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Cognitive Interviews with Small and Medium-Sized Businesses on Innovation

Phase 1 Report

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Introduction

As part of its mandate to provide a central clearinghouse for the collection, interpretation, and analysis of data on scientific and engineering resources, the National Science Foundation (NSF)'s National Center for Science and Engineering Statistics (NCSES) is engaged in several projects to measure innovation. NSF currently asks questions related to innovation on the Business R&D and Innovation Survey (BRDIS). With assistance from Westat, NSF developed a series of questions that asked about product, process, organizational, and marketing innovations that have been administered on the Microbusiness, Innovation, Science and Technology (MIST) survey and the MBRDIS survey.

In continuing to develop the innovation questions NSF engaged Westat to conduct exploratory interviews of small businesses in March 2017. The exploratory interviews addressed what types of innovations businesses perform, how they plan for and accommodate innovation, and what types of questions might be required to develop a complete picture of their innovation activities.

This report is a summary of cognitive interviews conducted with 20 businesses during August and September of 2017 to test a draft module of 13 innovation questions. Several of the questions have been tested and used previously on BRDIS, MIST, and the Community Innovation Survey (CIS). The objective was to assess respondent interpretation of the questions, relevance of the content, feasibility of response, and appropriateness of the response options. Westat gauged whether there was any need to change the question order; change question wording; add, remove, or revise the wording of response options; and provide or modify an introduction, definitions, and/or instructions. The intended result of the testing was to identify any refinements needed to make the questions appropriate for U.S. businesses and the Annual Business Survey (ABS).

Interview Procedures

Eight in-person interviews were conducted at the respondent's place of business in Chicago and in the Washington, D.C. metropolitan area. For the other 12, sessions were conducted remotely via WebEx online meeting software, which allowed the interviewer to share a computer screen with the respondent and show a PDF version of the questionnaire.

As an ice-breaker and to help establish some understanding of the innovation context for the company, each respondent was asked to briefly describe the type of work the company conducts. Then, the interviewer handed (for in-person) or showed (for WebEx) the assigned questionnaire version and asked the respondent to read the first question to himself or herself and answer it. For the in-person interviews, the respondent marked answers on a hard copy of the survey. For WebEx sessions, the interviewer allowed the respondent to control the shared screen and mark answers on a PDF version created to capture responses for the company. After the respondent completed the first question, the interviewer administered several scripted probes (e.g., how the respondent interpreted specific phrases, such as “new or significantly improved;” how the respondent decided on answer(s), and whether the company tracked that type of information). The interviewer and/or any NSF or Westat observers asked any follow-up questions needed for clarification, based on the respondent’s answers.

This same approach was used to cover the remaining questions in the assigned questionnaire version. If the respondent was not able to immediately answer a question, he or she was asked to describe what steps would be required, who might help to supply the data, and what level of effort would be involved.

At the end of the interview session time, the NSF survey manager and the interviewer thanked the respondent for their participation. As approved in the OMB clearance package, for in-person interviews, the respondent was given a \$40 cash incentive. Those who completed a WebEx session were sent a \$40 check. All those who participated were sent a thank-you letter after the interview.

Recruiting

The following criteria were established for recruiting businesses to the first phase of cognitive interviews:

- The firms should have between 5 and 500 employees, and
- The firms should be involved in innovation.

In addition, to maximize the chances for contacting firms that were eligible, the sample focused on those industries that were most likely to be involved in innovation. Since self-reports of being involved in innovation were relatively rare, and all recruiting and interviews had to be conducted within a relatively short time, this approach helped to identify eligible respondents both quickly and efficiently. NSF provided a list of the 20 industries with the intention of selecting one firm from each industry, but it was soon decided that those industries were not sufficiently diverse. For example, the top 20 included 6 industries that were wholesalers, possibly all sharing relatively similar perspectives, while none of the top 20 were retailers. One firm each from the following industries were selected (Table 1).

Table 1. Industries selected for cognitive interviews

NAICS	Industry
5112	Software Publishers
5417	Scientific Research and Development Services
4541	Electronic Shopping and Mail-Order Houses
5191	Other Information Service
3261	Plastics Product Manufacturing
4242	Drugs and Druggists' Sundries Merchant Wholesalers
3399	Other Miscellaneous Manufacturing
5182	Data Processing, Hosting, and Related Services
5111	Newspaper, Periodical, Book, and Directory Publishers
3121	Beverage Manufacturing
3363	Motor Vehicle Parts Manufacturing
4248	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers
3329	Other Fabricated Metal Product Manufacturing
3391	Medical Equipment and Supplies Manufacturing
5415	Computer Systems Design and Related Services
3118	Bakeries and Tortilla Manufacturing
3335	Metalworking Machinery Manufacturing
4532	Office Supplies, Stationery, and Gift Stores
4539	Other Miscellaneous Store Retailers
4251	Wholesale Electronic Markets and Agents and Brokers

The businesses were selected using a database maintained by the Small Business Administration (found at http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm). Anticipating that it might be difficult to recruit eligible businesses to participate, a sample of 25 firms per industry was created. When finding eligible and cooperative participants provided difficult, the sample was supplemented with additional firms in the targeted industries, and in some cases multiple participants per industry were allowed.

As part of the sampling process, the interviews were divided into three sets: we targeted five for in-person interviews in Chicago, three for in-person interviews within the Washington, D.C. metropolitan area, and 12 for online interviews using a service (WebEx) that allowed the interviewer and business to share the same computer screen. (Ultimately, four were conducted in Chicago, four in the Washington, D.C. metropolitan area, and 12 online.)

Detailed Findings and Recommendations

This chapter presents summary-level findings from the cognitive interviews for each of the 13 questions tested.¹

2.1 Q1. Importance of Business Strategies to Company

	Degree of importance			
	High	Medium	Low	Not important
1. During the three years 2015 to 2017, how important were each of the following strategies to your company?				
A. Focus on improving your existing goods or services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Focus on introducing entirely new goods or services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Focus on reaching new customer groups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Focus on customer-specific solutions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Focus on low price	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F. Focus on reducing costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Focus on satisfying key clients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H. Focus on developing niche or specialized markets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I. Focus on new domestic markets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
J. Focus on opening up new export markets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question Comprehension

This question worked well as an opening question; respondents all found it relatively easy to answer. Respondents generally seemed to understand the intent of this question. For example, one respondent paraphrased the question as: “What are your business’ priorities?” Others said the question asked what the strategies are for day-to-day business, what the organization is focused on, what the business plan is, or what the company’s business model is.

¹ The questions were numbered 1 – 14, but Question 11 was not included within the questionnaire, so the total number of questions tested was 13.

There were two minor comprehension issues with specific parts of the question. One respondent said that item D (focus on customer-specific solutions) and item G (focus on satisfying key clients) seem to “fall into the same group.” That company’s business is mostly generated through word-of-mouth and repeat business, so the respondent felt that both parts seemed to touch on selling to their existing clientele. Another respondent voiced a bit of confusion in response to item E (Focus on Low Price). She asked: “Low price of what?” and assumed it meant a focus on lowering her prices, or being “price competitive.” She found this part of the question to be worded in a grammatically awkward way and suggested revising it to “Focus on lowering price.”

Relevance of Question

Based on the fact that all 20 respondents marked “High” and/or “Medium” for more than one part of this question, it seemed relevant for the wide variety of companies that participated in this round of testing.

Feasibility of Reporting for 3-Year Reference Period

None of the respondents expressed any difficulty with answering this question for a 3-year period. However, several respondents commented on the time period in relation to the company’s current status or stage of development. One respondent who worked for a company in the start-up stage said that some of the strategies listed are not as relevant now, but will increase in importance as the business grows and starts to sell products. Another said that if he currently had more long-term contracts, his answers to the parts of the question would be different.

Response Accuracy and Consistency

All respondents found it generally easy to mark answers when they worked on their own. Respondents who were asked to describe their response thought process were able to easily explain and differentiate ratings for High and Medium for different parts of the question.

Respondents were also asked if any strategies they consider important for their company were missing from the list. Only four respondents said the list of strategies was complete. Some of the 16 other respondents suggested the following as strategies that were missing:

- Fundraising or financing (important to a small business)
- Advertising
- Expanding to existing clients
- Customer satisfaction
- Market dynamics
- The customers' position or receptiveness to innovation
- Developing and patenting technology
- Setting up streams of recurring revenue.

Respondents also said that the question asked only about strategies that were external. One explained that the parts of the question are all very “outside the building” and that the question is missing some “inside the building” topics, such as finding a way to borrow more money or finding a new advertising tool or technique. Suggestions from these respondents for strategies of improving internal processes or factors include the following:

- “Taking care of employees” to reduce turnover and avoid the costs associated with hiring and training new employees
- Improving the workforce
- Improving employee benefits
- Strategic planning
- Improving internal processes to increase cost efficiency
- Improving internal systems through increased use of technology
- Focusing on technological challenges
- Keeping current with technology changes and improvements (in processing).

Several respondents suggested asking this question in a different format, to collect priorities or rankings of the set of strategies vs. a rating for each strategy. These respondents had rated multiple parts of the question as High and/or Medium. They seemed to want to indicate their highest priority, but it would not be evident from their ratings. One respondent commented that he read

through all of the subparts first to determine his priorities, and then chose responses that would reflect his priorities.

Q1 Recommendations

Consider broadening the question to include strategies with an internal focus. Multiple respondents pointed out that the parts of the tested question are primarily focused on external factors. Given that this is the first question respondents will answer in the new innovation module, leaving out internally-focused strategies might have two implications: (1) making the question appear incomplete, and (2) possibly communicating to respondents that NSF defines innovation in a limited way—in terms of only the external market. Also of consideration is whether it is important for the parts of this first question to explicitly relate to innovation. For example, a focus on employee satisfaction might have little to do with innovation.

Through discussion of the initial findings with NSF, a decision was reached to add three parts to the question. The first, listed below, has an external focus. The other two reflect an internal focus, to ensure survey respondents will think about innovation more broadly, rather than limited to external factors. Although NSF may wish to revise the wording slightly, these additional parts to consider adding include:

- Focus on understanding customer needs
- Focus on improving employee skills
- Focus on improving internal processes.

Based on the respondent suggestions, an item related to the use of technology would also be a welcome addition. However, OECD's current stance is to avoid using the term "technology" because it can refer to almost everything, so NSF decided against that.

We do not recommend changing the question to ask for priorities. Aside from lessening comparability with international data, such a format might be harder to answer, and respondents' reported priorities could change depending on what items are listed.

2.2. Q2. New or Significantly Improved Products and Processes

2. During the three years 2015 to 2017, did your company introduce new or significantly improved:		
	Yes	No
A. Goods (<i>exclude the simple resale of new goods and changes of a solely aesthetic nature</i>). A good is usually a tangible object such as a smartphone, furniture, or packaged software, but downloadable software, music and film are also goods.	<input type="checkbox"/>	<input type="checkbox"/>
B. Services . A service is usually intangible, such as retailing, insurance, educational courses, air travel, consulting, etc.	<input type="checkbox"/>	<input type="checkbox"/>
C. Methods of manufacturing for producing goods or services	<input type="checkbox"/>	<input type="checkbox"/>
D. Logistics, delivery or distribution methods for your inputs, goods or services	<input type="checkbox"/>	<input type="checkbox"/>
E. Supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing	<input type="checkbox"/>	<input type="checkbox"/>

Question Comprehension

A key issue for this question is respondents' interpretations of the phrase "new or significantly improved" within the question stem.

Respondents seemed to differ in their assumptions of the level of newness of the "new or significantly improved" product or process. Two of the respondents thought the question asked about what was new to the world or to the marketplace.

- One respondent said he did not know whether "new or significantly improved" meant new/improved for the company or the world. He assumed the latter since the questions were about innovation. Their company niche is to develop things that other people are not doing. But he went on to say that perhaps the phrase could mean a new product for the company, and suggested that a clarification (new for the company or the world) was needed.
- Another respondent said the phrase meant a significant effort to bring something different to the world, to improve a product or service.

More of the respondents seemed to interpret the phrase as referring to what was new to their own company. For example:

- One said that he considered “new or significantly improved” as a product that they have not offered before or a new purchase for their company.
- One said the phrase meant making major changes to processes in their facility.
- One interpreted the phrase to mean revamping the way you had previously done business.
- One respondent defined “new or significantly improved” as new to his company, not necessarily new to the marketplace globally.
- One interpreted the phrase as asking if they did something—internal and/or external—that greatly improved their business.
- Another said that “new or significantly improved” means to improve upon the way of doing business, whether it be the design or actual services offered to customers, or the way of producing it.

Respondents differed in their assumption about the degree to which something would have to change to qualify as “new or significantly improved.” One narrowly interpreted the phrase as meaning “a simple facelift of an existing service.” Another respondent used the phrase “a generational product change” and said that a product is either brand new, or the same technology but a new product with a new marketing push. He gave the example of an iPhone 5 vs. an iPhone 6.

Some of the respondents went into more detail in explaining what the concept of “new or significantly improved” meant to them. For instance:

- One respondent said that there are two parts to this: (1) incremental continuous improvement and (2) transformational. While he said the process for both might be similar, he considers most innovation taking place today to be incremental (introducing new features, new processes, etc.).
- One respondent said: “We’re always tweaking what we do, but we’ve always done it well. How do you significantly improve an investigation?” The respondent seemed to want some way to quantify change, as in improving something by X percent or more.
- One said that the term “significant” is subjective; what he might think of as significantly improved, someone else might not think so. He elaborated that this question was easier to answer because there is “more leeway.”
- One respondent said during probing that “new or significantly improved” means “upgrade.” However, he did not consider that meaning until after he had read through the separate parts of the question. He said that the question made more sense to him and helped him to define the meaning after he finished reading items A–E. In particular, item E (Supporting activities) made him think about upgrades to the accounting system.

Two other key terms were “goods” and “services.” Most respondents found the explanations to align with how they operate or what they produce. However, several expressed some confusion about how to classify certain types of products, as described below.

- One respondent was confused by the definition of “Goods” because her company primarily resells rather than manufactures items. However, they do purchase certain items (for instance, herbs) and combine those ingredients into products that they sell. She wondered whether such products qualify as goods, and ultimately decided to count them.
- One respondent described goods as the curriculum they have developed and regularly improve. She elaborated that it was difficult to separate this good from the service of training.
- One respondent was confused by the wording “but downloadable software... are also goods” of the explanation for item A. He thought that phrase implied there is some other type of software that is not included.
- About item B (Services), one respondent said: “I’m not quite sure what you mean by intangible...in our industry, if you perform a service, you give someone the result.” His company does lab testing, so customers send him samples and he sends back results. He viewed the reports as tangible, but also as a service: “That would be a service because you receive something from the customer and you process it and you give them the result.”
- One respondent did not agree with the item B explanation that services are usually intangible. He included their customer service as a tangible service, based on his belief that customer service and long-term relationships are key components of a successful business and can be more important than pricing.

During probing, one respondent suggested clarifying “processes” in the wording of item E (Supporting activities for your processes) to more clearly indicate this means administrative processes. He thought only about manufacturing processes when answering the question.

Relevance of Question

As evidence of the relevance of this question, 18 of the respondents who answered this question all marked “Yes” for two or more parts of this question. The other two respondents only responded “Yes” to one part of the question.

However, one respondent said that three items in this question—items A, B, and D—were not applicable for her company because they do not make or sell products. This response appears to reflect a definition we have run into elsewhere: businesses that prepare electronic products or

reports sometimes do not think of these products as either goods or services. This particular firm served companies and government agencies, conducting investigations to detect financial fraud and mismanagement; collecting intelligence on “high profile” people and companies to determine legal, financial, and reputational risks; and performing compliance monitoring for educational service grants. She suggested adding a “Not applicable” response option for the parts of this question since she felt that “No” was not an appropriate response for their company.

Feasibility of Reporting for 3-Year Reference Period

We did not explicitly ask respondents about the feasibility of reporting these types of innovations for the reference period. However, several respondents commented on the reference period indicating that it was feasible for them to consider that time period in their response. They said they answered “No” because they might have had that type of innovation at some point, but not within the 3-year period. For example, one respondent who indicated uncertainty about item C (Methods of manufacturing) explained that he thought of several software-type products, but he did not think there were any new or significant improvements in how they manufactured them during the reference years.

The respondent who works for a new company mentioned that new companies may not have goods or services at the point in time they respond to the survey.

Response Accuracy and Consistency

For the first interviews we held, we asked respondents to describe how they decided on their answers—to judge accuracy of their “Yes” and “No” answers. (In later interviews, we probed less on the responses, to conserve interview time for later questions.) Most of the explanations indicated respondents were able to answer the different parts of the question.

However, a couple of respondents had trouble answering a part of the question, or said something that might not align with NSF’s measurement intent. The respondent who considered his reports to be “tangible” services explained his “No” answer for item B (Services) by saying that it was because he didn’t charge his clients for the reports he provides, in addition to the fact that the service is not new or significantly improved. He did reports for free as a courtesy if customers had questions. When asked, he said he only considered things in this list if his company was paid to do them.

One respondent explained that his company does not make packaged software, so he had difficulty choosing between item A (Goods) and item B (Services). Each software package is unique to the client, so it seems more like a service than a good because they are not doing the same thing across clients. The company does not create an app (“a good”) and sell it; they create the whole package as a service. He decided to mark “Yes” for Services, because in the past 3 years, an improved service has been to gather metrics for clients (e.g., who uses the product, how it is being used, user information), which they sell as a part of the package.

During probing, one respondent decided that he should change his “No” answer to “Yes” for item D (Logistics). He thought he probably just “rushed through that a little bit” and did not think it through enough when he initially answered. His company makes products more accessible to customers. They don’t have their own trucks or do their own distribution.

Two respondents had trouble answering item E (Supporting activities for your processes); they wanted to add an example to those mentioned. One considered that “Supporting activities” for his company included “equipment, maintenance systems, software, and their employees,” and another suggested adding something related to “human resources” to the wording.

We also asked most of the respondents whether anything they considered innovative within their company was not captured in this question. The only things respondents mentioned were the following. We note that the latter two of these perceived missing innovations might be captured in Q10 (which the respondents had not yet seen), which covers organizational and marketing innovations.

- One had purchased large dual monitor computers for company staff, to increase their efficiency in processing of orders and inventory. She did not think this “technological update” fit into any of the parts of the question. (She did not seem to realize that it might fit with item E—“Supporting activities for your processes...”).²
- One respondent said his company is now focused on educating employees, to change their perceptions of their jobs and the company.
- As noted above, one respondent suggested adding “human resources” to item E.

² This example also displays the ambiguity of defining an innovation. As explained later in the discussion of other questions, some respondents would not consider this to be an innovation because both the technology and the use of the technology were already established. However, having two screens helped the staff to simultaneously view the orders and the inventory database.

Q2 Recommendations

We provide recommendations for changing Q2 in the section of recommendations for Q3 (below), since the results from testing these two questions suggest introducing concepts in a different order as well as revising the wording.

2.3. Q3. Product Innovations

3. If you answered “Yes” to either question 2a or 2b, were any of your product innovations during the three years 2015 to 2017:		Yes	No
New to your market?	Your company introduced a new or significantly improved product (good or service) onto your market before your competitors (it may have already been available in other markets)	<input type="checkbox"/>	<input type="checkbox"/>
Only new to your company?	Your company introduced a new or significantly improved product (good or service) that was already available from your competitors in your market	<input type="checkbox"/>	<input type="checkbox"/>

Question Comprehension

Most respondents seemed to understand the difference between new to their market vs. new only to their company. However, one respondent said that she had to read the definition for “Only new to your company” a couple of times before she really got it. She noted that she had to go back to the bold text on the left in order to grasp the definition (the text in regular font).

Two respondents had an issue with the definition. They made the point that if a company is bringing a new product to the market, there may be no competitors. The definition also seemed confusing if they were looking to introduce a product where there is not a lot of competition.

Another respondent wondered aloud why the question asked about “Only new to your company” because she considers this as a situation where the competitor has done the innovation, and you are essentially stealing the idea: “It’s theft of intellectual property.”

We probed respondents for their interpretation of the term “product innovations” in the question stem. Examples include the following.

- One said: “Something about your product is different from before you did it. Whether you were first to the market, or if you make improvements to something that’s already there.”
- For one respondent, “product innovation” means novel ideas or solutions for clients; the “product” is the service.
- One respondent said that since Q3 refers to Q2A and Q2B, he assumed product innovation and goods were the same thing.
- Another explained that product innovation is something that came to the marketplace with some significant difference from what came before.
- One described innovation as an “aha” moment; something was being done one way (status quo), but then someone else introduced an easier path. This respondent said the word “novel” is used in the R&D community.

Where time allowed, respondents were also asked to explain their thoughts on the phrase “product (good or service)” within the question stem. Probing revealed some differential interpretation across respondents. Several considered products to be the same as goods (or perhaps somewhat broader), but not to include services. For example:

- One respondent thought that the phrase was confusing and unclear, saying that it first talks about a product, but then the qualification says goods and services. To him, products are tangible goods and services are intangible.
- Another respondent said: “Well there's product innovations and then there's service innovations.” What his company does falls in a grey area between products and services: “It's a product in that it's tangible, it was basically a report...but to develop that report we were providing a service. So I basically said we're a product...”
- One respondent initially had an issue with the term “products,” and said: “This is not relevant to us because we don't sell products.” She does not think of services as being products—“Product in my mind in a physical good.” After she noticed and thought more about the “good or service” in parentheses, she decided it was okay, but suggested that it would be better to just say “goods or services.”
- One respondent said that goods and products are the same thing to him.

On the other hand, several respondents indicated that they clearly understood that “product (good or service)” means the product could be either a good or a service. For example, one respondent said that a product can be a good or a service. However, he would prefer that the two were broken out and asked about separately, since to him, they are different.

Relevance of Question

We judged this question as relevant to a variety of companies based on the finding that the 18 respondents who completed it answered “Yes” to one or both parts of it.

Feasibility of Reporting for Three-Year Reference Period

We did not probe on ease or difficulty of reporting for the 3-year period. However, none of the respondents explicitly expressed any difficulties in reporting for this reference period.

Response Accuracy and Consistency

Respondents seemed to select the correct response based on their explanations. Examples of “Yes” responses for “New to your market” include: providing energy via fiber, turning what had been only an idea into a final product, and developing a new device for doing resuscitation for a different patient population than they had targeted with a prior product before. One mentioned having done extensive research on what her competitors do, even getting details on their government contracts through FOIA requests.

Three participants explicitly mentioned issues related to the order of the questions. One participant stated that if he had understood Q2 as asking about what was “new to your company,” not new to the market, he would have answered Q2 differently. Another said that when answering Q2, he was not really thinking about “innovative new products or services.” Although he did not consider it an issue to begin using the word “innovation” in Q3, he said he did not immediately apply that term before reading Q3. A third respondent said that when responding to Q2, he was thinking about innovations that were new to his company, not to their market.

Two respondents said they needed a different response option. One respondent said she only knows what products are new to her company, so wished there was a “Don’t know” or an “I’m not sure” option in addition to “Yes” and “No.” A second respondent said he would like a “Not known” response to the “New to the market” part of the question because he does not know for sure if some of the products they are developing exist elsewhere.

Q2 and Q3 Recommendations

Modify the wording for the reference period to improve clarity and consistency. For these questions (and all subsequent questions with the same reference period), we also recommend using the wording “2015 through 2017” to make the 3-year reference period clearer.

Consider adding a “Don’t know” response option. Underlying Q3 is an assumption that respondents know everything going on in their market. Two respondents made the point that this is not always the case or possible. Some new companies, and even some companies with longer tenure, may not have goods or services during the 3-year reference period. As noted above, two respondents suggested adding a “not applicable” response option. One was not comfortable responding “No” to multiple parts of Q2 when she felt they were really not applicable. We also note that respondents may perceive that answering “No” to parts of Q2 or Q3 suggests a lack of interest in innovation. This is a socially undesirable response, especially for companies in areas of business that value innovation. When discussing these initial results for these two questions with NSF, we explored the approach of providing an additional response column for capturing “Not applicable” responses. NSF decided against this recommendation.

Modify the approach for respondent reporting of product and process innovation. Question 2 is complex, due to having multiple parts as well as a phrase (new or significantly improved) that was differentially interpreted. There was also evidence that information provided in Q3 (new or significantly improved goods or services are considered to be product innovations, as well as the distinction between new to the market vs. only new to the company) was needed at the time respondents read Q2. Some respondents appeared to think only of innovation that is new to the market, not both types of innovations. If Q2 is retained as is, survey respondents may under-report innovation at that point; they need to be instructed or reminded to consider innovation that is new to the company as well as to the world. Making a change should help to improve data quality.

Based on the Q2 and Q3 comprehension and order issues, we suggest using an unfolding approach, to ask for innovation data in a different sequence of questions, with the aim of ensuring each individual question will be easier to understand and answer. Parsing the concepts into simpler questions should help to improve data quality.

The sequence could be:

- First, identify whether the company produced or offered goods and/or services during the 3-year reference period.
- Ask a follow-up question only of those who produced/offered goods during the reference period: determine if the company introduced new or significantly improved goods—new to the market and new to the company.
- Ask a separate follow-up question only of those who produced/offered services during the reference period: determine if the company introduced new or significantly improved services—new to the market and new to the company.
- In a separate question, ask about remaining aspects of innovation covered in items C–E of the tested version of Q2 (Methods of manufacturing; Logistics, delivery or distribution methods; and Supporting activities).

We expect this approach will help respondents to define innovation in a more consistent manner. Question routing (as noted below) will be need to be handled through programming to ensure that respondents get only the questions that are appropriate for them in the new question sequence.

Here are the suggested revisions for order and wording of four new questions (to replace the tested Q2 and Q3 versions).

2. During 2015 through 2017, did your company offer any:

- | | | |
|---|-----|----|
| A. Goods? (<i>place the definition here</i>) | Yes | No |
| B. Services? (<i>place the definition here</i>) | Yes | No |

[If Yes to Q2A]**3. During the three years 2015 through 2017, did your company introduce new or significantly improved goods that were:**

		Yes	No
A. New to your market?	Your company introduced a new or significantly improved good to your market before your competitors (it may have already been available in other markets)	<input type="checkbox"/>	<input type="checkbox"/>
B. Only new to your company?	Your company introduced a new or significantly improved good that was already available from your competitors in your market	<input type="checkbox"/>	<input type="checkbox"/>

[If Yes to Q2B]**4. During the three years 2015 through 2017, did your company introduce new or significantly improved services that were:**

		Yes	No
A. New to your market?	Your company introduced a new or significantly improved service onto your market before your competitors (it may have already been available in other markets)	<input type="checkbox"/>	<input type="checkbox"/>
B. Only new to your company?	Your company introduced a new or significantly improved service that was already available from your competitors in your market	<input type="checkbox"/>	<input type="checkbox"/>

5. During the three years 2015 through 2017, did your company introduce new or significantly improved:

	Yes	No
A. Methods of manufacturing for producing goods or services?	<input type="checkbox"/>	<input type="checkbox"/>
B. Logistics, delivery or distribution methods for your inputs, goods or services?	<input type="checkbox"/>	<input type="checkbox"/>
C. Supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing?	<input type="checkbox"/>	<input type="checkbox"/>

2.4. Q4 Percentage of Total Sales

4. Using the definitions above, please give the percent of your total sales in 2017 from:	
New or significantly improved products (goods or services) introduced during the three years 2015 to 2017 that were new to your market	<input type="text" value=""/> <input type="text" value=""/> <input type="text" value=""/> %
New or significantly improved products (goods or services) introduced during the three years 2015 to 2017 that were only new to your company	<input type="text" value=""/> <input type="text" value=""/> <input type="text" value=""/> %
Products (goods or services) that were unchanged or only marginally modified during the three years 2015 to 2017 (include the resale of new products purchased from other companies)	<input type="text" value=""/> <input type="text" value=""/> <input type="text" value=""/> %
Total sales in 2017	<input type="text" value="1"/> <input type="text" value="0"/> <input type="text" value="0"/> %

Question Comprehension

Based on their responses, the nine respondents understood the overall purpose of this question. However, almost none of the respondents understood which time period applied to this question.

Q4 asks for the total number of sales in 2017, based on various categories defined by a 2015–2017 period. None of the respondents understood that they should only report 2017 sales (with the possible exception of one respondent whose response was unclear).³

Relevance of Question

A majority of respondents did not express concerns about the relevance of this question to their company. However, two respondents had no sales in 2017 and did not know how to respond, since the question assumes that the three categories will sum to 100% of sales. One respondent decided to put 100% under “products... that were marginally modified.” The other respondent with no sales put 100% under “new to market,” using the rationale that the products would eventually be new to market when sold in 2018. Both of these respondents expressed misgivings about their answer.

Reactions to Definitions

Q4 contained no definitions. However, one respondent expressed concerns about the wording of the “only new to your company” option. This respondent felt that “only new to your company” sounded negative (e.g., the company missed something common in the marketplace).

Feasibility of Reporting for Reference Period

A few respondents volunteered that reporting for 3 years was easier than reporting for 1, partly because they felt freer to provide estimates when asked about a 3-year time period, and in one case because the most recent year was atypical for that firm. In a few cases, respondents stated that they did not read the question carefully since it did not apply to their company (see below); however, even respondents who read and answered the question did not notice the 2017 time period.

Response Accuracy and Consistency

Many respondents expressed doubt about their ability to respond to this question. Of the seven respondents whose companies had sales:

- Four stated that they guessed or used very rough approximation

³ Throughout this report, not every respondent provided information on every topic.

- Two estimated using a specific process
- One refused to answer due to the difficulty of estimating.

The four respondents who guessed expressed uncertainty about their estimates. For example, one respondent stated that he did not deal with sales numbers, so he was uncertain. Another respondent was uncertain about which products were new to the market, versus just to her company. She partially answered the question, indicating a “Don’t know” response for “new to market.” One respondent was reasonably confident in his estimate due to his company role, but he pointed out that answering this question would be very difficult unless the survey carefully screened for knowledgeable respondents. He expressed concern that estimates would vary widely; he felt he could give the survey to six different engineers in his company and get six different answers.

Two respondents provided estimates and also provided their rationale for the estimates. One of these respondents was the company comptroller and reported having a deep knowledge of the company’s finances.

One respondent refused to answer the question, stating that it was too difficult given his company’s business model, which sold bundles of innovative and established products. He said that disentangling how much income came from the new products would not be worth his time: “This is a level of granularity that I would say is a pain in the b*** and I wouldn’t do it.”

Finally, responses to this question should be consistent with Q3. However, one respondent’s responses were inconsistent: in Q3, he indicated no innovative products or services to the market, but in Q4, he indicated that these were 10% of sales.

Q4 Recommendations

Consider deleting Q4 or screening for knowledgeable respondents. Most respondents did not feel confident in their estimates of sales; one said she did not know how to answer part of the question, and one refused to answer due to the difficulty. Another respondent suggested screening for survey respondents who would be in a position to provide reasonable estimates. Due to these concerns, we recommend weighing the value added of this question against the possibility of inaccurate data, and/or consider screening respondents for this question.

Add the word “approximate.” If this question is retained, consider rephrasing to make respondents more comfortable providing ballpark estimates. For example, instead of “please give the percent of your total sales in 2017,” consider the phrasing: “please estimate the approximate percent of your total sales in 2017.”

Consider possibilities to fix the time period issue. All of the respondents incorrectly reported for the 2015–2017 period, as described above for the reference period. This issue could lead to incorrect estimates: as one respondent stated, small businesses can have huge swings in sales, with a contract in one year swinging sales dramatically. If Q4 is retained, consider the following options to address this issue:

- **Change question to focus on 2015–2017 instead of 2017 only.** A disadvantage of this approach is that this question will no longer be internationally comparable. However, since none of the respondents answered this question accurately, the data may not currently be useful for comparisons regardless. As a benefit, focusing on 2015–2017 would be consistent with the rest of the survey, as respondents who are in the mind frame of answering for 2015–2017 would not have to switch gears at this question.
- **Continue to report percentages only for 2017, but reinforce this timeframe.** For example, consider adding an introductory sentence saying, “Unlike other questions on this survey, this question focuses on 2017 only. Please consider your company’s sales in 2017 only when answering this question.” Consider also underlining “2017” throughout and increasing the font size of instructions related to the 2017 time frame. However, one of the confusing elements of the question is that in different places it refers both to 2017 and to 2015 through 2017. For maximal clarity, it would be best to refer to only one time period throughout the question.

Ensure consistency between Q3 and Q4. Respondents who did not check “new to market” in Q3 should report zero sales for this category in Q4. One respondent provided inconsistent responses, saying in Q3 that he did not have anything “new to market,” but reported 10% of sales in Q4 for that category. Consistency between Q3 and Q4 could be achieved via several options. For example:

- Programming to guide presentation of appropriate parts of the question (e.g., assuming web administration, provide only those options that were checked in Q3); or
- Cleaning on the back end (e.g., permit respondents to provide inconsistent responses on Q3 and Q4 and clean their data for these items if necessary).

Clarify the distinction between products, goods, and services. Respondents often viewed *products* as a larger category than *goods*, but without including services within *products*. One solution is to avoid the word *products*; another is to use all three terms.

Permit companies to enter zero sales. A few companies had zero sales during the time frame (e.g., new companies). Consider adding language to permit companies to report no sales. Some options include:

- Add another question before Q4 to screen for companies with sales; or

Add an option to Q4 to indicate “no sales,” perhaps below the question options.

2.5. Q5. Engagement in Innovation Activities & Investment

5. During the three years 2015 to 2017, did your company engage in the following innovation activities? If yes, please also enter the total investment in each, rounding to the nearest thousand.		Yes	No	Total Investment
A. In-house R&D	Research and development activities undertaken by your company to create new knowledge or solve scientific or technical problems (include software development that meets this requirement)	<input type="checkbox"/>	<input type="checkbox"/>	\$ _____,000
	If yes, did your company perform R&D during the three years 2015 to 2017:			
	Continuously (your company had permanent R&D staff in-house)	<input type="checkbox"/>	<input type="checkbox"/>	\$ _____,000
	Occasionally (as needed only)	<input type="checkbox"/>	<input type="checkbox"/>	\$ _____,000
B. External R&D	Your company contracted-out R&D to other companies (include affiliated companies) or to public or private research organizations	<input type="checkbox"/>	<input type="checkbox"/>	\$ _____,000
C. Acquisition of machinery, equipment, software & buildings	New machinery, equipment software and building that were acquired for the purpose of developing the goods, services, manufacturing or logistics mentioned previously in Question 2	<input type="checkbox"/>	<input type="checkbox"/>	\$ _____,000
D. Acquisition of existing knowledge from other companies or organizations	Acquisition of existing know-how, copyrighted works, patented and non-patented inventions, etc. from other companies or organizations for the development of new or significantly improved products and processes	<input type="checkbox"/>	<input type="checkbox"/>	\$ _____,000
E. Training for innovative activities	In-house or contracted out training for your personnel specifically for the development and/or introduction of new or significantly improved products and processes	<input type="checkbox"/>	<input type="checkbox"/>	\$ _____,000
F. Market introduction of innovations	In-house or contracted out activities for the market introduction of your new or significantly improved goods or services, including market research and launch advertising	<input type="checkbox"/>	<input type="checkbox"/>	\$ _____,000
G. Brand Building	In-house or contracted out activities to build your company's brand identity	<input type="checkbox"/>	<input type="checkbox"/>	\$ _____,000
H. Design	In-house or contracted out activities to alter the shape, appearance or usability of goods or services	<input type="checkbox"/>	<input type="checkbox"/>	\$ _____,000
I. Other	Other in-house or contracted out activities to develop or implement new or significantly improved products or processes such as feasibility studies, testing, tooling up, industrial engineering, etc.	<input type="checkbox"/>	<input type="checkbox"/>	\$ _____,000

Half of the respondents were given version A of Q5, which included the column for total investment, and half were given version B, which did not include the column for total investment. However, not all respondents were administered the question because after initial testing we began skipping Q5 in order to allow time to test other questions later in the survey. Interviewers returned to Q5 if time allowed. Seventeen respondents discussed Q5, and fourteen provided answers to the questionnaire items.

Question Comprehension

Respondents were asked what they thought the question asked, and what “innovation activities” and “engage in innovation activities” mean. Their responses were used to assess their general question comprehension.

Most respondents generally understood that the question focused on innovation, but several did not articulate an understanding that the question was specifically about innovation activities. Two respondents said that the question was about any materials, products, or services that were new and different for the company. One of those two said “change” and “innovation” are almost synonymous. Another respondent said “innovation activities” made him think about the acquisition of machinery, knowledge, and training, and talked about obtaining the knowledge needed to develop a new product. One respondent said innovation activities referred to efforts made in order to bring products or services to market. Another said the question looks at where they invest their resources in the development of the company.

Relevance of Question

None of the respondents expressed concerns about the relevance of this question to their company. Almost all respondents who answered the question provided an answer for all items A through I.

Reactions to Definitions

When asked if they read the information in the middle column of Q5A, eight of the respondents said they read or at least skimmed the definitions. Most said the definitions were clear and helped them better understand the term in the column to the left. One respondent said she changed some of her answers after reading the information in the middle column. Another said he read the definitions a few times before answering. Another said he read the middle column first and then the associated term in the left column.

Only two respondents said they did not read the middle column carefully. One said he did not spend much time on the middle column (20%), compared to the first column (80%). He said that was due to the amount of time it would take to read it. He read the middle column only when he needed clarification or didn't understand the term on the left. During probing, this respondent read the definition for F. Market introduction of innovations. After reading it he changed his answer from "No" to "Yes." The other respondent said he only skimmed the middle column definitions.

One respondent felt that the first column was difficult to read because the question items were too close together, especially items C, D, and E.

A–H Definitions: Some respondents commented on specific definitions.

- **A and B (in-house and external R&D).** One respondent at a small software and hardware design company struggled with both of these items because he did not know what would be considered an investment. Another respondent asked "How do you define R&D?" He defines research as the fact that they are prototyping, testing, and finding the solutions and applications "on the fly." He feels the more traditional definition of R&D implies a more sophisticated process and is not sure if his company's process would qualify. He felt the question assumes that all innovation occurs in R&D, but that is not always true. Sometimes "someone has an idea in the shower and that is not part of R&D."
- **C (Acquisition of machinery, equipment, software & buildings).** One respondent noted that property and machinery are often leased, rather than acquired. She answered C "Yes" based on leasing two new offices but wondered if her answer was correct.
- **D (Acquisition of existing knowledge from other companies or organizations).** One respondent felt that the middle column definition was too wordy.
- **E (Training for innovative activities).** One respondent wondered if one of his engineers taking a class or course to learn better use of a software program on design projects should be included in E.
- **F (Market introduction of innovations).** One respondent did not understand why "in-house" was specified and felt that the definition was not useful. This same respondent found it difficult to discriminate between F, G, and H. He felt that G overlapped with both F and H. Another respondent asked if F should include email blasts to customers. Another respondent said F should include email campaigns, product announcements on the website and LinkedIn, and going to research and scientific meetings.
- **G (Brand building).** See F and H.
- **H (Design).** One respondent was thinking about design work on the website and training manuals and put it under H, but then moved it to G since she decided H was only relevant

to goods. Another respondent wasn't sure if H included web design, since the respondent considers web design an innovative activity since it affects the appearance of the good to the market.

- **I (Other).** One respondent found this item confusing. Another respondent wanted to put “contracting out software development” in I, but was not sure. She noticed references to software in A and C and she was further confused. She decided to put it in A for software developed by your own employees rather than C, which she thought was about purchasing software. One respondent wondered if “tooling up” in I was redundant with “acquiring new equipment” in C. One respondent answered “Yes” to I because he had to lease some equipment from other companies. He wasn't sure if his answer was correct since he was only assuming that this is “tooling up.”

Feasibility of Reporting for 3-Year Reference Period

We did not probe on this topic. Only three respondents mentioned the 3-year reference period. All three noted that they were referring specifically to the reference period.

Feasibility of Reporting Investment Totals

Many respondents' first reaction was to the total investment portion of the question. Respondents felt the question was primarily about the investment totals rather than determining innovation activities, and had a lot to say about it. Nine of the eleven respondents who commented on the total investment column responded negatively. They stated that filling out the total investment column would require going over numbers, consulting the finance person, or would be a tedious, time-consuming process. They found it difficult to enter rough estimates, and were not very confident. One respondent said he probably undercounted and to take his answers “with a grain of salt.” Another respondent said he was frustrated with the question and was unable to provide percentage estimates. He said it was “off-putting.” Respondents felt that this portion of the question was asking for too much detail.

One respondent was neutral in his response; he stated that it wasn't too difficult but that it might be for a larger company. One other respondent said he retains a lot of information and was easily able to answer the 5A Total Investment.

Response Accuracy and Consistency

Four respondents expressed a clear preference for considering the two options under 5A (Continuously and Occasionally) as requiring a choice between the two, rather than answering yes or

no for each option. The CIS also formats the question to require a choice between the two, and NSF expressed a preference for returning to the CIS format.

One respondent had difficulty answering 5A because her staff are not specifically R&D staff, but contribute to R&D as part of their regular responsibilities. She considered this “continuous” but did not think that it met the survey definition of continuously. She suggested using “daily” or “weekly” instead of “continuously.”

When asked if there were any additional innovation activities not shown in question 5 that were relevant to their company, four respondents made suggestions. One said that legal activities related to innovation (intellectual property) should be included. Another said his company goes on research or inspirational trips. For example they spent time and money to go to Disneyland to see the newest attractions. One respondent mentioned “open management,” management that is open to new ideas and input, and encourages employees to try new things. He provided the example of Google giving employees time to just think. Another employee said Q5 is missing “recruiting suitable employees who fit well with innovation.”

Q5 Recommendations:

Keep middle definitions. Respondents find them useful.

Add spacing between rows to improve readability.

Revise definition of A. In-house R&D. Add “formal or informal” to the definition of A (Formal and informal research and development activities undertaken...).

Revise definition of C. Acquisition of machinery, equipment, software buildings. Add “acquired or rented” to the definition.

Simplify definition of D. Acquisition of existing knowledge from other companies or organizations. “Acquisition of existing know-how or inventions from other companies or organizations for the development of new or significantly improved products or processes.”

Edit definition of E. Training for innovative activities to include coursework. “In-house or contracted out training or coursework for your personnel for the development or introduction of new or significantly improved products or processes.”

Improve definitions of F, G, and H.

- Provide more detail in the definition for G to differentiate it from F and H.
- Add “email and social media announcements” to F.
- Add website design to a definition and consider proper placement in F, G, or H.

Consider revisions to the definition of I. Other.

- Eliminate “tooling up.”
- During later cognitive testing, allow a space for respondents to write in an example. Qualitative data will inform the potential need for additional items.

Consider adding additional innovation activities. Consider “legal activities related to innovation” and “research or personal development trips” as new items or examples within existing definitions.

Eliminate the Total Investment column.

Within item A, reformat the sub-items.

- Use bold instructions for A. follow-up questions. Revise 5A so respondents understand to go to the follow-up questions if they answer yes to 5A. Bold “If you answered YES,…”
- Revise the follow-up questions so that respondents can select “Yes” for just one or the other. Add an instruction to check just one of the two boxes.

If you answered YES to A. In-house R&D, did your company perform R&D during the three years 2015 to 2017:

- Continuously (your company had permanent R&D staff in-house)

OR

- Occasionally (as needed only)

2.6. Q6. Innovation Activities – Abandoned/Suspended or Ongoing

6. During the three years 2015 to 2017, did your company have any innovation activities that did not result in a product or process innovation because the activities were:		
	Yes	No
Abandoned or suspended before completion	<input type="checkbox"/>	<input type="checkbox"/>
Still ongoing at the end of 2017	<input type="checkbox"/>	<input type="checkbox"/>

Sixteen respondents answered this question and seventeen responded to probes about the question.

Reactions to Definitions

Some of the respondents did not appear to understand what “product or process innovation” within the question stem meant, or appeared to be thinking of only “product” or “process,” but not both. One said he was thinking of the things listed in Q2 but went on to explain that he thought it referred to innovation activities, trying to get different things to market. Another found the question a little unclear and went on to explain that when she read “process innovation” she thought about how her company is always trying to improve their processes. Another said “process” can be in reference to either product or service. Another was thinking of new products or new equipment to make new products. Another thought of innovation overall, and did not separate between product or process innovation.

However, several other respondents appeared to understand the question stem. When directly asked what product or process innovation he was thinking of, one respondent explained he was thinking back to items listed in the previous questions and of new and novel solutions for things the company is currently working on. Another respondent felt the question was clear and that it asked if something resulted in a product or process improvement. One respondent said he was thinking of products and services, but more about service, the way his company executes the delivery of the good.

Question Comprehension

We probed about the meaning of the phrase “Abandoned or suspended before completion.” Some respondents were not sure if something qualified as “abandoned” or “suspended.” For example, one asked if it is abandonment or suspension if you have an idea and you change it because of the

market or funding. This respondent had a difficult time answering the question since “innovation is a perpetual process. You don’t abandon innovation,” because you have to adjust to the market.

Another respondent seemed unsure of his “No” response. The company had developed some products that they might have introduced to the market, but decided instead to abandon them due to not being completely happy with them. The respondent decided that perhaps in “their corner of the world” these might have been innovation, but not “in the big scheme.”

Another respondent answered “Yes” even though she does not think of her innovation activities as “abandoned or suspended.” She said they “evolve” or are “put on the back burner.”

One respondent confidently answered “No” to this part and explained that they cannot abandon projects because they produce made-to-order products according to specs. The respondent considered this customer service and problem solving, not process innovation.

We also probed about the phrase “Still ongoing at the end of 2017.” One respondent who easily answered “Yes” to the first item also answered “Yes” to the second item, but said he did not know how to answer it. This respondent explained how the company has a solid product development process but that they do not put money into products they cannot complete. Another respondent similarly answered “Yes” to both items but struggled more with the second item and explained that because of the engineering and design focus of the company they always have a number of things going on.

Another respondent answered “No” but asked “Is that innovative?” after explaining that they have looked at expanding their market internationally.

Two respondents had no problem answering “No” to the first item and “Yes” to the second item, explaining that they have not abandoned anything, and that their innovation is ongoing.

Some tended to think of innovation only in terms of the final release or implementation, so that abandoning an innovation meant abandoning it after it had been released (e.g., because it failed to develop a market) rather than abandoning something during the development process.

Some did not consciously seek to innovate, but rather sought to solve problems (their own problems or customers’ problems), which may or may not involve innovation. For them, the term “innovation activities” was not fully meaningful.

Relevance of Question

We did not probe directly about relevance for this question. However, based on the finding that the majority of respondents answered “Yes” to at least one item, we judged that it is a relevant question.

Feasibility of Reporting for Three-Year Reference Period

We did not probe about the reference period for this question.

Response Accuracy and Consistency

For two respondents, it was unclear if their “Yes” responses were correct. One who answered “Yes” to both items of the question explained that his first company was abandoned before completion because they ran out of investor funding and his second company is still ongoing. Another respondent answered “Yes” to the first item because he created a product but suspended it because nobody was buying it.

While some respondents were unsure of their answers to the two items (as described above), other respondents appeared to answer correctly and when probed, provided an explanation.

For the first item (Abandoned or suspended before completion), one respondent answered “Yes” and explained that projects frequently fall apart or budgets fail. Another answered “Yes” and said the company suspended the development of a product because of the lack of engineering resources to develop it, but that it is “still on the table.” Another respondent appeared to accurately report “Yes” based on some ideas the company started to develop, but then stopped after evaluating the prototype. One respondent appeared to correctly answer “Yes” to this item based on his explanation that they tested several concepts that were eventually abandoned because they were not funded. Still another answered “Yes” and explained how the company just “looked at” creating something.

For the second item (Still ongoing at the end of 2017), one respondent answered “Yes” and explained that some innovation is ongoing and related to multi-year projects. Another appeared to answer “Yes” correctly based on his explanation that they started something this year but may not complete and release it until next year, so it is “still ongoing.”

Q6 Recommendations

This question presented multiple issues that are likely to result in collecting inconsistent data: people sometimes thought of innovation activities as final products rather than development activities, they did not know how to handle activities that evolved or went into temporary abeyance, there was a general reluctance to say they had stopped innovating, and they did not know how to report on continuous improvement efforts. However, we understand that NSF wishes to minimize changes in order to promote comparability with CIS data. One partial solution is to provide an introduction or text box that defines innovation activities in more detail. Similarly, it may help to provide supplemental definitions for both items.

NSF might consider the possibility of adding a question where respondents would be able to report that they have continuous innovation due to the nature of their business and/or an R&D department that is always innovating. Some respondents answered “Yes” to the second item because of continuous innovation, not necessarily because there was something specific started during the reference period that has yet to be completed.

2.7. Q7. Public Financial Support for Innovation Activities

<p>7. During the three years 2015 to 2017, did your company receive any public financial support for innovation activities from the following levels of government? Include financial support via tax credits or deductions, grants, subsidised loans, and loan guarantees. Exclude R&D and other innovation activities conducted entirely for the public sector under contract.</p>		
	Yes	No
Local or State Government	<input type="checkbox"/>	<input type="checkbox"/>
Federal Government	<input type="checkbox"/>	<input type="checkbox"/>

Seven respondents answered this questions and eight responded to some of the probes about the question.

Question Comprehension

Of those respondents asked, most appeared comfortable when answering the question, but some may have interpreted the question more broadly than intended, counting any kind of tax credit or

deduction regardless of the relevance to innovation. Two respondents said they understood it to be asking if any money came from the government, federal or state. Two others said they could easily answer it and that the answers were obvious to them. One respondent stated that she was hesitant to answer since she does not file the company's taxes. She answered "Yes" to both items of the question because she knew that they receive tax credits for certain purchases and for installing solar panels.

Relevance of Question

When asked if the question was easy or difficult to answer, three respondents said "easy" or "very easy." Another respondent felt it was difficult because she is not knowledgeable about the company's taxes. Another respondent did not say whether the question was easy or difficult to answer, but said that it was a good question. One other respondent suggested separating out "local" from "state." (However, this change would probably make the question harder to answer for some companies.)

Feasibility of Reporting for 3-Year Reference Period

We did not explicitly probe about the reference period for this question.

Response Accuracy and Consistency

Only three respondents explained their "Yes" answer(s). One answered "Yes" for Local or State Government because they receive a tax increment financing for where their building is located. Another answered "Yes" and provided the example of a tax credit for installing solar panels. However, one respondent answered "Yes" for Federal Government because they have a subcontract on a federal grant, which appeared to be an incorrect answer based on the instruction to "Exclude R&D and other innovation activities conducted entirely for the public sector under contract." This respondent eventually explained that they also get federal funding in the form of a tax deduction for R&D.

Q7 Recommendations

Consider adding a "Don't know" response option. Some of the respondents may not know or have access to this information.

Consider reformatting the instructions to make them more salient. To make the include and exclude text more likely to be noticed and read, consider using bullet points to set them off from the bold text. Also change “subsidised” to “subsidized” for the U.S. business population. For example:

7. During the 3 years 2015 to 2017, did your company receive any public financial support for innovation activities from the following levels of government?

- **Include** financial support via tax credits or deductions, grants, subsidized loans, and loan guarantees.
- **Exclude** R&D and other innovation activities conducted entirely for the public sector under contract.

2.8. Q8. Innovation Cooperation

8. During the three years 2015 to 2017, did your company co-operate on any of your innovation activities with other companies or organizations? Innovation co-operation is active participation with other companies or organizations on innovation activities. Both partners do not need to commercially benefit. Exclude pure contracting out of work with no active co-operation.

- Yes (GO TO QUESTION 9)
 No (GO TO QUESTION 10)

Question Comprehension

Generally, the eight respondents who answered this question understood the question as intended and provided relevant responses. An exception was one respondent: her organization shared office space with a community-based organization (CBO). She answered “Yes” because she considered this arrangement to be an innovative partnership in their town, which may not reflect the intention of this question.

Despite understanding the overall purpose of the question, we suspect that many respondents did not fully grasp the definition of partnership embedded in this question, which has implications for question comprehension (see Reactions to Definitions).

Relevance of Question

Most respondents did not express concerns about the relevance of this question to their company, and almost all answered “Yes” to Q8. These examples illustrate the relevance of cooperative innovation activities to respondents’ companies:

- A respondent’s company was hired to design a car dashboard for another company. Although the other company decided not to sell the product, the respondent felt that the dashboard was innovative and that the two companies collaborated.
- Another respondent’s company asked undergraduates in a class to develop an app, which the company then hoped to market. No money exchanged hands, and the app did not work out. The respondent considered this a partnership with a university.
- Another respondent’s company developed a product to track football speed and collaborated with another company that makes similar equipment to manufacture it. They are still trying to figure out how to work together to merge their skillsets to make a final product.

The only potentially irrelevant response was, again, the respondent who described office-sharing with a CBO (see above). Finally, one respondent answered “No” to Q8 but grasped the *potential* relevance of the question to his company: he did not form partnerships as he did not want to share intellectual property with other companies.

Reactions to Definitions⁴

Innovation cooperation. No one expressed confusion about this definition, and a few volunteered that the definition helped them to understand the overall question.

Both partners do not need to commercially benefit. Respondents did not express confusion about this sentence.

Exclude pure contracting out of work with no active co-operation. Respondents expressed confusion about this sentence. One suggested removing the clause “out of work.” Another disagreed with the premise of the definition: he felt that contracting relationships necessarily involved cooperation (e.g., providing the vendor with specifications). Finally, one respondent expressed no confusion with this sentence,

⁴ Due to time constraints, our data is limited on some of these definitions. For example, only 4 out of 8 respondents were probed on “Exclude pure contracting out of work with no active co-operation.”

but interpreted it incorrectly to mean he should exclude *all* “for hire” partnerships (versus just excluding “for hire” partnerships with no active cooperation).

Partner. Q8 excludes “for hire” partnerships with no active cooperation, but includes “for hire” partnerships with meaningful collaboration on innovation activities. With this goal in mind, some respondents’ definitions of partnership aligned with the sense of Q8, but a few of respondents’ definitions did not or were unclear. For example, a majority of respondents described “for hire” partnerships such as clients or contractors, but in a few cases, it was not clear whether these relationships included active cooperation on innovation activities.

Respondents’ intuitive understanding of the word “partner” also varied. Again, one respondent considered all contractors as partners because he felt that contracting fundamentally required cooperation to conduct the work. On the other hand, other respondents stated that they would *not* consider anyone that worked for hire as a partner (e.g., clients or contractors). In addition, one respondent had a definition of partner that seemed overly broad, including another business that merely shared office space with her organization. Another respondent narrowly defined a partner as a company that sold another company’s products.

Finally, two respondents volunteered that they considered informal business relationships to be partnerships, with one specifically stating that signed paperwork was not necessary to constitute a partnership. In fact, one respondent found it challenging to answer this question because his business had many informal connections to other businesses. For each relationship, he asked himself, “Do they meet the threshold of ‘partner’ or are they an acquaintance?”

Feasibility of Reporting for 3-Year Reference Period

We did not specifically probe about the reference period for this question, but most respondents did not volunteer any issues related to the 3-year reporting period.

Response Accuracy and Consistency

In the majority of responses to this question, we suspected inconsistencies related to the respondents’ definition of “partner” (see above).

Q8 Recommendations

Please see the recommendations that follow Q9.

2.9. Q9. Innovation Cooperation Partner and Location

9. Please indicate the type of innovation cooperation partner by location.		
<i>(Mark all that apply)</i>		
Type of cooperation partner	United States	All other countries
A. Other affiliated companies (legal entities under common ownership)	<input type="checkbox"/>	<input type="checkbox"/>
B. Suppliers of equipment, materials, components, or software	<input type="checkbox"/>	<input type="checkbox"/>
C. Clients or customers from the private sector	<input type="checkbox"/>	<input type="checkbox"/>
D. Clients or customers from the public sector	<input type="checkbox"/>	<input type="checkbox"/>
E. Competitors or other companies in your sector	<input type="checkbox"/>	<input type="checkbox"/>
F. Consultants or commercial labs	<input type="checkbox"/>	<input type="checkbox"/>
G. Universities or other higher education institutes	<input type="checkbox"/>	<input type="checkbox"/>
H. Government or public research institutes	<input type="checkbox"/>	<input type="checkbox"/>
I. Private research institutes	<input type="checkbox"/>	<input type="checkbox"/>

Question Comprehension

Almost all of the seven respondents correctly identified the overall purpose of this question when asked. Only one respondent indicated a possible misunderstanding, stating the purpose of the question was to learn how free the company was to work with domestic or foreign entities.

Despite almost all respondents understanding the general purpose of this question, specific aspects of this question created comprehension challenges.

Innovation cooperation partners. Q9 contains instructions to focus on “innovation cooperation partners” (i.e., according to Q8, only partners that actively participated in innovation, not all partners). About half of respondents correctly described partnerships that included an innovation component. However, in several cases, it was unclear whether respondents understood they should include only *innovation*-specific partnerships. For instance, one respondent may have been reporting *any* client in the United States or abroad and not just those partners in innovation.

In addition, one respondent understood that he should include only partners actively involved with innovation, but was uncertain whether one partner met this definition. His company made innovative products and hired a partner to manufacture one piece in another country. Although the overall product was innovative, the piece manufactured in the other country was not.

Location of partner. A majority of respondents correctly indicated the location of their partner. One respondent stated the location reflected where the *innovation* occurred, as well as the benefactors of the innovation (e.g., potential customers). Another respondent expressed doubt about which location to indicate: he worked with a foreign company with locations in the United States, but he only worked with its employees in the United States. He decided to put “U.S.” as location.

Categories. Almost all of the seven respondents expressed confusion about this question’s categories. Broadly, several categories overlapped, were unclear, or provoked questions from respondents. Below, we list the categories and the various issues identified by respondents.

Type of Cooperation Partner	Respondents’ Issues and Questions
A. Other affiliated companies (legal entities under common ownership)	A respondent did not understand how a co-owned company could be a partner; he would consider it part of the company.
B. Suppliers of equipment, materials, components, or software	One respondent asked if this category included vendors, or if vendors should go under C.
C. Clients or customers from the private sector	One respondent pointed out that a company could fall under both C and E (e.g., he worked with a partner sometimes as a client and sometimes as a competitor).
D. Clients or customers from the public sector	One respondent said that this option overlapped with Option H. Another respondent asked what public sector meant: “Does that mean government?”
E. Competitors or other companies in your sector	One respondent did not like the word “competitor” here. By definition, he would not cooperate with a competitor. He suggested changing to “other companies in your sector.”
F. Consultants or commercial labs	None.
G. Universities or other higher education institutes	One respondent suggested adding “K-12 schools” as well.
H. Government or public research institutes	See comment above on D.
I. Private research institutes	None.

Finally, one respondent expressed concern that her partner did not fit neatly into the list (a community-based organization); however, NSF would likely not consider this organization would to be an innovation partner.

Relevance of Question

None of the respondents expressed concerns about the relevance of this question to their company, and all respondents checked at least one box in Q9.

Feasibility of Reporting for 3-Year Reference Period

Q9 does not contain a reference period, but the preceding lead-in question does. We did not probe on this topic, but no respondent volunteered concerns about the 3-year reference period. One respondent worked at two companies during the 3-year period and picked one company for this question.

However, one respondent described a possible challenge that could be exacerbated by the 3-year reference period. Although his company did not have many partners, he predicted that large companies with multiple partnerships might struggle to remember all their partners. (See also Q8, where one respondent struggled to remember all his partners).

Response Accuracy and Consistency

The various issues noted above may have implications for respondents' ability to consistently report information into the categories that NSF has listed.

Q8 and Q9 Recommendations

Consider combining Q8 and Q9. Q8 is a filter for Question 9 and contains a skip pattern for Q9 if answered "No." However, some respondents might not spontaneously think of all the entities listed in Q9, yielding inconsistent responses between the two items. For example, one respondent reported that his company co-owned another company on Q9, but stated that this company did not occur to him when responding to Q8. Also, some respondents were confused about what constituted a partner (e.g., if a client counted). Having a list of specific examples would be helpful to resolve this confusion. Placing Q8's detailed instructions immediately before Q9 will also reinforce

the definition of active innovation partner in Q9. For these reasons, we suggest combining Q8 and Q9, adding an option for “no innovation cooperation partners.”

Consider adding an “other” option. One respondent did not know how to indicate a partner that did not fit on the list (a community-based organization; CBO). In this particular case, the CBO may not have met NSF’s definition of “partner.” However, this instance points to a larger issue: some innovation partners may not be captured if they do not fit into the categories in this list. For this reason, NSF may wish to consider adding an “other partner” option to the list. If NSF is open to coding text fields, NSF could also consider allowing an open text response (“Other, *please specify*: _____”) to obtain more information about these other partners.

Consider clarifying whether “for hire” contracting should be included in Q8 (and by extension, in Q9). Currently the question states, “Innovation cooperation is active participation with other companies or organizations on innovation activities,” but also instructs to “exclude pure contracting out of work with no active cooperation.” The directions imply that contractors can be included if they actively cooperated on innovation, but a few respondents assumed that *all* contractors should be excluded.

To address this issue, we recommend explicitly stating that contracting *with* cooperation on innovation should be included. An alternative phrasing is:

Include subcontractors who work actively with you on an innovation activity. Exclude work that is contracted out with no active cooperation.

Consider clarifying that partnerships can be either formal or informal. Some respondents included informal relationships, but others described only formal relationships. For this reason, responses across respondents may be inconsistent without explicit instructions. If informal partnerships should be included, some phrasing options are:

- Both partners do not need to commercially benefit, and partnerships can be formal or informal in nature.
- Both partners do not need to commercially benefit. Include both formal and informal partnerships.

Consider changing the “Type of cooperation partner” heading. A few respondents reported all partners, not just those participating in innovation. Combining Q8 and Q9 (see above) should help to reinforce the definition of innovation partnership. However, we also recommend adding the

word “innovation” to the left-side column heading as a reminder, or as a heading above the two response columns. Some suggestions include:

- Type of partner in innovation (above the left column); or
- Location of partner in innovation (above response columns).

Consider clarifying the definition of “location of partner.” One respondent collaborated with a foreign company, but only encountered their U.S.-based employees within their U.S.-based entity. He expressed uncertainty about marking “U.S.” or “all other countries” (he decided on “U.S.” for this company). Although this issue did not frequently occur in testing, it could point to a larger concern: many companies have multiple offices around the world. For companies that have both U.S. and non-U.S. offices, respondents may not select “U.S.” or “non-U.S.” consistently without instruction.⁵ We recommend adding instructions to clarify how to classify such companies (e.g., consider only the company headquarters, or consider the office with which you work most frequently). NSF may wish to consider utilizing a similar approach to other NSF surveys, such as HERD, when asking respondents to identify company locations.

Consider adding “Location of partner” as a column heading above “United States” and “All other countries.” The majority of respondents thought that they should mark the location of their partner. However, one person thought he should mark the location of the *innovation*. Adding a column heading above the location columns will reduce the potential for confusion. If desired, reinforce the definition of partner location within this heading (see above; e.g., “Location of partner headquarters.”)

Consider reworking the response categories to improve clarity. Currently, the list of categories contains two overlapping concepts: 1) the type of organization (e.g., university, company, government; A, C, D, E, F, G, H, I), and 2) the nature of the partnership (e.g., a client, a vendor; B, C, D, E). These are not mutually exclusive concepts. As one respondent pointed out, the same entity can fall in multiple categories (e.g., a university that is also a client). In addition, two categories also contain *both* the type of entity and the nature of the partnership (C and D), which is more specific than the other categories. Together, these overlapping categories have the potential for confusion. If desired, Westat would be happy to develop alternative constructions of this question (e.g., revised non-overlapping categories). Alternatively, if NSF’s priority is to maintain comparability with other

⁵ The problem was exacerbated by a mistake in the design of the questionnaire, which did not allow respondents to check both columns for a single line. Several wanted to check both columns because they had multiple partners, and those that had a partner in both locations might have checked both columns.

questionnaires used internationally, then analysts should be advised that the same partner may be listed in multiple categories. For clarity, it would be best to instruct respondents how to handle such situations—i.e., whether to pick all applicable categories or to pick the category that best applies. Otherwise, the meaning of the responses is likely to vary across respondents.

2.10. Q10. New Organizational and Marketing Innovations

10. During the three years 2015-2017, did your company introduce new:	Yes	No
a. Business practices for organizing procedures (i.e. first time use of supply chain management, business re-engineering, knowledge management, lean production, quality management, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
b. Methods of organizing work responsibilities and decision making (i.e. first time use of a new system of employee responsibilities, team work, decentralisation, integration or de-integration of departments, education/training systems, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
c. Methods of organizing external relations with other companies or public organizations (i.e. first time use of alliances, partnerships, outsourcing or sub-contracting, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
d. Aesthetic design or packaging of a good or service (exclude changes that alter the product's functional or user characteristics – these are product innovations)	<input type="checkbox"/>	<input type="checkbox"/>
e. Media or techniques for product promotion (i.e. first time use of a new advertising media, a new brand image, introduction of loyalty cards, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
f. Methods for product placement or sales channels (i.e. first time use of franchising or distribution licenses, direct selling, exclusive retailing, new concepts for product presentation, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
g. Methods of pricing goods or services (i.e. first time use of variable pricing by demand, discount systems, etc.)	<input type="checkbox"/>	<input type="checkbox"/>

Question Comprehension

This question differed from previous questions by focusing on “new” rather than “new or significantly improved.” The respondents differed in whether they noticed this difference and how they responded. Following are examples of their interpretations.

- One said the phrase meant “Brand new.” This respondent mentioned that variations or upgrades could count as new if the company had purchased new software or tooling in the process of making those changes. The respondent considered this part of keeping up with their competition.

- One respondent noted that he answered based on what was not necessarily new, but basically a change from what they have done in the past.

A few of the respondents had a slightly broader interpretation of “new.” Three respondents seemed to think along the lines of earlier questions that used explicit wording of “new or significantly improved.” Their interpretations were as follows.

- One respondent said that he was thinking about improvement and went on to say: “New does not necessarily mean improvement, but that is the hope.”
- One who works for a new company said he would consider a variation or an upgrade as new, but he did not have to think of it at that level since they are still in a rapid growth phase and are doing something new all the time.
- One respondent said that for his company, a variation or an upgrade would in some instances count as something new. For example, when they upgrade software on their device with a new component, he would consider that a new software platform, even though it is not a completely new system.

Another respondent was initially confused about whether the question was focused on new to the company or new to the market. He explained that the practice may be new to them, but he would not know for sure if it is new to others. He initially reasoned that the question seemed to be asking about innovation in business practices, but he would not know this information. After further thought, he reasoned the question might be about whether the business practice is new for the company. He mentioned that part a (business practices for organizing procedures) of the question did not identify whether the new practice is new for the company or new to the world.

Relevance of Question

None of the respondents said this question was irrelevant for their company. All answered “Yes” for one or more parts of the question, providing further evidence that at least parts of the questions were relevant for every company. One said that he was not the appropriate person to answer about business practices for his company. His expertise and involvement are with product and process innovations. This may be a general problem in larger companies: one person may not be qualified to answer questions concerning all types of innovation.

Reactions to Definitions

When probed about their attention to and need for the definitions, several said the provided examples were helpful. For example, one said the definitions “absolutely” clarified the questions, especially for item g (Methods of pricing goods or services). Another said the examples helped because they “narrowed in on choices.”

One said he did not read the text in the middle column; he only read the text in the left column that was bold. He elaborated that if he had not understood the lead-in text for each item, he would have continued on to read the “no-bold text.” He explained a preference to see text like this in bullet points rather than full sentences; for him, that would make it easier to read and process the information.

One participant suggested using bold font for the word “exclude” in item d (Aesthetic design or packaging of a good or service), based on his thinking that some people would not notice that.

Feasibility of Reporting for 3-Year Reference Period

The reference period seemed to work well for this question; no respondents mentioned difficulty in reporting for the 3-year period. One respondent who works for a new company mentioned that it was easy for him to report for 3 years, but it would have been harder to report for a short period, such as 6 months.

Response Accuracy and Consistency

As time allowed, respondents were also asked to give examples for their “Yes” responses, to check for reporting accuracy. Their examples seemed to qualify; respondents mentioned new ways of partnering, new ways of training, new ways of branding, reorganizing the management structure or management model, and changing a website.

Respondents seemed to correctly explain “No” answers, as well. They reasoned that a change did not qualify because it was not new within the time period or was not really new. One decided that a “tweak” to an existing method rather than a completely new method did not apply; for item C (Methods of organizing external relations...), she said that the question was asking “about new systems rather than just new partners.”

The respondent, who works for a new company and interpreted “new” more broadly (to mean a variation or an upgrade), thought he was able to report accurately since they are still in a rapid growth phase and are doing something new all the time. If the reference period had been shorter (e.g., the last 6 months), he may have answered “No” to a few items of the question, but with a 3-year period he was easily able to answer “Yes.”

One respondent was going to answer “Yes” for the first item of the question, then read the example in parentheses and decided instead to answer “No.” Then for the remaining items of the question, she answered in a limited way, only marking “Yes” if they had introduced the specific examples in parentheses.

One respondent who answered “Yes” to all items of the question expressed the opinion that the question items are too broad: “If any one of those areas is a yes, then the whole question [item] is a yes.”

Q10 Recommendations

To help reduce the opportunity for misinterpretation and to further clarify that the focus of this question is new for the company, consider making a slight modification to the wording of the question stem. This is important since this question is placed later in the module than several questions that differentiate new to the company vs. new to the market. Without explicit direction, respondents may differ in their basis for answering this question. Three possibilities include the following:

During the 3 years 2015 through 2017, did your company introduce new (new to your company):

During the 3 years 2015 through 2017, were each of the following new (to your company)?

During the 3 years 2015 through 2017, were the following introduced as new methods in your company?

A larger issue is respondents' inclusion of significant improvements in their responses, rather than limiting themselves to what is new, even though every item but 10d includes the phrase "first time use." It may be helpful to add a note, such as an attention-grabbing box above the question items, providing an instruction such as the following:

<p>NOTE: This question asks you to consider only innovations that were new. Please do not count those things that were significantly improved.</p>
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Consider using bold font for the word "exclude" in item d (Aesthetic design or packaging of a good or service) of the question. It is important to draw attention to this key wording since it is in parentheses, where those who typically avoid reading parenthetical information may overlook it. This should help clarify what this item is asking for and improve reporting accuracy.

For consistency with questions that precede and follow this one, use capital letters for the individual items of the questions.

2.11. Q12. Factors that Hinder/Prevent Innovation

12. During the three years from 2015 to 2017, how important were the following factors in hampering or preventing your company from innovating?

	Degree of importance			
	High	Medium	Low	Not important
A. Lack of internal finance for innovation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Lack of credit or private equity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Innovation costs too high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Lack of skilled employees within your company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Lack of collaboration partners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F. Difficulties in obtaining government grants or subsidies for innovation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Uncertain market demand for your ideas for innovations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H. Too much competition in your market	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I. Legislation/regulation that generated excessive burden	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
J. Legislation/regulation that created uncertainty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
K. Legislation/regulation that lacked consistency across the United States	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L. Low demand for innovations in your market	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
M. No need to innovate due to previous innovations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
N. No need to innovate due to very little competition in your company's market	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
O. Lack of good ideas for innovations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question Comprehension

Of the five respondents probed specifically on what “hampering or preventing your company from innovating” means, two were confused by a high rating for something that has a negative connotation. One of the two asked how the question about preventing innovation is different from preventing your company from performing. The respondent also said that the question was confusing because, “It’s kinda like there’s a triple negative.” The respondent felt the scale was confusing if “High” means that it hampered a lot. The other respondent who was slightly confused said that “hampering or preventing your company from innovation” refers to things that get in the

way of running the business, and factors that keep you from running the company. This respondent tended to think about the business overall, and not just the innovative aspect of the business.

The three other respondents who responded to a probe on the phrase (specifically the word “hampering”) appeared to understand it. One said it refers to external factors interfering with her progress. Another said “hampering” suggests slowing down, not stopping, the innovation process. However, this respondent also said the word was not descriptive enough. Another respondent explained her answers by using the words “hinder,” “prevent,” and “prohibit.”

Respondents found some parts of the question confusing. One did not understand item A (Lack of internal finance for innovation); and said that innovation is not something you sell, but rather an inspiration when you encounter a problem and come up with a solution. Another respondent was confused by the parts of the question (A, B, D, E, and O) that included the phrase “lack of.” To him, that signifies that he is not concerned at all; therefore, it is of low importance.

Relevance of Question

Respondents were asked which part(s) of the question were not relevant for their company. Three respondents noted specific irrelevant parts. One respondent said H, L, M, N, and O did not apply to her company or market. She answered “Not important” for all of them. She would have chosen “Not applicable” if it were an option. She said, because there is a high demand for innovations in her market, rating the importance of the lack of demand was difficult for her. Another respondent also said items M, N, and O are not relevant to her business because innovation and competition are the key components of her industry.

Another respondent said item B (Lack of credit or private equity) was not relevant to his business. They are internally financed to maintain control of their scientific direction and do not seek out private equity.

Feasibility of Reporting for 3-Year Reference Period

We did not probe on the reference period for this question, but none of the respondents mentioned issues associated with reporting for a 3-year period.

Response Accuracy and Consistency

There were several instances in which the respondent's explanation of the company's situation did not seem to match the response option chosen. For example, the respondent who said item B (Lack of credit or private equity) was not relevant to his business gave the response "Low" rather than "Not important."

Six respondents provided examples of parts of the question that were most difficult for them to answer. These tended to be the parts that they cited as hard to understand and/or included a negative word. One respondent specifically mentioned that items A, B, D, E, and O were confusing; these all included the wording "lack of." To him, that signified that he is not concerned at all; therefore, it would be of low importance.

Another respondent said item K (Legislation/regulation that lacked consistency across the United States) was difficult to answer because the company has not had any exposure to anything that is regulated differently from another state. Another respondent said she did not know how to answer item H (Too much competition in your market) because it is not something that hinders you from innovating, but rather is the reason you have to innovate. Two other respondents also had some difficulty with item H; they were focused on whether or not the factor is important rather than whether it is a factor in preventing innovation. One needed to re-read the question stem. The other did not know what to check because the item did not seem applicable; they did not have too much competition, so he could not say having too much competition was hampering or preventing innovation. (This respondent answered "Low" for item H). This last respondent generally had a problem with Q12 because he preferred to think about what is important to further innovation rather than what is preventing innovation. He also said item E was difficult because they did not lack collaboration partners, and answered with "Low" to the item.

One respondent understood the question but said items A, B, and C were the most difficult to answer because his company only does work when the client wants it. As a business that does contract work, it is up to the client, not the company. One other respondent voiced some confusion over items L and N, although his answers appeared to match his situation. For item L he said, "What's low demand for innovations in your market?" He explained that any market can benefit from innovations and that you usually don't know what those innovations will be until they are created. He answered "Low." For item N (No need to innovate due to very little competition in your company's market) he was confused and said, "If your company doesn't have competition, you don't have a business." He answered "Medium."

When probed about other factors that affect their company’s ability to innovate but were not included on the list, five respondents offered the following comments and suggestions.

- One said that having to train employees because of their low skill set is a hindrance to their ability to innovate. Higher skill sets would improve their ability to innovate. This respondent also said lacking “local suppliers and support entities” could be a hindrance to innovation.
- Another respondent suggested adding the lack of access to tools, such as software.
- One respondent said a major obstacle is not the regulation itself, but rather the “bizarre interpretations on the part of the regulators and people inspecting the company premises.”
- Another respondent said what hampers their innovation is when another company claims to sell their product, but actually does not sell it, and then captures the market and figures out how to make the product.
- One respondent explained that innovation is hindered when “big players” in the aerospace market can afford to make mistakes, and smaller companies cannot. Another obstacle is that some countries pay international companies to innovate.

Q12 Recommendations

Modify the wording of the question stem, to clarify the concept and make the reporting task easier. We note that when NSF and Westat met to review preliminary results of the interviews, NSF explained that for the testing, they had merged two questions into Q12, to help minimize the number of questions within the innovation module. NSF suggested separating items L–O again. After meeting with NSF, Westat offered several alternative ways to word the question stem and the anchors, to eliminate the confusion about rating importance of negative factors. We also suggest using scale anchors that range from low (“Not at all”) to high (“A great deal”). Consider using the version shown below.

The recommended wording for the question stem should also work well with items L–O, so a separate question will not be needed.

12. During the 3 years from 2015 through 2017, how much did each of the following factors hinder or prevent your company from innovating?

	How much the factor hindered innovation
--	--

	Not at all	A little	A moderate amount	A great deal
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Another option to consider for the question is:

12. During the 3 years from 2015 through 2017, to what extent did each of the following factors hinder or prevent your company from innovating?

	Extent to which the factor hindered innovation			
	Did not hinder or prevent innovation	A slight extent	A moderate extent	A great extent

2.12. Q13. Effects of Legislation or Regulations on Innovation Activities

13. Please assess the effect of the following types of legislation or regulations on your company's innovation activities during the three years 2015 to 2017.

Legislation or regulation	Stimulated innovation	Created no major problems	Created uncertainty	Generated an excessive burden	Not relevant
Product safety / consumer protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operational and worker safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Environmental	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intellectual property	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tax	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Employment or social affairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other, Specify 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question Comprehension

Of the nine respondents who responded to probing about the ease or difficulty of the question, six provided insight into their thought process while answering the question. One of those six respondents appeared to answer according to what “could be” and not the actual effect on his company. The respondent felt it was a very difficult question because most of the listed legislations and regulations could have either a positive or a negative impact. They could have either viewed it as a constraint or as an opportunity to work around the constraint. The respondent suggested adding a column to capture a response that the effect could go either way. This respondent answered “Stimulated innovation” for all items and seemed to think in general terms about what could be. For example, he said that since they are a software company, “Environmental” would not affect them, but yet could be an opportunity to be more lean and efficient.

Four of the six respondents sometimes mentioned difficulties. Several said it was because items did not apply to their companies. In those cases, respondents answered appropriately with “Not relevant.” Specifically, one respondent said he had difficulty with “Operational work safety” because that is not a factor in his field. He answered appropriately with “Not relevant.” Another said “Environmental” was difficult to answer because it does not apply to her company. She appeared to understand and answer appropriately with “Not relevant.” Another respondent thought, at first glance, the question was not relevant to his company, but then recalled a proposal related to product safety. The respondent appeared to understand and answered either “Stimulated innovation” or “Not relevant” for each item. One respondent answered “Created uncertainty” and “Generated excessive burden” to the item “Product safety/consumer protection” but said she had some difficulty answering because she did not want to appear as if she did not care about the topic.

Probing revealed that one respondent clearly understood the question and provided varying answers for different items. He noted that none of these types of legislation or regulation caused his company to innovate, so he did not check “Stimulated” for any.

Relevance of Question

Two respondents wrote in a response for the “Other, specify” row. One wrote in “Enforcement of existing regulations” and “Licensing” and said that there is nothing about building regulations. Another respondent said to add “Competition” because she was thinking about the list as categories of things that stimulate innovation, not necessarily as part of regulations, but removed “competition” when she realized the listed items were specifically related to legislation.

Number of Responses to Allow

Of the nine respondents who answered this question, seven of them selected one response per row. Two respondents selected two or more responses per row for some parts of the question. One of these two respondents selected two per row for three of the six items. She said she was unable to narrow it down on those three (A, B, and D) and selected “Created Uncertainty” and “Generated Excessive Burden” because they go hand-in-hand.

Of those who selected one response per row, their response did not necessarily mean that the factor worked in only one direction. For example, when probed, one respondent said it would be possible to select more than one answer, but usually one outweighed the others, so he selected one answer per row. Another respondent did not have a problem selecting just one per row and felt the choices were appropriate. One respondent said she did not think about selecting more than one for each row and just selected the best one that applied. However, for some she was thinking about stimulating innovation and lost sight of the legislative side. In hindsight, she felt that for some items it would be better to select more than one.

One other respondent, who did not realize that the response format allowed for selecting options representing both stimulation and burden, suggested adding a column that shows legislation or regulations could go either way.

Q13 Recommendations

Change the question stem word order to put the reference period first. To be consistent with all other questions with the same reference period, start the question stem with “During the years 2015 through 2017,…”

Revise the question text to help clarify the intent of the question and facilitate response.

- Emphasize the actual effect on the respondent’s company, not the possible effect. Change the wording of the question stem from “...assess the effect...” to:

During the years 2015 through 2017, what was the effect of the following types of legislation or regulations on your company’s innovation activities?

- For consistency with other questions in the module, letter each row of the matrix.

- If relevant for measurement purposes, consider adding two additional types of regulations: building and licensing (as shown in the example below).
- Consider whether or not the definitions of “Licensing regulations” and “Building regulations” overlap with existing items, and if not add them to the list of Q13 items.
- Add the explicit instruction “Check all that apply for each row.”

Example:

Q13. During the 3 years from 2015 through 2017, what was the effect of the following types of legislation and regulations on your company’s innovation activities?

(Check all that apply for each row)

2.13. Q14. Intellectual Property

14. During the three years 2015 to 2017, did your company do any of the following?		
	Yes	No
a. Apply for a utility patent (patents for inventions)	<input type="checkbox"/>	<input type="checkbox"/>
b. Apply for a design patent (patents for appearance)	<input type="checkbox"/>	<input type="checkbox"/>
c. Register a trademark	<input type="checkbox"/>	<input type="checkbox"/>
d. Claim copyrights	<input type="checkbox"/>	<input type="checkbox"/>
e. Use trade secrets	<input type="checkbox"/>	<input type="checkbox"/>
f. Use nondisclosure agreements	<input type="checkbox"/>	<input type="checkbox"/>

Question Comprehension

Of the six respondents who answered this question, three did not have difficulty and the other three either had to change an answer or commented on parts of it that were unclear. One of the three respondents who had some difficulty asked if “trade secrets” is about licensing someone’s process or formula, and described a chemistry-based technology product they developed. Another respondent said he would not have known what a “utility patent” is without the description provided in parentheses, even though his company applied for patents a lot in the past.

Relevance of Question

Although we did not administer probes about the relevance of the question and response options, two respondents provided insight into the relevance of the question. One respondent felt the question was “limited” because it does not ask if the company was awarded any kind of patent or trademark, only if it applied or registered. He understood that the question was asking about intellectual property, but felt it left out material transfer agreements, MOUs, business-related contracts, CRADAS (cooperative research and development agreements, which are formal documents to do research with a government agency). Another respondent felt that the bulk of his company’s work was not covered in this question since everything his company does is public domain under government contacts.

Feasibility of Reporting for 3-Year Reference Period

Although probes about the reference period were not administered, one respondent explicitly mentioned and understood it. The respondent whose company developed a chemistry-based technology product explained that he answered “No” to “trade secrets” because it was developed before the 2015–2017 window.

Response Accuracy and Consistency

One respondent had a reporting issue: he changed his answer from “Yes” to “No” for item D (Claim copyright). He said everything his company does is public domain with government dollars, and suggested that it should be added as a response option.

Q14 Recommendations

Consider providing a brief definition of “trade secrets.” This may help improve reporting accuracy.

Consider adding more types of intellectual property agreements. If appropriate for measurement purposes, consider adding material transfer agreements, MOUs, business-related contracts, and CRADAS (cooperative research and development agreement).

