

Validation of a participant selection method within a mixed sequential research design for case studies of sustainable supply chains*

Validación de un método de selección de participantes dentro de un diseño de investigación mixta secuencial para estudios de caso de cadena de suministro sostenible

Validação de um método de seleção de participantes em um delineamento de pesquisa mista sequencial para estudos de caso de cadeias de suprimentos sustentáveis

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Abstract:

This research addresses the scarcity of literature on participant selection for the qualitative phase in a mixed Sequential Explanatory Design (DEXPLIS) in the field of sustainable supply chain management (SSCM). The Pathway participant selection method is applied and validated within DEXPLIS to investigate the influence of integration with secondary stakeholders on the implementation of advanced SSCM practices in Colombian Small and Medium-sized Enterprises (SMEs). The Pathway method selects “precise” cases (SMEs) with a greater influence of the independent variable on the dependent variable. Experts validate and prioritize the selected cases based on defined criteria. The results demonstrate the applicability and relevance of DEXPLIS and Pathway for SSCM studies.

JEL Codes: J21, M14.

Keywords: Mixed methods research, participant selection, case study, sustainable supply chain management.

Resumen:

Esta investigación aborda la escasez de literatura sobre la selección de participantes para la fase cualitativa en un Diseño Explicativo Secuencial (DEXPLIS) mixto en el campo de la gestión de cadenas de suministro sostenible (SSCM por sus siglas en inglés). Se aplica y valida el método de selección de participantes Pathway dentro de DEXPLIS para investigar la influencia de la integración con partes interesadas secundarias en la implementación de prácticas avanzadas de SSCM en pequeñas y medianas empresas (pymes) de Colombia. El método Pathway selecciona casos “precisos” (pymes) con una mayor influencia de la variable independiente sobre la dependiente. Expertos validan y priorizan los casos seleccionados según criterios definidos. Los resultados demuestran la aplicabilidad y pertinencia de DEXPLIS y Pathway para estudios en SSCM.

Códigos JEL: J21, M14.

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Palabras clave: Métodos mixtos de investigación, selección de participantes, estudio de caso, gestión de la cadena de suministro sostenible.

Resumo:

Esta pesquisa aborda a escassez de literatura sobre a seleção de participantes para a fase qualitativa em uma Abordagem Sequencial de Projeto Explicativo Misto (DEXPLIS) no campo da gestão sustentável da cadeia de suprimentos (SSCM, por sua sigla em inglês). O método Pathway de seleção de participantes no DEXPLIS é aplicado e validado para investigar a influência da integração com partes interessadas secundárias na implementação de práticas avançadas de SSCM em pequenas e médias empresas (PMEs) na Colômbia. O método Pathway seleciona casos “precisos” (PMEs) com maior influência da variável independente sobre a variável dependente. Especialistas validam e priorizam os casos selecionados de acordo com critérios definidos. Os resultados demonstram a aplicabilidade e a relevância do DEXPLIS e do Pathway para estudos de SSCM.

Códigos JEL: J21, M14.

Palavras-chave: Pesquisa de métodos mistos, seleção de participantes, estudo de caso, gestão sustentável da cadeia de suprimentos.

Introduction

The incorporation of environmental concerns into supply chain management has been addressed in Green Supply Chain Management (GSCM) studies. With the additional incorporation of the social dimension of sustainability, this field has been extended to Sustainable Supply Chain Management (SSCM), with a notable growth in SSCM-published articles since 2007 (Ansari & Kant, 2017). However, since SSCM can still be considered an emerging theory, appropriate methodological tools to address its interdisciplinary nature have yet to be fully developed (Min & Kim, 2012).

Previous works in the literature show the importance of multidisciplinary or interdisciplinary approaches in SSCM (Bag & Anand, 2016; D'Eusanio et al., 2019; Kaufman & Ülkü, 2018). Hence, there is a need to study SSCM problems with different tools from those commonly used in quantitative research (e.g., optimization), such as case studies (Gerring, 2017), which are complementary research approaches (Dubey et al., 2017a). In fact, case study research in SSCM has intensified recently (e.g., Prasad et al., 2018; Zhou et al., 2018).

Several authors suggest that the case study is one of the fundamental methods for research in GSCM or SSCM. For instance, Srivastava (2007) and Malviya and Kan (2015) propose the case study as one of the approaches to be used in GSCM. Similarly, Carter and Easton (2011) and Seuring (2011) suggest case study research as a fundamental approach for SSCM, supported by a broad body of literature (Khalid et al., 2015; Singh & Trivedi, 2016; Winter & Knemeyer, 2013).

Case studies can be immersed in several types of research designs, such as mixed designs (Guetterman et al., 2015) and, especially for the purposes of this paper, explanatory sequential designs (ESD) (Creswell & Plano Clark, 2017). In this type of mixed research design, knowing which participants should be involved in the study and how they are selected is relevant. However, few studies explain this process with some level of detail (e.g., Ivankova et al., 2006).

According to Ansari and Kant (2017), one of the most used methodologies in articles on SSCM is the case study (with 100 articles out of 286 analyzed), followed by conceptual models, survey-based studies, and mathematical modeling. Most case studies have no previous research hypothesis because they are qualitative exploratory or descriptive research (Levy, 2008; Yin, 2017), whose purpose is generally to use their results as a basis for future research (Ansari & Kant, 2017). In this regard, Seuring (2008) suggests that applying case studies in SSCM research often lacks methodological rigor.

SSCM research that considers a mixed research design or empirical triangulation (e.g., data collection and analysis by qualitative and quantitative methods in the same study) is minimal (4,20 %) (Ansari & Kant, 2017). Likewise, the use of the triangulation approach in GSCM studies is limited; therefore, it is an area that requires significant attention (Dubey et al., 2017b). There is a growing need to apply mixed

research methodologies (e.g., a mixture of case studies with analytical methods) that increase the advantages of research tools (Min & Kim, 2012) and encompass interdisciplinary sustainable supply chain approaches (Kaufman & Ülki, 2018).

Meanwhile, other research areas have shown an increased interest in mixed methods research, particularly explanatory sequential designs. Researchers in areas such as nursing (Apaydin Cirik et al., 2022; Donate-Manzanares et al., 2021), medicine (Bults et al., 2022; Romo-Cabrera & Agudelo-Suárez, 2022; Yam et al., 2020), and pharmacy (Hadi & Closs, 2016) have applied this specific design to understand healthcare workers' professional experiences and professional development, among other topics. In areas such as psychology (Baştemur & Uçar, 2022), education (Ghods et al., 2023; Suizzo et al., 2016), and management (Muller & Pelsler, 2022), researchers have used the explanatory sequential design with diverse purposes, from understanding academic burnout in students to examining the characteristics of effective psychological counselors. Finally, studies in the environmental (Bueddefeld et al., 2021), family (Gungordu et al., 2022), and social sciences (Hughes et al., 2021; Tandoc et al., 2020) have incorporated explanatory sequential designs (ESD) into their research agendas as well.

In response to the recognition of the need for more guidelines on how researchers should select cases within an ESD (i.e., Ivankova et al., 2006; Ivankova & Stick, 2007), the literature has been recently exploring the methodological aspects of ESD. For example, McCrudden and McTigue (2019) integrated both quantitative and qualitative approaches at different levels (method, study, interpretation, and reporting) while studying the judgments made by adolescents regarding scientific arguments related to beliefs and the underlying rationales for those judgments. In a similar vein, Draucker et al. (2020) integrated both approaches into a five-step process to study lung cancer screening.

Other studies expanded the traditional two phases of the explanatory sequential designs (i.e., quantitative and qualitative) and added a third phase. Framed in the paradigm of community-based participatory research, Maleku et al. (2021) added a third phase in which voices of African refugee communities were considered to start a cycle of dissemination and action that brings about transformation in those communities. Similarly, Haynes-Brown (2022) added a phase to draw meta-inferences from the quantitative and qualitative findings. In this way, the authors integrated this new phase into a theoretical model to better understand how beliefs influence the utilization of technology in the classroom.

As these previous examples have shown, an opportunity to apply the exploratory sequential design in studies of GSCM and SSCM emerges. As mentioned by Ayati et al. (2022), mixed methodologies in supply chain management studies, such as exploratory (e.g., Faisal, 2023) or explanatory (e.g., Angeles et al., 2019) sequential designs, are potentially helpful in gaining insights into the participant selection process. However, in the framework of SSCM studies, the literature on case selection procedures for the qualitative phase within an ESD is scarce. From a methodological perspective, the level of detail provided needs to be increased.

As James et al. (2022) suggest, further research is required to explore the methodological considerations in which the quantitative findings lead to the selection of qualitative sampling criteria in explanatory sequential designs. Following this advice, this research seeks better specification in the necessary procedures for an ESD to guarantee a more reliable method for participant selection in GSCM and SSCM case studies. In this way, this paper applies and validates a participant selection method in an ESD for Small and Medium-sized Enterprises (SMEs).

Theoretical framework and problem statement

In the last two decades, research on sustainable supply chain management has grown and gone from being a fringe topic to one within the mainstream of supply chain management (Allen et al., 2021). However, there are still abundant research opportunities in various branches of SSCM (Carter et al., 2019).

Globally, more than 90 percent of the impacts on natural resources and more than 80 percent of greenhouse gas emissions are produced by supply chain management activities (Bové & Swartz, 2016). If these and other environmental and social issues are not adequately addressed, they can have serious global consequences (Ripple et al., 2020). Furthermore, this can damage a focal company's relationships with its stakeholders, inside or outside the supply chain (Esty & Winston, 2006; Pagell & Wu, 2009).

Sustainable Supply Chain Management (SSCM) was developed to counteract those issues. SSCM is defined as the management of information, materials, and capital flows, having the objectives of the three dimensions of sustainability in mind, through collaboration between companies in the supply chain, without forgetting the requirements of other interested parties (Seuring & Müller, 2008, p. 1700). The most applied organizational theories in SSCM studies are the natural-resource-based view of the firm (RBV), stakeholder theory, institutional theory, and transaction cost theory (Touboulis & Walker, 2015). Carter and Easton (2011) defend the combination of multiple theoretical perspectives to offer original ideas in the field of SSCM.

It is crucial to note that implementing SSCM or GSCM practices can significantly and positively affect the companies' performance and sustainability indicators (Hong et al., 2018). Especially the implementation of SSCM practices triggers greater efficiency and innovation (Ageron et al., 2012) and improves economic performance and business transaction costs (Um & Kim, 2018). Furthermore, SSCM social practices can also positively affect competitive advantage and corporate reputation in the market (Chacón-Vargas et al., 2018; Zailani et al., 2012).

However, most companies and their supply chain strategies do not attach the same level of importance to the three dimensions of sustainability (also called triple bottom line –TBL–). Besides, these three dimensions are not fully incorporated into the core business either (Carter & Rogers, 2008). This is mainly because most companies, and researchers on SSCM, have focused on making unsustainable supply chains more sustainable rather than pursuing a “truly” sustainable supply chain management (Pagell & Shevchenko, 2014).

Additionally, many studies in SSCM have neglected smaller companies, some of which could radically rethink their sustainability strategy. One of the critical organizational capabilities to achieve this rethinking is integration with external or non-economic stakeholders, called external secondary stakeholders (ESS). According to various researchers, such integration can influence the development of social or environmental practices (Aschehoug et al., 2012; Beske et al., 2014; Buysse & Verbeke, 2003; Hart & Dowell, 2011; Hart, 1995), either with a focus on incremental innovation or disruptive innovation (Klewitz & Hansen, 2014). In this sense, disruptive innovation deals with radical practices that break the barriers of incremental innovations, cost reduction, or the search for eco-efficiencies to make a leap from existing practices within the organization that implements them.

A specific problem of recent interest in this literature is analyzing how stakeholders with non-economic objectives are enablers in deploying disruptive or –from now on– ‘advanced’ SSCM practices in SMEs (Pagell & Shevchenko, 2014). For example, an advanced environmental practice is the design of a closed-loop supply chain (circular economy), while an advanced social practice is to guarantee all ‘fair trade’ conditions in the supply chain (Marshall et al., 2015). More recently, Koberg and Longoni (2019) have shown that collaboration with these third-party actors is emerging in the research on SSCM, focusing on sustainability outcomes in all three sustainability dimensions.

Finding a niche in this relevant field of research, an application and validation of the participant selection method were conducted in this study. This is achieved through the use of the explanatory sequential design in a case study that investigates how the integration of Colombian SMEs with external secondary stakeholders (ESS) (e.g., NGOs, governmental organizations, the base of the pyramid, and universities) influences the development of disruptive socio-environmental practices deployed inside and outside of their supply chains. The participant selection method was depicted within a multiple case study of a diagnostic, explanatory type (Gerring, 2017). As previously stated, selecting relevant cases during this first stage of the mixed study is

crucial to allow for a better understanding of the phenomenon under study during the qualitative stage of the mixed research.

On the other hand, based on the analysis of the extant literature on mixed research methodologies (e.g., Creswell & Plano Clark, 2017; Hlebec & Mrzel, 2012; Ivankova & Stick, 2007; Hernández-Sampieri & Mendoza, 2018), it was found that mixed methodologies are not sufficiently detailed in terms of the procedure for participant selection in the explanatory sequential design (ESD). That is, most of this methodological literature does not delve into the issue of how to choose the participants or define the qualitative sample using data from a previous quantitative phase. Ivankova et al. (2006) suggest that better guidelines should be written on selecting cases within an ESD methodology. Some empirical studies applying ESD use deliberate sampling for the qualitative phase (e.g., Campbell & Profetto-Mcgrath, 2013; Schindler & Burkholder, 2016). For example, these studies chose participants with the highest scores on some variables from the quantitative results but without sufficient methodical treatment.

Therefore, this study addresses a significant research gap within the SSCM academic community by proposing a rigorous method for selecting cases in qualitative studies from quantitative data previously collected in the same mixed research.

Context for approaching the participant selection method

Since it is an area of interest in the literature, the integration between non-economic stakeholders and focal companies in SSCM research needs to be validated in the context of SMEs through a multiple case study in an emerging economy such as the Colombian one. Hence, a mixed research methodology called Explanatory Sequential Design (Participant Selection model) is proposed to address this research problem (Hernández-Sampieri et al., 2014).

The ESD consists of two major phases. The first phase is the data collection through a quantitative, non-experimental phase, with an explanatory scope and transversal temporality (Creswell, 2012). The second phase is the collection and evaluation of qualitative data (Creswell & Plano Clark, 2017). According to Creswell and colleagues (Creswell & Creswell, 2018; Creswell et al., 2003; Creswell & Plano Clark, 2017), this is a method characterized by successive stages so that the quantitative data collected and analyzed in the first stage can be used to improve the qualitative data collection and analysis of the second stage.

Figure 1 shows the eight stages involved in this method. The cases are characterized according to certain features of interest related to the problem (Creswell & Plano Clark, 2017). Thus, SMEs are selected quantitatively because they meet the two related variables of the problem at a high level: the extent of integration with external secondary stakeholders (X) and the extent of deployment of innovative SSCM practices (Y). They are selected because there is quantitative evidence of greater influence of X on Y in those companies than in the other surveyed companies.

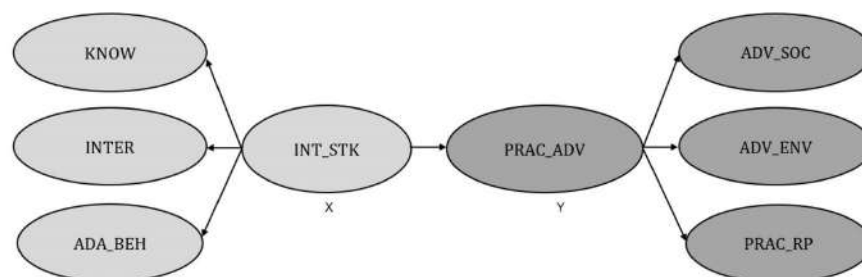


FIGURE 1
Explanatory Sequential Design - Participant selection model
Source: Creswell & Plano Clark (2017).

Seawright and Gerring (2008) offer seven techniques for case selection in situations where data are available in a large sample and associated with key variables: typical, diverse, extreme, deviant, influential, most similar,

and most different cases. Based on this typology, the Typical case is considered for this research since it intends to explore the causal mechanisms of the general relationship in depth. Gerring (2017) deepens this case selection technique and develops a more detailed classification. In his classification, a Pathway case is considered the typical case in the framework of a multiple case study of the causal and diagnostic type. In the Pathway case, the apparent impact of the causal relationship $X \rightarrow Y$ is adjusted to theoretical expectations and is stronger in magnitude. At the same time, background factors (Z) exert a “conservative” bias.

Consequently, a procedure for the participants’ selection phase is established. This procedure can be classified as sequential and convenience sampling to achieve comparability (Tashakkori & Teddlie, 2010). Specifically, the procedure is a typical case sampling using the Pathway strategy to choose the “ideal” participants for a multiple case study of causal and diagnostic types (Gerring, 2017).

Methodology

This section shows how the quantitative and qualitative phases of the explanatory sequential design are conducted. Then, the procedure for selecting participants is detailed.

Quantitative phase

Data were collected through an online survey strategy, with a questionnaire based on empirical survey research. Five experts pre-evaluated the survey’s content validity, and it was pre-tested in a convenience sample taken from the Directory of Exporting and Importing SMEs in Colombia. Afterward, the number of items in the original questionnaire was reduced from 65 to 50. The two operationalized theoretical dimensions were ‘advanced SSCM practices’ (Marshall et al., 2015) and ‘integration with stakeholders’ (Plaza-Úbeda et al., 2010). Subsequently, the final questionnaire was applied to managers of Colombian SMEs from a sampling frame of 1,300 companies. These companies, which were involved in knowledge transfer activities with varied stakeholders, were identified through the National Association of Industrial, Administrative, and Production Engineering Students (ANEIAP).

From the collected data, missing cases and outliers were treated accordingly (Hair et al., 2010). Then, an Exploratory Factor Analysis (EFA) was performed with the Varimax rotation method. Later, Confirmatory Factor Analysis (CFA) suggested eliminating nine items to achieve better goodness of fit. This exercise provided a final sample of 100 SMEs, corresponding to a 7,7 % response rate. The sample was composed of 60 small and 40 medium-sized companies. In terms of sectors, 43 SMEs belong to the manufacturing sector, 39 to the service sector, and the remaining 18 to other activities.

The EFA validated the multidimensional construct of integration of stakeholders, consisting of three dimensions: knowledge of interested parties and their demands (KNOW), interaction with external actors (INTER), and adaptive behavior (ADA_BEH). These dimensions are crucial to integrating interested parties in corporate sustainable management.

Specifically, the first variable (KNOW) implies receiving and interpreting information and sustainability expectations from the stakeholder by comparing internal and external knowledge (Aschehoug et al., 2012). The second dimension (INTER) incorporates activities such as meetings with the stakeholders, consulting them before making decisions, and devoting time and resources to the relationship with them (Plaza-Úbeda et al., 2010). The third dimension, adaptive behavior (ADA_BEH), refers to applying changes in the behavior of the company to satisfy the demands of its interest groups (Maignan & Ferrell, 2004), either by adapting policies, strategies, or activities to further the integration with the stakeholder (Plaza-Úbeda et al., 2010).

Advanced sustainable practices (PRAC_ADV) involve a redefinition of the supply chain strategy and a more radical than incremental, sustainable innovation. These practices have been traditionally less studied

in the empirical literature (Pagell & Shevchenko, 2014). For this reason, the results were rather different compared to the reference model predicted by Marshall et al. (2015). Consequently, the factors associated with advanced sustainable practices were modified into three factors.

The first one, ‘advanced social practices’ (ADV_SOC), implies designing practices that not only consider reducing costs or environmental impacts. This factor goes beyond incremental changes in their green strategies and proposes disruptive practices throughout the entire supply chain. The second factor, ‘advanced environmental practices’ (ADV_ENV), is based on previous literature (Kearins et al., 2010; Klewitz & Hansen, 2014; Marshall et al., 2015; Pagell & Wu, 2009; Rothenberg, 2007) and was operationalized through items that materialize the concepts of circular economy (both for the industrial cycle and the natural cycle), biomimicry, servicizing, and “decommoditization.”

Finally, the third factor is related to ‘product responsibility practices’ (PRAC_RP), which are divided into five key elements for the focal company (Chacón-Vargas et al., 2018): First, establishing quality relationships and a fair price for its clients; second, providing quick and respectful responses to customers’ concerns; third, offering customers transparent promotions; fourth, providing complete and accurate information about the company’s products or services and their impacts; and the final key element is striving for total customer satisfaction (Ağan et al., 2016; Govindan et al., 2018; Shafiq et al., 2014).

Figure 2 classifies the latent factors of the integrated model according to whether they are first or second-order variables in the model, which then serve as the basis for selecting participants. The operationalized variables shown in Figure 2 serve as input for the participant selection procedure that will be detailed later. Observed variables are not shown in the figure.

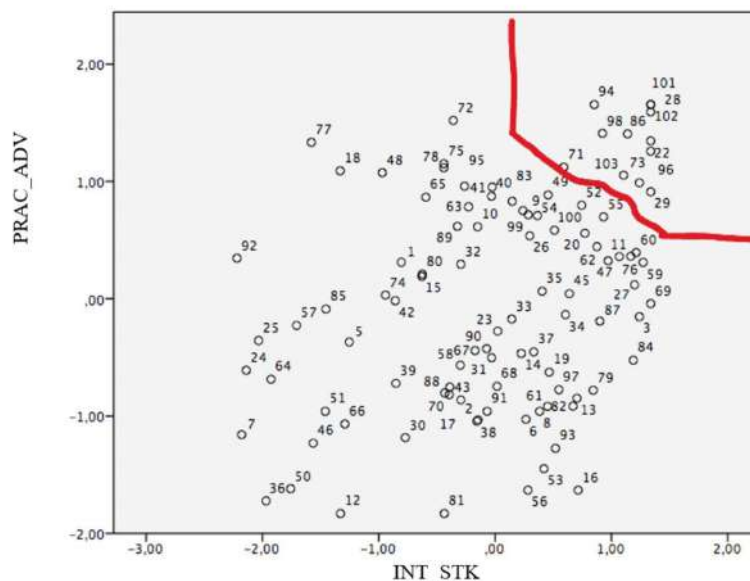


FIGURE 2

Factors used in the participant selection procedure

Source: Own elaboration.

Qualitative phase

After the participant selection procedure (see in the following section), the qualitative phase consisted of a multiple case study (Yin, 2017). The case study was classified as explanatory, causal, and diagnostic. It aimed to investigate the causal mechanisms that connect the relationship of the phenomenon $X \rightarrow Y$ (Gerring, 2017), where X is the integration with stakeholders with non-economic objectives (INT_STK), and Y is the deployment of advanced sustainable practices (PRAC_ADV). These advanced practices may involve a redefinition of the supply chain sustainability strategy and more radical than incremental, sustainable innovation. The primary data collection tools were semi-structured interviews and non-participant observation. The data collected were systematized and studied through detailed content analysis (Saldaña, 2013). The analysis strategy consists of theoretical propositions, and the analysis technique is explanation building (Yin, 2017).

Participant selection method

In the first place, the chosen method sought to select those SMEs that offer evidence of above-average performance in the study’s main variables: 1) the deployment of sustainable advance practices of SSCM, and 2) the effective integration with external secondary stakeholders. The selection of these companies as cases in the case study should offer sufficient evidence within each case and represent importance for the academic community. Moreover, they should prove to be a Pathway case type (Gerring, 2017). In the Pathway case, the result score (Y) is strongly influenced by the theoretical variable of interest (X), considering other factors (Z). Therefore, it should be easier to “observe” the causal mechanisms between X and Y in this case type. The equations proposed by Gerring (2017) served to select the Pathway cases. These cases have the greater absolute value for the difference between the residual for the minimum specification (Equation (1)) and the residual for the complete specification (Equation (2)), as follows:

$$Y = Z + \epsilon_1 \quad (\text{minimum specification}) \quad (1)$$

$$Y = Z + X + \epsilon_2 \quad (\text{complete specification}) \quad (2)$$

$$\text{Pathway} = |\epsilon_1 - \epsilon_2|, \text{ if } |\epsilon_1| > |\epsilon_2| \quad (\# \text{ Residual}) \quad (3)$$

Using the resulting data from the quantitative phase and after applying the modifications derived from the EFA and CFA, LISREL® was used to calculate the Latent Variable Scores (LVS) for the first- and second-order variables (Marsh et al., 2013; Schumacker & Lomax, 2010). The values obtained were standardized (i.e., mean of zero and standard deviation of one). With these data, a column was created for the residuals of the minimum specification using Equation (1). For doing this, the variables defined as Z were: 1) the number of employees (LN_EMP), 2) if the company had any quality or environmental management certifications (CERTIF), and 3) its economic sector (SECTOR). The standardized residual of this regression is defined as ZRE_1.

Then, another column was created for the residuals of the complete specification using Equation (2). The standardized residual of this second regression is ZRE_2. Finally, a column was created for the Pathway variable using Equation (3) (i.e., the absolute value of the difference between standardized residuals), ordered from the highest to the lowest values and with a threshold greater or equal to 0.4.

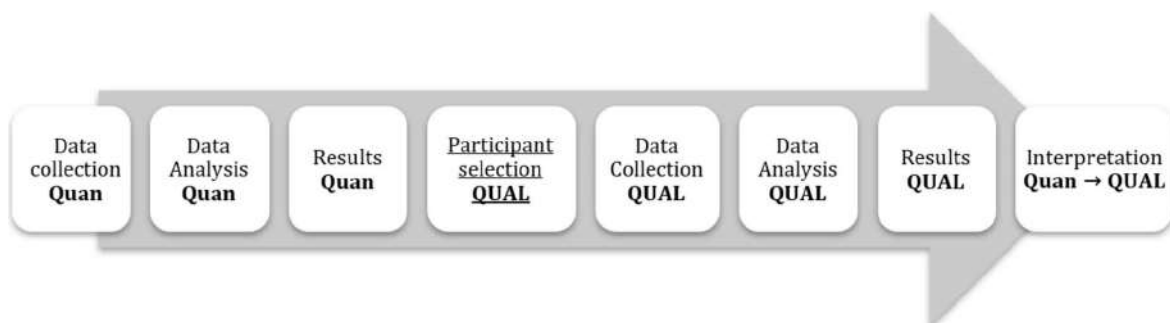


Figure 3

Scatter plot for second-order linear regression model (INT_STK→PRAC_ADV)

Source: Own elaboration.

Application and validation of the participant selection procedure

Applying the procedure proposed in Gerring (2017), and once the Δ s of the residuals from the linear regressions were calculated, a scatter plot comparing the two variables of the model (X and Y) was depicted (Figure 3). After that, three additional linear regressions were generated, one for each first-order dependent variable (ADV_SOC, ADV_ENV, PRAC_RP) vs. the second-order independent variable (INT_STK).

The obtained graphs were analyzed to find those cases that showed higher integration with ESS (INT_STK) and higher development of advanced practices (PRAC_ADV) simultaneously. These cases were found in the upper right corner of the Scatter Plot (Figure 3). Additionally, cases were selected to exceed the predefined Pathway threshold ($\geq 0,4$). In short, it is a requirement to be preselected that the case should appear 1) in the upper right corner (Figure 3), 2) in the second-order linear regression model, and 3) at least in one of the other three first-order models. The last column of Table 1 shows the obtained preselected participants from the Pathway procedure.

TABLE 1
Preselected cases from linear regressions developed through the Pathway strategy

Cases with Pathway (residual $\Delta \geq 0,4$ at the four linear regressions)					Preselected cases
INT_STK-PRAC_ADV	Upper right corner - scatter Plot	INT_STK-PRAC_RP	INT_STK-ADV_ENV	INT_STK-ADV_SOC	
103	103	X	X		103
102	102	X	X	X	102
101	101	X	X		101
94	94	X			94
86	86	X	X	X	86
73	73	X			73
98	98	X	X		98
29	29	X	X	X	29
28	28	X	X		28
22	22	X	X	X	22
	71				
	96				
59		X			
76		X			
55		X			
51		X	X	X	
50		X	X	X	
46		X	X	X	
36		X	X	X	
66		X			
64			X	X	
25		X	X		
24		X		X	
60		X			
7			X	X	
5			X		
57			X	X	
11					
				Total	10

Sources: Own elaboration.

After this procedure was conducted, it was considered necessary to verify the ten pre-selected cases by contrasting them with the SME's primary or secondary data sources. Consequently, a report for each SME was written. Those reports have information from their website, social media, and other secondary sources. In addition, first-hand data were obtained through telephone calls or emails sent to the company to verify or complement the report. No information was found for one company; hence, it was eliminated from the preselected cases.

Despite the detailed participant selection procedure, an expert panel review of the chosen cases also was considered necessary. Donaldson et al. (2013) suggest eight types of methods to select cases where the "consultation of an expert panel" is highlighted (as mentioned in Cimadamore et al., 2002). This method is a way to guarantee sampling validity. Additionally, the method can provide a solid basis for analysis and discussion since judgments come from expert participants (Donaldson et al., 2013).

TABLE 2
Criteria for the evaluation of preselected cases

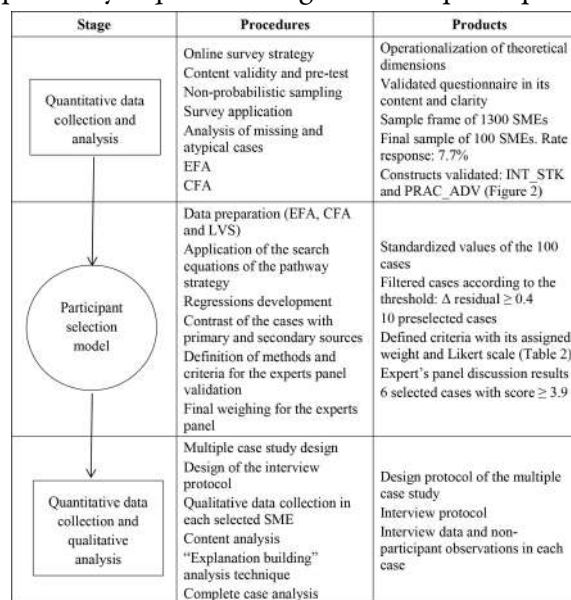
Criteria	Subcriteria of selection	Weight (%)
The case is important for the academic community of researchers in SSCM	The SME goes beyond adapting traditional environmental or social practices and, instead, seems to be sustainability-oriented.	20
	The SME supply chain strategy is reframed to be “truly” sustainable.	15
	The SME innovation in new products, processes, and marketing is based on organizational learning.	15
Within-case evidence is provided	The case offers new evidence or evidence that is not readily available. Additionally, the case adds value to the knowledge of a specific topic.	15
	The case offers enough data, and the right kind of data, to address the issue of interest at an internal level of analysis.	20
	The case offers evidence that allows studying the black box of interest deeply.	15

Note: Likert scale: 6 - Very strongly agree, 5 - Strongly agree, 4 - Agree, 3 - Disagree, 2 - Strongly Disagree, 1 - Very strongly disagree

Source: Own elaboration based on Gerring (2017), Brown (2010), Pagell & Shevchenko (2014), Tidd et al. (2005), and Alegre & Chiva (2008).

From the different methods of consultation with experts, the Delphi method is discarded since it requires the experts to be anonymous and several rounds of evaluation (Taylor, 2020). Methods such as multi-criteria decision-making or the analytical hierarchy process were also discarded (Triantaphyllou, 2000). Consequently, the team of experts composed of 4 people, including the main researcher and three university professors acquainted with innovation research, jointly designed a simple qualification and weighting procedure in Excel. This procedure is based on two key criteria and six sub-criteria adapted from Gerring (2017) and additional literature. Table 2 shows these criteria and their assigned weight. Additionally, a consensus was reached using a 1-to-6 Likert scale for rating each sub-criterion, where 1 was “very strongly disagree,” and 6 was “very strongly agree” (Brown, 2010).

TABLE 3
Visual model for the explanatory sequential design with the participant selection procedure



Source: Own elaboration based on Ivankova et al. (2006)

Table 3 synthesizes the explanatory sequential design. It summarizes how the quantitative phase is linked to the qualitative phase through the participant selection procedure detailed in this study. This table is a synthesized model of the methods and techniques used in this work, along with the products of each procedure.

After an expert's panel discussion, the threshold for selecting the cases was set to 3,9 or greater, resulting in six cases being selected for the next qualitative phase. Finally, the cases identified with numbers 94, 102, 73, 101, 103, and 22 were selected by the panel of experts following the established procedure. The targeted cases are believed to be of importance to the scientific community, offering enough evidence and facilitating a deep understanding of the phenomenon of interest in the qualitative phase.

Discussion

This study shows how it is possible to apply the Pathway method of selecting participants for so-called typical cases proposed by Gerring (2017) in the research field of GSCM and SSCM. In addition, it also shows the relevance of extending the techniques and the necessary methods for a thorough selection of cases in an explanatory sequential design.

Table 4 compares various sampling or participant selection methods for case studies mentioned within the SSCM theory. Various methods, selection criteria, or forms of sampling are used, with several degrees of systematization and replicability.

TABLE 4
Sampling methods in SSCM case study literature

Author	Sampling method
El Baz et al. (2018)	"Preliminary sample was formed using a governmental database... From previous research on green practices of Moroccan companies we compiled additional data. A preliminary sample of 20 companies was selected and contacted" (p. 203).
Azevedo et al. (2011)	"The main criterion used to choose the companies was certification under the ISO 14001 standard or progress toward that end. This selection criterion might lead to bias in responses and ultimately affect the results" (p. 858).
Lee (2009)	"The choice of context is grounded in the industry's international orientation and exposure to the issues of green management. In addition, a certain level of industry representativeness in a chosen sector was considered for this study, for example, market share, sales volume, business operation periods, and international expertise" (p. 1107).
Aschehoug et al. (2012)	"...if the phenomenon to be studied may appear, and if it is feasible and ethical (...) a firm with high environmental standards (...) [and] a firm of a certain size in order to be able to study EI [environmental information] including EE [environmental expectations] in a multiple stakeholder environment" (p. 1).
Jabbour et al. (2013)	"The selection criteria for the researched companies included the following: (a) the relative importance of companies in their market segments and (b) permission to access both the company and detailed data for the research" (p. 809).
Carballo-Penela et al. (2018)	"First, we selected a local supply chain which produces canned - mussels in Galicia (Spain)... the selected local supply chain comprises four companies, which produce different mussel-based products: fresh (stage 1), boiled/frozen (stage 2) and canned mussels (stages 3 and 4). Hence, we assess the effect of different actions aimed at reducing the canned mussels' CF [carbon footprint]" (p. 732)

Source: Own elaboration based on Aschehoug et al. (2012), Azevedo et al. (2011), Carballo-Penela et al. (2018), El Baz et al. (2018), Jabbour et al. (2013), and Lee (2009)

Interestingly, most of these case studies in SSCM are exploratory or descriptive. Therefore, we suggest a different and rigorous alternative method for an explanatory case study. Henceforth, the Pathway method within ESD described and applied in this study is particularly suitable for causal, explanatory, and diagnostic studies (Gerring, 2017).

Next, it is also interesting to compare our adapted and extended method for selecting participants with other sampling approaches used by previous research that also applied the mixed methodology –explanatory sequential design (ESD). Table 5 makes a parallel between these procedures and ours.

As seen in Table 5, some of the studies that apply the ESD mixed methodology use a more intentional and expeditious sampling approach, while other samples are based on cases with high scores obtained from the measurements in the quantitative survey. Perhaps, the most thorough selection method is the one performed by Ivankova and Stick (2007), which selected the participants in two steps, using mean scores within a standard error of the mean and a maximum variation strategy. Our approach also considers high scores but draws firstly from the Pathway method (Gerring, 2017), which is applied to the causal relationship of interest in the study. Furthermore, our procedure for selecting participants goes beyond the Pathway with two additional steps: verification with primary or secondary data sources and an expert panel for final validation.

TABLE 5
Participant selection approaches from selected ESD studies

Authors	Participant selection approach
Campbell and Profetto-Mcgrath (2013)	"The participant selection model was then used to identify the participants for the interview portion. The participant selection model was based on the demographic data relevant to the level of education, and those with a master's or PhD were included" (p. 246).
Schindler and Burkholder (2016)	"Criterion sampling was used to select participants for interviews. Typically, the criterion in phenomenological studies is that participants must have experienced the phenomena being studied (...) [W]e conducted standardized open-ended interviews with five participants who had the highest scores on the support, training transfer, and transfer motivation scales in the survey" (pp. 296-297).
Ivankova and Stick (2007)	"A systematic two-stage case selection procedure was developed. During the first stage, typical respondents in each participant group were identified, first, by calculating the summed mean scores and their respective group means for all participants in each of the four groups based on their responses to the survey questions, and then by selecting a few respondents from each group with the mean scores within one standard error of the mean. During the second stage, one "best informant" from each group was selected using a maximal variation strategy" (pp. 101-102).
Current study	The participant selection model includes three steps. First, preparing the data with an EFA, CFA and LVS, then applying the Pathway strategy proposed by Gerring (2017). Second, obtaining background information for the preliminary cases from primary and secondary sources (verification). And third, validating and filtering the entire selection with a panel of experts using this background information.

Source: Own elaboration based on Campbell and Profetto-Mcgrath (2013), Ivankova and Stick (2007), and Schindler and Burkholder (2016)

Conclusions

This research adapts the Pathway approach suggested by Gerring (2017) and implements a participant selection method within an explicative sequential design followed in a study of sustainable supply chains in Colombia. The method defines how the cases can be selected rigorously from a quantitative phase that proceeds to a later qualitative phase consisting of a multiple case study. Additionally, it is worth emphasizing that the selection method is extended using an expert judging procedure for filtering and validating the cases obtained.

This can be seen as a strength of our method compared to previous SSCM case studies and studies that apply ESD outside of SSCM theory. Another strength lies in the rigor employed when selecting participants, following an ideal procedure for explanatory causal studies, which is also reinforced by validation with the panel of experts.

Once the relevant cases have been selected, the case study will show how the integration with external secondary stakeholders influences the development of advanced sustainable practices in Colombian SMEs. Although the literature concerning participant selection in the mixed exploratory sequential design is scarce, our study shows that it is possible to incorporate methodological strategies from this area in contemporary GSCM and SSCM research.

The method described in this research allows the selection of participants who meet the pre-established criteria in the literature, which experts then validate. For this reason, these cases are of interest, and the insights gained from their study are important for the academic community, providing enough evidence for the studied relationships.

In the context of the ongoing research in SSCM, the literature suggests applying mixed methods or empirical triangulation, whether in an explanatory, exploratory, or descriptive study. Studying how participants are selected or how the sampling frame is established are vital procedures to ensure greater knowledge transferability or analytic generalization.

Therefore, methods for rigorously selecting participants in case studies should be refined in future research, especially when framed in a mixed method sequential design. In summary, it is necessary to deepen the study of methods and techniques that guarantee greater credibility and auditability in GSCM and SSCM research.

Ethical considerations

The investigation did not require ethical endorsement of any kind.

Authors' contributions statement

Each of the authors of this article participated in the design and execution of the research, the literature review, and the writing and revision of this article.

Interest conflicts

The authors do not have any type of conflict of interest associated with the development of the research or this article.

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Notes

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