

A methodological proposal for the sociocultural valuation of ecosystem services

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Abstract: In recent years, progress has been made towards incorporating the sociocultural perspective in the assessment of ecosystem services (ES) to identify the relevant services according to the different needs and perceptions of the populations consulted. New sociocultural assessment methods are being explored to respond to this emerging line of research, without a generally accepted alternative being found thus far. Aiming to contribute to this line of research, this article proposes a new methodological approach for the sociocultural assessment of ES. The new methodological approach is based on combining two different measurement procedures: a traditional Likert scale and the Kano model. The case of ES provided by forests will be considered for its development and application. With the application of the proposed methodology, the sensitivity and consistency of sociocultural assessments of ES would be improved, and the development of longitudinal analysis would be facilitated.

Keywords: Kano model; Likert scale; quantitative assessment; questionnaire; stakeholders

Research on ecosystem services (ES) is a line of work that emerged at the end of the 1970s and now becoming an increasingly significant area of study (McDonough et al. 2017). Initiatives such as the Millennium Ecosystem Assessment (2005) project, among others, have helped the concept of ES reach increasing relevance until it is considered a policy and management tool necessary to achieve sustainable use of natural resources (Meraj et al. 2022). The concept of ES includes the

characteristics, functions or ecological processes that directly or indirectly contribute to human well-being (Costanza et al. 1997).

Among the existing studies, it has been shown that assessments of ES should incorporate ecological, socio-cultural and monetary values. However, as Lyytimäki and Pitkänen (2020) point out, how ecosystems contribute to primarily being explored from the 'natural sciences' or 'economics' fields. A comprehensive as-

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assessment of ES requires collaboration between different areas of knowledge, including the social sciences (McDonough et al. 2017).

Likewise, Cuni-Sánchez et al. (2019) pointed out that the assessment of ES should have a broader view of the sociocultural context. Alba-Patiño et al. (2021) indicate that research and evaluation of ES should focus on what matters to people, given that the sociocultural benefits obtained from ES can be used as indicators of human well-being. That is why assessments of ES should shift towards a sociocultural approach, incorporating intangible aspects, for which the participation of different stakeholders is unavoidable. Stakeholders are any person or group that can affect or be affected by the outcome of a management process.

In the last decade, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) has highlighted the cultural context linked to the perception of ecosystem services and their social demand (Díaz et al. 2018). As a result, progress has been made towards incorporating the sociocultural perspective in the assessment of ES to identify relevant services according to the different needs and perceptions of the populations consulted. To respond to this emerging line, new methods of sociocultural assessment are being explored, although many times in these studies the assessments are an adaptation of a monetary evaluation (Suarez et al. 2021). In addition, traditionally, sociocultural assessments of ES have focused on evaluating recreational and tourist services. This indicates that a higher level of research development is required to address the set of services provided by ecosystems from a sociocultural perspective.

Therefore, the sociocultural assessment of ESs should be based on the use of social science research methods (in collaboration with other areas of knowledge), rating them in 'nonmonetary' terms where stakeholders explicitly become the central point of the research. Scholte et al. (2015) suggest working with pluralistic methods (that is, combining several methods) and point out that the most commonly used collection techniques for sociocultural assessments are (from highest to lowest level of use): *i*) questionnaire, *ii*) in-depth interview (unstructured or semistructured), *iii*) focus groups, *iv*) expert-based methods, *v*) document research, and *vi*) observational approaches.

This work aims to contribute to this line of research by proposing a new methodological approach for the sociocultural assessment of ES based on the participation of different stakeholders. For this purpose, in the methods section, the different phases for developing the socio-cultural evaluation of services will be present-

ed, identifying the limitations of using the Likert scale, the most widespread method. Next, the Kano model and the advantages of its use in conjunction with the Likert scale in sociocultural service evaluation studies are presented. Then, in the results section, a theoretical application proposal is based on the socio-cultural valuation of the services provided by a forest ecosystem that forms part of a natural park for tourist use. Finally, the main recommendations for applying the proposed approach are presented.

MATERIAL AND METHODS

Sociocultural assessment of ecosystem services. Studies on the sociocultural assessment of ES show the lack of a standard methodology or procedure, which makes it difficult, on the one hand, to quantify the results and the valuation of the benefits obtained from each ES, and, on the other hand, an effective comparison between different studies. In general, what predominates in valuation studies is using a semistructured questionnaire as a measurement instrument proposed ad hoc. Therefore, their characteristics and how they are prepared to vary significantly from one study to another. These substantial differences are mainly identified in the following three components: *i*) selection methods (sampling) of the ES to be analysed and their classification, *ii*) stakeholders that participate in the assessment and target sample, and *iii*) assessment methodologies used.

There is no need for uniformity in the scientific literature regarding the ES analysed, their definition and terminology (nomenclature). This inconsistency also continues in the methodology used for selecting the ES, identifying three possible scenarios for the selection of services to be evaluated: *i*) based on a literature review, *ii*) conducting a preliminary study with a panel of experts and/or stakeholders to determine the most important ES in the study area through workshops, interviews or focus groups, and *iii*) omitting this previous phase of selecting a list of ES, and the interviewees in the same field study can be simultaneously consulted on what services they identify and their assessment of them.

On the other hand, there are also differences in the classification of ES. Some studies reference the MEA classification (2005) of four service categories: provisioning, regulating, cultural and supporting (e.g. Crivellaro et al. 2020). However, studies based on the CICES (Common Classification of Ecosystem Services) classification predominate, reducing the valuation categories to three and eliminating the support category (Rodríguez-Morales et al. 2020). This shows that, in general, when

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ES is assessed from a sociocultural perspective, this fourth category is not used, given the difficulty of delimiting these services and the lack of knowledge about them by all stakeholders. Therefore, it is recommended to follow the CICES classification (Haines-Young and Potschin-Young 2018). This way, standardising a classification for all studies with a sociocultural approach would be achieved. In addition, there is a lack of consensus in the scientific-academic field on which ES each ecosystem can provide, as well as a lack of standardisation of the preestablished definitions for each service.

There is also variability in the criteria between studies regarding the determination of stakeholders in each study, as well as in which phase of the study their participation in the ES assessment is included. The criteria applied for stakeholder selection can be the following: *i*) activity or sector, *ii*) location or geographic influence, and *iii*) a combination of the two previous criteria. Regarding the moment in which the different stakeholders participate, there are studies in which they only do so in a preliminary phase to determine which ES provides services in the study area and other significant variables for the analysis. In this case, it could not be counted as a valuation but rather as an identification of services. In other studies, an analysis by different stakeholder groups is not directly proposed in any phase of the analysis; instead, they develop the assessment without delimiting specific groups beyond a demographic analysis. Finally, some studies develop the field study in a general way, but subsequently, to analyse the results obtained, propose a subdivision by different groups. The assessment methodologies in each study are also different.

The stakeholders that have participated in previous field studies can be grouped into 2 classes: *i*) according to their activity (breeders, farmers, hunters, people with environmental awareness, public administration, nongovernmental organisations, tourism promoters, companies linked to forest exploitation, academic sphere organisations and experts in ES), *ii*) according to their origin (urban population, local population, border population, regional population, visitor population, national population). Generally, a tendency to consult 4 stakeholder groups can be observed (Table 1). Regarding the sample size, there are notable differences depending mainly on the methodological procedure (sample sizes from 1–99 to over 400). Given the context-dependence of sociocultural valuation studies, it is recommended to assess in each case the variety of interest groups related to the topic of study. For the study to be representative, all groups that can be called 'key', those with a sufficient degree of influence to promote or prevent the adoption of measures must be involved (Velasco-Muñoz et al. 2022). Different estimation methods can be chosen to determine the minimum number of participants in each group, such as assigning confidence and occurrence percentages of the estimated variable proposed by Mensah et al. (2017).

Depending on each study, the procedure to assess the importance that stakeholders give to ES can be quantitative, qualitative or mixed since no reference guide recommends a specific methodology for this type of sociocultural assessment study. In this study, quantitative methods are considered those in which people assign a numerical value to each service. Table 2 compiles the scales used in a sample of previous studies, where it can

Table 1. Previous studies in which stakeholders are included both in the field study and in the analysis of results

Previous work	Naming of the groups
Bidegain et al. (2020)	cattle-related; urban-related; olive-related; environmentally aware (also compares results survey/experts)
Crivellaro et al. (2020)	public administrations and authorities; environmental NGO; tourism sector; private actors of forest-wood chain (also divided by the 3 regions where the study was conducted)
Rodríguez-Morales et al. (2020)	locals; vicinity; urban; others
Do Rosario et al. (2019)	local; regional
De Meo et al. (2018)	environmental NGOs; forestry industry actors; public administrations; tourism actors (also considers the different locations where the study was conducted)
Garrido et al. (2017)	civil; private; public (local and regional level)
Pastorella et al. (2016)	public administrations; associations/NGOs; academia; professional associations
Castro et al. (2016)	locals; tourists; business visitors; water managers; experts

NGO – non-governmental organisations

Source: Authors' own elaboration

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Table 2. Inventory of quantitative scoring procedures and scales used in previous studies

Previous work	Measurement technique	Scale
Ciftcioglu (2020)	Q-method (agree/disagree)	11
Bidegain et al. (2020)	score (significant, Likert-type)	5
Asah and Blahna (2020)	score (importance)	7
Do Rosario et al. (2019)	score (importance Likert-type)	5
De Meo et al. (2018)	Likert (importance)	5
Hough et al. (2018)	score (attractive, Likert-type)	5
Paudyal et al. (2018)	score (current and potential use)	4
Mensah et al. (2017)	score (importance)	4
Maestre-Andrés et al. (2016)	Likert (agree/disagree)	5
Pastorella et al. (2016)	Likert (importance)	5

Source: Authors' own elaboration

be seen that the 5-point scale is most commonly used. In addition, what is measured, is explicitly indicated in parentheses, noting that the importance of each ES is most sought.

What does the Kano model contribute? In evaluating ecosystem services based on the traditional Likert scale, stakeholders' perception, experience and satisfaction are assumed to be linear. However, this is not entirely true. Based on Herzberg's two-factor theory (Herzberg 1996), satisfaction and dissatisfaction are different concepts. Thus, a person's non-dissatisfaction with a service is not necessarily the same as his or her satisfaction. In other words, the focus and intensity of valuation are not exclusively linear. This limitation, present in ecosystem service valuation studies, can be overcome by applying Kano's proposal, which considers that the relationship between the coverage of a need and the experienced satisfaction or dissatisfaction is asymmetric and nonlinear

(Rashid 2010; Guerrero-Alonso 2016; Dace et al. 2020). Table 3 shows the main elements of both measurement methods, evidencing their complementarity as a methodology for obtaining primary information to improve the evaluation of ecosystem services from a sociocultural perspective. Specifically, Kano's model makes it possible to identify essential quality services, which can cause dissatisfaction if they are not present but do not cause satisfaction if present. The over-quality services can increase stakeholders' satisfaction if they are present but do not cause dissatisfaction if they are not present. This knowledge is impossible to be obtained by applying the Likert method alone. For example, it may be that a service scoring 5 points on the Likert scale (maximum score) does not cause dissatisfaction because it is not an expected service by the stakeholders.

Sociocultural assessment of ES combining the Likert scale and the Kano model. This section proposes

Table 3. Comparing the traditional Likert scale and Kano model

Dimensions	Likert scale	Kano model
Approach	lineal	non lineal
Measure	based on an interval scale: not important – very important	based on 2 questions (direct and complementary): I like it, I expected it, I don't care, I can tolerate it, I don't like it
Application	culturally more familiar question format and simpler survey to be administered (face-to-face)	format of the questions unknown, therefore requires a training session (workshop)
Output	relevance level (1–5 points)	service categories: attractive, one-dimensional, compulsory, indifferent, inverse
Contribution	allows to identify which services are best qualified (first approach)	allows contrasting which services are really needed and which are their satisfaction coefficients

Source: Authors' own elaboration

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a new methodological approach combining two measurements: a traditional Likert scale and the Kano model. This contribution is novel since no previous studies have adopted and applied the Kano model to assess ecosystem services. The Likert scale is widely used in valuation studies. However, this 5-point scoring scale is characterised by a lack of sensitivity, which can have a negative impact and be a handicap when proposing the analysis of trends in different time stages. That is, pretest-posttest designs, assessment after an intervention or policy change. In terms of the results, the differences in the perceptions between the two stages may not be statistically significant. That is why it would be interesting to complement this scale with another methodological procedure that can broaden the sociocultural context.

The Kano model is a theory of product development and customer satisfaction proposed by Noriaki Kano in the 1980s to classify customer preferences (Kano et al. 1984). The Kano model has been widely used in the last three decades in the field of product design and development and in other areas, such as academia. On the other hand, this model has been applied in other less common areas, serving as a justifying framework for its adaptation to the assessment of ES. Thus, different researchers have used the Kano model for the design of quality indicators related to environmental services, specifically in several recreation areas, like indicators of the quality of environmental tourism land-based facilities, including structures, commercial and non-commercial services, and public traffic facilities, waterway, water activity facilities and tourism services, as well as the condition of scenic spots (Chen et al. 2018). Likewise, Dace et al. (2020) concluded that the Kano model has a high potential for assessing environmental quality, considering that it is a relevant methodology if its application is designed correctly. Similarly, Li et al. (2021) validated Kano's proposal as a feasible analysis method to explore the relationship between demand and user satisfaction in eco-cities.

A distinctive aspect of Kano's own model is that applying the principle of the relative majority can directly obtain the final categorisation and valuation for each service (Dominici and Palumbo 2013). In addition, at the methodological level, a remarkable characteristic of the Kano model is that the attributes are 'dynamic, so the perception and evaluation by the people consulted will change over time. Considering the subjective component involved in assessing a service, the contribution of knowing the stakeholders' satisfaction is a determining aspect of the assessment and classification process (Coleman 2014). In this sense, this model can be beneficial for ES assessments, where it would be vital to know and

understand the change in the perception of the benefits obtained from different ES. In summary, the Kano model could broaden the assessment of ES from the sociocultural approach to more reliably determine people's satisfaction with their environment. In addition, the synergistic element can involve integrating several measurement scales to obtain a more reliable and consistent assessment. At the same time, longitudinal studies would help to increase the sensitivity of the evaluation made by different stakeholders. Concerning the effectiveness of the Kano model, it is a model that has been sufficiently validated by the scientific community. This aspect can be corroborated by it being increasingly used in research on quality management (Meng and Dong 2018). However, it also has some limitations. For example, it overemphasises the quality of the product being evaluated but does not consider the experience of the person evaluating it (Shyu et al. 2013). Song (2018) proposes a new approach to pose the questions and a 5-point ordinal scale to avoid one-directional effects on the perception of the people who perform the assessment. This limitation can be solved with the proposal presented in this work, since this aspect can be compensated for by integrating the Likert scale and its alternative responses.

RESULTS AND DISCUSSION

The proposed methodological approach is composed of several phases or stages that are explained below. The following description is based on the theoretical proposal of applying the proposed methodology to a real case study, the sociocultural valuation of ecosystem services provided by recreational forests. However, this proposal has not yet been implemented, which is the next research phase.

Phase 0. Design and development of the measurement instrument (questionnaire). This study has been applied to the case of forest ES (for the complete version designed specifically for this proposal, see electronic supplementary material, ESM). This questionnaire included a selection of ES in its three categories. The final proposal of the questionnaire is structured into three blocks. In the first block, questions related to the sociodemographic characterisation of the people surveyed are posed, as well as a quiz on the participants' previous knowledge about ES. The second block includes the questions posed according to the proposed approach, that is, the Likert scale and the adapted Kano model, to assess the importance that the different stakeholders give to the selected ES. Finally, a third block with open-ended questions of a qualitative nature was included,

<https://doi.org/10.17221/298/2022-AGRICECON>

to obtain more information about the stakeholders' perceptions and complement the quantitative part. When designing the questionnaire, it must be considered that for each service analysed, two measurement scales must be included, both Likert and Kano. The latter consists of two questions for each service. In addition to the fact that the concepts related to ecosystem services are often unfamiliar to respondents, the use of Kano questions gives additional complexity to the questionnaire. Therefore, it is not advisable to include more than 5–6 services per category in the questionnaire, considering the inclusion of other types of questions, such as socio-demographic ones. Table 4 shows a summary of the content of the different blocks, including the complete list of services analysed.

Phase I. In this phase, the data obtained from the questions posed according to the classic 5-point Likert scale are treated and studied through a quantitative analysis using descriptive statistics (m – median, μ – arithmetic mean, σ – standard deviation and CV – coefficient of variation, among other indicators). This allows obtaining some initial hypotheses to be contrasted with the results obtained from the adaptation of the Kano model. It is important to mention that the attributes (items) on which they are consulted refer to the ES being evaluated. Table 5 shows the part of the questionnaire that assesses provisioning services using the Likert scale.

Phase II. Categorising the Kano model into different categories: attractive, one-dimensional, must-be, and indifferent. Specifically, an adaptation of the Kano

Table 4. Summary of the content of the questionnaire

Block	Variables
	age gender education
1. Sociodemographic characterisation	involvement in environmental organisations place of residence (location/country) group classification definition of ecosystem service
	questions related to provisioning services almond crop (organic) beekeeping and collection of aromatic plants fauna in the context of hunting grounds grass for cattle (sheep and goats) esparto, firewood and similar resources questions related to regulating services air purification conservation of aquifers climate regulation soil quality natural habitat
2. Ecosystem services assessment (Kano) and degree of importance of services (Likert)	questions related to cultural services sustainable tourism aesthetic values of the environment recreational activities essence of the Park as a hallmark feature natural and cultural heritage environmental education and awareness
	missing service
3. Final questions	disservices other comments

Source: Authors' own elaboration

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Table 5. Example of a Likert question to evaluate provisioning ecosystems services

Provisioning services	Assessment scale score				
	1	2	3	4	5
Almond crop (organic)				×	
Beekeeping and collection of aromatic plants (e.g. lavender, thyme, rosemary...)	×				
Fauna in the context of hunting grounds (e.g. wild boars, hares, partridges...)		×			
Grass for cattle (sheep and goats)			×		
Esparto, firewood and similar					×

1 (not important at all) – 5 (very important)

Source: Authors' own elaboration

model, previously experimented with by González-Yebra et al. (2018, 2019), has been redesigned and developed. To do this, the frequency analysis is carried out in stakeholders' responses, distributed by the three groups of service types to be assessed. Table 6 shows an example of a questionnaire designed from the adap-

Table 6. Examples of questions to evaluate an ecosystem service based on the Kano model

Questions	Description	Answers	Selection
Functional question (i)	If, within the lines of work of the Park, it is included to promote the provision of firewood (tree clearing) and esparto, how would you feel?	I like it	
		I expect it	×
		I'm neutral	
		I can tolerate it	
		I dislike it	
Dysfunctional question	If the provision of firewood (tree clearing) and esparto were NOT promoted, how would you feel?	I like it	
		I expect it	
		I'm neutral	
		I can tolerate it	
		I dislike it	×
Functional question (ii)	If the Park is protected to maintain the purity of the air (as well as favour the elimination of CO ₂) as a key objective, how would you feel?	I like it	×
		I expect it	
		I'm neutral	
		I can tolerate it	
		I dislike it	
Dysfunctional question	If air purity is NOT maintained in the Park, how would you feel?	I like it	
		I expect it	
		I'm neutral	
		I can tolerate it	
		I dislike it	×
Functional question (iii)	If one of the lines of action of the Park is to promote recreational activities (e.g. bird watching, hiking, camping...), how would you feel?	I like it	×
		I expect it	
		I'm neutral	
		I can tolerate it	
		I dislike it	
Dysfunctional question	If the recreational activities of the Park are NOT promoted, how would you feel?	I like it	
		I expect it	
		I'm neutral	
		I can tolerate it	×
		I dislike it	

(i) – provisioning category; (ii) – regulation service; (iii) – cultural category (for the rest of the questions and services, see ESM)

Source: Authors' own elaboration

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Table 7. Reference table to classify the responses to the questions of the Kano model

Functional questions (+)	Dysfunctional question (-)				
	liked	expected	neutral	tolerated	disliked
Liked	Q	A	A	A	O
Expected	R	I	I	I	M
Neutral	R	I	I	I	M
Tolerated	R	I	I	I	M
Disliked	R	R	R	R	Q

A – attractive; O – one-dimensional; M – must-be; I – indifferent; R – reverse; Q – questionable

Source: Authors' own elaboration

tation of the Kano model for the specific case of assessing a regulating service (air purification).

The assessment of the ES is performed by combining the two responses to the questions 'functional' (direct) and 'dysfunctional' (complimentary), as shown in Table 7. With this procedure, the SE is classified into six categories: A = attractive, O = one-dimensional, M = must-be, I = indifferent, R = reverse, and Q = questionable. For each service, the classification is determined by the category with the highest frequency of responses. If two or more services had the same result, the following rule is applied. Likewise, to determine the consistency of the sample, Cronbach's alpha coefficient is calculated for both the functional and dysfunctional questions to validate the reliability of the measurement instrument. This coefficient has been established as a *de facto* index to evaluate the degree to which the items of an instrument are correlated.

To illustrate this phase, an adaptation and hypothesis of the Kano classification are being made for the assessment of each of the forest ESs by the stakeholders:

Attractive services (A) have the most significant influence on stakeholder satisfaction. The attractive services are not expressed explicitly or expected by the population consulted.

One-dimensional services (O): Stakeholder satisfaction is proportional to their level of fulfilment. The more they are fulfilled, the higher the satisfaction of the population consulted and vice versa.

Must-be services (M): if the services classified in this category are not satisfied or fulfilled, the stakeholders will feel extremely dissatisfied. On the other hand, since the population consulted already considers these services part of the ecosystem, their fulfilment does not increase their satisfaction. Must-be services are the primary or minimum services of the ecosys-

tem to be assessed. Satisfaction with must-be services is only expressed by stakeholders when perceiving dissatisfaction.

Indifferent services (I): those whose presence does not increase or decrease stakeholders' satisfaction with the ecosystem to be assessed.

Reverse services (R): these are ecosystem services to be assessed that are not only not desired by stakeholders but are even expected to be the opposite.

Questionable services (Q): produce contradictory assessments, which is why the services are not classified in this category. The issues (functional and dysfunctional) whose response can be classified as questionable indicate that the question was incorrectly expressed or that the stakeholders needed to have understood the question or stated an incorrect response by mistake.

Phase III. To complement the previous phase and as an additional step, the satisfaction coefficient is calculated, which is defined by two sub-coefficients: satisfaction '*SI*' [Equation (1)] and Dissatisfaction '*DI*' [Equation (2)] (Berger et al. 1993). These indices could serve as an indicator of the strength with which a service could influence the satisfaction or, in case of nonfulfillment, dissatisfaction of the stakeholders, thus reflecting the importance of each ES evaluated compared to the rest. Finally, a representation of the results of Phases II and III is made in a two-dimensional map (Tontini 2007), that is, a bispatial dispersion graph is developed to describe the ES assessments that are easy to interpret graphically.

$$SI = \frac{A + O}{(A + O + M + I)} \tag{1}$$

$$DI = \frac{O + M}{(A + O + M + I)(-1)} \tag{2}$$

where: A, O, M, I – number of responses of each of the respondents by stakeholder, classified according to the procedure described in the previous point as attractive services (A), one-dimensional (O), must-be (M) or indifferent (I). In the calculation of this coefficient, services classified as reverse (R) and questionable (Q) are not considered.

CONCLUSION

Studies on the sociocultural assessment of ES show the lack of a standard methodology or procedure, which makes it difficult, on the one hand, to quantify the results and the valuation of the benefits obtained

from each ES, and, on the other hand, an effective comparison between different studies.

No previous work on the sociocultural assessment of ES has been identified where a methodological procedure based on the traditional 5-point Likert scale combined with the adaptation of the Kano model (including the perspective of satisfaction) is proposed to improve over time the sensitivity and consistency of ES assessments. This new approach could facilitate the development of longitudinal section analyses that have rarely been performed.

Regarding the analysis developed in this article, the multidisciplinary with which the three components have been characterised must be an indispensable part of the design of a field study of ES assessments: *i*) selection methods (sampling) of the ESs to be analysed and their classification, *ii*) stakeholders that participate in the assessment and target sample, and *iii*) assessment methodologies used. Finally, based on the different elements identified, a first questionnaire model has been designed expressly incorporating the proposed Likert-Kano methodological approach.

Two important aspects to consider when applying the proposal of this work should be highlighted: *i*) make a correct and justified selection of the stakeholders that will make up the ES assessment panel, and *ii*) perform a pedagogical and exhaustive explanation of the questionnaire before it is filled out, given the particularities of the Kano questions which may not be as familiar to the target population as is the popular 5-point Likert scale. In addition, it would be advisable to carry out a prior experimental validation, for example, through a workshop with 10–30 participants.

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