share our findings with you upon the study's completion.**

**If there are questions that you are unwilling to or unable to answer, you may skip them. However, we encourage you to skip as few as questions as possible.**

Your participation is voluntary, and your consent is implied by submission of the survey. Should you have any questions or concerns about the study, you may contact the researchers: Richard Stuebi at richardts@vt.edu or Jinyan Xiang at jxiang5@vt.edu.

Thank you again for your participation!

Please click the arrow button below to advance the screen and enter the survey.

→

## Corporate demographics

Progress Bar

What is the name of your firm?  
If you prefer not to identify your firm, please respond "NA".

Go-back Button

What category of economic activity best describes your firm?

<input type="radio"/> Mining and quarrying	<input type="radio"/> Motor vehicles
<input type="radio"/> Food products and beverages	<input type="radio"/> Other transport equipment
<input type="radio"/> Tobacco products	<input type="radio"/> Furniture, other manufacturing n.e.c.
<input type="radio"/> Textiles	<input type="radio"/> Recycling
<input type="radio"/> Wearing apparel and fur	<input type="radio"/> Electricity, gas and water supply
<input type="radio"/> Leather products and footwear	<input type="radio"/> Construction
<input type="radio"/> Wood and cork (not furniture)	<input type="radio"/> Marketed Service
<input type="radio"/> Pulp, paper and paper products	<input type="radio"/> Sale, retail, maintenance and repair of motor vehicles and motorcycles
<input type="radio"/> Publishing, printing and reproduction of recorded media	<input type="radio"/> Other wholesale trade
<input type="radio"/> Coke, refined petroleum products and nuclear fuel	<input type="radio"/> Hotels and restaurants
<input type="radio"/> Chemicals and chemical products	<input type="radio"/> Land transport and via pipelines
<input type="radio"/> Chemical products less pharmaceuticals - Pharmaceuticals	<input type="radio"/> Water transport
<input type="radio"/> Chemical products less pharmaceuticals -Rubber and plastic products	<input type="radio"/> Air transport
<input type="radio"/> Non-metallic mineral products	<input type="radio"/> Supporting and auxiliary transport activities, travel agencies
<input type="radio"/> Basic metals	<input type="radio"/> Post and telecommunications
<input type="radio"/> Fabricated metal products (except machinery and equipment)	<input type="radio"/> Financial intermediation
<input type="radio"/> Machinery n.e.c.	<input type="radio"/> Real estate, renting
<input type="radio"/> Office, accounting and computing machinery	<input type="radio"/> Computer and related activities
<input type="radio"/> Electrical machinery	<input type="radio"/> Research and development
<input type="radio"/> Electronic equipment (radio, TV and communications)	<input type="radio"/> Other business activities
<input type="radio"/> Medical, precision and optical instruments, watches, clocks (instruments)	

← →

Please describe your firm's business activity.



(if *Other Business Activities* is selected)

## Block A: Innovation engagement in four types of innovation

**Corporate innovation is a multi-faceted topic.** In this survey, we will ask your opinions about **your firm's performance in four types of innovation:**

- Product Innovation
- Process Innovation
- Marketing Innovation
- Organizational Innovation

Before asking for your opinions, we will first define each of these types of innovation.



A **Product Innovation** is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.

A **Marketing Innovation** is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.

A **Process Innovation** is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.

An **Organizational Innovation** is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations.

How would you **proportionally weight the relative importance of the four types of innovation to your firm** in the past three years (the total is 100)?

Product Innovation

0

Process Innovation

0

Marketing Innovation

0

Organizational

0

Total

0



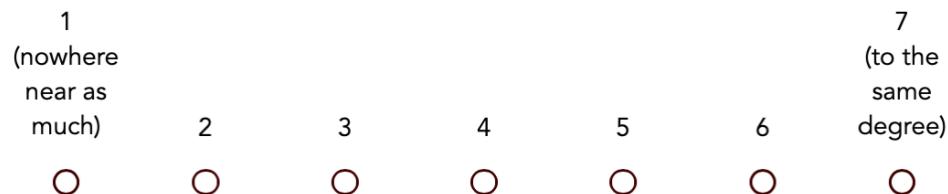
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An **Organizational Innovation** is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations.

Relative to **best practices**, to what extent has your firm engaged in **product innovation** during the last three years (1 = nowhere near as much, 7 = to the same degree)?



What has been the **most successful product innovation** undertaken by your firm during the past three years?

Please briefly elaborate **why you think this product innovation was most successful?**



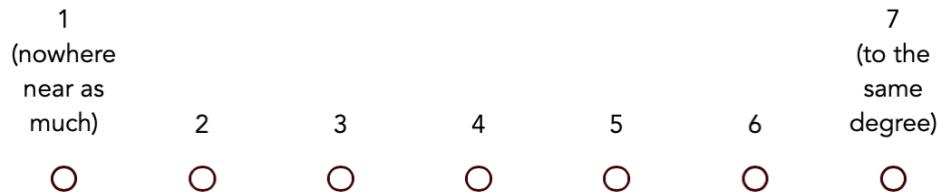
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An **Organizational Innovation** is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations.

Relative to **best practices**, to what extent has your engaged in **process innovation** during the last three years (1 = nowhere near as much, 7 = to the same degree)?



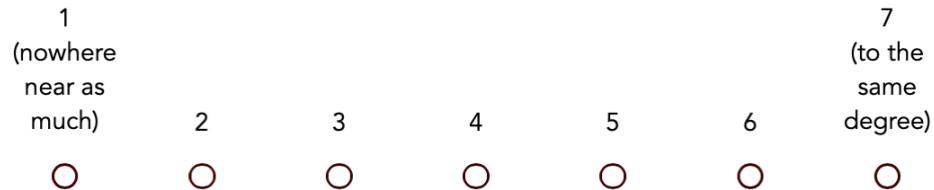
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Please briefly elaborate **why you think this process innovation was most successful?**



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<p><b>A Process Innovation</b> is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.</p>	<p>An <b>Organizational Innovation</b> is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations.</p>

Relative to **best practices**, to what extent has your firm engaged in **marketing innovation** during the last three years (1 = nowhere near as much, 7 = to the same degree)?



What has been the **most successful marketing innovation** undertaken by your firm during the past three years?

Please briefly elaborate **why you think this marketing innovation was most successful?**



<p>A <b>Product Innovation</b> is the introduction of <u>a good or service</u> that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.</p>	<p>A <b>Marketing Innovation</b> is the implementation of a new marketing method involving significant changes in <u>product design or packaging, product placement, product promotion or pricing</u>.</p>													
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## Block B: Innovation performance on three dimensions

<p><b>A Product Innovation</b> is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.</p> <p><b>A Process Innovation</b> is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.</p>	<p><b>A Marketing Innovation</b> is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.</p>																																																
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<p>To what extent has each of the four types of innovations achieved by your firm been <b>adopted, either within the firm or externally (e.g., by the industry, by customers, by society)</b> (1 = not at all, 7 = to a great extent)?</p> <table style="width: 100%; text-align: center; border-collapse: collapse;"> <thead> <tr> <th></th> <th colspan="6">(not at all)</th> <th>(to a great extent)</th> </tr> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> </tr> </thead> <tbody> <tr> <td>Product Innovation</td> <td><input type="radio"/></td> </tr> <tr> <td>Process Innovation</td> <td><input type="radio"/></td> </tr> <tr> <td>Marketing Innovation</td> <td><input type="radio"/></td> </tr> <tr> <td>Organizational Innovation</td> <td><input type="radio"/></td> </tr> </tbody> </table>			(not at all)						(to a great extent)		1	2	3	4	5	6	7	Product Innovation	<input type="radio"/>	Process Innovation	<input type="radio"/>	Marketing Innovation	<input type="radio"/>	Organizational Innovation	<input type="radio"/>																								
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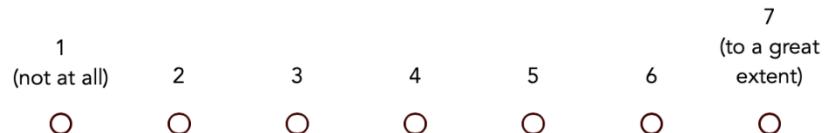
**←**      **→**

## Block C: Innovation impacts on the market and the organization

To what extent have your firm's innovation activities during the past three years resulted in **increased value for your established customers** (1 = not at all, 7 = to a great extent)?



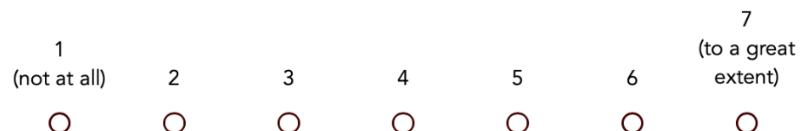
To what extent have your firm's innovation activities during the past three years resulted in **increased market share** (1 = not at all, 7 = to a great extent)?



To what extent have your firm's innovation activities during the past three years resulted in **new products and services** (1 = not at all, 7 = to a great extent)?



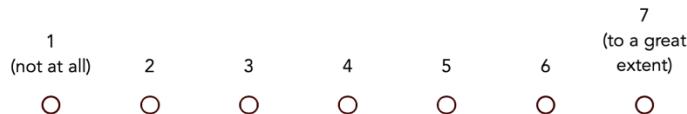
To what extent have your firm's innovation activities during the past three years resulted in **entry to new markets** (1 = not at all, 7 = to a great extent)?



To what extent have your firm's innovation activities during the past three years resulted in **increased competitive strength** (1 = not at all, 7 = to a great extent)?



To what extent have your firm's innovation activities during the past three years resulted in **improved financial results** (1 = not at all, 7 = to a great extent)?



To what extent have your firm's innovation activities during the past three years resulted in **increased organizational effectiveness** (1 = not at all, 7 = to a great extent)?



To what extent have your firm's innovation activities during the past three years resulted in **improvements for employees** (1 = not at all, 7 = to a great extent)?



To what extent have your firm's innovation activities during the past three years resulted in **improvements to society** (1 = not at all, 7 = to a great extent)?



## *Concluding Section*

### Integrated questions

In your opinion, how satisfied is your firm with its innovation activities over the past three years (1 = unsatisfied, 7 = satisfied)?

1 (unsatisfied)	2	3	4	5	6	7 (satisfied)
<input type="radio"/>						

In your opinion, what has been **the biggest impediment** to successful innovation at your firm?

In your opinion, **what might your firm have done differently** to better address this impediment?



## *Respondent demographics*

Thank you for your opinions on your firm's innovation activities. We very much appreciate your valuable contribution of time and perspectives to our research.

Now, just four remaining questions to collect some demographic information.

What is **your title** within your firm?

What is **your functional responsibility** within your firm?

How many years have you been employed by your firm?

How many years of business experience do you have?



Process Bar

Thanks again for participating in our survey. Your response has been recorded. We assure your anonymity and confidentiality. We appreciate your contribution of valuable time and perspectives to our research effort.

## Appendix C

### *Biographical Profiles of Pilot Test Respondents*

The researchers would like to thank the two pilot survey respondents for their time and thoughtful engagement when testing the initial draft survey discussed herein.

#### **George Head**

Based in Houston, George Head is currently an Executive Coach at Lee Hecht Harrison. Mr. Head has ten years of experience as CEO and board member of middle market and start-up companies in the telecommunications, energy and construction sectors, and has served on several for-profit and non-profit boards. He began his career with a tenure of 23 years at Sprint Corporation, rising from an entry level position to Vice President.

<https://www.linkedin.com/in/george-head/>

#### **Tom Steding**

Based in Northern California, Tom Steding has extensive experience in founding and leading high technology companies dealing with complex applications, having served as CEO of a dozen startups. He is also co-author of Built on Trust (2001) and author of the upcoming Real Teams Win (2021). Mr. Steding holds an MBA from the Stanford Graduate School of Business and a Ph.D. in Electrical Engineering from the University of California at Berkeley.

<https://www.linkedin.com/in/tom-steding-2409/>

## Appendix D

### *Derivation of Required Sample Size*

Given response errors assumed to be distributed N (4,1):

$$s^2 = 1$$

Assume:

$$\alpha = 0.05$$

$$e = 10\% * \text{error variance} = 0.1 * 1 = 0.01$$

$$N = 5000$$

Given  $\alpha = 0.05$ :

$$z_{\alpha/2} = 1.96$$

With Finite Population Correction, the formula to estimate required sample size in a simple random sampling approach is given by:

$$n_{SRS} = \frac{\frac{N * z_{\alpha/2}^2 * s^2 / e^2}{2}}{N + \frac{z_{\alpha/2}^2 * s^2 / e^2}{2}} = \frac{5,000 * 1.96^2 * 1^2 / 0.01^2}{5,000 + (1.96^2 * 1^2 / 0.01^2)} = \frac{5,000 * 384.16}{5,000 + 384.16} = 356.7502 \approx 357$$