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Creating and refining a questionnaire to assess firm-level innovativeness: a study on a multinational company

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Abstract:

The literature on innovation is extensive, but unanimous on assessing the importance of innovation for firms to grow and survive on the market. Therefore, it is vastly advocated that firms benefit from being aware of their overall ability and capability to innovate. This predisposition to innovation is often referred as firms' innovativeness, however, there is no agreement on its conceptualization, hampering the creation of standard tools, metrics, and systems for its measurement and assessment.

First, this internship report, done at SGS Portugal, aims to give an overview concerning the concepts of innovation and innovativeness, paying special attention to the conceptualization of firm-level innovativeness and a notice to its measurement. Then, based on a literature review, it presents a questionnaire that was piloted with a number of SGS's affiliates, and whose consistency was assessed through a qualitative methodology (interviews) and a quantitative methodology (Cronbach's Alpha coefficient calculation), not only assessing which dimensions and indicators are considered to affect firm-level innovativeness, but also providing comparable data and insights on the innovation-related operations in each SGS affiliate around the world.

The results gave an overall validation of the theorical framework that was the foundation for the creation of the questionnaire, confirmed the importance of the chosen pillars – Culture, Resources, Structure & Strategy, Ecosystems, and Performance – and offered important feedback for the refinement of the instrument.

The final product, that was the main goal of the internship, is a refined version of the questionnaire, providing SGS Portugal a new self-assessment tool, that can further evolve and turn into a fully validated instrument.

JEL codes: O30; O39.

Keywords: Innovation; Innovativeness; Measurement; Firm-level innovation; Questionnaire; Affiliates.

Resumo:

A literatura sobre inovação é extensa, mas unânime em avaliar a importância que a inovação tem para as empresas crescerem e sobreviverem no mercado. Por conseguinte, é amplamente defendido que as empresas beneficiam de estar conscientes das suas habilidades e capacidades globais para inovarem. Esta predisposição para a inovação é muitas vezes referida como a capacidade inovativa das empresas, no entanto, não existe um acordo sobre a sua conceptualização, dificultando a criação de ferramentas, métricas e sistemas padrão para a sua medição e avaliação.

Em primeiro, este relatório de estágio, feito na SGS Portugal, pretende dar uma visão geral sobre os conceitos de inovação e capacidade inovativa, prestando especial atenção à conceptualização da capacidade inovativa a nível de empresa e à sua medição. Em segundo, com base numa revisão literária, é apresentado um questionário que foi pilotado com uma série de filiais da SGS, e cuja consistência foi avaliada através de uma metodologia qualitativas (entrevistas) e uma metodologia quantitativa (cálculo do coeficiente do Cronbach Alpha), não só avaliando quais as dimensões e indicadores escolhidos afetam a capacidade inovativa a nível das empresas, mas também fornecendo dados comparáveis sobre as operações relacionadas com a inovação em cada filial da SGS em todo o mundo.

Os resultados validam globalmente o enquadramento teórico que serviu de base para a criação do questionário, confirmam a importância dos pilares escolhidos – Cultura, Recursos, Estrutura & Estratégia, Ecossistemas e Performance – e oferecem feedbacks importantes para o refinamento do instrumento.

O produto final, que era o principal objetivo do estágio, é uma versão refinada do questionário, que proporciona à SGS Portugal uma nova ferramenta de autoavaliação que pode evoluir e transformar-se num instrumento totalmente validado.

Códigos JEL: O30; O39.

Palavras-chave: Inovação; Capacidade inovativa; Medição; Questionário; Inovação empresarial; Filiais.

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1. Introduction

SGS Portugal is one of SGS S.A affiliates, which shares the same principles, values, and mission of the main group. Therefore, it pays special notice to the sphere of innovation and considers it to be a crucial component for success in any business.

Innovation has been referred as "the life blood of corporate survival and growth" (Zahra & Covin, 1994, p. 183) and has been for a long time a subject of research. It is possible to find, in the extant literature, countless studies with different approaches and strands, namely within the firm-level context where innovation aptitude is generally considered as a source of competitive advantage and a key element for firms' growth and success (e.g. Zahra & Covin, 1994; Heunks, 1998; Kumar, Haleem, & Qadri, 2020). However, regarding innovation measuring, there is still not a standard way to measure a firm's innovative ability and/or capability, which has been reported as a problematic and polemic issue (Borocki, Orcik, & Cvijic, 2013; Edison, Ali, & Torkar, 2013).

The inexistence and the difficulty of establishing commonly accepted measurements, metrics, and systems to measure innovation within firms is due to the fact that the concept of innovation is broad and multidimensional (Wang & Ahmed, 2004). Nevertheless, some scholars (e.g. Carayannis & Provance, 2008) and, following COTEC's Portugal (2016) report, companies like, for example, McKinsey, PwC, and Fraunhofer, have designed and put to practice their own innovation measuring systems and assessment tools, created according to their personal objectives and perspectives. Yet, there are several criticisms arising mainly from the fact that quantitative measures are preferred but hard to obtain (OECD/Eurostat, 2018), the majority of those systems use data collected from self-evaluating mechanisms making them passible of bias (Knowles, Hansen, & Dibrell, 2008a), and they often times neglect the multidimensionality of the innovation concept (Wang & Ahmed, 2004; Knowles et al., 2008a) focusing only on output measures (Adams, Bessant, & Phelps, 2006)

However, it is important and useful for firms to know at which "stage/level of innovativeness" they are at, not only because, as said, innovation can impact the firms' overall performance and growth, but also to help identify when there is a need to make changes in order to stay competitive and what changes need to be done. Moreover, if a measurement construct is created and the same is used and applied in several firms, it can enable the comparison across firms and, if the results are made public, might even provide insights on what is being done by the firms on the market.

Given all the limitations mentioned and the inherent advantages to assessing firm-level innovativeness, the focus of this work will concern the creation and refinement of a questionnaire that demonstrates which indicators are thought to impact firms' innovation level, making it a capable tool for assessing firm-level innovativeness, yet in the context of a specific company.

Through a literature review and considering the already existing systems and surveys on innovation measuring and assessment, and empirical and non-empirical studies on the matter (e.g. Wang & Ahmed, 2004; Moos, Beimborn, Wagner, & T. Weitzel, 2010; Gamal, Salah, & Elrayyes, 2011; OECD/Eurostat, 2018), the aim of the innovativeness assessment questionnaire created throughout this work will be to suppress some of the limitations found on those studies and to tailor the construct according to SGS's system of beliefs and goals. Additionally, from this study's perspective, it is considered to be important and differentiating for the questionnaire to be done based on input (e.g. institutionalized innovation culture; innovation strategy aims; investment on I&D) and output (e.g. number of new products and services launched; patents count; sales growth from innovations) indicators able to evaluate the firms' overall abilities and capabilities concerning innovation making and adoption, therefore, employing both qualitative and quantitative data, contemplating the multidimensionality of innovation.

When finished, the resulting questionnaire might become a self-assessment tool for SGS Portugal to review its own innovation practices, assess its overall level of innovativeness, and may develop and adapt itself into a SGS Portugal's new available service for clients, able to perform as a benchmarking and comparison instrument. Furthermore, since the chosen pilot sample will be only SGS's affiliates, the results found through the answers received and the interviews will also provide an overview of what is being done in the company at a global scale and how diffuse or not the innovation practices are across them.

To achieve the mentioned goals, section 2 presents an overview of SGS and of the internship. Then, section 3 of this report concerns a literature review focused on the definition, framework, and conceptualization, of the terms of innovation and innovativeness, and provides an overview of the exiting models and tools to assessment and measure of firm-level innovation. Section 4 encompasses some of the main work done in the internship, presenting and explaining the theoretical framework of the report by the proposed main dimensions to impact firm's innovativeness, and that later operates as the foundation for the

development of the questionnaire. Then, section 5 involves the description of this study's process and the qualitative and quantitative methodologies used, regarding the creation and refinement of the questionnaire and the chosen samples. In section 6 the results are analyzed and in section 7 the questionnaire is refined. In section 8 the main conclusions and the suggestions for future research are drawn.

2. Framework of the internship

SGS S.A is a multinational company, well known as the world's leading inspection, verification, testing and certification company, and complements its core services by also offering consultancy, outsourcing, and training services. The company was created in 1878 and, currently, has over 94.000 employees and 2.600 offices and laboratories across the world, providing customized services to 11 industries - Agriculture and food; Chemical; Consumer goods and retail; Energy; Industrial manufacturing; Life sciences; Mining; Oil and gas; Public sector; Transportation. Furthermore, it characterizes and distinguishes itself by its passion, integrity, entrepreneurialism, and innovative spirit (SGS Portugal, 2021).

SGS Portugal was founded in 1922 and has 300 employees and 11 offices and laboratories throughout the country. Given SGS's innovative spirit and importance attributed to innovation, SGS Portugal has its own innovation direction called "Digital & Innovation", which entails a full-time working team dedicated to national and international funding capture, innovation projects' development, services improvement and development, among others, where I was allocated and got assistance on developing the present internship report (SGS Portugal, 2021).

The main goal of the internship was to, by conducting the study within SGS affiliates, create and refine a questionnaire that would work as an innovativeness assessment instrument. The action implementation consisted of:

- Surveying and identifying the best practices related to innovation within firms.
- Regularly participating in reunions to present and discuss the findings.
- Creating a tailored framework and questionnaire.
- Paying assistance to the Business & Finance Control unit in internal management tasks.

The internship had the duration of 8 months, lasting from September 2020 to April 2021, being done predominantly in a remote way due to Covid-19 constrains.

It is important to note that the internship was done alongside another student, we worked together on developing the theoretical framework, the questionnaire, and all the internship tasks. Therefore, our internship reports have similar aims and include common conceptual work.

3. Literature review

In this section the main concepts and subjects under analysis in this study, that ultimately lead to the development of the intended questionnaire, are defined and conceptualized.

3.1. Innovation

Innovation is unquestionably a source of economic growth, particularly through the business sector (Hasan & Tucci, 2010). On this note, it is important to mention the work of Joseph Schumpeter on the field of innovation, as one of the first and one of the most influential authors to study it through an economic perspective and to extend it towards the entrepreneurial context (Hagedoorn, 1996).

Following Schumpeter's legacy, over the years the phenomenon of innovation continued to be heavily studied, however, it is hard to state only one definition of the term innovation. In fact, according to Adams' et al. (2006) study, the existing literature on innovation is extensive but disperse since it draws the attention of scholars and researchers from different and diverse backgrounds. This therefore leads to different knowledge, perspective, and experience inputs and, consequently, plenty definitions for the term.

Analogously, Crossan & Apaydin (2010) also assessed the complex and multidimensional nature of the innovation concept, considering it both a process and an outcome, and contemplating that besides the existence of different approaches on the topic, the different types, dimensions, and forms of innovation also influence studies' aims and results.

Nevertheless, numerous definitions of innovation have been stated and refined over time, and it is possible to find in the literature several that have been commonly accepted. Most recently, an innovation can be defined in a general and adaptable way as "a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)" (OECD/Eurostat, 2018, p. 20).

3.2. Innovativeness

Towards a more firm-level approach, Baregheh, Rowley, & Sambrook (2009) consider innovation to be a "multi-stage process whereby organizations transform ideas into

new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace" (p.1334).

On this sphere, the term of innovativeness arises, which is normally related with the level of novelty of an innovation, but when applied at a firm level, for Hult, Hurley, & Knight (2004) it generally expresses "the firm's capacity to engage in innovation" (p.429), considering the firm's overall characteristics that make it able and capable to create and adopt innovations. More specifically, innovativeness, for some authors, can be considered as an inherent aspect of the firms, shown by "the propensity of firms to create and/or adopt new products, manufacturing processes, and business systems" (Knowles et al., 2008a, p. 2).

Summarizing, Kamaruddeen, Yusof, & Said (2010) disserted on the difference between the terms of innovation and innovativeness. In spite of both concepts being strongly related, they are often times used interchangeably, so the authors state that, in a firm, innovation occurs when something is actually implemented, while innovativeness, as mentioned, refers to the firm's capacity or propensity to implement it.

The cited definitions and views have some common points, as they appeal to innovation and innovativeness' inherent relation with the adoption or creation of something new that can differentiate the innovator. According to Zahra & Covin (1994), those innovative characteristics allied with a well-oriented innovation strategy can be the source and sustenance of a firm's competitive advantage and position, highlighting innovation's importance and claiming it as a core element to companies' survival and endurance. Furthermore, it is commonly noted to be a positive relation between firms' innovativeness and their overall performance and financial outcomes (e.g: Rubera & Kirca, 2012; Bedi, 2016; Pallas, Böckermann, Goetz, & Tecklenburg, 2013).

However, Subramanian & Nilakanta (1996) emphasize that the mentioned positive relations depend on the choosen definition of innovativeness, proving the multidimensionality of the concept, and adressing the issue of choosing the right dimensions and indicators to consider when trying to access or measure firm's innovativeness.

3.2.1. Conceptualization of innovativeness

Focusing on one of the main objectives of this report, that is the creation of a questionnaire to assess firm-level innovativeness, a first and crucial step is to be aware of the main factors that influence firms' innovativeness (Kumar et al., 2020).

According to Salavou (2004), plenty of the early studies on the conceptualization of innovativeness aim towards a unidimensional approach. Common examples are the definition of the concept through solely technology-oriented, behavior-oriented, or product-oriented approaches. However, a unidimensional approach to conceptualize, and posteriorly measure, innovativeness is not sufficient because, as previously stated, the concept is in fact multidimensional and should be assessed as such (Subramanian A. , 1996).

Wang & Ahmed (2004), mindful of the gaps on the domain of innovation measuring, and of the importance of considering the multidimensionality of the innovativeness construct, focused their research on organizational innovativeness and defined and identified five main dimensions that impact it – product, market, process, strategic, and behavioral innovativeness – and whose inputs and outputs should be taken in account when creating a tool/system to assess firms' innovativeness. This study is very influential and distinguishes itself because the authors compiled which dimensions were more commonly used to conceptualize innovativeness, and then validated their own construct, considering all those dimensions and making it general and complete, but outcome oriented, approach.

With the same aim, additionally to Wang & Ahmed's five proposed and compiled dimensions, studies as Boer & During's (2001) and Knowles, Hansen, & Shook's (2008b) suggest the existence of an additional sixth dimension for innovativeness – business systems innovativeness.

Instead of focusing on innovation outcomes, another multidimensional view often used is the conceptualization of innovativeness in a more abstract way, as an underlying part of the firm's atmosphere and system of beliefs (e.g. Ruvio, Shoham, & E. Vigoda-Gadot, 2014); Pallas et al., 2013). All the values and characteristics considered on this type of conceptualization are said to constitute the firm's climate, able to encourage and lever innovation activities.

Likewise, innovativeness can also be conceptualized and defined by focusing on firms' overall capabilities. Through this viewpoint, authors concentrate on the main dimensions

that impact the firms' capabilities to innovate and, therefore, their innovativeness (e.g. Björkdahl & Börjesson, 2012; Doroodian, Rahman, Kamarulzaman, & Muhamad, 2014; Siddiquee, Jain, & Rajan, 2015; Calik, Calisir, & Cetinguc, 2017).

Table 1 summarizes the mentioned multidimensional approaches on the conceptualization of innovativeness, with the mentioned studies given as examples and with their corresponding proposed dimensions to conceptualize it.

Approach	Authors	Proposed Dimensions
Outcome-oriented conceptualization of innovativeness.	(Wang & Ahmed, 2004)	Product, market, process, strategic, and behavioral innovativeness.
	(Knowles et al., 2008a)	Product, process, and business systems.
Conceptualization of innovativeness as inherent to the firms' culture.	(Pallas et al., 2013)	Strategic innovative focus, openness in communication, extrinsic motivation system, and management encouragement.
	(Ruvio et al., 2014)	Creativity, openness, risk taking, future orientation, and proactiveness
Aim to define innovativeness through the main factors that influence firms' overall innovation capabilities.	(Björkdahl & Börjesson, 2012)	Strategy, prioritization, culture, idea management, external environment and linkages, implementation, systems and decision rules, organizational context, and learning.
	(Doroodian et al., 2014)	Knowledge and technology management, idea management, project development, and commercialization capabilities.
	(Siddiquee et al., 2015)	R&D, manufacturing, marketing, and organizational capabilities.
	(Calik et al., 2017)	Innovation culture, innovation resources, product, organizational, process, and marketing innovation capabilities.

Table 1. Multidimensional approaches on the conceptualization of innovativeness

Source: Author based on referenced papers

As it is conceivable, the broadness and multitude of dimensions and perspectives intrinsic to innovativeness toughens the task of achieving a consensual conceptualization of the term. Nevertheless, Lynch, Walsh, & Harrington (2010) review emphasizes five dimensions that commonly arise among the variety of definitions for innovativeness, those are creativity,

openness to new ideas, intention to innovate, willingness for risk-taking, and technological capacity to innovate.

Furthermore, after defining which innovativeness approach to consider, a general and commonly found methodology when trying to assess innovativeness, is to divide the selected indicators by inputs and outputs. Moos et al. (2010), based on a review of existing methods, suggest that firm-level innovativeness should be assessed by both input-oriented and output-oriented indicators. The input indicators aiming to capture the firm's capability and propensity to innovation, and the output indicators reflecting the innovativeness outcomes.

3.3. Measuring Firm-level Innovation

The interchangeable and inconsistent use of the concepts of innovation and innovativeness leads to incoherent results (Kamaruddeen et al., 2010). However, innovativeness can be viewed as a result of the firm's execution of innovations, and "innovative firms exhibit a consistently high level of innovativeness" (Kamaruddeen et al., 2010, p. 71).

As a consequence of this lack of consistency, it is not possible to find in the literature a consensual or standard system or set of measurements and metrics to measure firm's innovation/innovativeness. This issue also derives from innovation's multidimensional nature and the existing gaps regarding the conceptualization of its associated constructs (Wang & Ahmed, 2004; Kamaruddeen et al., 2010; Lynch et al., 2010).

Since the importance in the current highly competitive environment for a firm to measure or assess its innovation overall level, ability, or capability, and the lack of common indicators and metrics to do it cannot be neglected (Borocki et al., 2013; Edison et al., 2013), a lot of tools, systems and models aimed to measure firm's innovation/innovativeness have emerged over time (Hügel, 2019). Furthermore, it is by measuring innovation that firms can better and more efficiently manage and understand it (Verhaeghe & Kfir, 2002; Adams et al., 2006).

3.3.1. Existing systems and tools

A widely known measurement framework for innovation is the Oslo Manual, described as "the international standard of reference for conceptualizing and measuring innovation" (OECD/Eurostat, 2018, p. 27). Mainly through the scope of the business sector, this manual

aims to mitigate the gaps regarding the establishment of standard measures for innovation by providing guidelines to the creation and development of innovation measurement constructs, and to the interpretation and gathering of innovation data.

Besides the Oslo Manual, others of the most known and used measurement frameworks for innovation are the Diamond Model, the Innovation Funnel, and the Innovation Value chain, and it is mostly based on these frameworks that companies and governments developed their own tools and instruments (Gamal et al., 2011). Additionally, as previously stated, some authors have taken an extra step and, besides conceptualizing the innovation/innovativeness construct, they effectively developed a system able to measure it (e.g. Carayannis & Provance, 2008).

Only on a firm-level analysis and with the same approach as the work intended with this report, similarly to Haar's (2018) research, table 2 shows some of the existing systems on innovation/innovativeness measuring and assessment, and their approach on the conceptualization of the concept.

Author/Entity	Type	Model/Tool	Dimensions
European Union	Measurement	CIS - Community Innovation Surveys	Product, process, market, and organizational innovations.
IMP³rove – European Innovation Management Academy	Assessment	IMP³rove Assessment	Innovation strategy, innovation organization and culture, innovation life cycle processes, innovation enabling factors, and innovation results.
Fraunhofer	Measurement	InnoScore	Strategy, process, market, product and service, innovation culture, project management, skills and knowledge, technology, and structure.
SPRING Singapore	Measurement	I-Class	Leadership, costumers, strategy, people, processes, knowledge, and results.
COTEC Portugal	Measurement	Innovation Scoring	Conditions, resources, processes, and results.

(Carayannis & Provance, 2008)	Measurement	CII - Composite Innovation Index	Posture, propensity, and performance.

Table 2. Existing models/tools on innovation measuring and assessment

Source: Author based on COTEC Portugal (2016) and Haar (2018)

As the Oslo Manual advocates, the models and tools displayed use surveys to collect the firms' data on innovation, however, one of the arising criticisms is their lack on the employment of quantitative data (OECD/Eurostat, 2018).

3.4. Proposed pillars for innovativeness

On developing the intended innovativeness assessment tool, based on an extensive literature review and analysis of existing studies, models, and tools, this report proposes five pillars to conceptualize innovativeness – culture, resources, structure & strategy, ecosystems, and performance – that are stated in table 3, referring some authors found in the literature validate and attest each pillar's effective impact on firm's innovativeness, including innovative outcomes and performance.

Pillar	Authors
Culture	(Ahmed, 1998; Sashittal & Jassawalla, 2002; Lee, Tan, & Chiu, 2008; Büschgens, Bausch, & Balkin, 2013; Tian, Deng, Zhang, & Salmador, 2018)
Resources	(Hadjimanolis, 2000; Alvarez & Busenitz, 2001; Baumane-Vitolina & Cals, 2013)
Structure & Strategy	(Pierce & Delbecq, 1977; Damanpour, 1991; Zahra & Covin, 1994; Kalay & Gary, 2015; Kamasaka, 2015)
Ecosystems	(Damanpour, 1991; Ahuja, 2000; Chesbrough, 2003)
Performance	(Roberts, 1998; Carayannis & Provance, 2008; Rubera & Kirca, 2012)

Table 3. Proposed pillars to conceptualize innovativeness

Source: Author based on referenced papers

4. Theoretical Framework

This section contains the theoretical framework developed during the internship that was the foundation to elaborate the questionnaire. Each proposed pillar to conceptualize innovativeness is here explained more detailly.

4.1. Culture

When trying to assess firm-level innovativeness, the firm's culture is a recurring subject, due to the link between innovation and culture. Its purpose is to value the impact of an innovation-levering culture, as the most innovative firms are accounted to have a suitable culture that evolves both the firm's formal structure and personnel (Ahmed, 1998).

So, a firm's culture, which the proposed subdimensions are reviewed in table 4, reflects its behavior towards innovation, by comprehending its practices of openness and promotion of innovation through leaders and employees.

Subdimension	Topics	Indicators	Authors
Innovation prioritization	Openness	Practices	(Ahmed, 1998; Jassowalia & Soshittal, 2002; Szczepańska-Woszczyna, 2014)
		Participative decisions	
	Leadership	Managerial attitude	(Ahmed, 1998; Szczepańska-Woszczyna, 2014)
		Transformational leadership	(Gumusluoglu & Ilsev, 2009)
	Training	Training programs	(Schneider, Brief, & Guzzo, 1996; Ahmed, 1998; Jassowalia & Soshittal, 2002; Lee et al., 2008)
Behavior	Cooperation and teamwork	Motivation and collaboration attitudes	(Ahmed, 1998; Jassowalia & Soshittal, 2002; Tian et al., 2018)
	Risk taking	Tolerance and support attitudes	

Table 4. Culture

Source: Author based on referenced papers

4.1.1. Innovation prioritization

Deriving from Dobni's (2008) proposed framework, the innovation prioritization subdimension reflects the firm's intent to innovate, by promoting an innovation prone and oriented culture, and prioritizing innovation-related activities, in order to create and sustain a competitive advantage and boost the firm's performance.

Considering innovation as one of the top priorities of the firm, it must cultivate an open culture by creating an environment of trust and fostering the involvement of the employees in decision making processes and in engaging innovation activities. To do so, the firm can encourage practices as regular meeting where everyone is invited to participate and share their ideas, give time for employees to dedicate to innovation activities and relates issues, and can promote the implementation of an open layout workspace to increase employee's interaction (Ahmed, 1998; Jassowalia & Soshittal, 2002; Szczepańska-Woszczyna, 2014).

Authors like Szczepańska-Woszczyna (2014) and Ahmed (1998) emphasize the role of leaders and the impact their managerial attitudes have in innovation. Hence, leaders should not only incentivize and promote innovation and employees' engagement in innovation activities/processes, but also nurture relations and communicate with employees, paying individual attention to each one of his team members and giving them a certain level of freedom to work on their projects.

Moreover, Gumusluoglu & Ilsev (2009) defend this as a transformational leadership, which involves specific approaches and characteristics, like the leader's charisma, and individualized consideration, inspirational motivation, and intellectual stimulation, paid to employees. All the mentioned attitudes are said to stimulate both innovation and creativity.

It is also advocated that learning oriented cultures also have a positive impact and stimulate innovation (Lee et al., 2008). This type of culture can be achieved through the realization of training programs and specialized workshops for both leaders and employees, aiming to improve innovation levering skills, knowledge creation and diffusion, and work performance (Schneider et al., 1996; Ahmed, 1998; Jassowalia & Soshittal, 2002).

4.1.2. Behavior

Firm's culture is often defined in an abstract way, as a set of intrinsic and stablished values, beliefs, and behaviors, that reflects its overall climate, workers characteristics, and way of doing things, which also impacts innovation practices and outcomes (Schein, 1984; Martins & Terblanche, 2003).

Tian et al. (2018) state that, in a firm, individualistic behaviors can inhibit innovation. Likewise, Jassowalia & Soshittal (2002) positively link cooperation and teamwork to innovation outcomes as the development of new products. Therefore, innovative firms must encourage cooperative behaviors and spirits and teamwork between employees.

Specific behaviors and characteristics as risk taking and tolerance for mistakes can also be levers of innovation and creativity. For that, it is supported that leaders should promote an environment where employees feel free to take risks and mistakes are not penalized but seen as learning experiences (Ahmed, 1998; Jassowalia & Soshittal, 2002).

4.2. Resources

Drawing from the resource-based view, the firms' unique resources and capabilities explain, from a strategic perspective, their source of competitive advantage. Applied to the innovation sphere, those are the same resources, physical or not, that can lever the firms' innovation related outcomes and engagement (Hadjimanolis, 2000; Barney, Wright, & Ketchen, 2001; Baumane-Vitolina & Cals, 2013).

Therefore, the resources pillar encompasses the tangible and non-tangible - physical, human, or technological - elements that the firm has to leverage its innovative activity, hence divided in two main subdimensions – competences and technological infrastructures – explained in the following subsections and summarized in table 5.

Subdimension	Topics	Indicators	Authors
Competences	Internal expertise	Existence of an innovation team	(Hewitt-Dundas, 2006; Cohen & Levinthal, 1998; Lee et al., 2008)
		Specialization	
		R&D practices	

	Human Capital	Education levels	(Nohria & Gulati, 1996; Leiponen, 2000; Mariz-Pérez, Teijeiro-Álvarez, & García-Álvarez, 2012; OECD/Eurostat, 2018)
		Work experience and know how	
		Slack	
		Profile	
Technological Infrastructures	Physical Resources	Machinery	(Adams et al., 2006)
		Technology access	
	Infrastructures	Buildings/Specialized facilities	

Table 5. Resources
Source: Author based on referenced papers.

4.2.1. Competences

Firms' competences are considered to be a crucial resource for differentiation and to stay competitive in the market (Nordhaug & Gr⊘nhaug, 1994).

In the context of this report, competences can be described as the sum of the firm's knowledge and capabilities, expressing the impact of the employees' overall skills and knowledge on the firm's ability to engage in innovation.

Hewitt-Dundas (2006) find that the lack of internal expertise, which refers to the workforce diversity of specialized skills, is positively associated with other barriers and constrains of firms' innovation processes and activities. Also, this topic is related with the firms' absorptive capacity, as its' ability to assimilate and apply new knowledge through R&D activities and, similarly, by the employees range of expertise, positively affecting the firm's innovation activity (Cohen & Levinthal, 1998; Lee et al., 2008). So, here we define internal expertise by the existence of employees or teams/groups of employees' whit specialized knowledge being inputted to innovation practices.

It is by their skilled human capital capabilities that firms can increase their innovative and overall performance and efficiency (OECD/Eurostat, 2018). According to Mariz-Pérez et al. (2012), human capital, evolving the workforce skills and knowledge, influences the firms' innovation ability and can be assessed through indicators as employees' education, work

experience, and skills and capacities. Employees' education levels must be considered, as they positively influence the firm's ability to acquire knowledge and lever innovation (Leiponen, 2000). Likewise, employees' innovation-oriented profiles, related to their skills and capacities, also consist of innovation levering characteristics as, for example, creativity, teamwork, eagerness to learn, and adaptability to change (Mariz-Pérez et al., 2012).

Also to be noted is the human slack impact on firms' innovation, since there is a controversial relation between personnel shortage and innovation, as the optimal slack level differs across firms based on their characteristics (Nohria & Gulati, 1996). Therefore, the firms' human capital topic relates to the employees' overall profile and education and knowledge levels.

4.2.1. Technological infrastructures

The firms' technological infrastructures represent the physical resources and infrastructures – machinery, technology, and facilities – that the firm has to assist its innovation projects and processes, which are inputs to the firm's innovation activity and management that should be assessed (Adams et al., 2006).

4.3. Structure & Strategy

Both the firms' organizational structure and the firm's strategy are accounted to have diverse impacts on the firms' innovation performance (Kalay & Gary, 2015; Kamasaka, 2015).

So, on one hand, a firm's formal structure can impact its innovativeness by enhancing or repressing its innovative behavior (Pierce & Delbecq, 1977). On the other hand, a firm's strategy here relates to and impacts its innovativeness through the market. It expresses the firm's innovative behavior, approaches, and orientation, when in a competitive setting, conveying the ability to differentiate itself and fill market gaps. Then, the 'structure & strategy' dimension, summarized in table 6, is about the firm's orientation and way of doing things on the inside and on the market.

Subdimension	Topic	Indicators	Authors
Market	Market innovativeness	Novelty of market approaches	(Wang & Ahmed, 2004)
		Market sensing	

	Technology orientation	Importance of investment in R&D	(Ritter & Gemünden, 2004; Jeong, Pae, & Zhou, 2006)
		Importance of new products development	
		Desire to be the technological leader in the market	
	Innovation strategy	Innovation as the core of the strategy	(Björkdahl & Börjesson, 2012; Kalay & Gary, 2015)
		Commitment and consistence to innovation	
CRM	Costumer orientation	Clients propose ideas and assist in the innovation process	(Frambach, Prabhu, & Verhallen, 2003; Kalay & Gary, 2015)
		Interaction with clients in activities	
		Costumer service	
Flexibility & Continuity	Business Models	Flexibility and adaptability	(Teece, 2010)
	Business Processes		(Ahmed, 1998; Verhaeghe & Kfir, 2002)
	Planning	Flexibility	(Dibrell, Craig, & Neubaum, 2014)
	Knowledge management	Processes and practices	(Gold, Malhotra, & Segars, 2001; Adams et al., 2006; Ferraresi, Quandt, Santos, & Frega, 2012)
Innovation Process	Standardization	Processes	(Chakrabarti & Hauschildt, 1989; Boer & During, 2001; Hansen & Birkinshaw, 2007; Damanpour & Aravind, 2012)
		Clarity of functions	
		Routines	

Table 6. Structure & Strategy

Source: Author based on referenced papers.

4.3.1. Market

The aim of the market subdimension and topics is to express the firm's behavior in and towards the market.

Analogously to Wang & Ahmed's (2004) conceptualization, we define market innovativeness by the originality of the firms' market approaches, englobing the novelty of their advertising and market research activities, their capacity to sense and anticipate new opportunities or changes in the market, and their strategies to enter in new markets or segments.

The positive relations between the firm's technology orientation and its technological competences, and between the firm's technological competences and innovation's success, are to consider. Therefore, a firm's technology orientation is a crucial strategic element that can be defined by the firm's emphasis and investment on R&D activities, new product developments, and on technology acquisition (Ritter & Gemünden, 2004; Jeong et al., 2006).

Additionally, the aim of the innovation strategy topic is to assess if the firm's strategy has innovation at its core and, if so, at what level it is structured and followed in order to enhance its performance through innovation (Björkdahl & Börjesson, 2012; Kalay & Gary, 2015). To do so, we consider the firm's commitment and resulting consistency towards innovation practices and outcomes.

4.3.2. CRM – Consumer relationship management

The performance of the innovation projects and the firm's consumer relationship are also connected, since a customer-oriented approach, based on the customer needs and feedbacks, and the openness to involve and cooperate with the customers in the innovation processes, can boost its results (Frambach et al., 2003; Kalay & Gary, 2015).

4.3.3. Flexibility & Continuity

The flexibility and continuity subdimension states the importance of firm's flexibility towards innovation related structures and practices, emphasizing the agility and adaptability of the firm as innovation levering capabilities (Ahmed, 1998; Mello, Marx, & Salerno, 2012).

Following Teece (2010), a business model can be defined as the way the firm organizes its process of creating, delivering, and capturing value. Therefore, it is related with the firm's

sustenance of competitive advantage, and innovation processes efficiency and performance, making it important for the firm to be able to innovate and design its own business model(s), and make it adaptable and flexible to changes in customer needs and preferences, and in the economic, technological, or industrial paradigms.

A business process is a set of linked tasks that lead the development of a specific output, for example, a product or a service. According to Verhaeghe & Kfir (2002), innovation can be managed and understood as a business process, and business processes themselves can be uses to facilitate and lever innovation. As so, firms benefit from having adequate business processes, and processes in general can promote innovation by having low levels of bureaucracy (Ahmed, 1998).

As for the planning flexibility topic, it is both related with firms' innovativeness and performance, being crucial for innovation processes to be planned in a flexible way to facilitate dealing with unexpected threats and opportunities (Dibrell et al., 2014).

On the realm of firm-level innovation management, knowledge management is assessed as a topic that must be taken in consideration, which includes the firm's structures and processes for generation, absorption, organization, and transference of knowledge. Therefore, it implies that those knowledge management capabilities must be efficient and effective on handling knowledge and on using it to lever innovation (Gold et al., 2001; Adams et al., 2006). According to Ferraresi et al. (2012), when allied with a strategic orientation, there is a positive relation between knowledge management and firm's innovativeness, as knowledge is seen as a resource that should be inputted in innovation processes and practices.

4.3.5. Innovation Process

An innovation process, through a firm-level and innovation generation perspectives, encompasses the phases and procedures from when ideas are generated until they are fully developed and ready to create value (Damanpour & Aravind, 2012). Throughout this process, and to enhance the firm's capacity to successfully innovate, it is important have a strategic and organized flow of phases, meaning that the innovation process should follow specific, but also flexible, guidelines, clarifying the functions and roles of the employees or teams of employees involved in the process, and an efficient management and regular

supervision of the process (Chakrabarti & Hauschildt, 1989; Boer & During, 2001; Hansen & Birkinshaw, 2007).

4.4. Ecosystems

The ecosystems pillar, summarized in table 7, covers the firm's external and internal relationships, including its alliances' networks and the employees' social relations and engagement.

Subdimension	Topic	Indicators	Authors
Internal engagement	Dynamics	Engagement practices	(Damanpour, 1991; Yen & Chou, 2001; Maher, 2014)
	Incentives	Incentives/Rewards programs	(Ahmed, 1998)
	Communication	Transparency	(Ahmed, 1998; Martins & Terblanche, 2003; Maher, 2014)
		Internal knowledge transfer	
External engagement	Open innovation	Collaborations	(Damanpour, 1991; Ahuja, 2000; Chesbrough, 2003)
	IPRs	Knowledge transfer and protection	(Peeters & Potterie, 2003; Hagedoorn & Zobel, 2015)

Table 7. Ecosystems

Source: Author based on referenced papers.

4.4.1. Internal engagement

Given the previously mentioned importance of a firm's human capital, Damanpour (1991) assesses the importance and positive impact of internal communication and interaction on innovation, by encouraging idea and knowledge sharing and creativity. Therefore, it is of value for firms to retain, motivate and stimulate its employees through internal engagement practices and dynamics.

To simultaneously become more innovative and engage workers, a firm can implement different methods of communication and interaction, inclusively through activities (e.g.

bootcamps) or technological means (e.g. intranets and social networks) to promote collaboration and communication, incite innovation and creativity, and facilitate information access within the firm's workforce (Yen & Chou, 2001; Maher, 2014).

Still in the internal engagement practices, structured incentive programs, for example, through financial (monetary bonuses or prizes) or not-financial (professional growth or recognition) rewards, support and encourage innovative and creative behaviors, as employees are more motivated to work and share their ideas and knowledge (Ahmed, 1998).

For the communication inside the firm, either within employees or leaders and employees, to be effective and incite an innovation prone and creative environment, it must be based on the principles of openness and transparency. Also, innovative firms promote internal transferences of knowledge between work units, incentivizing employees to communicate and exchange insights and perspectives (Ahmed, 1998; Martins & Terblanche, 2003; Maher, 2014).

4.4.2. External engagement

Similarly to the internal engagement, firms must also promote interaction and transference of knowledge across the firm borders, by creating a network of collaborative relations (Damanpour, 1991; Chesbrough, 2003)

The concept of open innovation, vastly advocated by Chesbrough (2003), refers to an environment where the firms in the market cooperate with each other, by exchanging resources, information, and ideas, and creating a sustainable competitive setting. Thus, the creation of collaborative relations, alliances, and networks, have a positive impact on firm's innovation and performance, as it also allows the absorption of new knowledge and increases efficiency, especially from direct links (Ahuja, 2000).

Also, a "key element in the innovation process is the firms' ability to efficiently manage their intellectual property rights" (Peeters & Potterie, 2003, p. 9). It is by possessing knowledge and expertise in IPRs (e.g. patents, copyrights, trademarks, …) and contracts that firm's working in an collaborative framework can better protect and transfer knowledge across partners and also within employees, in order to prevent the unlawful appropriation of ideas, information, and innovations (Hagedoorn & Zobel, 2015).

4.5. Performance

Due to the relation between innovativeness and firm's performance, to assess/measure firm's innovativeness, it is crucial to consider some performance indicators that express innovation results and outputs (Rubera & Kirca, 2012). Table 8 condenses the chosen, and most used, indicators to evaluate the firms' performance related with innovation activities.

Subdimension	Topic	Indicators	Authors
Patents		Number of patents	(Artz, Norman, Hatfield, & Cardinal, 2010; OECD, 2009)
		Income from patents	
Funding		Sources	(Almus & Czarnitzki, 2003; Bronzini & Piselli, 2016; Greco, Grimaldi, & Cricelli, 2017)
		Capture estimates	
Results		Products/Services launched	(Hagedoorn & Cloodt, 2003; Carayannis & Provance, 2008; Artz et al., 2010)
		Newness of products/services	
Financial measures	ROII	Sales	(Anthony, 2013)
		R&D	
		Investment	
		Ideas	

Table 8. Performance

Source: Author based on referenced papers

4.5.1. Patents

OECD (2009) says that patents are a good, and one of the most used, statistical indicators to assess innovation, however, they carry both advantages and disadvantages.

Patent indicators, as raw counts of the number of patents granted to a firm, can be used as representation of the firm's innovative activity (Artz et al., 2010). Also, firms can benefit from potential financial revenues associated to patents, as royalties and licensing incomes, that consequently increase innovation performance results (OECD, 2009).

4.5.2. Funding

Firms have different levels of R&D expenditures, and one justification for that fact is related with the grant of public subsidies, since firms who receive higher amounts of public funds are accounted to have higher levels of R&D activity (Almus & Czarnitzki, 2003) and patents submission (Bronzini & Piselli, 2016), which are both related whit the firms' innovative activity. In addition, Greco et al. (2017) link public subsides with the increase of collaborations between firms and with innovation efficiency, taking a step further and emphasizing the relevance of distinguish between types of public funds, especially national and international funds, the latter being harder to obtain.

As seen, firms' innovativeness benefits from fund capturing, making essential and differentiating for firms to have both strategy and knowledge on public subsidies capture.

4.5.3. Results

In the results subdimension, we highlight the weight of new products and services launched by the firm, which are commonly used indicators of its innovative activity and performance (e.g. Hagedoorn & Cloodt, 2003; Artz et al., 2010). Additionally, and similarly to Carayannis & Provance (2008), we also consider the newness of those products/services, either for the market, and for the firm, as an output-oriented measure for innovation and considering that an innovation that is new for the market is more significant.

4.5.4. Financial measures

With the aim of supressing the limitations of the ROE – Return on Equity – metric and to better assess firm's innovativeness, Anthony (2013) developed an alternative one: the ROII – Return on Investment on Innovation. This new metric, whose formula is bellow, uses the Dupont logic:

$$ROII = Innovation\ Magnitude\ \times Innovation\ Sucess\ Rate\ \times Innovation\ Efficiency$$

$$= \frac{Innovation's\ profits}{Nr\ of\ sucessful\ ideas} \times \frac{Nr\ of\ sucessfull\ ideas}{Nr\ of\ ideas\ explored} \times \frac{Nr\ of\ ideas\ explored}{Innovation's\ Investment}$$

5. Methodology

The process of this study consisted of two stages:

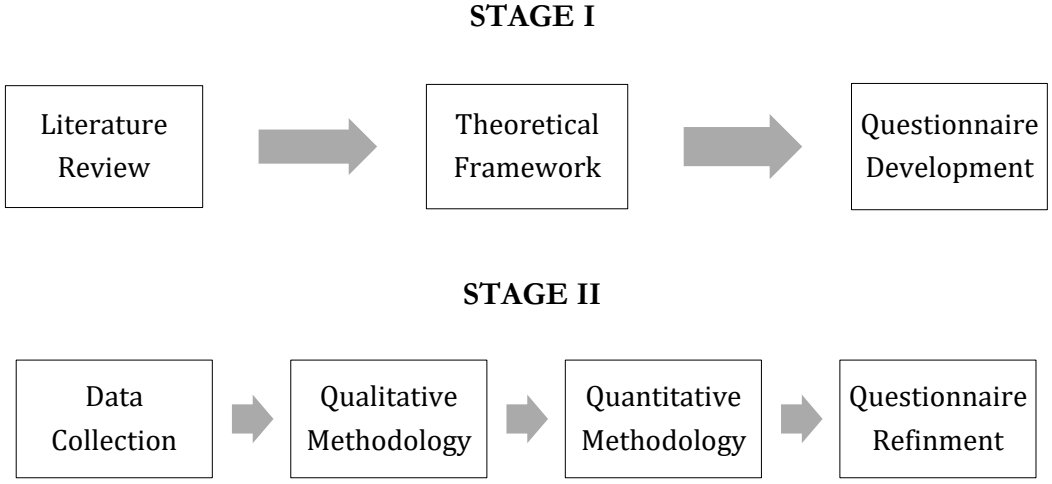

Figure 1. Scheme of the study's process

For the purpose of this study, the collection of the intended data was made through online questionnaires and interviews, and it were applied qualitative and quantitative methodologies. The chosen methods aim to validate the previously elaborated theoretical framework and ensure that the developed questionnaire is reliable. Both concepts of validity and reliability are important when evaluating this kind of instruments.

The validity ensures that "an instrument measures what it is intended to measure" (Tavakol & Dennick, 2011, p. 1), in this case, making sure that the theoretical framework's chosen pillars can assess firm-level innovativeness. Therefore, through the selected qualitative methodology – interviews with non-innovation experts – the opinions of the interviewees are able of ensuring face validity, confirming the validity of the developed items and assessing the overall content of the questionnaire as accurate and fitted to its aim (Gignac, 2009; Holden, 2010).

The reliability, applied to the questionnaire, "is concerned with the ability of an instrument to measure consistently" (Tavakol & Dennick, 2011, p. 1) and can be assessed over quantitative testing.

All used procedures are further explained in this section.

5.1. The questionnaires

Despite not existing a standard way to create and design questionnaires, they are advocated to be a good source to collect information for studies' research, including data on innovation (Artino Jr, La Rochelle, Dezee, & Gehlbach, 2014; OECD/Eurostat, 2018).

"The first step to developing a questionnaire, is to perform a literature review" (Artino Jr et al., 2014, p. 464), therefore, based on the formerly literature review, analysis of already existing frameworks and questionnaires, and elaborated theoretical framework, the questionnaires to be sent to SGS's affiliates to answer and, later, to be refined, were created with the help and guidance of the internship supervisor and are available in Annex I and Annex II, correspondently.

Questionnaire number 1 was first elaborated, which is more extensive, involves questions regarding all topics from all the 5 pillars and, due to the administrative specificity of some questions, was only directed to workers with CEO and management positions. Then, Questionnaire number 1 was adapted into Questionnaire number 2, which was directed to firm employees regardless of job position and excludes all questions concerning the performance pillar and some of the more specific questions about the firm resources. In both questionnaires, language was adapted according to the correspondent and most of the questions have a 5-point Likert scale answer to better and easily obtain, understand, and compare the degree of agreement of each correspondent (Johns, 2010).

5.2. Description of the process

In a first stage, for the qualitative part of the methodology, in the beginning of March, additionally to SGS Portugal, other 5 SGS affiliates were contacted by email to assess their availability to participate in this study and, as presented in table 9, 3 of them agreed to help.

Affiliate	Number of correspondents interviewed	Type of Questionnaire	Code
SGS Portugal	1	Management	SGSP-M1
	3	Employee	SGSP-E1; SGSP-E2; SGSP-E3

SGS A	2	Employee	SGSA-E1; SGSA-E2
SGS B	1	Management	SGSB-M1
	2	Employee	SGSB-E1; SGSB-E2
SGS C	1	Management	SGSC-M1
Total	**10 interviews**		

Table 9. Sample number 1 presentation

After confirming availabilities and having an initial online meeting with each affiliate to clearer explain the project, the first step was to send the questionnaires via google forms to the correspondents to simultaneously answer and examine. Then, during the months of March and April, individual online interviews with some of the correspondents were scheduled to discuss the overall structure and relevance of the questionnaire.

Due to time constrains, a limit date to conclude the interviews' part of the project was set, therefore, it was not possible to schedule interviews with the total of all the 17 correspondents that answered the questionnaire in this first phase.

For the quantitative part of the methodology, the questionnaires were sent to a bigger sample of SGS affiliates, another 6 affiliates received the questionnaires and collaborated. Until the mid of June, as shown in table 10, a total of 58 correspondents had answered the questionnaires.

Affiliate	Questionnaire nr 1	Questionnaire nr 2
SGS Portugal	2	4
SGS A	1	2
SGS B	2	3
SGS C	1	2
SGS D	2	1
SGS E	3	1
SGS F	25	-
SGS G	5	-

SGS H	2	-
SGS I	2	-
Total	**45**	**13**
	58	

Table 10. Sample number 2 presentation

5.3. Qualitative Methodology: The interviews

Interviews are often done on a small sample of the study's population as a method to test questionnaires, to ensure that the questionnaire does not have errors nor ambiguities before it is ready for a full-scale administration (Artino Jr et al., 2014; OECD/Eurostat, 2018).

As advocated by Bewley (2002), the interviews were structured according to this report's research goal, that was to globally validate the theoretical framework's items and refine the questionnaire with the received feedback. So, as shown in table 11, all interviews were semi-structured, following a generic guideline to collect as much information and insights as possible, and to allow the discussion of some aspects that could emerge (Doody & Noonan, 2013).

Also, all interviews had the duration of, approximately, 30 minutes and were recorded with the consent of the interviewees.

1st	The same general questions and discussion about the interviewee's perception of innovation.
2nd	Personalized questions about each of the pillars according to the interviewee's previous answers in the questionnaire and adapted to the development of the interview.
3rd	Question and discussion about SGS being innovative or not.
4th	To finalize the interview, it was asked for an overall feedback of the questionnaire.

Table 11. Guideline of the interviews

5.4. Quantitative methodology: Statistically testing the questionnaire

The next step of the methodology entailed the submission of the questionnaire through a statistic test, identified as an important step when developing a questionnaire to assess its reliability (Artino Jr et al., 2014).

To do so, the most common method is to calculate the Cronbach's Alfa coefficient, as it is able to measure the reliability - internal consistency - of a questionnaire and its value signs if the questionnaire's questions are correlated (Bland & Altman, 1997; Tavakol & Dennick, 2011). Therefore, measuring the strength of the instrument's consistency by the following formula:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum s_i^2}{s_t^2}\right)$$

k = number of items; s_i^2 = variance of individual item i; s_t^2 = total variance

The interpretation of the coefficient is further explained in the following section, where the results of the test are analyzed.

Despite its widespread use, Cronbach's Alfa coefficient has some limitations, especially when it is used as sole index of reliability. The coefficient is sensible to the construct's number of items and to the chosen sample and has underlying assumptions that are commonly violated. However, the Cronbach's Alfa coefficient allows to easily calculate reliability through a single teste and is universally used in research studies (Agbo, 2010; Al-Osail, et al., 2015).

For this part, to assemble the most data, the answers collected from sample number 2 - 58 correspondents - from questionnaires numbers 1 and 2 were joined, considering only the questions that were common to both questionnaires and had the five-point Likert-scale answer type. Therefore, the reliability analysis done in the next section encompasses Questionnaire number 2.

It is to note that this data does not aim a detailed a statistic analysis, only the calculation of the Cronbach's Alfa coefficient.

6. Analysis of the results

In this section the results from both methodologies – qualitative and quantitative - are analyzed.

6.1. Qualitative methodology

The interviews were analyzed with the assistance of a qualitative data analysis software - NVivo - which is accounted to ease the process of analyzing a big amount of data as ours by the creation of nodes and codes that automatize the process and make it easier to draw conclusions (Hilal & Alabri, 2013). In this case, it was done an individual analysis of each pillar of the theoretical framework and a general analysis of the rest of the interviews' topics.

6.1.1. Perception of innovation

To start the interview, all interviewees were asked to define innovation in their own terms. As expected, there was not one consensual or standard definition, nevertheless, it is possible to state some common points amongst the given definitions. The adjective 'new' was widely used to define innovation, either applied to products and services, or processes and methods. However, interviewees stated that being 'something new' was not enough to define it, and that an innovation should also be something that is disruptive and that adds value internally - to the firm - or externally - to the market, as innovation was also said to be related with the market, aiming to follow and suppress the market's evolution and needs.

Then, when asked about which factors can influence innovation the most and that are essential for a firm to be assessed as innovative, the most common answer referred the culture of the firm as the main factor, focusing mainly on its attitude towards risk and errors acceptance, on its mindset towards innovation, and on the managers' leadership approach. Additionally, interviewees also claimed that resources – human, physical and monetary - were a key factor, particularly the human resources. Yet, none of the interviewees mentioned the ecosystems as a crucial factor for innovation.

The interviewees were also asked if they thought that innovation should be measured inside the firms and, unanimously, all answered 'yes', arguing that everything we invest in should be measured, and that by measuring we can better understand where we are at, either what

we need to improve internally, or what is our position compared to our competitors. To do so, it was suggested the use of indicators, metrics and KPIs that look to innovation in a global way, not only through an economic and short-term perspective.

6.1.2. Culture

About the Culture pillar, as mentioned, the interviewees unanimously agreed on the importance and impact of the firm's culture on innovation, however, emphasizing different aspects.

In terms of the firm's prioritization of innovation subdimension, it was claimed that the firm's culture can be highly influenced by those who run it, so innovation must come from those in leadership positions that can promote practices like meetings and the active involvement of employees in those practices. This highlights the importance of communication, as the firm's culture was also said to be able to impact innovation "by making sure that the message about what it wants to achieve in terms of innovation comes out regularly and that that message reaches all employees" (SGSB-E2).

It was also highlighted the importance of giving employees time and autonomy to think about innovation and to pursue their own ideas, "because if what we are looking for is tried and true and all we spend our time on is tried and true, we get very uncomfortable with anything that starts to push to that edge, and an innovation needs to be something well beyond the edge of what feels reasonable right at this moment" (SGSB-E1).

The only indicator that led to different opinions was about the use of open spaces to promote innovation, differing from the theoretical framework an interviewee mentioned that "open spaces are, in fact, a sign of a more open communication", but they are not "a big sign of an innovation culture" (SGSC-M1).

As for the firm's behavior subdimension, interviewees' points of view confirmed the chosen topics and indicators, and the aspect of risk taking and mistakes tolerance, referred as the making it 'OK' to fail, was considered as "the most important factor of the culture, because there has to be the viewpoint that not all ideas and innovations are going to succeed" (SGSB-M1) and that "it is by failing that we move our learning forward" (SGSB-E1). However, stressing that when mistakes happen, people should be warned about them, not to be

reprehended but to be aware of what they have done wrong and to learn and improve in the future.

6.1.3. Resources

In the Resources pillar there was accordance between the interviews and the theoretical framework, as "if there is not resources allocation towards innovation, innovation will not occur" (SGSA-E1). Nevertheless, despite all the interviewees having agreed on the importance of both human and physical resources for innovation, their opinions diverged on which should be more relevant.

On one hand, the majority of the interviewees stated that the human resources were the key factor because the ideas to innovate can only come from people and they are the ones who best know the firm's core, especially if they are specialized and/or dedicated to innovation. Through this viewpoint, technology is still important but was mentioned as a mean to pursue and support those ideas, and firms that want to be innovative should focus and invest more in the training and capacitation of their employees.

On the other hand, it was also stated that "if we do not have the technological means to make a difference, we can have an exceptional team, but the team alone needs certain means to make that difference" (SGSP-M1), emphasizing the cruciality of the physical resources.

6.1.4. Structure & Strategy

The collected insights about the Structure & Strategy pillar fully corresponded to the theoretical framework, as the interviewees agreed on the importance of having a well-defined and efficient strategy for innovation and on the impact that a firm's structure can have. It is to note that the opinion of SGS being a highly bureaucratic company was unanimous amongst the different affiliates, underlining how a rigid and heavy administrative intensity can stifle communication and innovation processes and outcomes.

SGSP-E1	"Innovation must be approached in a structured way, which is why when we talk about strategy, we are assuming that strategy does the job of

	understanding what value innovation brings to the organization and to the market."
SGSB-E2	"You need a whole structure in place for innovation to happen, and the focus needs to happen at every single level. So, is essential for a company to have its role and position in place with specific objectives."
SGSP-E3	"I think SGS is a bit slow because of its heavy structure, we are many and we have a lot of departments, so, the communication factor has to do with it. Sometimes, when they are smaller structures of management it is easier to "flow"."
	"The fact that SGS is a large and multinational company makes it have rules, guidelines, and procedures that we have to follow. It turns out not flexible, because it takes time to react and there is a hard path to reach the desired goal. The many policies we have to comply with, to respond to the mother house, impact innovation because they make the company less light."
	"It is necessary to have a "fine" analysis and to increase market surveying to better understand its needs and to be able to innovate. We also need the inputs of customers to be able to innovate, they must be an active part in the development of the process, product, or service in question. They are players, without them you cannot innovate because innovation is also for customers."
SGSA-E2	"Investment in technology is essential to the innovation process."

Table 12. Importance of the Structure & Strategy pillar

6.1.5. Ecosystems

In terms of internal engagement, the interviewees agreed on the importance of the existence of engagement practices and dynamics and affirmed that those are the things that start to build a culture around innovation and that can improve the communication and collaboration inside a firm. However, they cautioned that the simple existence of those things is not enough, they must effectively work. For example:

> "We asked employees for their ideas, and they gave them to us. Then, we did nothing with them, because our process was very slow and there were a lot of levels of hierarchy for approvals. So, ultimately, a lot of those ideas just died. Some of those employees are no longer with the company or if they are, they feel resentful, because we asked them for their ideas and we did not do anything with them." (SGSB-M1)

> "It is not because there are intranets and social networks among affiliates that it means that the communication is being efficient, it's not, they do not do what they should. At the end of the day, they basically exist, they do not improve communication and do not have any positive effect on innovation." (SGSP-E2)

About the external engagement, the value of external partnerships and collaborations was irrefutable, to bring specialized knowledge, new ideas and cultures, increase efficiency, and alleviate resource strain. However, interviewees' opinions diverged on the IPRs' – intellectual property rights' – topic. While some agreed on its importance to protect and encourage innovation, others claim that it can inhibit and get in the way of innovation, especially when it comes to partnerships where both parts cannot agree on the collaboration terms and/or do not have the knowledge to handle those legal aspects, so, "firms got to figure out how to fail forward in partnerships, in ways that they can gain knowledge and learning, even if we haven't gained a patent or something else" (SGSB-E2).

In the literature, Cho, Kim, & Shin (2015) advocate that the implementation of IPRs must be customized, since the relation between IPRs and innovation can be ambiguous, depending on the industry/sector in question and on the strength of the used IPRs. Nevertheless, the authors conclude that there is an overall negative relation between strong levels of IPRs and innovation.

6.1.6. Performance

The Performance pillar was the most problematic of the questionnaire since it was not possible to collect the intended values to calculate and compare the ROIIs. This problem was referred by some interviewees as a reflection of a lack of communication and transparency, as those values and data should be communicated and able to be easily assessed by everyone, especially by the ones in management positions.

Patents were mentioned as "a sign that something is happening, because if you are not innovating at all, you will not have patents" (SGSC-M1), however, interviewees did not believe to exist a proportional correlation between patents and innovation. In the literature we also find that, despite patents being accounted as a good measure of innovation performance and outputs, they are better suited for certain industries and, to ensure a more reliable comparison, patent data should be compared within the same industry (Katila, 2000). Furthermore, not all patents turn into innovations and not all inventions can be patented and, even those who can, not always are due to the time consuming, expensive, and slow process beneath (Archibugi & Planta, 1996; OECD, 2009).

Other than patents count, the additional performance indicators considered in the questionnaire were assessed as good performance indicators and as signs of innovation.

6.1.7. The case of SGS: Is SGS innovative?

When asked if they thought that the SGS affiliate they were working on was innovative, most of the interviews answered 'No' and gave some feedback on what they thought was working well and on what needed improvement. The opinions of the interviewees about SGS ended up also confirming some aspects of the theoretical framework. Table 13 summarizes the collected results, showing how SGS is generally assessed as not innovative.

Is SGS innovative?			
	Yes	**No**	
SGS Portugal	-	4	The communication is missing, it should be better and more transparent. The innovation culture is missing. The structure is too complex. The current strategy is just to follow the market and be reactive, to innovate it needs to also be proactive.
SGS A	1	1	Has the right and the best physical resources. Has good external partnerships programs. Has a high level of bureaucracy. It is missing an innovation team/department.

			The culture needs to improve towards innovation, especially in terms of leadership.
SGS B	1	2	Some business lines are more innovative than others. The innovation culture is missing. There is a fear of taking risks and making mistakes.
SGS C	1	-	-

Table 13. Opinions on SGS innovativeness

As seen, one of the most common feeling was that SGS, as a multinational firm, has too much bureaucracy and hierarchy, and those factors are claimed to be hindering innovation.

Despite that, in theory, all SGSs would be similar and share the same culture, in practice that does not happen, since many interviewees claimed that they felt that a culture and focus on innovation was missing. Also, by the answers on the questionnaire, it is visible that not all SGS affiliates have the same resources available, either human or physical, as SGS A even reports not having and innovation team/department as the other affiliates considered in this study.

6.1.8. Interviews overview

As mentioned, the purpose of the interviews was to globally validate the questionnaire's theoretical framework with face validity and, with that feedback, refine the questionnaire and gain insights about the innovation practices in SGS affiliates. Besides that, if there was some misunderstanding related to any question or topic, the interviews could also help identifying the problem. Overall, the process of the interviews went well and met its aims.

Despite the sample consisting of affiliates from different parts of the world and on interviewees with different job positions, those differences were not very noticeable, as all perceived innovation as important and as a key element to any firm, and all agreed on the importance of instruments as the one proposed in this study to assess firm-level innovativeness. Also, all the interviewees understood the asked questions and their purpose in the same way, but it is to note that they all belong to the same group and share its vision. Nonetheless, the goal of interviewing this sample was to have a wide range of perspectives and opinions, making the feedback more valuable.

As a suggestion, several interviewees recommended the use of interviews as the ones done as a complement for the questionnaire, even when it is totally refined.

6.2. Quantitative methodology

For the quantitative part, the collected data was analyzed using a SPSS computer program.

The present reliability test showed in table 14 followed the same aim as the ones done by Wang & Ahmed (2004) and Knowles et al. (2008a).

Components	Item	Item-total correlation (a)	Alpha if item deleted (a)	Apha of component	Item-total correlation (b)	Alpha if item deleted (b)
Culture	1	0,329	0,907	0,906	0,544	0,966
	2	0,659	0,897		0,710	0,965
	3	0,467	0,903		0,413	0,966
	4	0,523	0,902		0,428	0,966
	5	0,653	0,899		0,585	0,966
	6	0,577	0,900		0,567	0,966
	7	0,517	0,902		0,436	0,966
	8	0,469	0,903		0,424	0,966
	9	0,522	0,902		0,433	0,966
	10	0,560	0,901		0,552	0,966
	11	0,665	0,898		0,519	0,966
	12	0,667	0,897		0,624	0,966
	13	0,625	0,899		0,606	0,966
	14	0,527	0,902		0,471	0,966
	15	0,635	0,898		0,652	0,965
	16	0,582	0,900		0,627	0,965
	17	0,634	0,898		0,631	0,965
	18	0,496	0,903		0,419	0,966
Resources	19	0,671	0,820	0,849	0,737	0,965
	20	0,704	0,816		0,734	0,965
	21	0,570	0,834		0,689	0,965
	22	0,659	0,822		0,681	0,965
	23	0,550	0,837		0,495	0,966
	24	0,600	0,830		0,549	0,966
	25	0,544	0,840		0,516	0,966
	26	0,666	0,931		0,619	0,966

Structure & Strategy	27	0,728	0,930	0,935	0,686	0,965
	28	0,639	0,932		0,588	0,966
	29	0,656	0,932		0,699	0,965
	30	0,703	0,931		0,694	0,965
	31	0,778	0,929		0,759	0,965
	32	0,599	0,933		0,547	0,966
	33	0,515	0,934		0,600	0,966
	34	0,771	0,930		0,729	0,965
	35	0,513	0,934		0,553	0,966
	36	0,616	0,933		0,617	0,966
	37	0,728	0,930		0,659	0,965
	38	0,276	0,939		0,290	0,967
	39	0,608	0,933		0,587	0,966
	40	0,660	0,932		0,629	0,965
	41	0,723	0,930		0,790	0,965
	42	0,508	0,934		0,597	0,966
	43	0,720	0,930		0,718	0,965
	44	0,667	0,932		0,654	0,965
Ecosystems	45	0,201	0,839	0,822	0,536	0,966
	46	0,483	0,812		0,690	0,965
	47	0,433	0,814		0,407	0,966
	48	0,626	0,797		0,531	0,966
	49	0,623	0,793		0,582	0,966
	50	0,471	0,810		0,417	0,966
	51	0,569	0,800		0,636	0,965
	52	0,683	0,790		0,555	0,966
	53	0,632	0,798		0,464	0,966
	54	0,494	0,808		0,413	0,966

The scale used is a five-point Likert Scale ranging from 1 (strongly disagree) to 5 (strongly agree).

(a) Results on component factors.

(b) Results on full 54-item instrument.

Table 14. Reliability test

Following Tavakol & Dennick (2011), the Cronbach's alpha coefficient value is between 0 and 1 and higher values indicate higher levels of internal consistency. As mentioned in the methodology, the test was performed on the 54 questions (items) of the questionnaire directed to non-management positions – Questionnaire number 2 – and the Cronbach's alpha coefficient value of the total construct was 0,966. Despite this being a high value, it is

to note that the questionnaire under analysis is considered long and, also according to the mentioned authors, the Cronbach's alpha coefficient value is affected by length and a value higher that 0,900 indicates that the construct might have too many items and some might be redundant.

Since the construct entails several components, the value of the Cronbach's alfa coefficient of each component was calculated to alleviate the inflation of the value due to the high number of items of the whole construct (Tavakol & Dennick, 2011). The calculated values are all higher that 0,700, that is the minimum acceptable value suggested by (Price & Mueller, 1986), therefore, indicating consistency.

7. Refinement of the questionnaire

In the interviews, the goal of asking the interviewees directly for feedback of the questionnaire was to have more specific insights on how to refine it. Even though all feedback is good, table 15 compiles and divides the most relevant collected feedback on what to maintain and what to improve.

	Positive Feedback
SGSP-M1	"I think it is well built, makes sense, the questions have logic and it is perceptive. I did not think it was extensive."
SGSP-E2	"The inputs you wanted to take were clear."
SGSP-E1	"I think that there was not any topic missing."
SGSP-E3	"I think it is very intuitive and easy to answer, it is also well structured."
SGSA-E2	"Well structured and organized."
SGSA-E1	"I liked it, it brings questions and topics that a person does not think about; simple and subtle things that have a huge impact on processes and innovation."
SGSB-M1	"One of the things that I really liked was the opportunity to choose a questionnaire according to the job position and that in some questions of the more specific topics you gave the opportunity to say "I don't know"."
	Negative Feedback
SGSA-E2	"Too long."
SGSB-E1	"The problem I had with the questionnaire was that it had too many questions related to too many different things where you do not see really how you are going to interpret these questions."
SGSB-E2	"There was a couple of terms - as "IPRs" - that were used in it that threw me off and that, at the time, I was not willing to go look up what they meant. The other thing that threw me off was the term "firm" in relationship to who our company is, it would be better 'the group'. One of the things you may also want to investigate is the maturity of the organization and how long somebody's been reporting to somebody.

	The other thing is that in the places where I answered a three, the three was more 'I do not know'. If you have an opinion, you don't get to sit in the middle with "neither agree nor disagree", because you want people to give you more feedback."
SGSB-M1	It felt very long. Also, using the term "the firm" was not very good to me, it did not feel comfortable. Plus, I am one of those people that it is very easy for me to go in the middle and just answer 'neither agree nor disagree', so I prefer when surveys make me take a position and eliminate the middle one. "
SGSC-M1	"I would change the answer scale, taking off the middle option and adding the option of "I do not know". Also, I would include a field for people to say what they do and how many positions they are below the CEO of the company, to see better the different points of view."

Table 15. Collected feedback of the questionnaire

Summarizing, it was assessed that many thought that the questionnaire, despite being well structure, was too long. Plus, another common criticism was about the chosen answer scale, suggesting changing to a 4-point answer scale and adding the option of answering "I do not know", therefore, eliminating the option of "Neither agree not disagree" and making the correspondents choose a side of agreement. Other suggestions were changing the use of the term "firm"; explaining what "IPRs" stands for; and asking how long the correspondent has been reporting to its current leader and how many positions he is below the CEO of the firm.

The reliability test performed confirmed that the questionnaire, despite generally being assessed as reliable, might be too extensive and needs to be shortened, especially the pillars with more questions.

Having in mind all the considerations from both methodologies used, the main changes to do on the questionnaires can be condensed as:

- Requesting additional information about the correspondent's job position.

- Changing the answering scale.
- Do linguistic corrections as advised.
- In some question, not only ask if things exist, but also if they are efficiently working.
- Elimination of some questions on topics that led to discordance.
- Shortening the questionnaire through the elimination of questions that after further analysis might be redundant.
- The performance pillar needs further elaboration in order to effectively get assess to numeric values.
- Consider implementing interviews to complement the questionnaire.

Therefore, Annex III and Annex IV present, respectively, a proposal of refinement for Questionnaire number 1 (management positions) and Questionnaire number 2 (employee positions). The changes made are minor and are just a suggestion, they have in consideration all the collected feedback, the results' analysis, and the questionnaires' overall responses.

The main alterations consisted of changing the answer scale and of a cut of 22 questions from Questionnaire number 1 and a cut of 10 questions from Questionnaire number 2. As shown in table 15, the questionnaire directed to management positions suffered a larger cut because of the performance pillar, where the approach to assess some of the more specific information must be rethought.

	Initial Questionnaire		**Refined Questionnaire**	
	Nr 1	**Nr 2**	**Nr 1**	**Nr 2**
Number of questions	**77**	**54**	**53**	**44**
Culture	18	18	13	13
Resources	12	7	12	7
Structure & Strategy	19	19	16	16
Ecosystems	10	10	8	8
Performance	18	-	4	-

Table 16. Number of questions in the questionnaires' versions

8. Conclusion

In general, the evidence collected, from both the literature review and the interviews, highlights the importance of innovation and of assessing innovativeness within firms, the latter only being achievable if there are stablished metrics, tools, and/or systems, to do it.

As this process started with a literature review, from that it was possible to assess the lack of consensus regarding the definition and conceptualization of innovation and innovativeness, mainly due to their multidimensionality, which leads to the difficulty of creating instruments as the one intended. So, the purpose of this internship and final report was to create and to start refining a questionnaire that, by contemplating the multidimensionality of innovation, would be able to work as an instrument to assess firm-level innovativeness.

The created instrument had in consideration the most common criticisms found on the literature and on the existing measurement and assessment instruments and tried to suppress them. Therefore, its theoretical framework considered the multidimensionality of the concepts, involved the most used dimensions/pillars utilized in the existing systems, and tried to combine both qualitative and quantitative data to assess its overall quality. Despite the effort, the quantitative data was not possible to collect in a consistent way, since the correspondents did not know or did not have access to all the asked values and/or information, confirming the difficulty of collecting that kind of data. Therefore, this was one of the suggestions of refinement done in the final questionnaire.

In this study, qualitative and quantitative methodologies were used. After analyzing the results, the insights collected through the qualitative methodology – interviews - mostly corroborate the questionnaire's theoretical framework, confirming the relevance of the chosen pillars – culture, resources, structure & strategy, ecosystems, and performance – on firms' innovativeness, giving it and overall validation and, in the interviewees perception, assessing the 'culture' as the main pillar.

Those insights from the interviews also allowed the discussion of the importance of some topics and shed light on the controversy of others, as some interviewees had different opinions and perspectives from the ones found in the literature. Controversy rose mainly on the topics of the use of IPRs to protect innovation and the use of patent counts to evaluate innovation performance.

The collected feedback on the questionnaire, gathered from the interviews and joined with the calculation of the Cronbach's Alpha coefficient, provided important suggestions that were applied on the presented suggested refinement versions of the questionnaires. The criticisms on the questionnaire were mainly focused on the answer scale, used expressions, and on its length, the latter being corroborated by the statistic test performed.

Since the study was done only on SGS affiliates, despite the sample's reduced size, the information that was possible to gather provides SGS Portugal with insights on the innovation practices that are being done among other affiliates, where we see that there is not homogeneity in terms of practices and resources. Nevertheless, some criticisms are the same across the globe, especially on assessing the group as not innovative and with a heavy and bureaucratic structure that is hindering innovation and innovative outcomes.

In conclusion, the final questionnaire offers SGS Portugal a self-evaluation tool to be further elaborated and tailored to its specific goals. As for the internship itself, its goals were successfully achieved, not only the innovativeness assessment instrument was created, but the whole experience was valuable to both parts, since there was a continuous exchange of knowledge about innovation in theory and in practice, adding value to both parts.

8.1. Further Research

For future refinement and validation of the questionnaire, there are extra steps that can be taken.

Qualitatively, having a second round of interviews can be beneficial to further validate the questionnaire, but this time with innovation experts that can give more specific information and insights. This approach, additionally to face validity, can provide content validity, as the interviewees can confirm if all relevant aspects to assess firm-level innovativeness are present in the instrument (Gignac, 2009; Singh, 2017).

Quantitatively, the questionnaire can be sent to a bigger sample in order to be assessed through other quantitative tests for validation and to assure more reliability: For example:

- Factorial validity can be assessed through Exploratory Factorial Analysis (EFA) and Confirmatory Factorial Analysis (CFA) (Gignac, 2009). Knowles et al. (2008a), whose study has a similar aim, uses this two kind of procedures.

- EFA should be used prior to CFA, does not need the development of hypothesis, and can be used a measure of internal reliability. It is a statistical method that examines the underlying factor structure of the instrument and can detect items that can be removed (Yu & Richardson, 2015).
- CFA is also a statistic technique and allows the test of hypothesis about the relationships between the instrument's considered variables and with the main construct (Tinsley & Brown, 2000).
- Besides the calculation of the Cronbach's Alpha coefficient, McNeish (2018) suggests several alternative ways to assess reliability.

After the questionnaire is refined in light of the new results, it could be adapted according to specific types of industries and according to firms' sizes. It would not be fair to evaluate all firms the same way, as some topics may not be fully applicable to some firms.

Finally, after all the refinements and adaptations, the ultimate goal would be to create a score system based on innovativeness levels, where after responding the questionnaire, a score was attributed to the firm. This system would consider different ponderations according to the relevance of each pillar/subdimension/topic and would serve as an assessment and measurement tool that could be sold as an innovation consultancy service.

For SGS, besides gaining a new service, the final questionnaire could be useful do further confirm and understand the collected feedback, analyzing the relations between the group and the most common criticisms.

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Annexes

Annex I. Questionnaire Number 1

SGS Affiliate:
Your current job position in the firm:
Your department:

Culture			**Answer**
Innovation Prioritization	Openness	1. Innovation is one of the priorities of the firm. 2. The firm incentives regular meetings and everyone is incentivized to share their opinion and participate in the decisions. 3. The firm prefers the existence of open spaces to maximize interaction between employees. 4. Employees are allowed to have time dedicated only to innovation (ex: to work on their innovative ideas).	Likert scale *
	Leadership	5. Managers foster an environment of trust. 6. Managers continuously search for new opportunities and focus resources on new projects/ innovation. 7. Managers lead employees to the right direction, instead of being too rigid and giving orders. Employees feel free to choose the methods to complete the given objectives. 8. Managers build relationships with each member of their team and seek to know their individual needs. 9. Managers are able to communicate the future vision of the company and how to achieve it. 10. Managers try to open the interests of the team and individuals and taking them out of their comfort zone.	

	Training	11. The firm incentives a learning culture and offers training programs. 12. Everyone in the firm is involved in training. 13. The firm offers special workshops and there is an expectation to develop new skills, capabilities and knowledge that is directed toward supporting innovation.	
Behavior	Cooperation and teamwork	14. Employees feel motivated to work in the organization. 15. There is an environment of cooperation in the organization and employees constantly share information and learn from one another. 16. Employees feel the support of managers and team members when working on innovation projects.	
	Risk taking	17. There is an understanding by the firm that mistakes will occur, and employees feel free to fail and take risks. 18. Failing is seen as a learning experience. The firm supports failure and employees are not penalized.	
Resources			
Competences	Internal Expertise	19. Estimate percentage of people working on innovation related issues.	Numeric value
		20. Do you have an innovation team? 21. Does the firm have employees dedicated to R&D practices?	No; Yes; I do not know
		22. There is heterogeneity in the composition of teams (in terms of experience, cultural background, interdisciplinary…).	Likert Scale

	Human Capital	23. Most of the firms' personnel have higher education degrees. 24. The firm's human capital policy is innovation-oriented (employees have know-how and experience working on innovation issues). 25. Personnel shortages does not inhibit innovation in this firm. 26. The firm has a defined recruitment process and targets employees that have innovation-levering characteristics (as creativity, eagerness to learn, adaptability to changes, collaboration skills…). 27. The firm seeks to retain talents and the best professionals.	
Tec. Infra.	Physical Resources	28. The firm invests/takes notice in technology acquisition. 29. The firm's IT infrastructure and IT tools are able to support the development of innovation projects.	
	Infrastructures	30. The firm has facilities dedicated to innovation (such as design rooms, prototyping, …).	
Structure & Strategy			
Market	Market Innovativeness	31. The firm has systematic processes of market research to evaluate and comprehend the market's opportunities and necessities. 32. The firm implements new marketing methods to promote our products. 33. Innovation inside the firm is influenced by the external variables, as dynamism, hostility and heterogeneity of the market.	Likert Scale
	Technological Orientation	34. The firm is willing to spend significant resources to encourage R&D activities. 35. The firm puts high emphasis on new products development.	

		36. The firm emphasizes technological superiority to differentiate our new products and we are fast to adopt new technologies.	
	Innovation Strategy	37. Vision or mission of the firm includes a reference to innovation. 38. The firm has a well-articulated strategy for innovation. 39. Innovation engagement and outcomes are regular and consistent over time.	
	CRM	40. The firm proactively takes time to interact with clients to ensure satisfaction and be aware of their needs. 41. New ideas and feedbacks that come from customers are evaluated continuously, and the firm tries to include them into product development and innovation activities.	
Flexibility & Continuity	Planning	42. This firm can be described as flexible and continually adapting to change.	
	Business Models & Business Processes	43. There is a lot of administrative intensity in this firm. 44. The firm actively works to constantly adjust and improve its business processes and models.	
	Knowledge Management	45. The organization has efficient knowledge management structures and processes to generate, acquire, organize, and transfer knowledge.	
	Innovation Process	46. The firm works according to a documented and efficient innovation process. 47. The firm uses different techniques of creativity and idea generation. 48. The firm is successful in commercializing and institutionalizing new products.	

		49. The firm has well defined routines and methodologies for project management.	
Ecosystems			
Internal Engagement	Dynamics	50. The firm has platforms to promote interaction between employees/departments/subsidiaries (as internal intranet, internal "social network", etc). 51. The firm promotes several activities related to innovation (ex: bootcamps, ideas contest).	Likert Scale
	Incentives	52. The firm has specific reward programs for those who bring new ideas, either non-monetary rewards or financial rewards.	
	Communication	53. Communication is open and transparent. 54. The firm has an effective environment for collaboration and transference of knowledge within and between departments.	
External Engagement	Collaborations	55. The firm develops several collaborations with external partners (Universities, competitors, customers, etc) to promote innovation. 56. The knowledge acquired with external partners is easily transferred to the firm.	
	IPRs	57. The firm utilizes several times IPRs (copyrights, patents, trademarks, etc) and contracts on open innovation. 58. The existence of IPRs or contracts facilitates cooperation and the share of information with external partners. 59. The firm has specialized personal that has competences related with legal knowledge and IPRs.	
Performance			

Funds	60. The firm has a strategy to capture public funds. 61. Most of the public funds captured are national funds. 62. Most of the public funds captured are European or International funds.	No; Yes; I do not know
	63. Please state the public funds acceptance of the last 3 years. 64. Please state the percentage of public funds on total innovation investments.	Numeric values
Patents	65. Please state the number of patents granted in the last 3 years.	
	66. The firm takes advantage of the existing patents by generating income from them (example: selling, royalties, etc).	No; Yes; I do not know.
Results	67. On average, in the last 3 years, the percentage of products/services launched as "first-to-market" is higher than the percentage of products/services "new-to-firm". 68. In comparison with competitors, the firm has introduced more innovative products/services in the past 3 years.	
ROII	69. Please chose which of these metrics is normally used to measure innovation inside the firm.	List of options **
	70. Please state the amount of total sales in the last 3 years. 71. Please state the amount of sales from new products/services. 72. Please state the amount of R&D spending in the last 3 years. 73. Please state the amount of Total capital and operational investment in new products/services.	Numeric values

	74. Please state the number of Total ideas explored in the last 3 years. 75. Please state the number of Successful ideas in the last 3 years.	

*** Likert Scale:** Strongly disagree; Disagree; Neither agree nor disagree; Agree; Strongly agree.
**** Options:** Investment in R&D; ROI; ROII; Sales; I do not know; Others.

Annex II. Questionnaire Number 2

SGS Affiliate:
Your current job position in the firm:
Your department:

Culture			**Answer**
Innovation Prioritization	Openness	1. Innovation is one of the priorities of the firm. 2. The firm incentives regular meetings and everyone is incentivized to share their opinion and participate in the decisions. 3. The firm prefers the existence of open spaces to maximize interaction between employees. 4. Employees are allowed to have time dedicated only to innovation (ex: to work on their innovative ideas).	Likert scale
	Leadership	5. My manager fosters an environment of trust. 6. My manager continuously searches for new opportunities and focus resources on new projects/ innovation. 7. My manager leads employees to the right direction, instead of being too rigid and giving orders. Employees feel free to choose the methods to complete the given objectives. 8. My manager builds relationships with each member of his team and seek to know their individual needs. 9. My manager is able to communicate the future vision of the company and how to achieve it. 10. My manager tries to open the interests of the team and individuals and taking them out of their comfort zone.	
	Training	11. The firm incentives a learning culture and offers training programs.	

		12. Everyone in the firm is involved in training. 13. The firm offers special workshops and there is an expectation to develop new skills, capabilities and knowledge that is directed toward supporting innovation.	
Behavior	Cooperation and teamwork	14. Employees feel motivated to work in the organization. 15. There is an environment of cooperation in the organization and employees constantly share information and learn from one another. 16. Employees feel the support of managers and team members when working on innovation projects.	
	Risk taking	17. There is an understanding by the firm that mistakes will occur, and employees feel free to fail and take risks. 18. Failing is seen as a learning experience. The firm supports failure and employees are not penalized.	
Resources			
Competences	Human Capital	19. The firm's human capital policy is innovation-oriented (employees have know-how and experience working on innovation issues). 20. Personnel shortages does not inhibit innovation in this firm. 21. The firm has a defined recruitment process and targets employees that have innovation-levering characteristics (as creativity, eagerness to learn, adaptability to changes, collaboration skills…). 22. The firm seeks to retain talents and the best professionals.	Likert Scale
Tec. I	Physical Resources	23. The firm invests/takes notice in technology acquisition.	

		24. The firm's IT infrastructure and IT tools are able to support the development of innovation projects.	
	Infrastructures	25. The firm has facilities dedicated to innovation (such as design rooms, prototyping, …).	
Structure & Strategy			
Market	Market Innovativeness	26. The firm has systematic processes of market research to evaluate and comprehend the market's opportunities and necessities. 27. The firm implements new marketing methods to promote our products. 28. Innovation inside the firm is influenced by the external variables, as dynamism, hostility and heterogeneity of the market.	Likert Scale
	Technological Orientation	29. The firm is willing to spend significant resources to encourage R&D activities. 30. The firm puts high emphasis on new products development. 31. The firm emphasizes technological superiority to differentiate our new products and we are fast to adopt new technologies.	
	Innovation Strategy	32. Vision or mission of the firm includes a reference to innovation. 33. The firm has a well-articulated strategy for innovation. 34. Innovation engagement and outcomes are regular and consistent over time.	
CRM		35. The firm proactively takes time to interact with clients to ensure satisfaction and be aware of their needs. 36. New ideas and feedbacks that come from customers are evaluated continuously, and the	

		firm tries to include them into product development and innovation activities.	
Flexibility & Continuity	Planning	37. This firm can be described as flexible and continually adapting to change.	
	Business Models & Business Processes	38. There is a lot of administrative intensity in this firm. 39. The firm actively works to constantly adjust and improve its business processes and models.	
	Knowledge Management	40. The organization has efficient knowledge management structures and processes to generate, acquire, organize, and transfer knowledge.	
	Innovation Process	41. The firm works according to a documented and efficient innovation process. 42. The firm uses different techniques of creativity and idea generation. 43. The firm is successful in commercializing and institutionalizing new products. 44. The firm has well defined routines and methodologies for project management.	
Ecosystems			
Internal Engagement	Dynamics	45. The firm has platforms to promote interaction between employees/departments/subsidiaries (as internal intranet, internal "social network", etc). 46. The firm promotes several activities related to innovation (ex: bootcamps, ideas contest).	Likert Scale
	Incentives	47. The firm has specific reward programs for those who bring new ideas, either non-monetary rewards or financial rewards.	
	Communication	48. Communication is open and transparent.	

		49. The firm has an effective environment for collaboration and transference of knowledge within and between departments.	
External Engagement	Collaborations	50. The firm develops several collaborations with external partners (Universities, competitors, customers, etc) to promote innovation. 51. The knowledge acquired with external partners is easily transferred to the firm.	
	IPRs	52. The firm utilizes several times IPRs (copyrights, patents, trademarks, etc) and contracts on open innovation. 53. The existence of IPRs or contracts facilitates cooperation and the share of information with external partners. 54. The firm has specialized personal that has competences related with legal knowledge and IPRs.	

Annex III. Questionnaire Number 1 – Suggestion of refinement

SGS Affiliate:
Your current job position in the firm:
Your department:
How many levels are you bellow the CEO?

Culture			**Answer**
Innovation Prioritization	Openness	1. Innovation is one of the priorities of the firm. 2. The firm/group incentives regular meetings and everyone is incentivized to share their opinion and participate in the decisions. 3. Employees are allowed to have time dedicated only to innovation (ex: to work on their innovative ideas).	4-points Likert scale + I do not know
	Leadership	4. Managers continuously search for new opportunities and focus resources on new projects/ innovation. 5. Managers lead employees to the right direction, instead of being too rigid and giving orders. Employees feel free to choose the methods to complete the given objectives. 6. Managers build relationships with each member of their team and seek to know their individual needs. 7. Managers try to open the interests of the team and individuals and taking them out of their comfort zone.	
	Training	8. The firm/group incentivizes a learning culture and offers training programs and special workshops and there is an expectation to develop new skills, capabilities and knowledge. 9. Everyone in the firm/group is involved in training.	

Behavior	Cooperation and teamwork	10. Employees feel motivated to work in the firm/group. 11. There is an environment of cooperation in the firm/group and employees constantly share information and learn from one another.	
	Risk taking	12. There is an understanding by the firm/group that mistakes will occur, and employees feel free to fail and take risks. 13. Failing is seen as a learning experience. The firm/group supports failure and employees are alerted but not penalized.	
Resources			
Competences	Internal Expertise	14. Estimate percentage of people working on innovation related issues.	Numeric value
		15. Does the firm/group have an innovation team? 16. Does the firm/group have employees dedicated to R&D practices?	No; Yes; I do not know
		17. There is heterogeneity in the composition of teams (in terms of experience, cultural background, interdisciplinary…).	4-points Likert scale + I do not know
	Human Capital	18. Most of the firm's/group's personnel have higher education degrees. 19. The firm's/group's human capital policy is innovation-oriented (employees have know-how and experience working on innovation issues). 20. Personnel shortages do not inhibit innovation in this firm/group. 21. The firm/group has a defined recruitment process and targets employees that have innovation-levering characteristics (as creativity, eagerness to learn, adaptability to changes, collaboration skills…).	

		22. The firm/group seeks to retain talents and the best professionals.	
Tec. Infra.	Physical Resources	23. The firm/group invests/takes notice in technology acquisition. 24. The firm's/group's IT infrastructure and IT tools are able to support the development of innovation projects.	
	Infrastructures	25. The firm/group has facilities dedicated to innovation (such as design rooms, prototyping, …).	
Structure & Strategy			
Market	Market Innovativeness	26. The firm/group has systematic processes of market research to evaluate and comprehend the market's opportunities and necessities. 27. Innovation inside the firm/group is influenced by the external variables, as dynamism, hostility and heterogeneity of the market.	4-points Likert scale + I do not know
	Technological Orientation	28. The firm/group is willing to spend significant resources to encourage R&D activities and new products development. 29. The firm emphasizes technological superiority to differentiate our new products and we are fast to adopt new technologies.	
	Innovation Strategy	30. Vision or mission of the firm includes a reference to innovation. 31. The firm has a well-articulated strategy for innovation. 32. Innovation engagement and outcomes are regular and consistent over time.	
CRM		33. The firm proactively takes time to interact with clients to ensure satisfaction and be aware of their needs.	

		34. New ideas and feedbacks that come from customers are evaluated continuously, and the firm tries to include them into product development and innovation activities.	
Flexibility & Continuity	Planning	35. This firm can be described as flexible and continually adapting to change.	
	Business Models & Business Processes	36. There is a lot of administrative intensity in this firm. 37. The firm/group actively works to constantly adjust and improve its business processes and models.	
	Knowledge Management	38. The firm/group has efficient knowledge management structures and processes to generate, acquire, organize, and transfer knowledge.	
	Innovation Process	39. The firm/group works according to a documented and efficient innovation process. 40. The firm/group is successful in commercializing and institutionalizing new products. 41. The firm/group has well defined routines and methodologies for project management.	
Ecosystems			
Internal Engagement	Dynamics	42. The firm/group has platforms to promote interaction between employees/departments/subsidiaries (as internal intranet, internal "social network", etc) and they are efficient. 43. The firm/group promotes several activities related to innovation (ex: bootcamps, ideas contest) and they are efficient.	4-points Likert scale + I do not know
	Incentives	44. The firm/group has specific reward programs for those who bring new ideas, either non-	

		monetary rewards or financial rewards, and they are efficient.	
	Communication	45. Communication is open and transparent.	
External Engagement	Collaborations	46. The firm/group develops several collaborations with external partners (Universities, competitors, customers, etc) to promote innovation. 47. The knowledge acquired with external partners is easily transferred to the firm.	
	IPRs	48. The firm/group utilizes several times IPRs – Intellectual Property Rights - (copyrights, patents, trademarks, etc) and contracts on open innovation. 49. The firm/group has specialized personal that has competences related with legal knowledge and IPRs - Intellectual Property Rights.	
Performance			
Funds		50. The firm/group has a strategy to capture public funds.	No; Yes; I do not know
Patents		51. The firm/group takes advantage of the existing patents by generating income from them (example: selling, royalties, etc).	
Results		52. In comparison with competitors, the firm/group has introduced more innovative products/services in the past 3 years.	
		53. Please chose which of these metrics is normally used to measure innovation inside the firm.	List of options *

*** Options:** Investment in R&D; ROI; ROII; Sales; I do not know; Other.

Annex IV. Questionnaire Number 2 – Suggestion of refinement

SGS Affiliate:
Your current job position in the firm:
Your department:
How long have you been reporting to your current manager?

Culture			**Answer**
Innovation Prioritization	Openness	1. Innovation is one of the priorities of the firm. 2. The firm/group incentives regular meetings and everyone is incentivized to share their opinion and participate in the decisions. 3. Employees are allowed to have time dedicated only to innovation (ex: to work on their innovative ideas).	4-points Likert scale + I do not know
	Leadership	4. My manager continuously searches for new opportunities and focus resources on new projects/ innovation. 5. My manager leads employees to the right direction, instead of being too rigid and giving orders. Employees feel free to choose the methods to complete the given objectives. 6. My manager builds relationships with each member of their team and seek to know their individual needs. 7. My manager tries to open the interests of the team and individuals and taking them out of their comfort zone.	
	Training	8. The firm/group incentivizes a learning culture and offers training programs and special workshops and there is an expectation to develop new skills, capabilities and knowledge. 9. Everyone in the firm/group is involved in training.	

Behavior	Cooperation and teamwork	10. Employees feel motivated to work in the firm/group. 11. There is an environment of cooperation in the firm/group and employees constantly share information and learn from one another.	
	Risk taking	12. There is an understanding by the firm/group that mistakes will occur, and employees feel free to fail and take risks. 13. Failing is seen as a learning experience. The firm/group supports failure and employees are alerted but not penalized.	
Resources			
Competences	Human Capital	14. The firm's/group's human capital policy is innovation-oriented (employees have know-how and experience working on innovation issues). 15. Personnel shortages do not inhibit innovation in this firm/group. 16. The firm/group has a defined recruitment process and targets employees that have innovation-levering characteristics (as creativity, eagerness to learn, adaptability to changes, collaboration skills…). 17. The firm/group seeks to retain talents and the best professionals.	4-points Likert scale + I do not know
Tec. Infra.	Physical Resources	18. The firm/group invests/takes notice in technology acquisition. 19. The firm's/group's IT infrastructure and IT tools are able to support the development of innovation projects.	
	Infrastructures	20. The firm/group has facilities dedicated to innovation (such as design rooms, prototyping, …).	

Structure & Strategy			
Market	Market Innovativeness	21. The firm/group has systematic processes of market research to evaluate and comprehend the market's opportunities and necessities. 22. Innovation inside the firm/group is influenced by the external variables, as dynamism, hostility and heterogeneity of the market.	4-points Likert scale + I do not know
	Technological Orientation	23. The firm/group is willing to spend significant resources to encourage R&D activities and new products development. 24. The firm emphasizes technological superiority to differentiate our new products and we are fast to adopt new technologies.	
	Innovation Strategy	25. Vision or mission of the firm includes a reference to innovation. 26. The firm has a well-articulated strategy for innovation. 27. Innovation engagement and outcomes are regular and consistent over time.	
CRM		28. The firm proactively takes time to interact with clients to ensure satisfaction and be aware of their needs. 29. New ideas and feedbacks that come from customers are evaluated continuously, and the firm tries to include them into product development and innovation activities.	
Flexibility & Continuity	Planning	30. This firm can be described as flexible and continually adapting to change.	
	Business Models & Business Processes	31. There is a lot of administrative intensity in this firm. 32. The firm/group actively works to constantly adjust and improve its business processes and models.	

	Knowledge Management	33. The firm/group has efficient knowledge management structures and processes to generate, acquire, organize, and transfer knowledge.	
	Innovation Process	34. The firm/group works according to a documented and efficient innovation process. 35. The firm/group is successful in commercializing and institutionalizing new products. 36. The firm/group has well defined routines and methodologies for project management.	
Ecosystems			
Internal Engagement	Dynamics	37. The firm/group has platforms to promote interaction between employees/departments/subsidiaries (as internal intranet, internal "social network", etc) and they are efficient. 38. The firm/group promotes several activities related to innovation (ex: bootcamps, ideas contest) and they are efficient.	4-points Likert scale + I do not know
	Incentives	39. The firm/group has specific reward programs for those who bring new ideas, either non-monetary rewards or financial rewards, and they are efficient.	
	Communication	40. Communication is open and transparent.	
External Engagement	Collaborations	41. The firm/group develops several collaborations with external partners (Universities, competitors, customers, etc) to promote innovation. 42. The knowledge acquired with external partners is easily transferred to the firm.	

	IPRs	43. The firm/group utilizes several times IPRs – Intellectual Property Rights - (copyrights, patents, trademarks, etc) and contracts on open innovation. 44. The firm/group has specialized personal that has competences related with legal knowledge and IPRs - Intellectual Property Rights.	