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ORIGINAL RESEARCH

# From centralized control to participatory co-management: how institutional pluralism shapes stakeholders' perceptions of the governance transition

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**ABSTRACT.** Governance frameworks for small-scale coastal fisheries have historically relied on centralized, top-down management, limiting local stakeholder participation. This study analyzed the perceptions of 72 stakeholders involved in the artisanal hake fishery (*Merluccius gayi peruanus*) in northern Peru regarding the implementation of an Integrated Model of Participatory Governance for Small-Scale Fisheries (IMPG-SSF). To this end, Q methodology was applied using a forced distribution of 30 statements and factor analysis with Varimax rotation, complemented by a bootstrap procedure to assess the stability of the factor solution. The results enabled the identification of three differentiated narratives. The first interpreted co-management as an opportunity to strengthen socioecological sustainability, participation, and coordination among actors. The second expressed a favorable stance, although conditioned by the need for technical capacities, operational clarity, and institutional support. The third reflected a more critical view, associated with concerns about conflict, institutional weakness, and possible difficulties in implementing the model in complex local contexts. The factor solution exhibited high levels of reliability and stability under resampling. The integration of the findings showed that the transition toward participatory governance schemes depends not only on the recognition of local knowledge, but also on institutional strengthening, coordination among actors, and the gradual building of trust, leading to the conclusion that the implementation of the IMPG-SSF requires strategies adapted to the territorial and social dynamics of the artisanal fishery.

**Key words:** Participatory governance, Q methodology, socioecological sustainability.

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**Del control centralizado a la cogestión participativa: cómo el pluralismo institucional moldea las percepciones de las partes interesadas sobre la transición de la gobernanza**

**RESUMEN.** Históricamente, los marcos de gobernanza para la pesca costera a pequeña escala se han basado en una gestión centralizada y jerárquica, lo que limita la participación de las partes interesadas locales. El presente estudio analizó las percepciones de 72 actores vinculados a la pesquería artesanal de merluza (*Merluccius gayi peruanus*) en el norte del Perú respecto a la implementación de un Modelo Integrado de Gobernanza Participativa para Pesquerías de Pequeña Escala (IMPG-SSF). Para ello, se aplicó la metodología Q mediante una distribución forzada de 30 declaraciones y un análisis factorial con rotación Varimax, complementado con un procedimiento *bootstrap* para evaluar la estabilidad de la solución factorial. Los resultados permitieron identificar tres narrativas diferenciadas. La primera interpretó la cogestión como una oportunidad para fortalecer la sostenibilidad socio-ecológica, la participación y la articulación entre actores. La segunda expresó una posición favorable, aunque condicionada por la necesidad de capacidades técnicas, claridad operativa y respaldo institucional. La tercera reflejó una visión más crítica, asociada a preocupaciones sobre conflictos, debilidad institucional y posibles dificultades para implementar el modelo en contextos locales complejos. La solución factorial presentó altos niveles de confiabilidad y estabilidad frente al remuestreo. La integración de los hallazgos evidenció que la transición hacia esquemas de gobernanza participativa depende no solo del reconocimiento del conocimiento local, sino también del fortalecimiento institucional, la coordinación entre actores y la construcción progresiva de confianza, concluyendo que la implementación del IMPG-SSF requiere estrategias adaptadas a las dinámicas territoriales y sociales de la pesquería artesanal.

**Palabras clave:** Gobernanza participativa, metodología Q, sostenibilidad socio-ecológica.

## INTRODUCTION

On Peru's northern coast, small-scale coastal fisheries play a vital role in food security, income generation, and the maintenance of social cohesion (Jara et al. 2020). However, governance frameworks that regulate them have historically been dominated by centralized management approaches and top-down decision-making processes, which have limited the essential inclusion of local stakeholders, consequently eroding institutional legitimacy, shared responsibility in management, and levels of trust between the State and fishing communities. These weaknesses are most evident in the regions of Piura and Tumbes, where conflicts among stakeholders, institutional fragmentation, and persistent informality have led to complicated, complex, and unresolved governance scenarios.

Although the idea has gained traction internationally that participatory governance and co-management approaches contribute to strengthening both the sustainability and legitimacy of small-scale fisheries (Berkes 2008; Jentoft and Chuenpagdee 2022), empirical evidence suggests that these schemes are implemented within institutional frameworks that are far from neutral. In scenarios of institutional pluralism, characterized by the coexistence of state regulations, community rules, traditional practices, and informal arrangements, the viability of co-management schemes is not explained by the technical quality of the design, but rather by the capacity to interact with and adapt to pre-existing regulatory configurations (Calò et al. 2023; Banikoi 2024).

Within this framework, the present study poses the following research question*:* How do key actors in the artisanal hake fishery of northern Peru perceive the social and institutional viability of the Integrated Model of Participatory Governance for Small-Scale Fisheries as a mechanism for transitioning governance from a centralized authority scheme toward co-management arrangements? Addressing this question allows us to understand not only the degree of acceptance of the model, but also the tensions, expectations, and conditions that stakeholders consider necessary for its effective implementation. The study included fishing communities in the regions of Piura and Tumbes, which constitute a socio-ecological system vital for food security and economic development in both regions. Despite sharing the same resource, they exhibit divergent dynamics of institutional pluralism that shape fishers' perceptions: while in Piura institutional pluralism tends toward more robust technical and participatory integration, in Tumbes a logic of territorial autonomy and skepticism regarding the effectiveness of the formal system prevails, factors that are decisive for the transition from a centralized scheme to one of co-management.

In this context, the Q methodology was adopted as the central analytical framework. This allowed for the capture of narratives, cognitions, and consensus and disagreement represented by actors in dynamic contexts of green governance (Brown 1980; Watts and Stenner 2012). More broadly, compared to purely qualitative or quantitative methods, the Q methodology is well-suited to the task of mapping discursive configurations representing how actors collectively interpret institutional transformations (Zabala et al. 2018). In artisanal fisheries, where perceptions, trust, and historical experience decisively influence the viability of co-management, this approach has proven suitable for analyzing governance transitions (Kinyua et al. 2022; Furqan and Schlüter 2023). The Q methodology has been successfully employed in other contexts to assess principles of good governance, such as transparency, accountability, and informed participation, as demonstrated by Kuyini Mohammed (2023) within the framework of the FLEGT system in Ghana.

This research proposed the Integrated Model of Participatory Governance for Small-Scale Fisheries (IMPG-SSF) as an original framework designed to optimize decision-making in the artisanal hake fishery of northern Peru. The model is based on the theoretical synthesis and adaptation of best governance practices drawing on international studies from Uruguay (Bausero-Jorcin et al. 2024), Indonesia (Dudayev et al. 2023), Chile (González-Roca et al. 2023), and Spain (Aguado et al. 2021), as well as the FAO's Good Governance Framework (2015).

## MATERIALS AND METHODS

### Base study model

The IMPG-SSF was structured as a circular and multilevel system aimed at strengthening governance in artisanal fisheries through processes of learning, monitoring, and institutional adaptation (Figure 1).


Figure 1. Components of the Integrated Model of Participatory Governance for Small-Scale Fisheries (IMPG-SSF) for sustainability and local-state co-responsibility adapted from FAO (2015), Aguado et al. (2021), Dudayev et al. (2023), González-Roca et al. (2023), and Bausero-Jorcin et al. (2024).

*Central core: systemic purpose*

The central core was composed of the principles of socioecological sustainability, resilience, social equity, and food security, oriented toward promoting fishery resource conservation, community strengthening, and social well-being.

*First level: structural dimensions of the socioecological system (SES)*

The first level integrated the social, economic, ecological, and legal dimensions of the socioecological system. These dimensions included aspects related to community participation, sustainable livelihoods, ecological conservation, fisheries management, and institutional strengthening for fisheries governance.

*Second level: operational implementation mechanisms*

The second level grouped operational mechanisms aimed at governance implementation, including co-governance platforms, participatory monitoring, feedback systems, community observatories, and the integration of scientific and local ecological knowledge. These instruments facilitated the coordination, evaluation, and continuous adjustment of the fisheries governance system.

*Methodological approach and research design*

The study assessed the perceptions and levels of agreement among key stakeholders regarding the IMPG-SSF in the small-scale hake fishery of northern Peru. A mixed-methods approach was employed, combining qualitative and quantitative components, aimed at understanding shared subjectivities and narratives associated with fisheries co-management (Kerlinger et al. 2002; Gray et al. 2023).

*Q Methodology as the analytical framework of the study*

The Q methodology constituted the analytical framework of the study, as it allowed for the identification and comparison of the shared forms of interpretation held by the actors regarding fisheries management. Although it generates numeric and ordinal data based on a forced classification of statements, its purpose is interpretive rather than causal, as it seeks to reveal discursive structures and patterns of shared subjectivity. For this reason, it proved particularly relevant in a complex context such as the artisanal hake fishery, where cultural, ecological, economic, and institutional dimensions interact (Brown 1980; Watts and Stenner 2012; Zabala et al. 2018; Furqan and Schlüter 2023).

*Construction of the concourse*

The methodological process began with the construction of the concourse, understood as the set of discourses and narratives surrounding the artisanal hake fishery and co-management in Piura and Tumbes. To this end, interviews were conducted with key stakeholders, alongside a review of technical documentation and scientific literature, as well as consultations with fisheries governance specialists, following the principles of Q methodology. The collected statements were organized according to the structural dimensions of the socioecological system (SES), including social, economic, ecological, and governance components, as well as criteria associated with the acceptability of the proposed co-management model. This process allowed the structuring of the discursive universe that supported the construction of the Q-set (Brown 1980; Watts and Stenner 2012).

*Selection and validation of the Q-set*

Based on the concourse, representative and conceptually relevant statements were selected, seeking to reflect the diversity of stakeholders' perspectives and avoid normative or technical biases (Zabala et al. 2018). The preliminary Q-set was subjected to a pilot test to assess its clarity and comprehensibility, with adjustments made until a final set of 30 statements was obtained. These statements were distributed according to the analytical dimensions defined for the study, encompassing components of the socioecological system (SES) and acceptability criteria related to the proposed co-management model (Table 1) (Watts and Stenner 2012; Svolkinas et al. 2023).

*Participant selection (P-set)*

Participants were selected through purposive sampling and included key stakeholders in the artisanal hake fishery of Piura and Tumbes, among them artisanal fishers, community representatives, traders, and institutional stakeholders (n = 72). The selection prioritized discursive diversity and heterogeneity of perspectives, a central criterion of the Q methodology, over statistical representativeness (Brown 1980; Kinyua et al. 2022).

*Presentation and familiarization with the IMPG-SSF model*

Before the Q-sort was administered, participants were introduced to the IMPG-SSF through participatory workshops held in the fishing villages of El Ñuro, Los Órganos, Máncora, and Acapulco. The sessions, lasting approximately two hours, were facilitated by the research team and used visual and schematic materials to explain the model's structure and guiding principles. The workshops combined brief presentations with open discussion spaces, promoting active participation and situating the model within the local dynamics of fisheries governance. Prior to the Q-sort administration, participants' understanding was verified through rounds of feedback and clarification.

*Q-sort administration procedure*

Each participant ranked the statements in the Q-set according to their level of agreement or disagreement using an 11-point forced-choice scale, with values ranging from -5 to + 5 (Figure 2). This procedure allowed for the identification of relative patterns of consensus and dissent regarding the governance model under evaluation (Watts and Stenner 2012; Zabala et al. 2018). The scale included 30 statements organized into single cells, which required participants to prioritize and differentiate the statements based on their perceived representativeness (Appendix 1). The process was complemented by group discussions and focus groups aimed at delving deeper into the reasons underlying the classifications made and providing context for the interpretation of the identified factors (Vargas-López et al. 2023).

*Complementary instruments and sociodemographic data*

A section on sociodemographic variables, such as age, sex, institutional role, and region of origin, was included for descriptive and contextual purposes (Appendix 2). This data allowed us to characterize the participants associated with each factor without altering the interpretive logic of *t*he Q analysis, which focuses on relationships between people rather than between variables (Brown 1980; Watts and Stenner 2012).

*Data analysis strategy analysis and methodological rigor*

The Q-sort analysis was conducted following standard procedures of the Q methodology (Brown 1980; Watts and Stenner 2012). First, a correlation matrix was constructed among the Q-sorts to identify patterns of similarity in the ordering of the statements. Then, principal component analysis (PCA) with Varimax rotation was applied to extract and facilitate the interpretation of perceptual structures, thereby aiding the identification of interpretatively consistent clusters. Factor retention was based on (i) eigenvalues greater than 1, (ii) the proportion of explained and cumulative variance, (iii) the principle of parsimony, and (iv) the interpretative coherence of the factors. In addition, the conceptual consistency of the factorial configurations was considered to identify the solution that provided the best balance between explanatory capacity and theoretical interpretability. (Brown 1980; Watts and Stenner 2012). Factor loadings were considered significant when they exceeded $\pm$ 0.5 ($p < 0.05$), and Q-sorts with a significant loading on a single factor were treated as defining, excluding those without statistical significance. For each retained

Table 1. Q-set statements organized according to the dimensions of the socioecological system (SES) and the acceptability criteria of the proposed model.

| | Dimensions | | |
|---|---|---|---|
| $D_i$ | SES | Model acceptability | Statements |
| D1 | Legal | Relevance | A Comprehensive Model of Active Governance (the IMPG-SSF) would address the real governance issues in small-scale fisheries |
| D2 | Social | Relevance | The model is complex in nature and does not adapt to the local reality of fishers |
| D3 | Social | Relevance | Fishing communities would view the IMPG-SSF as a means of strengthening their collective voice |
| D4 | Social | Relevance | It prioritizes external agendas over the needs of coastal artisanal communities |
| D5 | Economic | Feasibility | Local authorities have the technical resources to implement the IMPG-SSF |
| D6 | Economic | Feasibility | The model is not viable without sustained financial support from the government or international cooperation |
| D7 | Legal | Feasibility | This model can be implemented with the current capabilities of local governments |
| D8 | Legal | Feasibility | The model must have a functional structure that artisanal communities currently lack |
| D9 | Ecological | Impact | The IMPG-SSF will enhance the stewardship of fishery resources and the sustainability of artisanal fishing |
| D10 | Social | Impact | The model will generate conflicts due to the redistribution of power in decision-making |
| D11 | Social | Impact | Its implementation will promote the empowerment of historically excluded actors |
| D12 | Economic | Impact | There will be no concrete improvements in the quality of life of fishing families |
| D13 | Legal | Alignment | The IMPG-SSF complements regional and local fisheries development plans |
| D14 | Legal | Alignment | There is no consistency between the IMPG-SSF and current fisheries sector policies |
| D15 | Economic | Alignment | Public stakeholders view the model as an opportunity to integrate scattered efforts |
| D16 | Legal | Alignment | The model interferes with traditional management practices that are already working |
| D17 | Social | Inclusion | The model promotes the effective participation of women and youth in fisheries governance |
| D18 | Social | Inclusion | The participatory process is perceived as a formality with no real results |
| D19 | Ecological | Inclusion | Decisions are made taking into account the local knowledge of artisanal fishers |
| D20 | Social | Inclusion | Co-management meetings are often dominated by the same leaders as always |
| D21 | Social | Capacities | Co-management is feasible if community leadership capacities are strengthened |
| D22 | Legal | Capacities | Communities lack clarity regarding their roles and responsibilities within the model |
| D23 | Legal | Capacities | The lack of oversight limits the effectiveness of the IMPG-SSF |
| D24 | Social | Capacities | Local institutions are willing to work with communities |
| D25 | Ecological | Sustainability | The IMPG-SSF must mitigate the overexploitation of at-risk species |
| D26 | Ecological | Sustainability | The issues under consideration have not been integrated with climate change or environmental diversity in the model’s solutions |
| D27 | Social | Sustainability | The model can help preserve traditional and ancestral ecological knowledge |
| D28 | Economic | Sustainability | It is unclear how the model would ensure continuity over time |
| D29 | Social | Trust | The model will build greater trust among communities, authorities, and other stakeholders |
| D30 | Legal | Trust | The lack of clarity in the proposal undermines its legitimacy |

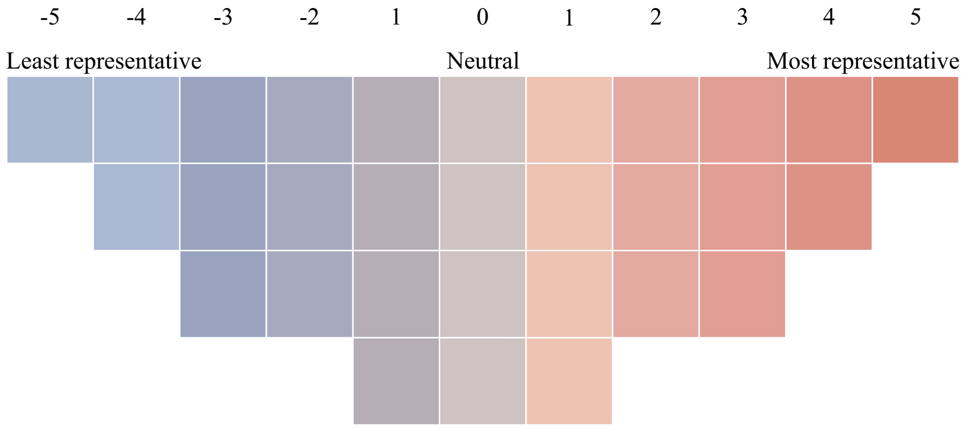


Figure 2. Forced distribution used in the Q Method (Q Method Software 2025).

factor, factor matrices were developed to identify distinctive and consensus statements. The factor interpretation integrated Z-scores, differences between factors, and qualitative information obtained from workshops and focus groups. Additionally, triangulation with sociodemographic data was performed to reinforce the interpretive consistency of the analysis. Finally, a nonparametric bootstrap was applied to evaluate the stability of the factor loadings and the consistency of the assignment of Q-sorts to the retained factors. The procedure was implemented using a factor solution with several factors determined in previous steps, with Varimax rotation and 1,000 resampling iterations. This procedure was incorporated as a complementary criterion of robustness and interpretive reliability for the obtained factor solution (Zabala and Pascual 2016; Cinti et al. 2024; Rice et al. 2024).

## RESULTS

### Characterization of the participants

Study participants comprised a predominantly adult community, with 77.8% over the age of 35 and a predominance of people between 45 and 54 years old (41.7%). Participation was overwhelmingly male (98.6%), reflecting the traditional composition of fishing communities. Most maintained an active relationship with their organizations, 58.3% participated frequently, and only 12.5% reported not participating at all (Table 2).

Prior to the presentation of the IMPG-SSF, awareness of it was almost nonexistent (2.8%). However, after learning about it, 76.4% considered it relevant or very relevant, and the same percentage perceived their communities as having the capacity, either fully or partially, to participate in co-management processes. The willingness to get involved was high (90.3%); the sample consisted mainly of fishers (73.6%), supplemented by commercial and institutional actors (26.4%) who provide key perspectives for governance. But this openness to participation was also accompanied by challenges, particularly the need for funding, which 91.4% of participants identified as an essential requirement for implementing the model.

Participants identified several barriers limiting their active participation, associated with the lack of interest among some fishers, institutional distrust, and gaps in information, training, and sectoral coordination. In addition, structural constraints were observed, linked to informality, conflicts among communities overfishing gears and methods, and economic restrictions, which may affect the implementation of the model.

Table 2. General description of participants and summary of their perceptions.

| Category | Indicator | Value/result | Interpretation/observation |
|---|---|---|---|
| Sociodemographic profile | Predominant age group | 45-54 years (50%) | Middle-aged adults with established experience in the fishing industry predominate |
| Sociodemographic profile | Participants over 35 years old | 80% | The sample consisted mainly of individuals with accumulated experience |
| Organizational participation | Frequent or active participation | 57.5% | More than half reported sustained interaction with organizational or institutional spaces |
| Organizational participation | Never participated | 12.5% | A segment with weak participatory ties was identified |
| Knowledge of the IMPG-SSF | Prior knowledge of the model | 5% | The model was virtually unknown prior to the study |
| Knowledge of the IMPG-SSF | Lack of knowledge of the model | 95% | Evidence of the need for institutional dissemination and socialization |
| Relevance of the model | High or very high relevance | 72.50% | The IMPG-SSF was evaluated favorably following its presentation |
| Relevance of the model | Low or no relevance | 7.50% | Marginal rejection of the proposed approach |
| Community capacity | Affirmative or partial capacity | 75% | Mostly positive perception of the community's capacity to get involved |
| Community capacity | Lack of capacity | 25% | A significant group identified structural limitations |
| Willingness to participate | Positive willingness | 90% | There was a high potential openness to participatory co-management schemes |
| Willingness to participate | Not willing | 10% | A resistant or disinterested minority |
| Role of the actor | Predominant role | Fisher (62.5%) | The discourse was dominated by actors directly involved in the extractive activity |
| Role of the actor | Other institutional and commercial roles | 37.50% | Complementary presence of traders (25%) and technical/institutional authorities (12.5%), key actors for governance |
| Priority demands (multiple responses) | Main demand | Financing (90%) | Economic sustainability emerged as a central concern |
| Priority demands (multiple responses) | Technical and institutional demands | > 80% | High consensus on the need for technical and institutional strengthening |
| Priority needs (multiple responses) | Social inclusion | 57.50% | Gender and generational equity were relevant, though secondary |

Note: prepared by authors based on the studied data. Complete descriptive statistics are provided in Appendix 3 and 4.

## Structuring the perspectives of fishing stakeholders using the Q methodology

*Eigenvalues*

The eigenvalues showed a progressive decline, with the largest proportion of explained variance concentrated in the first factors (Figure 3). Although the criterion of eigenvalues > 1 identified sixteen factors, this approach tended to overestimate the number of interpretatively relevant structures within Q methodology (Kaiser 1960). The inflection point ('knee') analysis indicated a clear break in the third factor, after which the eigenvalues decreased more uniformly, suggesting that the first three factors concentrated the main perceptual structure of the study, while the subsequent factors showed a more limited explanatory and interpretative contribution (Cattell 1966) (Figure 3).

*Individual and cumulative variance*

The explained variance showed an increasing cumulative distribution (Figure 4), where the first factors concentrated the largest proportion of information. The first factor explained 33.5% of the total variance, while the second and third factors increased the cumulative variance to 45.8% and 53.8%, respectively, from the fourth factor onward, the increase in explained variance became progressively smaller, reflecting a marginal contribution of the additional factors (Jolliffe 2002).

*Factor characteristics*

Varimax rotation allowed for the identification of a clear factor structure composed of three distinct perceptual configurations (Table 3). Factor 1 (F1) had the highest representativeness, with 29 eigenvalues, an eigenvalue of 17.4, and an explained variance of 24%. Factor 2 (F2) comprised 22 factor loadings, with an eigenvalue of 12.2 and 17% explained variance, while Factor 3 (F3) included 14 factor loadings, with an eigenvalue of 9.1 and 13% explained variance. The factor solution showed high levels of composite reliability (0.98-0.99), indicating a consistent and stable internal structure. Likewise, F1 and F2 showed a moderate correlation (r = 0.64), while F3 showed low correlations with the other factors (r = 0.16 and r = −0.04), reflecting a more differentiated perspective within

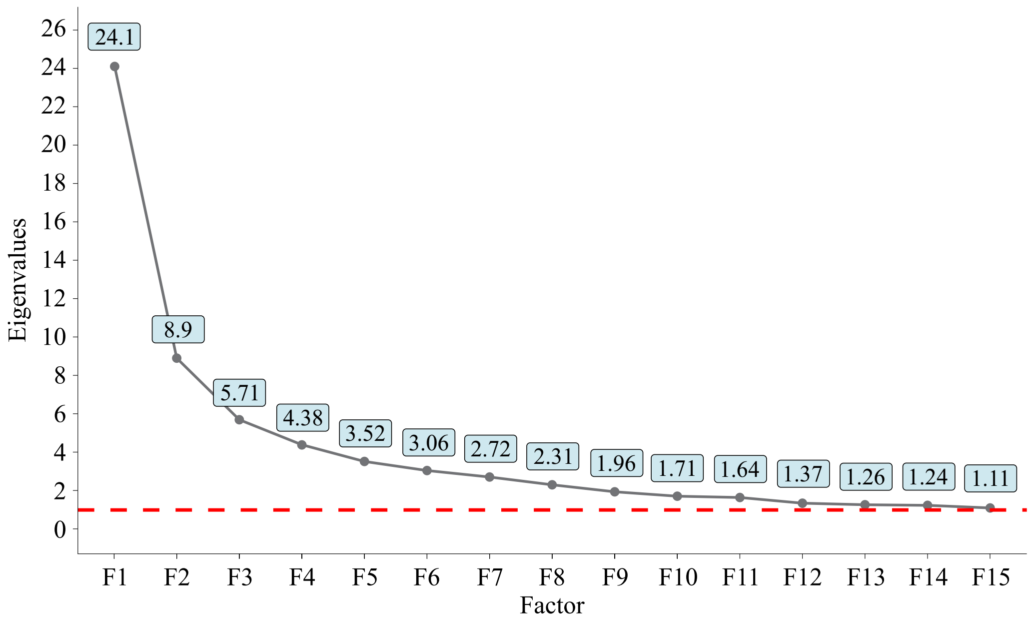


Figure 3. Eigenvalues and factor retention criterion (F).

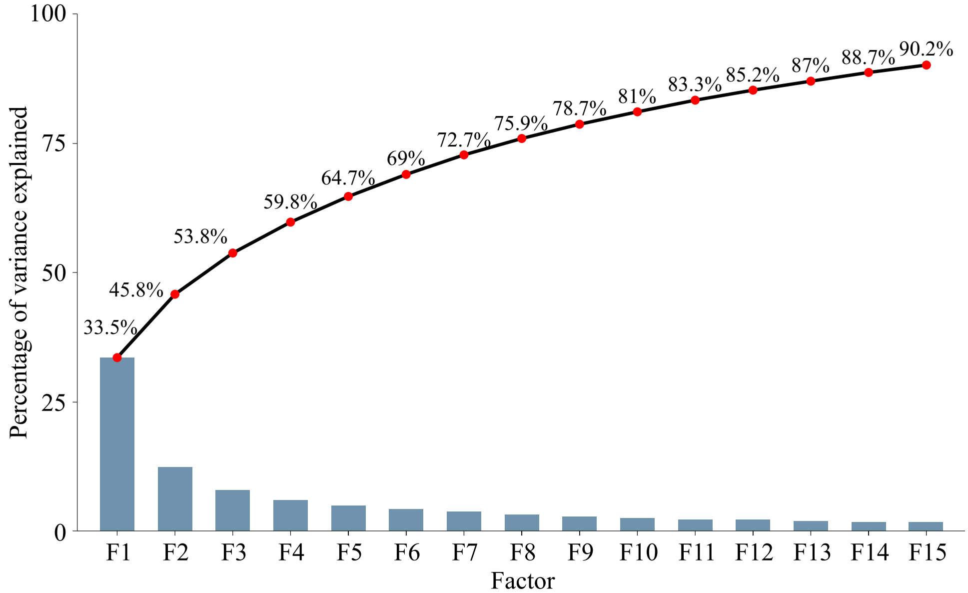


Figure 4. Individual and cumulative explained variance by factor.

Table 3. General characteristics of the factors with Varimax rotation.

| Indicator | F1 | F2 | F3 | Correlation between factor z-scores | | | |
|---|---|---|---|---|---|---|---|
| | | | | | ZSC-F1 | ZSC-F2 | ZSC-F3 |
| Number of loadings | 29 | 22 | 14 | | | | |
| Equity | 17.4 | 12.2 | 9.1 | ZSC-F1 | 1 | 0.64 | 0.16 |
| Explanatory variance (%) | 24 | 17 | 13 | ZSC-F2 | 0.64 | 1 | -0.04 |
| Reliability | 0.99 | 0.99 | 0.98 | ZSC-F3 | 0.16 | -0.04 | 1 |

the factor structure. To complement the robustness assessment, a bootstrap procedure was applied to examine the stability of the factor loadings and the persistence of the Q-sorts in their dominant factors.

*Factor stability via bootstrap*

The bootstrap procedure confirmed the stability of the factor solution obtained via Varimax rotation. The bootstrapped loadings retained a consistent structure relative to the original loadings, with the dominant assignment of the Q-sorts remaining within the same factors initially identified. Likewise, the factor assignment frequencies showed high levels of participant stability within their dominant factors throughout the 1,000 iterations (Appendix 5).

*Factor map*

The factor map showed a differentiated distribution of participants across three main perceptual configurations (Figure 5). The Q-sorts associated with Factor 1 clustered in a compact and homogeneous manner, indicating high internal consistency. Factor 2 formed a clearly delimited cluster that was perceptually distinct from Factor 1. In contrast, Factor 3 exhibited a more dispersed distribution,

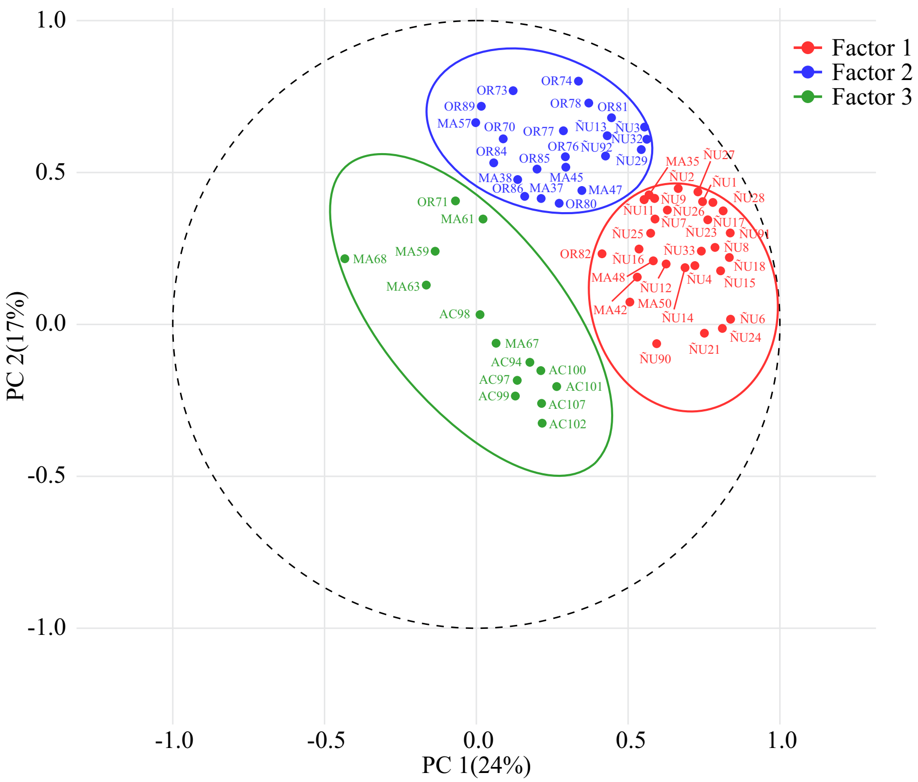


Figure 5. Distribution of participants in the factor space.

reflecting greater internal heterogeneity, although it maintained a clear visual separation from the other factors.

*Standardized Z-scores by factor*

Factor 1 showed a marked favorable orientation toward sustainability, institutional strengthening, and the valorization of local knowledge. The highest positive scores corresponded to D25 (mitigation of overexploitation; Z = 2.11), D27 (conservation of traditional ecological knowledge; Z = 1.75), D23 (limitations due to lack of enforcement; Z = 1.35), D9 (strengthening of fisheries sustainability; Z = 1.17), and D24 (institutional willingness to work with communities; Z = 1.15). Likewise, D1, D3, D11, D17, and D19 showed moderate positive values, associated with participation, social inclusion, and coordination among stakeholders (Figure 6). In contrast, negative scores were concentrated in D28 (model continuity; Z = -1.77), D22 (clarity of community roles; Z = -1.53), D26 (integration of climate change and environmental diversity; Z = -1.49), D20 (dominance of traditional leaders; Z = -1.10), and D18 (participation perceived as a formality; Z = -0.96). Negative values were also observed in D16 and D14, reflecting disagreement with the model's alleged incompatibility with local practices and current policies. Likewise, Factor 2 showed high positive scores in statements associated with environmental benefits and participatory empowerment. Notable were D9 (sustainability of artisanal activity; Z = 1.84), D25 (mitigation of overexploitation; Z = 1.72), D3 (strengthening of the community's voice; Z = 1.69), D1 (Z = 1.48), D11 (Z = 1.13), and D30 (lack of clarity in the proposal; Z = 1.10). Likewise, D17 and D29 showed moderate positive values.

The negative scores were concentrated in state-

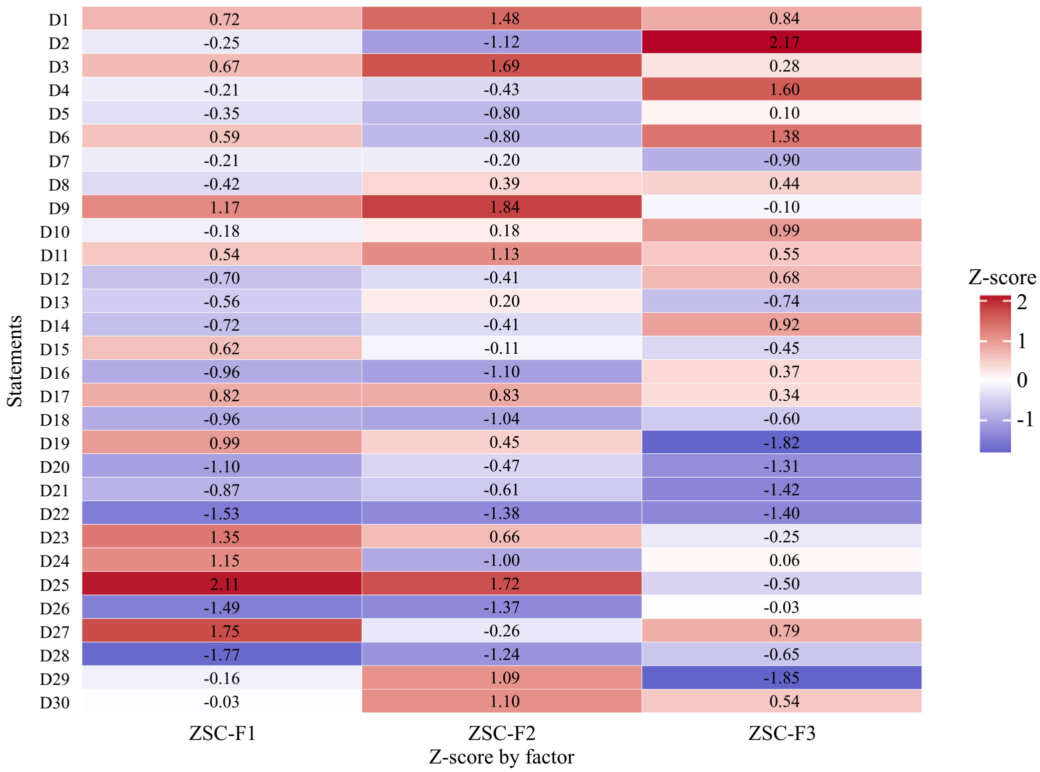


Figure 6. Distribution of standardized Z-scores across factors.

ments related to organizational limitations and community capacities, particularly D22 (clarity of roles and responsibilities; Z = -1.38), D28 (continuity of the model; Z = -1.24), D16 (Z = -1.10), D18 (Z = -1.03), and D21 (strengthening of community leadership; Z = -0.61). Moderate negative values were also observed in D5 and D6. Finally, Factor 3 presented a more critical and polarized configuration regarding the model's institutional viability and local adaptation. The highest positive scores corresponded to D2 (complexity and poor adaptation of the model to the fishing reality; Z = 2.17), D4 (prioritization of external agendas; Z = 1.60), D6 (dependence on state or international funding; Z = 1.38), D10 (conflicts over power redistribution; Z = 0.99), and D14 (inconsistency with current fisheries policies; Z = 0.92). Positive values were also observed in D1, D12, and D17. The most significant negative scores were recorded for D29 (building trust among stakeholders; Z = -1.85), D19 (incorporating local knowledge into decision-making; Z = -1.82), D21 (feasibility of co-management through strengthening community leadership; Z = -1.42), D22 (clarity of community roles; Z = -1.40), and D20 (dominance of traditional leaders; Z = -1.31). Likewise, D7, D13, and D28 showed moderate negative values.

*Differences in standardized Z-scores by factor (consensus and distinctive statements)*

Most of statements distinguished between at least two factors, highlighting substantive differences between the identified perspectives. Only statement D22 ('communities lack clarity regarding their roles and responsibilities in the model') showed no significant differences between factors, constituting a consensus statement (Table 4).

Among statements that distinguished exclusive-

Table 4. Distinctive and consensus statements across factors (F).

| $D_i$ | Consensus and distinctions | F1-F2 | Next | F1-F3 | Sig. | F2-F3 | Next |
|---|---|---|---|---|---|---|---|
| D1 | Factor 2 distinctive | -0.120 | 6* | -0.120 | | 0.645 | *** |
| D2 | Distinctive among all factors | -2.417 | 6* | -2.417 | 6* | -3.285 | 6* |
| D3 | Significant among all factors | 0.386 | 6* | 0.386 | * | 1.409 | 6* |
| D4 | Factor 3 distinctive | -1.813 | | -1.813 | 6* | -2.028 | 6* |
| D5 | Significant among all factors | -0.457 | ** | -0.457 | ** | -0.905 | 6* |
| D6 | Distinctive among all factors | -0.790 | 6* | -0.790 | *** | -2.181 | 6* |
| D7 | Factor 3 distinctive | 0.688 | | 0.688 | *** | 0.698 | *** |
| D8 | Factor 1 distinctive | -0.855 | 6* | -0.855 | 6* | -0.042 | |
| D9 | Distinctive among all factors | 1.275 | *** | 1.275 | 6* | 1.939 | 6* |
| D10 | Distinctive among all factors | -1.170 | ** | -1.170 | 6* | -0.806 | *** |
| D11 | Factor 2 distinctive | -0.020 | *** | -0.020 | | 0.577 | *** |
| D12 | Significant among all factors | -1.376 | * | -1.376 | 6* | -1.088 | 6* |
| D13 | Factor 2 distinctive | 0.175 | 6* | 0.175 | | 0.931 | 6* |
| D14 | Distinctive among all factors | -1.649 | * | -1.649 | 6* | -1.339 | 6* |
| D15 | Distinctive among all factors | 1.075 | 6* | 1.075 | 6* | 0.340 | * |
| D16 | Factor 3 distinctive | -1.327 | | -1.327 | 6* | -1.467 | 6* |
| D17 | Factor 3 distinctive | 0.484 | | 0.484 | ** | 0.490 | ** |
| D18 | Factor 3 distinctive | -0.356 | | -0.356 | * | -0.435 | * |
| D19 | Distinctive among all factors | 2.817 | *** | 2.817 | 6* | 2.276 | 6* |
| D20 | Factor 2 distinctive | 0.218 | *** | 0.218 | | 0.846 | 6* |
| D21 | Factor 3 distinctive | 0.546 | | 0.546 | *** | 0.812 | *** |
| D22 | Consensus | -0.133 | | -0.133 | | 0.018 | |
| D23 | Significant among all factors | 1.600 | 6* | 1.600 | 6* | 0.910 | 6* |
| D24 | Distinctive among all factors | 1.095 | 6* | 1.095 | 6* | -1.052 | 6* |
| D25 | Distinctive among all factors | 2.613 | ** | 2.613 | 6* | 2.217 | 6* |
| D26 | Factor 3 distinctive | -1.457 | | -1.457 | 6* | -1.344 | 6* |
| D27 | Distinctive among all factors | 0.964 | 6* | 0.964 | 6* | -1.046 | 6* |
| D28 | Distinctive among all factors | -1.122 | *** | -1.122 | 6* | -0.597 | *** |
| D29 | Distinctive among all factors | 1.692 | 6* | 1.692 | 6* | 2.937 | 6* |
| D30 | Significant among all factors | -0.566 | 6* | -0.566 | *** | 0.568 | *** |

ly a single factor, Q8 was identified for Factor 1; D1, D11, D13, and D20 for Factor 2; and D4, D7, D16, D17, D21, and D26 for Factor 3. This pattern indicated that Factor 3 comprises the largest number of statements with a distinct character of their own, while the remaining factors share a broader set of interpretive tensions. When considering the statements that discriminated across all factors, the following stand out: D2, D3, D5, D6, D9, D10, D12, D14, D15, D18, D19, D23, D24, D25, D27, D28, D29, and D30. These statements encapsulate the main points of divergence among the three factor configurations and refer particularly to aspects related to the model's complexity and adaptability.

In the comparison between factors, the largest significant differences between Factor 1 and Factor 2 were observed in D2(0.87), D3(-1.02), D6(1.39), D9(-0.66), D15(0.73), D19(0.54), D23(0.69), D24(2.15), D27(2.01), D28(-0.52), D29(-1.24), and D30 (-1.13), while between Factor 1 and Factor 3, the most pronounced and significant differences were recorded in D2(-2.42), D6(-0.79), D9(1.28), D10(-1.17), D12(-1.38), D14(-1.65), D15(1.07), D19(2.82), D23(1.60), D24(1.1), D25(2.61), D27(0.96), D28(-1.12), D29(1.69) and D30(-0.57). Meanwhile, the comparison between Factor 2 and Factor 3 revealed significant differences, particularly in D2(-3.28), D3(1.41), D5(-0.9), D6(-2.18), D9(1.94), D10(-0.81), D12(-1.09), D14(-1.34), D19(2.28), D23(0.91), D24(-1.05), D25(2.21), D27(-1.05), D28(-0.60), D29(2.94) and D30(0.57). Taking together, these differences show that the factors are distinguished not only by the level of agreement or disagreement with the IMPG-SSF, but also by the way in which each group prioritizes governance issues, institutional viability, and the conditions necessary for the implementation of the model.

## Interpretative configurations of the factors around the IMPG-SSF

*Factor 1: co-management as a socio-ecological opportunity and a means of community strengthening*

This factor primarily articulates the ecological, social, and legal dimensions of the IMPG-SSF model. The dominant reading is favorable, as the model is not perceived merely as an arrangement for fisheries management, but as a mechanism to respond to real governance problems, strengthen resource sustainability, and revalue local ecological knowledge. From the ecological dimension, its potential to mitigate overexploitation and foster more sustainable practices is recognized. From the social dimension, it is valued for expanding participation, inclusion, and the voice of marginalized actors. At the same time, from the legal dimension, co-management is seen as requiring stronger enforcement, greater organizational clarity, and an institutional framework capable of making participation effective. From this perspective, the problem is not the model itself, but rather the need for its institutional and social mechanisms to translate into governance that is genuinely legitimate and operational.

*Factor 2: co-management as a possibility conditioned by capacities, clarity, and institutional support*

This factor also recognizes the value of the IMPG-SSF model, but from a more pragmatic and conditional perspective, in which the social, ecological, legal, and economic dimensions acquire particular relevance. The central narrative does not question the objectives of co-management, but rather the conditions required for its viable implementation. On the one hand, a positive assessment of its ecological contributions is maintained, particularly regarding fisheries sustainability and the reduction of pressure on resources. On the other hand, its social potential to strengthen community participation, includes excluded actors, and create spaces for empowerment is emphasized. However, this perspective is constrained by legal and economic concerns, including a lack of clarity regarding roles and responsibilities, persistent uncertainty about the continuity of the model, and the recognized need for institutional support and resources to prevent the proposal from remaining merely declarative. Thus, this factor reflects a favorable position, although conditioned on the model's ability to be sustained through stronger organizational and institutional foundations.

*Factor 3: co-management as a risk of institutional misalignment and loss of legitimacy*

This factor is primarily organized around the legal, social, and economic dimensions, reflecting a more critical interpretation of the IMPG-SSF model. Here, co-management is understood as a proposal that may introduce greater institutional complexity, generate power conflicts, and depend on external resources, thereby weakening its viability in local contexts. From the legal dimension, concerns are raised regarding its coherence with existing fisheries policies and its capacity to articulate with already established institutional frameworks. From the social dimension, there is strong distrust concerning the genuine incorporation of local knowledge, the development of trust among actors, and the strengthening of community leadership. From the economic dimension, dependence on external funding reinforces the perception of the model's fragility. Thus, this perspective conceives co-management as a proposal vulnerable to institutional and territorial misalignment.

## DISCUSSION

The findings of this study suggest that transitions toward participatory governance schemes in artisanal fisheries in northern Peru do not follow a homogeneous logic, but rather differentiated perceptual configurations conditioned by institutional experiences, territorial dynamics, and expectations regarding the viability of the proposed model. This interpretation is consistent with the arguments put forward by Berkes (2008) and Jentoft and Chuenpagdee (2022), who maintain that fisheries governance should be understood as a transitional and multilevel process, where legitimacy depends on the interaction between actors, institutions, and local contexts. It also aligns with the findings of Ouréns et al. (2022), who highlight that the effectiveness of co-management schemes depends on both institutional arrangements and existing organizational and territorial capacities.

Furthermore, the differences observed among factors suggest that perceptions of the IMPG-SSF were not determined solely by abstract principles of sustainability or participation, but also by the socio-productive trajectories of the involved actors. Participants with greater direct involvement in extractive activities and frequent levels of participation tended to express more favorable views toward co-management, while more heterogeneous profiles, including institutional actors, marketers, and participants with less organizational involvement, expressed more cautious or critical stances regarding the model's viability. This trend aligns with the findings of Jentoft and Chuenpagdee (2022), who note that the acceptance of participatory arrangements depends largely on previous experiences of interaction between communities, the state, and local governance systems.

The first narrative interpreted the IMPG-SSF as an opportunity to strengthen socio-ecological sustainability and institutional coordination in artisanal fisheries. Participants associated with this factor viewed the integration of local ecological knowledge, coordination among actors, and the model's potential to improve resource conservation and community participation positively. This perception aligns with the findings of Galappaththi et al. (2021), who highlight that incorporating local knowledge strengthens the resilience and legitimacy of fisheries governance. Similarly, House et al. (2023) argue that participatory processes yield better results when they promote interactive learning and shared responsibility between the state and communities. The favorable assessment of participation and sustainability is also consistent with the findings of González-Roca et al. (2023) and Bausero-Jorcin et al. (2024), who show that acceptance of co-management models increases when these models recognize local practices and strengthen community institutions. In socio-territorial terms, this narrative was primarily associated with artisanal fishers who participate frequently and have strong community ties. This suggests that daily experience in extractive activities and sustained participation in collective spaces can strengthen favorable perceptions of collaborative governance schemes. In artisanal fisheries contexts, various studies have shown that social capital, horizontal trust, and territorial identity are fundamental elements for the legitimacy of co-management processes (Berkes 2008; Ostrom 2010).

The second narrative reflected a more cautious stance toward the model. Although it did not reject co-management, it emphasized concerns related to the clarity of roles, institutional capacity, and the financial sustainability of the IMPG-SSF. Participants associated with this factor expressed doubts about the operational capacity of institutions and the feasibility of implementing participatory mechanisms in contexts with limited state presence and restricted resources. This perception aligns with the findings of Bowman et al. (2021) and Calò et al. (2023), who note that participatory models may face difficulties when institutional weaknesses and limitations in implementation capacity exist. Likewise, Kinyua et al. (2022) note that fisheries stakeholders tend to evaluate governance not only based on normative principles but also on its practical applicability and operational sustainability. The more diverse composition of this group, including technical and institutional actors, was consistent with the greater concern for operational and implementation aspects. Unlike narratives focused primarily on expectations of local sustainability, this profile appeared to evaluate the IMPG-SSF based on criteria of functional governance, emphasizing the need for administrative and enforcement capacities, regulatory clarity, and financial sustainability. This interpretation aligns with the findings of Ouréns et al. (2022), who argue that the effectiveness of co-management systems depends not only on the participation of local actors but also on institutional capacity to sustain collaborative processes over time.

The third narrative expressed a more critical view of the IMPG-SSF, primarily linked to concerns about institutional complexity, power struggles, and a disconnect between the model and local realities. Participants associated with this factor pointed out risks related to dependence on external support, potential incompatibility with existing fishing dynamics, and the limited effective incorporation of local knowledge into decision-making. This perceptual framework aligns with the arguments of Banikoi (2024), who highlights that coastal systems are characterized by forms of institutional pluralism where state, community, and informal rules coexist and are not always easily reconciled. Similarly, Furqan and Schlüter (2023) argue that the acceptance of participatory models depends on their ability to adapt to specific socio-territorial contexts and not on the uniform application of institutional designs. Along the same lines, Aguado et al. (2021) argue that fisheries governance tends to be more effective when built upon existing territorial arrangements rather than through externally imposed homogeneous schemes.

The greater presence of actors involved in technical functions, marketing, and more heterogeneous territorial dynamics was consistent with a more critical perception regarding the risk of institutional fragmentation and loss of legitimacy of the participatory process. In scenarios where there is a history of weak coordination between the state and communities, new governance arrangements may be viewed with skepticism, especially when stakeholders perceive uncertainty regarding the model's actual benefits or the continuity of institutional support. This situation has been widely documented in small-scale fishing systems characterized by institutional pluralism and low organizational trust (Furqan and Schlüter 2023; Banikoi 2024).

The narratives identified reflected a relevant territorial and institutional dimension within the artisanal fishing system of northern Peru. Although the study included communities in Piura and Tumbes, perceptual differences did not correspond to rigid regional divisions, but rather to local configurations of governance and institutional pluralism. In localities in Piura, more favorable perceptions of the IMPG-SSF were associated with higher levels of organizational participation and community coordination, while in sectors linked to Tumbes and interconnected areas such as Acapulco, more cautious stances emerged regarding the institutional viability and operational continuity of the model. These differences suggest that transitions toward co-management schemes occur in contexts where formal rules, community arrangements, and specific territorial dynamics coexist, shaping different ways of interpreting the legitimacy and feasibility of fisheries governance (Ostrom 2010).

These perceptual configurations showed that the viability of the IMPG-SSF was linked both to its principles of sustainability and participation and to its ability to establish institutional mechanisms compatible with the territorial and organizational dynamics of fishing communities. Despite differences in narratives, participants shared positive assessments of the model's potential to strengthen resource sustainability, promote greater participation, and improve coordination among actors involved in artisanal fisheries. These findings suggest that transitions toward co-management schemes in Piura and Tumbes require territorially situated approaches capable of integrating institutional trust, recognition of local knowledge, and operational viability within contexts of institutional pluralism.

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### Author contributions

Carlos M. Salazar: investigation; conceptualization; methodology; formal analysis; funding acquisition; supervision; project administration, writing-original draft; writing-review and editing. Joe M. Macalupú Rosado: investigation; conceptualization; writing-review and editing. Víctor J. Morales Gallo: investigation; conceptualization; data curation; formal analysis; software; visualization; writing-review and editing.

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APPENDIX 1

**Q-Method survey used for the study**

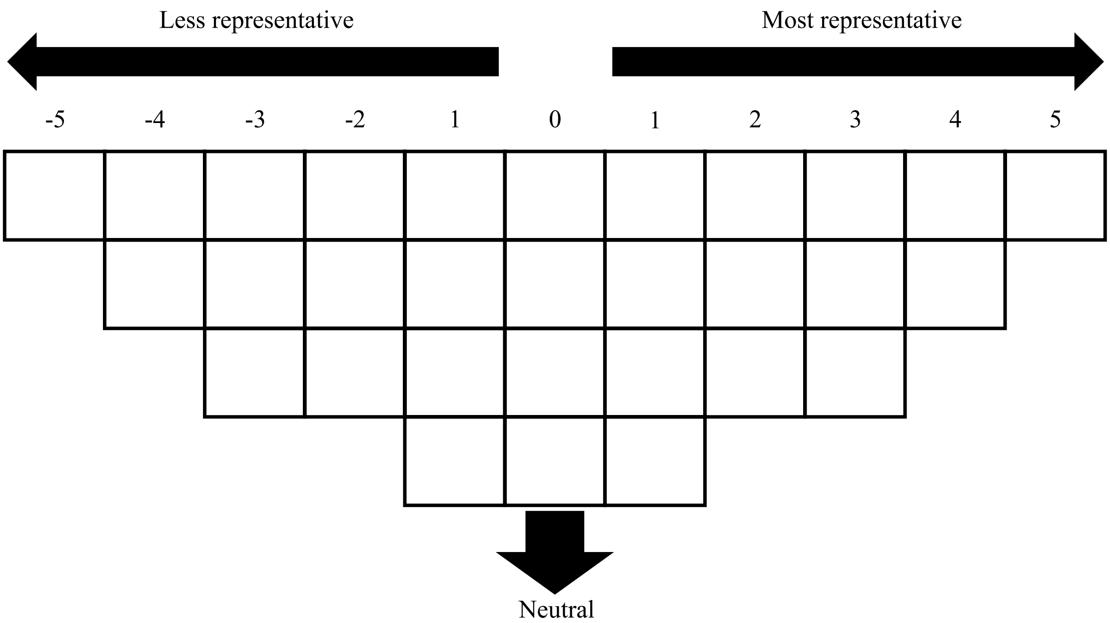
Application of the Q-Method to explore perceptions of the Integrated Model of Participatory Governance (IMPG-SSF) in artisanal fisheries.

| $D_i$ | Dimension | Statements |
|---|---|---|
| D1 | Relevance | A Comprehensive Model of Active Governance (the IMPG-SSF) would address the real governance challenges in small-scale fisheries |
| D2 | Relevance | The model is complex in nature and does not adapt to the local reality of fishers |
| D3 | Relevance | Fishing communities would view the IMPG-SSF as a means to develop their own voice |
| D4 | Relevance | It prioritizes external agendas over the needs of coastal artisanal communities |
| D5 | Feasibility | Local authorities have the technical resources to implement the IMPG-SSF |
| D6 | Feasibility | The model is not viable without sustained financial support from the government or international cooperation |
| D7 | Feasibility | This model can be implemented with the current capabilities of local governments |
| D8 | Feasibility | The model must have a functional structure that artisanal communities currently lack |
| D9 | Impact | The IMPG-SSF will enhance the stewardship of fishery resources and the sustainability of artisanal fishing |
| D10 | Impact | The model will generate conflicts due to the redistribution of power in decision-making |
| D11 | Impact | Its implementation will promote the empowerment of historically excluded actors |
| D12 | Impact | There will be no concrete improvements in the quality of life of fishing families |
| D13 | Alignment | The IMPG-SSF complements regional and local fisheries development plans |
| D14 | Alignment | There is no consistency between the IMPG-SSF and current fisheries sector policies |
| D15 | Alignment | Public stakeholders view the model as an opportunity to integrate scattered efforts |
| D16 | Alignment | The model interferes with traditional management practices that are already working |
| D17 | Inclusion | The model promotes the effective participation of women and youth in fisheries governance |
| D18 | Inclusion | The participatory process is perceived as a formality with no real results |
| D19 | Inclusion | Decisions are made taking into account the local knowledge of artisanal fishers |
| D20 | Inclusion | Co-management meetings are often dominated by the same leaders as always |
| D21 | Capacities | Co-management is feasible if community leadership capacities are strengthened |
| D22 | Capacities | Communities lack clarity regarding their roles and responsibilities within the model |
| D23 | Capacities | The lack of oversight limits the effectiveness of the IMPG-SSF |
| D24 | Capacities | Local institutions are willing to work with communities |
| D25 | Sustainability | The IMPG-SSF must mitigate the overexploitation of at-risk species |
| D26 | Sustainability | The issues under consideration have not been integrated with climate change or environmental diversity in the model’s solutions |
| D27 | Sustainability | The model can help preserve traditional and ancestral ecological knowledge |

Appendix 1. Continued.

| $D_i$ | Dimension | Statements |
|---|---|---|
| D28 | Sustainability | It is unclear how the model would ensure continuity over time |
| D29 | Trust | The model will build greater trust among communities, authorities, and other stakeholders |
| D30 | Trust | The lack of clarity in the proposal undermines its legitimacy |

Instructions: please place each statement on the distribution graph ranging from -5 to 5, where 5 represents the statement with which you totally agree or consider most representative of your opinion, and -5 the statement with which you totally disagree or consider least representative; the intermediate positions reflect varying degrees of agreement or disagreement, so you should order the statements so that those that best express your point of view are near the positive end and those that least represent it are near the negative end, ensuring that you follow the distribution scale assigned for the exercise.



## APPENDIX 2

**Supplementary sociodemographic survey conducted for the study**

Survey on the perception and applicability of the Integrated Model of Participatory Governance (IMPG-SSF) in artisanal fisheries and its implications for future fisheries management.

1. Age
   - ☐ Under 25 years
   - ☐ 25-34 years
   - ☐ 35-44 years
   - ☐ 45-54 years
   - ☐ 55 and older

2. Gender
   - ☐ Male
   - ☐ Female

3. Primary role in artisanal fishing
   - ☐ Fisher
   - ☐ Marketer
   - ☐ Technical/institutional authority

4. Level of participation in fisheries decision-making forums
   - ☐ I have never participated
   - ☐ Occasionally
   - ☐ Frequently
   - ☐ I am currently an active participant

5. Were you previously familiar with the IMPG-SSF Model?
   - ☐ Yes
   - ☐ No

6. On a scale of 1 to 5, how relevant did you find the implementation of the model?
   - ☐ Not at all relevant
   - ☐ Somewhat relevant
   - ☐ Moderate
   - ☐ Relevant
   - ☐ Very relevant

7. Do you think communities currently have the capacity to implement a participatory governance model such as the IMPG-SSF?
   - ☐ Yes
   - ☐ No
   - ☐ Partially

8. Would you be willing to actively participate in co-management and participatory monitoring initiatives in your community?
   - ☐ Yes
   - ☐ No

9. What elements do you consider most important for this model to function effectively in your community? (You may select more than one)
   - ☐ Funding
   - ☐ Technical training
   - ☐ Transparency in management
   - ☐ Inclusion of women and youth
   - ☐ Respect for local knowledge
   - ☐ Other

10. In your opinion, what is the main obstacle that could hinder the implementation of the IMPG-SSF in your community?

______________________________________

______________________________________

______________________________________

______________________________________

______________________________________

# APPENDIX 3

## Identification and coding of participants (p-set) by fishing villages

| No. | Participant code | Fishing Village | Random code | No. | Participant code | Caleta | Random code |
|---|---|---|---|---|---|---|---|
| 1 | AC100 | Acapulco | 100 | 37 | ÑU18 | El Ñuro | 18 |
| 2 | AC101 | Acapulco | 101 | 38 | ÑU2 | El Ñuro | 2 |
| 3 | AC102 | Acapulco | 102 | 39 | ÑU21 | El Ñuro | 21 |
| 4 | AC100 | Acapulco | 100 | 40 | ÑU23 | El Ñuro | 23 |
| 5 | AC101 | Acapulco | 101 | 41 | ÑU24 | El Ñuro | 24 |
| 6 | AC102 | Acapulco | 102 | 42 | ÑU25 | El Ñuro | 25 |
| 7 | AC107 | Acapulco | 107 | 43 | ÑU26 | El Ñuro | 26 |
| 8 | AC94 | Acapulco | 94 | 44 | ÑU27 | El Ñuro | 27 |
| 9 | AC97 | Acapulco | 97 | 45 | ÑU28 | El Ñuro | 28 |
| 10 | AC98 | Acapulco | 98 | 46 | ÑU29 | El Ñuro | 29 |
| 11 | AC99 | Acapulco | 99 | 47 | ÑU3 | El Ñuro | 3 |
| 12 | MA35 | Máncora | 35 | 48 | ÑU32 | El Ñuro | 32 |
| 13 | MA37 | Máncora | 37 | 49 | ÑU33 | El Ñuro | 33 |
| 14 | MA38 | Máncora | 38 | 50 | ÑU4 | El Ñuro | 4 |
| 15 | MA42 | Máncora | 42 | 51 | ÑU5 | El Ñuro | 5 |
| 16 | MA43 | Máncora | 43 | 52 | ÑU6 | El Ñuro | 6 |
| 17 | MA45 | Máncora | 45 | 53 | ÑU7 | El Ñuro | 7 |
| 18 | MA46 | Máncora | 46 | 54 | ÑU8 | El Ñuro | 8 |
| 19 | MA47 | Máncora | 47 | 55 | ÑU9 | El Ñuro | 9 |
| 20 | MA48 | Máncora | 48 | 56 | ÑU90 | El Ñuro | 90 |
| 21 | MA49 | Máncora | 49 | 57 | ÑU91 | El Ñuro | 91 |
| 22 | MA50 | Máncora | 50 | 58 | ÑU92 | El Ñuro | 92 |
| 23 | MA57 | Máncora | 57 | 59 | OR70 | Los Órganos | 70 |
| 24 | MA59 | Máncora | 59 | 60 | OR71 | Los Órganos | 71 |
| 25 | MA60 | Máncora | 60 | 61 | OR73 | Los Órganos | 73 |
| 26 | MA61 | Máncora | 61 | 62 | OR74 | Los Órganos | 74 |
| 27 | MA63 | Máncora | 63 | 63 | OR76 | Los Órganos | 76 |
| 28 | MA66 | Máncora | 66 | 64 | OR77 | Los Órganos | 77 |
| 29 | MA67 | Máncora | 67 | 65 | OR78 | Los Órganos | 78 |
| 30 | MA68 | Máncora | 68 | 66 | OR80 | Los Órganos | 80 |
| 31 | ÑU1 | El Ñuro | 1 | 67 | OR81 | Los Órganos | 81 |
| 32 | ÑU10 | El Ñuro | 10 | 68 | OR82 | Los Órganos | 82 |
| 33 | ÑU11 | El Ñuro | 11 | 69 | OR84 | Los Órganos | 84 |
| 34 | ÑU12 | El Ñuro | 12 | 70 | OR85 | Los Órganos | 85 |
| 35 | ÑU16 | El Ñuro | 16 | 71 | OR86 | Los Órganos | 86 |
| 36 | ÑU17 | El Ñuro | 17 | 72 | OR89 | Los Órganos | 89 |

Note: the table shows the composition of the P-set (sample of participants), detailing the code assigned to ensure anonymity and traceability. The prefixes indicate the fishing village of origin: AC (Acapulco), MA (Máncora), ÑU (El Ñuro), and OR (Los Órganos).

# APPENDIX 4

## Descriptive characterization of participants

| Variable | Category | n | % |
|---|---|---|---|
| Age | Under 25 years | 2 | 2.80 |
| | 25-34 years | 14 | 19.40 |
| | 35-44 years | 15 | 20.80 |
| | 45-54 years | 30 | 41.70 |
| | 55 years or older | 11 | 15.30 |
| Sex | Male | 71 | 98.60 |
| | Female | 1 | 1.40 |
| Level of participation | I have never participated | 9 | 12.50 |
| | Occasionally | 21 | 29.20 |
| | Frequently | 35 | 48.60 |
| | I am currently an active participant | 7 | 9.70 |
| Familiarity with IMPG-SSF | Yes | 2 | 2.80 |
| | No | 70 | 97.20 |
| Model relevance (1-5) | Not at all relevant | 0 | 0.00 |
| | Slightly relevant | 4 | 5.60 |
| | Moderately relevant | 13 | 18.10 |
| | Relevant | 27 | 37.50 |
| | Very relevant | 28 | 38.90 |
| Community capacity | Yes | 29 | 40.30 |
| | No | 17 | 23.60 |
| | Partially | 26 | 36.10 |
| Willingness to participate | Yes | 65 | 90.30 |
| | No | 7 | 9.70 |
| Primary role | Fisher | 53 | 73.60 |
| | Trader | 11 | 15.30 |
| | Technical/Institutional authorities | 8 | 11.10 |
| | | | |
| Multiple Responses | | | |
| Key elements for model functioning | Funding | 106 | 91.40 |
| | Technical training | 98 | 84.50 |
| | Management transparency | 97 | 83.60 |
| | Inclusion of women and youth | 59 | 50.90 |
| | Respect for local knowledge | 68 | 58.60 |

# APPENDIX 5

**Comparison of standard and bootstrap results for Q-sort factor loadings (F: factor)**

| | Standard factor loadings | | | Bootstrapped factor loadings (& se) | | | | | | Factor loading frequency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q-Sorts | F1 | F2 | F3 | F1 | F2 | F3 | F1 | F2 | F3 | F1 | F2 | F3 |
| AC100 | 0.191 | -0,184 | 0.834 | 0.176 | -0.005 | -0.181 | -0.008 | 0.768 | -0.006 | 0.000 | 0.021 | 0.926 |
| AC101 | 0.265 | -0.206 | 0.723 | 0.228 | -0.004 | -0.168 | -0.008 | 0.669 | -0.007 | 0.011 | 0.026 | 0.868 |
| AC102 | 0.214 | -0.294 | 0.693 | 0.171 | -0.004 | -0.254 | -0.008 | 0.633 | -0.009 | 0.003 | 0.081 | 0.805 |
| AC107 | 0.212 | -0.237 | 0.742 | 0.188 | -0.004 | -0.220 | -0.008 | 0.683 | -0.008 | 0.000 | 0.040 | 0.887 |
| AC94 | 0.164 | -0.154 | 0.723 | 0.132 | -0.006 | -0.146 | -0.009 | 0.681 | -0.007 | 0.000 | 0.022 | 0.899 |
| AC97 | 0.190 | -0.196 | 0.644 | 0.165 | -0.005 | -0.180 | -0.007 | 0.608 | -0.007 | 0.003 | 0.039 | 0.878 |
| AC98 | 0.012 | 0.032 | 0.738 | 0.010 | -0.005 | -0.010 | -0.008 | 0.715 | -0.004 | 0.000 | 0.002 | 0.993 |
| AC99 | 0.115 | -0.226 | 0.817 | 0.097 | -0.005 | -0.216 | -0.008 | 0.764 | -0.007 | 0.000 | 0.032 | 0.947 |
| MA35 | 0.570 | 0.426 | -0.158 | 0.548 | -0.005 | 0.445 | -0.008 | -0.128 | -0.004 | 0.601 | 0.351 | 0.000 |
| MA37 | 0.214 | 0.414 | -0.049 | 0.198 | -0.005 | 0.416 | -0.007 | -0.018 | -0.004 | 0.073 | 0.678 | 0.000 |
| MA38 | 0.122 | 0.506 | 0.202 | 0.157 | -0.004 | 0.432 | -0.005 | 0.231 | -0.006 | 0.010 | 0.713 | 0.074 |
| MA42 | 0.520 | 0.163 | 0.114 | 0.553 | -0.005 | 0.156 | -0.005 | 0.113 | -0.003 | 0.956 | 0.028 | 0.000 |
| MA43 | 0.221 | 0.240 | 0.117 | 0.281 | -0.007 | 0.184 | -0.007 | 0.134 | -0.006 | 0.241 | 0.084 | 0.024 |
| MA45 | 0.322 | 0.519 | -0.051 | 0.259 | -0.007 | 0.552 | -0.007 | -0.013 | -0.005 | 0.140 | 0.835 | 0.002 |
| MA46 | 0.292 | 0.340 | -0.129 | 0.320 | -0.005 | 0.316 | -0.006 | -0.110 | -0.006 | 0.303 | 0.305 | 0.000 |
| MA47 | 0.326 | 0.475 | 0.034 | 0.307 | -0.005 | 0.476 | -0.005 | 0.060 | -0.005 | 0.140 | 0.824 | 0.000 |
| MA48 | 0.584 | 0.209 | -0.230 | 0.491 | -0.007 | 0.311 | -0.01 | -0.226 | -0.006 | 0.600 | 0.256 | 0.015 |
| MA49 | 0.256 | 0.393 | -0.371 | 0.178 | -0.007 | 0.457 | -0.008 | -0.332 | -0.005 | 0.040 | 0.640 | 0.101 |
| MA50 | 0.489 | 0.094 | -0.181 | 0.386 | -0.008 | 0.199 | -0.010 | -0.184 | -0.007 | 0.556 | 0.217 | 0.027 |
| MA57 | -0.002 | 0.664 | 0.537 | 0.062 | -0.006 | 0.521 | -0.007 | 0.566 | -0.007 | 0.000 | 0.427 | 0.547 |
| MA59 | -0.136 | 0.241 | 0.596 | -0.016 | -0.006 | 0.083 | -0.008 | 0.617 | -0.006 | 0.003 | 0.010 | 0.958 |
| MA60 | -0.207 | 0.473 | 0.497 | -0.123 | -0.005 | 0.320 | -0.007 | 0.526 | -0.007 | 0.005 | 0.164 | 0.705 |
| MA61 | 0.011 | 0.345 | 0.662 | 0.084 | -0.005 | 0.199 | -0.008 | 0.666 | -0.005 | 0.000 | 0.029 | 0.971 |
| MA63 | -0.165 | 0.129 | 0.617 | -0.077 | -0.005 | -0.007 | -0.007 | 0.619 | -0.005 | 0.000 | 0.000 | 0.980 |
| MA66 | -0.394 | 0.473 | 0.479 | -0.321 | -0.006 | 0.306 | -0.008 | 0.521 | -0.008 | 0.022 | 0.097 | 0.571 |
| MA67 | 0.078 | -0.085 | 0.384 | 0.150 | -0.007 | -0.146 | -0.007 | 0.376 | -0.005 | 0.027 | 0.017 | 0.519 |
| MA68 | -0.434 | 0.215 | 0.613 | -0.321 | -0.005 | 0.046 | -0.009 | 0.637 | -0.007 | 0.028 | 0.000 | 0.879 |
| ÑU1 | 0.731 | 0.436 | 0.047 | 0.694 | -0.004 | 0.457 | -0.006 | 0.065 | -0.003 | 0.865 | 0.123 | 0.000 |
| ÑU10 | 0.450 | 0.525 | 0.430 | 0.486 | -0.005 | 0.444 | -0.006 | 0.443 | -0.005 | 0.146 | 0.143 | 0.028 |
| ÑU11 | 0.553 | 0.410 | 0.129 | 0.480 | -0.009 | 0.446 | -0.01 | 0.137 | -0.005 | 0.495 | 0.443 | 0.003 |
| ÑU12 | 0.626 | 0.198 | -0.047 | 0.550 | -0.007 | 0.278 | -0.009 | -0.047 | -0.006 | 0.785 | 0.187 | 0.000 |
| AC100 | 0.431 | 0.621 | -0.004 | 0.412 | -0.007 | 0.592 | -0.006 | 0.031 | -0.005 | 0.261 | 0.716 | 0.000 |

Appendix 5. Continued.

| | Standard factor loadings | | | Bootstrapped factor loadings (& se) | | | | | | Factor loading frequency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q-Sorts | F1 | F2 | F3 | F1 | F2 | F3 | F1 | F2 | F3 | F1 | F2 | F3 |
| AC101 | 0.689 | 0.187 | 0.103 | 0.702 | -0.004 | 0.197 | -0.006 | 0.098 | -0.004 | 0.983 | 0.012 | 0.000 |
| AC102 | 0.806 | 0.177 | 0.012 | 0.797 | -0.004 | 0.211 | -0.006 | 0.006 | -0.003 | 0.985 | 0.012 | 0.000 |
| ÑU16 | 0.536 | 0.247 | 0.113 | 0.544 | -0.006 | 0.242 | -0.007 | 0.103 | -0.005 | 0.869 | 0.074 | 0.005 |
| ÑU17 | 0.804 | 0.382 | 0.010 | 0.753 | -0.005 | 0.419 | -0.008 | 0.019 | -0.003 | 0.880 | 0.102 | 0.000 |
| ÑU18 | 0.835 | 0.220 | -0.005 | 0.814 | -0.003 | 0.252 | -0.007 | -0.004 | -0.003 | 0.988 | 0.012 | 0.000 |
| ÑU2 | 0.666 | 0.447 | 0.167 | 0.637 | -0.006 | 0.442 | -0.008 | 0.173 | -0.004 | 0.714 | 0.191 | 0.000 |
| ÑU21 | 0.770 | -0.016 | -0.02 | 0.790 | -0.005 | 0.029 | -0.005 | -0.042 | -0.004 | 0.995 | 0.005 | 0.000 |
| ÑU23 | 0.796 | 0.360 | 0.083 | 0.756 | -0.005 | 0.376 | -0.009 | 0.082 | -0.004 | 0.888 | 0.089 | 0.000 |
| ÑU24 | 0.813 | 0.005 | 0.033 | 0.821 | -0.005 | 0.057 | -0.005 | 0.008 | -0.003 | 0.995 | 0.005 | 0.000 |
| ÑU25 | 0.575 | 0.300 | 0.259 | 0.558 | -0.005 | 0.303 | -0.007 | 0.256 | -0.005 | 0.760 | 0.059 | 0.000 |
| ÑU26 | 0.622 | 0.398 | 0.093 | 0.572 | -0.007 | 0.425 | -0.008 | 0.103 | -0.004 | 0.655 | 0.284 | 0.000 |
| ÑU27 | 0.724 | 0.418 | 0.217 | 0.682 | -0.006 | 0.425 | -0.009 | 0.217 | -0.004 | 0.758 | 0.135 | 0.000 |
| ÑU28 | 0.791 | 0.389 | 0.015 | 0.730 | -0.007 | 0.424 | -0.009 | 0.027 | -0.004 | 0.822 | 0.168 | 0.000 |
| ÑU29 | 0.543 | 0.576 | -0.005 | 0.499 | -0.007 | 0.587 | -0.007 | 0.028 | -0.005 | 0.378 | 0.602 | 0.000 |
| ÑU3 | 0.578 | 0.656 | 0.030 | 0.549 | -0.007 | 0.638 | -0.007 | 0.067 | -0.004 | 0.362 | 0.611 | 0.000 |
| ÑU32 | 0.593 | 0.615 | 0.030 | 0.561 | -0.007 | 0.600 | -0.008 | 0.060 | -0.004 | 0.440 | 0.537 | 0.000 |
| ÑU33 | 0.742 | 0.241 | 0.308 | 0.716 | -0.004 | 0.255 | -0.007 | 0.287 | -0.004 | 0.934 | 0.013 | 0.003 |
| ÑU4 | 0.722 | 0.194 | 0.149 | 0.734 | -0.003 | 0.192 | -0.005 | 0.136 | -0.003 | 0.988 | 0.007 | 0.000 |
| ÑU5 | 0.366 | 0.470 | 0.410 | 0.360 | -0.006 | 0.419 | -0.007 | 0.425 | -0.004 | 0.141 | 0.275 | 0.080 |
| ÑU6 | 0.839 | 0.018 | 0.109 | 0.835 | -0.004 | 0.070 | -0.005 | 0.081 | -0.004 | 0.998 | 0.000 | 0.000 |
| ÑU7 | 0.594 | 0.359 | 0.265 | 0.583 | -0.005 | 0.353 | -0.007 | 0.262 | -0.004 | 0.736 | 0.081 | 0.000 |
| ÑU8 | 0.787 | 0.253 | 0.255 | 0.766 | -0.005 | 0.257 | -0.008 | 0.232 | -0.004 | 0.942 | 0.022 | 0.002 |
| ÑU9 | 0.589 | 0.415 | 0.416 | 0.592 | -0.004 | 0.380 | -0.007 | 0.410 | -0.004 | 0.534 | 0.027 | 0.005 |
| ÑU90 | 0.595 | -0.036 | 0.000 | 0.590 | -0.004 | 0.006 | -0.006 | -0.020 | -0.004 | 0.988 | 0.007 | 0.000 |
| ÑU91 | 0.837 | 0.300 | 0.065 | 0.775 | -0.006 | 0.342 | -0.009 | 0.061 | -0.004 | 0.898 | 0.079 | 0.000 |
| ÑU92 | 0.425 | 0.555 | 0.023 | 0.402 | -0.008 | 0.527 | -0.008 | 0.052 | -0.005 | 0.338 | 0.617 | 0.000 |
| OR70 | 0.094 | 0.603 | -0.003 | 0.102 | -0.005 | 0.581 | -0.006 | 0.045 | -0.006 | 0.014 | 0.949 | 0.002 |
| OR71 | 0.100 | 0.446 | 0.663 | 0.149 | -0.005 | 0.324 | -0.008 | 0.663 | -0.004 | 0.002 | 0.071 | 0.911 |
| OR73 | 0.154 | 0.749 | -0.383 | 0.139 | -0.006 | 0.732 | -0.005 | -0.295 | -0.006 | 0.002 | 0.934 | 0.005 |
| OR74 | 0.342 | 0.777 | -0.128 | 0.321 | -0.007 | 0.750 | -0.005 | -0.065 | -0.005 | 0.027 | 0.943 | 0.000 |
| OR76 | 0.317 | 0.553 | -0.191 | 0.301 | -0.004 | 0.579 | -0.005 | -0.136 | -0.004 | 0.020 | 0.921 | 0.000 |
| OR77 | 0.309 | 0.607 | -0.087 | 0.269 | -0.007 | 0.609 | -0.005 | -0.038 | -0.004 | 0.082 | 0.908 | 0.000 |
| OR78 | 0.376 | 0.694 | -0.14 | 0.352 | -0.005 | 0.690 | -0.005 | -0.081 | -0.005 | 0.043 | 0.923 | 0.000 |
| OR80 | 0.256 | 0.359 | 0.119 | 0.237 | -0.005 | 0.368 | -0.006 | 0.136 | -0.003 | 0.090 | 0.566 | 0.005 |
| OR81 | 0.445 | 0.68 | -0.273 | 0.396 | -0.006 | 0.699 | -0.006 | -0.205 | -0.005 | 0.073 | 0.839 | 0.000 |
| OR82 | 0.415 | 0.232 | -0.185 | 0.368 | -0.004 | 0.304 | -0.006 | -0.172 | -0.004 | 0.445 | 0.226 | 0.003 |

Appendix 5. Continued.

| | Standard factor loadings | | | Bootstrapped factor loadings (& se) | | | | | | Factor loading frequency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q-Sorts | F1 | F2 | F3 | F1 | F2 | F3 | F1 | F2 | F3 | F1 | F2 | F3 |
| OR84 | 0.056 | 0.532 | -0.189 | 0.080 | -0.004 | 0.510 | -0.006 | -0.124 | -0.007 | 0.002 | 0.885 | 0.000 |
| OR85 | 0.199 | 0.511 | -0.210 | 0.182 | -0.004 | 0.524 | -0.005 | -0.158 | -0.005 | 0.008 | 0.924 | 0.000 |
| OR86 | 0.176 | 0.408 | 0.071 | 0.226 | -0.005 | 0.369 | -0.007 | 0.103 | -0.006 | 0.103 | 0.526 | 0.010 |
| OR89 | 0.015 | 0.719 | 0.119 | 0.038 | -0.005 | 0.666 | -0.005 | 0.165 | -0.007 | 0.000 | 0.971 | 0.010 |

Note: the bootstrap procedure revealed two additional assignments to F3 (MA60 and MA66). However, these Q-sorts exhibited similar factor loadings between factors 2 and 3 in the standard solution, indicating factor ambiguity. For this reason, and considering both the original factor loadings and the assignment frequencies obtained through resampling, these cases were not included as defining Q-sorts in the final interpretation of the factors.