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Short Period Innovation Survey: general guidelines and the Brazilian experience

João Carlos Ferraz ^{*}, Jorge Britto ^{**}, Marina Szapiro ^{*}, Fernanda de Vilhena Cornélio Silva ^{***},
Alessandro de Orlando Maia Pinheiro ^{***}, Flavio Jose Marques Peixoto ^{***}, Aline Visconti
Rodrigues ^{***} and Márcia Franca Ribeiro ^{***}

^{*}*jcferraz@ie.ufrj.br; marina@ie.ufrj.br*

UFRJ - Rio de Janeiro Federal University - Rio de Janeiro - Brazil

^{**}*britto.jorge@gmail.com*

UFRJ - Rio de Janeiro Federal University - Rio de Janeiro - Brazil

^{***}*fernanda.vilhena@ibge.gov.br; alessandro.pinheiro@ibge.gov.br; flavio.peixoto@ibge.gov.br;
aline.rodrigues@ibge.gov.br; marcia.ribeiro@ibge.gov.br*

IBGE - Brazilian Institute of Geography and Statistics - Rio de Janeiro – Brazil

Introduction

The analysis discusses the general outlines to support the construction of a short period (conjunctural) innovation survey, with the aim to monitoring innovative business conduct and factors that may be influencing them in short time periods. This analysis will be addressed with reference to international practices, considering the methodological orientations provided by the last version of the Oslo Manual (2018) and the international experiences of different countries in the elaboration of Innovation Surveys, specially under the auspices of the latest version of guidelines proposed by the Community Innovation Survey (CIS). The scope of the analysis includes the following topics: the intentions of a conjunctural innovation survey; the analytical framework to guide this kind of research, its scope and breadth; the connection between a conjunctural innovation survey and other surveys; the ideal profile of the respondents, as well as about the size and coverage of the research; the basic specifications of a questionnaire to support this research; the general principles to evaluate its effectiveness and some suggestions for operationalizing its application. These aspects are connected to an attempt to implement a conjunctural innovation survey in the Brazilian industry, coordinated by IBGE (Brazilian Institute of Geography and Statistics), the official agency for the production of statistical information of the Brazilian government

Short Period Innovation Survey: methodological issues and international experience

Innovation Surveys are cross- sectional surveys that seek to identify what types of innovation, what efforts are made and what factors can affect the conduct of companies. In this sense, they favor a subject-focused approach (the innovative firm). The complexity of Innovation Surveys – and the need to maintain inter-temporal comparisons – reinforces the importance of a consolidated and relatively stable methodological framework. Therefore, changes to research manuals of this nature tend to be incremental in nature and undertaken with great caution, often

occurring with a time lag in relation to the emergence of this new element and the demonstration of its economic importance. The methodological orientations from Oslo Manual evolve from a limited definition of technological innovation restricted to manufacturing activities in its First Edition (1992), to an expansion to market services in the Second Edition (1997), to an expansion of the concept of innovation, including a distinction between product, process, organizational and marketing innovation in its Third Edition (2005) and to the definition of a broader concept of "business process innovations" in its Fourth Edition (2018).

Throughout this evolution, Innovation Surveys usually seek to gather information on specific topics: different types and scope of innovations (product, process, marketing or organizational and, more recently, "business process innovations"); expenditures and allocation of personnel and capital in innovative activities; information sources used; established cooperative arrangements; financing source and government incentives; impacts of innovations on the performance of companies and obstacles and facilities encountered when carrying out innovation activities. When approaching these different dimensions, it is usual to differentiate between mandatory issues and complementary issues. Mandatory questions usually refer to the type and scope of innovations and the expenditures and personnel involved in innovative activities. In the case of mandatory questions, it is usual to differentiate between measurable questions (numerical or monetary) and evaluative questions (dichotomous or categorical). In the case of complementary questions, approaches of an evaluative nature often prevail, in a dichotomous way - comprising a distinction between yes/no for the presence of a factor - or in a categorical way, often based on the identification of a certain scale of importance of the factor (more important, less important).

Based on the experience of German Innovation Survey, Rammer (2019) discusses some methodological choices that have to be made in similar surveys. Concerning the definition of the target population, it is possible to mention some advantages of the option by a panel survey. The advantages of this approach involve a time series data not subject to sampling changes, which allows a systematic panel analysis, facilitates the "learning" by respondents and permits more precision in the imputation of non-responded items by using historic firm-specific information and firm-specific trends. The experience of German CIS also illustrates the possibility of incorporate additional variables related to complementary innovation indicators, to more context variables and to special topics in every survey round. Another possibility comprises a survey of innovation in specific technologies or related to/ based-on specific technologies.

Rammer (2019) also points out the relevance of the role of the respondents in innovation surveys. Typically, these surveys collect data on firm activities that are usually not fully represented in firms' reporting and accounting system and that rely heavily on the respondent's knowledge and commitment. Moreover, the respondent has to translate the concepts and definitions used in the survey into the firm's actual practice, which eventually requires a high effort from the respondent due to a high degree of subjectivity of some question. The risk of a progressive fatigue of the respondents may also result in a trend to report innovation less frequent, the longer they participate in the survey, even when this effect is not as strong at the level of enterprises.

Another issue to be considered comprises a proper definition of the reference period of the survey. The traditional option for a 3-year reference period for evaluate innovation activities and the introduction of innovations may be justified by specific reasons: i) the length of innovation projects; ii) the supposition that Innovation results do not emerge immediately after

the introduction, but with some time lag; ii) the broader length of product life and technology cycles. On the other hand, despite the possibility of using panel data to identify inconsistencies in the responses, many firms seem to not respect the 3-years, but rather refer to one year when reporting on innovation. In this sense, the option for a one-year reference period has also some advantages to be considered. In some circumstances, this option permits a better time-structure of indicators, through the establishment of a clearer link between two innovation-related characteristics (e.g. public funding and cooperation). This option also allows an analysis of short-term changes in innovation behavior (e.g. persistence of innovation, stopping or starting innovation activities). On the other hand, care must be taken in defining a reference period for the question on the share of sales from product innovation. These aspects may be related to the experience some countries that moved the innovation survey to a one-year reference period, eventually articulated to other analysis based on longer reference periods, such as China, German, Australia and Canada.

The international experience in terms of short period innovation surveys points to the variety of approaches and institutions that carry them out. International practice points to a periodicity at most annually, with semi-annual surveys being also common. The realization and dissemination should comprise a period of around four months between collection, systematization and dissemination of aggregated information. The recurrence of the survey and the possibility of comparison with other surveys and inter-temporal comparison of similar indicators, guaranteed by the stability of the sample, is what gives value to short period innovation surveys. This recurring nature (quarterly, semi-annual or annual) of these surveys will guide, to a large extent, the formulation of questions in terms of the number (limited) and the specification (simple) of the questions. This recurrence guides the definition of the panel of enterprises and the profile of the respondents. It is also important to consider the nature of the demands of potential users of the Innovation Surveys (academy, firms, policy makers, etc). To achieve these objectives, indicators must be relatively simple and easy to understand, capable of being systematically reported and evaluated. These indicators can include quantitative and qualitative information, generating metrics (individual or composite) that aim to provide a synthetic representation of the innovation phenomenon.

It is also important to consider some relevant factors in defining the companies covered by the survey. The sample stratum of the population to be represented in terms of sector, size, location or any other specific criteria must be well defined. International experience also indicates that companies with some innovative capacity may be privileged, for example, defining as a potential universe the set of companies with expenditures on sales above some level. In order to enable the longitudinal assessment of innovative capacity, it should preferably choose to follow the same group of companies over time.

In the implementation of short period innovation surveys, some operational issues can also be highlighted. First, a relevant aspect comprises the identification of the respondent, or respondents, representatives of the company. The respondent's profile must be defined according to criteria such as position and functional affiliation (organizational area), involvement with strategic decisions related to innovation, professional training and the level of interest/knowledge in relation to new technologies. Secondly, it is important to propose a basic tabular plan, defined based on selected indicators, defining the estimator and expected error margins. In general, short period innovation survey surveys offer, as first results, rates of evolution over previous survey surveys, as long as the expansion criterion are the same.

Based on this general logic, short period innovation surveys tend also to be structured around some basic general principles that define the measurability of indicators. Five of these principles

can be highlighted. First, the need for conciseness and simplicity tends to be reflected in the option for a limited set of indicators, contemplating the fundamental dimensions of the innovative behavior of firms, preferably approached through self-explanatory metrics. Second, the comparability of collected evidence is essential, which may consider three dimensions: (i) between surveys in the same country; (ii) between countries and, (iii) between survey research and more structural research (including traditional innovation surveys), through the use, to some extent, of similar questions that become compatible indicators. Third, timeliness in terms of terms of deadlines for execution and dissemination of results must be present in the planning and execution of surveys. For this, the institutions involved must be able to implement the fieldwork, process the information and disseminate it in the shortest possible time, which must be measured in weeks, not months. As most of the information to be collected has a qualitative and comparative character with a recent past and a projection for the near future (increased, decreased, will increase, will decrease), this timeliness is essential to guide the work of analysts and policy makers, public or private. Forth, the notion of friendliness, both in understanding the issues and in the dissemination of results, constitutes a general principle to be considered, which refers to the preferential option for unambiguous indicators that are easy to record, understand and interpret.

The PINTEC Semiannual Innovation Survey

"PINTEC Semestral" (PINTEC Semiannual) is an empirical semiannual survey, which involves the collection of data from manufacturing companies based in Brazil through the application of an electronic questionnaire by trained interviewers, under the supervision of specialists, carried by IBGE (Brazilian Institute of Geography and Statistics), the official agency for the production of statistical information of the Brazilian government. The electronic questionnaire was developed specifically for the survey and will be updated with each cycle of its edition. The collection instrument is integrated with a database system based on Information and Communication Technologies (ICT) that allow the capture, registration, processing and availability of the data collected through reports and tabulations, allowing the management of the data collection and their processing flow. The results of each edition of PINTEC Semiannual will be disseminated through on a specific website, linked to IBGE's institutional page.

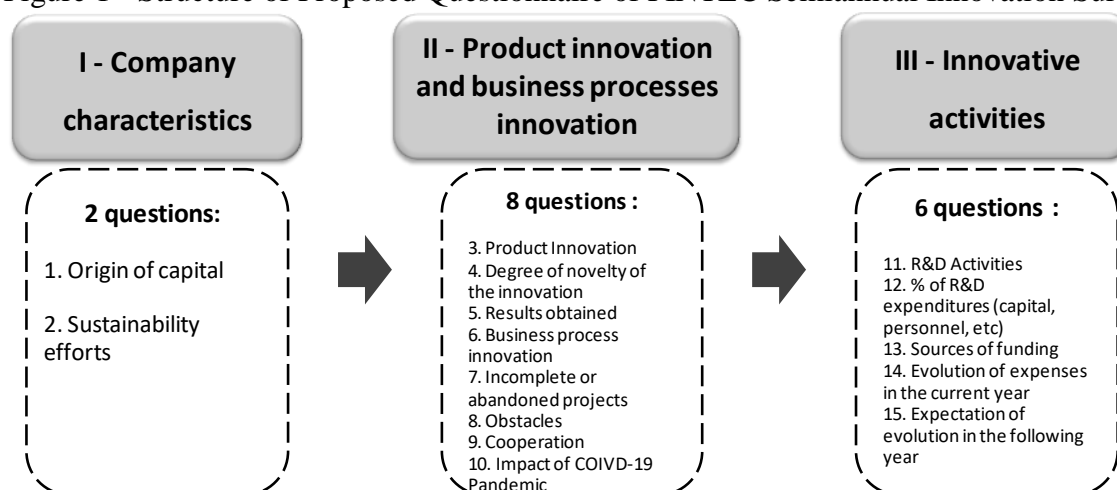
The construction of this survey reflects a methodological basis related to the progressive evolution of the Oslo Manual. It also reflects the methodological advances progressively incorporated into the CIS Survey of the European Community throughout its various versions. Specifically, the design of the PINTEC Semiannual Innovation Survey incorporates a concrete impact of the adaptation of OM4 Methodology towards the reduction of the basic definitions of a business innovation from the four types of innovations (product, process, organizational and marketing) presented in the OM3 to two main types: product innovations and business process innovations. With the incorporation of the methodology proposed in the Oslo Manual 2018, process innovations begin to incorporate characteristics of innovation that were previously referred to as organizational and marketing. The aim of this change is to facilitate reporting and comparisons across the entire business sector, including those enterprises specialized in providing knowledge-based services. The definition of business process innovation merges the CIS 2016 questions on process, marketing and organizational innovation and, thus, includes all the business functions related to both the core activity of producing and delivering products for sale, and other supporting operations characterizing the most advanced services activities. There is also one element of prior marketing innovation that has been moved to product innovation - significant changes to product design - with the definition of product innovation now also referring to changes in design.

PINTEC Semiannual Innovation Survey is structured with basis on a continuous core block that will be repeated systematically and a rotating thematic block to capture current topics related to innovative strategies of the companies such as sustainability and digital transformation, among others. The continuous core block aims to capture the introduction of innovation (product, process/business process) by manufacturing companies through questions that will be repeated in all editions of the survey. This block should be associated with the concept of innovation adopted by PINTEC Traditional Tri-annual Survey and, in this sense, the main references for defining the issues are the Oslo Manual and CIS. However, given that the next edition of PINTEC Traditional Survey (2022) will already incorporate the methodological orientations of the forth version of the Oslo Manual, following what has already been done by the CIS, a decision had to be made regarding PINTEC Semiannual: the research must incorporate the new concepts into its structure, approaching of orientations of OM (2018) and already anticipating the change that will be made in the next edition of PINTEC Traditional Survey. Based on this perspective, it is important to consider how these adaptations will impact and can be accommodated within the traditional PINTEC in the future, considering the eventual impacts in terms of series break and how to incorporate the new concepts in the calculation of expenses with innovative activities in a continuous base.

Based on a discussions about how those changes could be accommodated in the PINTEC questionnaire and possible impacts, a critical issue has been addressed: will PINTEC Semiannual adopt the new international references and remain integrated with the future (PINTEC 2022) or will it adopt the old international references and remain integrated with the past (PINTEC 2017). It is assumed that these adaptations bring the risk of loss of comparability with previous editions of PINTEC Innovation Survey with tri-annual results, even though the scope will remain the same. A "possible"- but perhaps imperfect -comparison can be made "backwards", when considering the rate of innovation from companies that innovated in product and/or process and/or organizational and /or marketing. Although imperfect, there is a clear attempt to bring the new categories closer to those of Oslo 2005. The attempt to minimize the impact of the series break will also require adaptations beyond those practiced at CIS 2018. Considering that PINTEC Semiannual will be mainly integrated with the future and partially integrated with the past, the next step comprises the construction and definition of questions, based on a systematic study of national and international short-term innovation business surveys to understand the alternatives in terms of type of questioning that will be carried out in this block. A subsequent step comprises the building of a question bank, in order to support the elaboration of the prototype of a questionnaire.

The main objective of the continuous core block is to capture quantitative information (expenditure and employed personnel) which will be referred to the previous year, alternating with qualitative questions referred to the previous semester. So, the continuous core block comprises a '2nd semester' questionnaire collected in the second semester of each year, which reference period will be the previous year, with a central theme comprising innovation and R&D efforts. The structure of the questionnaire comprises three main blocks and fifteen questions (see Figure 1): I - Company characteristics (two questions): 1. Origin of capital, 2. Sustainability efforts; II - Product innovation and business processes innovation (eight questions): 3. Product Innovation, 4. Degree of novelty of the innovation, 5. Results obtained, 6. Business process innovation, 7. Incomplete or abandoned projects, 8. Obstacles, 9. Cooperation, 10. Impact of COVID-19 Pandemic; III - Innovative activities (five questions): 11. R&D Activities, 12. Distribution of components of R&D expenditures (capital, personnel, etc), 13. Sources of funding, 14. Evolution of expenses in the current year, 15. Expectation of evolution in the following year.

Figure 1 - Structure of Proposed Questionnaire of PINTEC Semiannual Innovation Survey



Some operational issues, derived from the IBGE's experience, should also be considered in the implementation of The PINTEC Semiannual Survey. First, research of this nature should not focus attention on absolute values of variables of a quantitative nature, due to lack of sampling robustness. However, as qualitative questions have a temporal reference over the past or near future (increase-stability-decrease), it is necessary to have a minimum baseline reference. Naturally, care should always be taken when the information in this sample is expanded to the entire universe of companies. Secondly, it is important to consider the IBGE's institutional guideline for the restricted dissemination of survey results. While these guidelines must be observed, the possibility of statistical treatments for specific purposes, especially public policy, could not be ruled out, highlighting the care with expanding results and not identifying the reporting company. Third, the intrinsically limited character of a survey of a conjunctural nature points to the need for a hierarchy of issues and indicators, distinguishing those defined as mandatory, very important and important.

The compatibility between PINTEC Semiannual Survey and other more structural research (including the traditional PINTEC Tri-annual Survey) should be an object of attention, based on the similarity of reference models and the nature of some critical issues. Care with compatibility must ensure the correct specification of companies registration information in IBGE general register, identifying the company as well as the sectoral classification of activities. Efforts to articulate different databases would allow for more refined analyses. The following possibilities stand out: (i) structural research focusing on the economic performance of companies (considering data from structural annual economic surveys); (ii) databases of administrative records with information on work, income or foreign trade; (iii) sources of data on funding and other forms of support provided by funding agencies or similar organizations as well as data on the use of incentive instruments for innovative efforts; (iv) data on innovative outputs in the form of patents, utility models, trademarks or other intellectual property rights; (v) broad mappings of cooperative relationships, which provide evidence on the structuring of innovation networks connecting firms and research institutions; (vi) integration with broader S,T&I indicators in Innovation Scoreboards; (vii) interfaces with other conjunctural surveys aimed at assessing business expectations; (viii) interfaces with independent research focused on specific themes of the innovative behavior of companies (such as research aimed at registering the adoption of digitally based technologies).

The PINTEC Semiannual Survey also includes a rotating thematic block with the objective of capturing current topics such as sustainability and digital transformation, among others. This block comprises a '1st semester' questionnaire whose questions will change with each edition of the survey. It is intended to have a Bank of Themes (and associated questions) that will be selected at each edition. The choices must be endorsed with partners and society to define priority themes to be addressed. To structure the thematic block, a study of national and international research to understand the type of questioning will be carried out in each theme. The construction of a theme bank (with associated questions) will also guide the structuring of this block. The choice of questions, within the question bank, to integrate the thematic questionnaire will be submitted to an expert forum.

To assess the practical feasibility of applying a questionnaire based on the continuous block core structure, a cognitive test was applied to assess the understanding of the questionnaire by potential informants. The collection model systems was also tested, being based on a hybrid system that comprises the contact and scheduling of potential informants by phone, with the questionnaire being subsequently filled by the informant through a web link, which may also include a final contact by phone for questions and corrections. A prototype of the electronic information collection system was also tested, evaluating the effectiveness of this tool for the chosen collection method and the need for improvement. This test comprises a sample of 300 companies (with 100 or more employees), with guaranteed inclusion of companies from all stratification groups that will be considered in the survey, comprising major geo-economic regions and a disaggregated structure of economic activities.

Concluding Remarks

The experience with the implementation of PINTEC Semiannual Innovation Survey constitutes an effort to advance in the collection of systematic information with less periodicity about the performance and innovative efforts of Brazilian industrial firms, incorporating the contributions of a growing debate about the most adequate procedures to capture a phenomenon essentially complex. In this sense, three main guidelines emerge from the analysis carried out: i) the importance of adapting to methodological guidelines that guarantee an effective international comparability; ii) the incorporation of the general guiding principles of concepts of conciseness and simplicity, comparability, timeliness and friendliness.; iii) the importance of considering the specific needs of each country, reflecting the evolutionary stage of innovative activities in each context and the resulting implications both in terms of the need to monitor business efforts and evaluate the impact of the public policies; iv) the concern with an instrument for collecting information that is sufficiently flexible and capable of adaptation, both in terms of the results obtained and in terms of the learning process inherent to the application and evaluation of this type of research. In fact, the inherent nature of the theme -innovation- implies a permanently oriented focus to moving targets, and, in this context, innovation surveys should be conceived as a flexible tool to address new business issues in a dynamic world, being synthetic but keeping the possibility of including new topics according to the environmental circumstance, academic interests and policy issues.

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