This paper was presented at the XXXVII ISPIM Innovation Conference, held in Granada, Spain on 07 June to 10 June 2026. ISBN 978-952-65771-2-8.

# Using Delphi and Decision Tree Methods for Achieving Definition Consensus in Social Innovation Research

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**Abstract:**

This paper describes a novel approach to achieving definition consensus amongst a panel of international, cross-disciplinary experts engaged in scoping reviews of social innovation measurement. The paper describes how undertaking a thematic analysis of the consensus process can generate a rich description of how consensus methods are deployed, resulting in a level of data transparency and process detail that addresses some of the criticisms made of consensus methods. The paper suggests that consensus design should include process guidance for experts that establish high levels of social capital at the outset, which will be particularly relevant when seeking consensus for complex or contested subjects.

**Keywords:** Definition consensus; Delphi; decision tree; social innovation; scoping review; experts.

## 1 Introduction

The field of social innovation is increasingly recognized as a powerful means to address complex societal challenges (Cunha et al., 2022). The field has experienced significant growth in conjunction to technological, economic, political, and socio-cultural changes that include the 2008 financial crisis, digitalization of the economy, social networks, unemployment and migration movements (Edwards-Schachter and Wallace, 2017). While research efforts have increasingly focused on identifying the different theoretical approaches of this broad field, a scholarly sanctioned view or consensus on appropriate social innovation measurement is noticeably lacking (Sanzo-Pérez et al., 2024).

Finding appropriate indicators and measuring social innovation for assessing outcomes and impact in tandem with widely acceptable research and evaluation methods is identified as one of the most pressing issues in the field (Mihci, 2019), with greater accountability demands from funders of social innovation programs requiring more rigorous and relevant measurement methods and evidence of impact (Guerzovich and Poli, 2020; Antadze and Westley, 2012). An extensive literature review by Cunha et al. (2024) identified a lack of methodologies, frameworks, and tools capable of measuring the social impacts of social innovation and found limited studies undertaken to address this issue. Establishing cohesive and standardized frameworks for evaluating social innovation impact is suggested (Nazari et al., 2024), along with incorporating collaborative and co-creative approaches to impact evaluation (Rønning et al, 2022).

An evaluative approach to social innovation requires greater conceptual clarity in operationalizing measures, given the transformative nature of social innovation that involves a multitude of actors from different sectors and varying context conditions and social discourses (Terstriep et al., 2021). As Westley and Andtadze (2010) suggest, any sophisticated understanding of how novelty transforms complex systems requires great conceptual precision. Milley et al. (2018) identify a lack of evidence of concepts and theories of change that may have future importance to the measurement of social innovation outcomes and impacts.

To address the complexities involved in measuring social innovation, prominent scholars in the field were invited to conduct two scoping reviews encompassing multi-disciplinary, peer-reviewed literature and databases. The first team, focusing on qualitative analysis, will examine measurement concepts, theories, and frameworks relevant to the outcomes and impacts of social innovation. The second team, with a quantitative orientation, will evaluate instruments designed to evaluate and measure social innovation initiatives. Scoping reviews are exploratory and serve to systematically map key concepts within a research domain, determine critical factors related to those concepts, clarify precise definitions, and identify principal sources and types of evidence (Tricco et al., 2016; Peters et al., 2020b; Arksey and O'Malley, 2005). Scoping reviews are applicable to broad explorations of a knowledge base/evidence base and are especially useful for establishing what evidence exists in relatively novel or under-explored fields such as social innovation measurement (Munn et al., 2022). In this, they differ from systematic reviews that look for evidence of efficacy of a specific intervention.

Given the complexity of the concepts and diversity of the teams, an initial requirement for the scoping reviews was to establish agreement on the definition of "social innovation." As highlighted by De Bruin and Stangl (2013), the literature often presents varying definitional perspectives, which may overtly or subtly address the scale and impact of social innovations. Establishing consensus regarding definitions is regarded as a central objective of scoping reviews, rather than a secondary consideration (Peterson et al., 2017). Such consensus ensures that review teams adhere to clear, operational definitions for core concepts, populations, interventions, outcomes, or phenomena being mapped (Kanniyapan et al., 2019).

Upon review of different consensus methods, the study team identified the Delphi method as appropriate for the purposes of the scoping reviews. In comparison to traditional Delphi methods, the study would seek to achieve full definition consensus amongst the experts, rather than seeking general agreement of a substantial majority (Kanniyapan et al., 2019), rely more on qualitative rather than quantitative feedback to experts (Seker, 2015), and deploy an independent scholar as facilitator to actively encourage all biases and opinions to come to the fore for consideration and discussion (Devaney and Henchion, 2018). In addition to the modified Delphi method, the study adopted a modified decision tree method, which offers tree-like representations of decisions and their consequences that can be applied to consensus building and serve in decision support (Putora et al., 2014). The decision tree would help establish initial opinions from the experts on their preference of definitions from a set of pre-selected definitional options, which were determined through a previous scoping review process.

Both Delphi and decision-tree methods are subject to criticism from scholars. Several studies suggest significant deficiencies in the reporting of the Delphi method (de Loë et al., 2016; Diamond et al., 2014), and in securing response rates, given the focus on expert quality (Hsu and Sandford, 2007). While the decision tree method has been used extensively in scientific disciplines, it has received less attention in the social sciences (Song and Lu, 2015; Grimm et al., 2023). One issue facing participating parties is the problem of externalizing intrinsic knowledge and every-day know-how in the form of a decision tree (Niederman and Leitch, 2006).

In addressing these reported methodologic challenges, the focus of this paper is to describe a novel approach to achieving definition consensus amongst an international panel of experts engaged in scoping reviews of social innovation measurement. The paper highlights how the Delphi and decision tree methods can be successfully integrated for achieving full definitional consensus and describes how management of the consensus process can address and overcome some of the criticisms made of both methods.

The paper is structured as follows. A review of literature examines concepts and definitions of social innovation and their importance in scoping reviews, followed by a review of consensus methods and research purpose. The methods section summarizes the integration of the two methods and presents the study approach. This is followed by findings, discussion of results, which presents contributions, study limitations, and suggestions for future research, and conclusions.

## 2 Literature Review

### *2.1 Social Innovation: Concepts and Definitions*

One of the first tasks of a scoping review is to clarify key concepts and definitions (Tricco et al., 2016: Peters et al., 2020b), and this is particularly challenging for social innovation (Edwards-Schachter and Wallace, 2017). The conceptual problem is summarized by the observation of Pol and Ville (2009: 881) that "social innovation' is a term that almost everyone likes, but nobody is quite sure of what it means." Social innovation faces interpretive challenges in relation to both terms 'social' and 'innovation' contributing to the lack of definitional consensus on the concept (Nicholls and Murdock, 2012).

Social innovation has drawn from a diversity of disciplines that include management science, the arts, territorial development and political science and public administration (Moulaert et al., 2005) and different research communities such as psychology, sociology, regional studies, and local development (Van der Have and Rubalcaba, 2016; Edwards-Schachter and Wallace, 2017). Some scholars point to a widespread assumption about its origin being rooted in practice instead of scholarship and dominance of grey and policy-oriented literature as contributing factors for social innovation being a marginalized topic in both economic and sociological theories of innovation (Benneworth et al., 2015). Moreover, social innovation is associated with a babelizing phenomenon where the meaning of innovation moves between restrictive definitions based on technology to a vast range of adjectives identifying other innovation types (Edwards-Schachter, 2016).

Social innovation is described as a buzzword or quasi-concept (Pol and Ville, 2009; Jenson & Harrisson, 2013), whereby in many cases, its definition is avoided or ignored. The numerous interpretations of social innovation have "caused some scholars to drop it as a scientific concept" (Moulaert et al., 2013: 13) or to question its usefulness (Pel and Bauler, 2015). Becher and Trowler (2001) suggest that definitions of social innovation are distributed among a diversity of perspectives and territories. As suggested by Djellal & Gallouj (2012: 121), the field of social innovation is in a "desperate quest for a definition."

The plethora of definitions also vary as to how different dimensions of social innovation activity are emphasized or understood as the things that social innovation does and engages with in the surrounding context (Haxeltine et al., 2016). Social innovation ranges across different socio-structural levels and units of analysis – from micro, to meso, to macro – that offer multiple insights into the various contexts in which social innovation can operate (Nicholls et al., 2016).

### *2.2 Consensus Methods*

An absence of definition consensus is not unexpected given that social innovation is both an emerging field of study and is multidimensional and complex (De Bruin and Stangl, 2013). However, definition consensus is considered an essential requirement for scoping reviews in order to map out key concepts, types of evidence, and gaps in the defined field and for guiding systematic searching, selecting and synthesizing of existing knowledge (Colquhoun et al., 2014). Achieving definition consensus ensures that a review maps the same concept across studies rather than mixing different concepts under one label, improving internal coherence and interpretability. It also aligns the research question, search strategy, screening decisions, and data charting so that included studies address the intended scope rather than a drifting set of topics.

Achieving consensus can be further challenged when bringing together noted scholars (i.e., "experts") from different jurisdictions and disciplines (Sudore et al., 2018). Most consensus methods are based on the premise that an accurate and reliable assessment can be best achieved by consulting a panel of experts and accepting the group consensus (Murphy et al., 1998; Jones and Hunter, 1995). Consensus methods are particularly relevant to fields such as health and medicine due to their capacity to extract the profession's collective knowledge, which is often tacit and difficult to verbalize and formalize (Humphrey-Murto et al., 2017).

Consensus methods can be considered social coordination mechanisms that draw upon various theories of social capital (Bhandari et al., 2009). The theory of communicative action suggests an ideal social capital environment for consensus, which includes communication oriented towards mutual understanding, reciprocity, sincerity and openness to being persuaded, and validity claims (e.g., truth, rightness) that are open to challenge ((Van der Kroon et al., 2002; Habermas, 1985a, b). Facilitating dialogue is identified as an important communication tactic for collaboration and creating patterned flows of information, mutual understanding, signaling and shared language that promote social capital. Pragmatist sociolinguistic theory conceptualizes how consensus actually forms in practice, through iterative rounds, feedback loops and refinement cycles from which new meaning emerges (Milroy and Gordon, 2008). These theories may contribute to understanding the underlying social processes contributing to the consensus marking process.

### *2.3 Delphi and Decision Tree Methods*

The Delphi method is a useful support for participatory decision-making processes aimed at consensus building (Le Pira et al., 2017). The need for expert participation is one of the key arguments for using Delphi (Linstone and Turoff, 2002). There should be a clear definition of what constitutes expertise and a sampling strategy for locating experts who meet it (Jorm, 2015). The Delphi method allows for exploration of expert opinion, can

increase experts' understanding of others' positions, and can be used to make experts converge on shared judgements (Dalkey and Helmer, 1963).

The Delphi method, in contrast to other data gathering and analysis techniques, employs multiple iterations designed to develop consensus concerning a specific topic (Hsu and Sandford, 2007; Ludwig, 1994). A number of scholars suggest that three iterations are often sufficient to collect the needed information and to reach a consensus in most cases (Custer et al., 1999; Ludwig, 1997). Other benefits of the Delphi method are its capacity to include a large number of participants who are geographically dispersed and its relatively minimal support structure needs (Humphrey-Murto et al., 2017).

Iterative feedback is a distinguishing feature of the Delphi (Toppinen et al., 2017), setting it apart from traditional survey methodologies and allowing participants to re-consider their original responses in light of other participants' knowledge and opinion (Mathur et al., 2008). While the traditional Delphi relies on quantitative feedback so that the expert "tries only to check their predictions with common sense" (Seker, 2015: 369), modifications to Delphi include feedback of qualitative arguments made by experts that facilitate the sharing of tacit, hidden and/or codified knowledge which supports higher levels of social learning (Kuusi, 1999). Makkonen et al. (2016) suggest that the propensity of participants to change their opinion after considering the views of their peers, as encouraged by the rounds of Delphi, can often be linked back to their professional affiliation. However, Barrios et al. (2021) found that neither sociodemographic nor professional variables had a significant effect in explaining opinion shift in Delphi studies; rather it was feedback that showed an influence on individual responses and the achievement of consensus.

In the traditional Delphi method, participants never meet or interact directly (Humphrey et al., 2017). Depending on the context, the anonymity of parties may be of great value by excluding any bias towards more influential parties and avoiding direct confrontation among parties (Putora et al., 2014). At the same time, anonymity may lead to a lack of accountability and hasty decisions and provide bland general statements, giving the illusion of precision (Powell, 2003; Rennie, 1981).

Although the notion of consensus is fundamental to many Delphi studies, the definition of what constitutes consensus is less clear (Beattie and Mackway-Jones, 2004). A common definition of consensus is achieving the general agreement of a substantial majority (Kanniyapan et al., 2019). While the number of rounds is typically determined by the degree of consensus achieved by the group, some scholars suggest that consensus is meaningless if group stability has not been reached, which they define as the consistency of responses between successive rounds of a study (von der Gracht, 2012; Dajani et al., 1979).

In recognizing that lack of agreement can exist between experts (Kraus et al., 1992), definitions often derive through social disputes and consensus, whereby some voices gain legitimacy while others could be silenced or marginalized across time (Becher and Trowler, 2001; Segercrantz and Seeck, 2013). In this context, the Delphi process is about creating the conditions for a multi-actor approach that actively encourages all biases and

opinions to come to the fore for consideration and discussion (Devaney and Henchion, 2018).

Another method for consensus building is the decision tree, which offers tree-like representations of decisions and their consequences that can be applied to consensus building and serve in decision support (Putora et al., 2014). By connecting several elements from a starting point, a decision tree can be constructed by adding possible options as branches. Recommendations (or actions) are situated at the end of the branches (analogous to leaves at the end of each branch). Consensus is considered to be available if any recommendation is provided as the most common.

Advantages of the decision tree method include ease in understanding and interpretation; ability to simplify complex relationships by dividing original input variables into subgroups; and offering a non-parametric approach without distributional assumptions (De Ville, 2013). The feasibility of the decision tree method is dependent on the question being asked (Putora et al., 2014) and should not be too complex for practical interpretation. Each question should reduce ambiguity, move consensus participants closer to definitional clarity, and be answerable with available expertise. For the purposes of this study, decision tree questions should help experts make tacit assumptions explicitly, identify points of divergence early, avoid repetitive debate, and move from broad conceptual space to a stable definition core. While the Delphi method draws out opinions on questions, decision trees structure them, and iterative feedback helps experts reconsider positions (Barrios et al., 2017; Toppinen et al., 2017).

### *2.4 Criticisms of Consensus Methods*

Despite the extensive use of consensus group methods, these research approaches are poorly standardized and inconsistently used and described in several fields (Humphrey-Murto et al., 2017; de Loë et al., 2016; Diamond et al., 2014). Common deficiencies include failing to describe: (1) the selection and description of participants, (2) information provided to the participants at the start of the process, (3) response rates for all rounds, (4) measures of consensus, (5) formal feedback of group ratings, (6) outcomes after each round, and (7) how it was determined that consensus was achieved (Waggoner et al., 2016; Giannarou and Zervas, 2014; Hsu and Stanford, 2007; Dalkey, 1972; Campbell and Cantrill, 2001; Keeney et al., 2001). Securing response rates for a Delphi can also be challenging, given the focus on expert quality which can limit the pool of people available to participate and the commitment required through multiple rounds (Hsu & Sandford, 2007).

With decision-trees, participating parties are faced with the problem of externalizing intrinsic knowledge and every-day know-how in the form of a decision tree (Niederman and Leitch, 2006). While the decision tree method is a powerful statistical tool for classification, prediction, interpretation, and data manipulation and has been used extensively in the scientific disciplines (Song and Lu, 2015), it has received less attention in the social sciences (Grimm et al., 2023). More methodological work is suggested to adapt decision tree-based methods for social-science problems, as researchers who need clear, communicable estimates for theory or policy frequently choose models whose parameters map directly to substantive quantities (Brand et al., 2021). This may be less of

an issue in this study, which has fewer branch trees, less complex parameters, which is expected to make it easier to interpret and summarize data outputs.

### *2.5 Research Purpose*

This paper describes the development and application of a modified Delphi and decision tree method in building definition consensus for scoping reviews related to social innovation measurement. The scoping reviews were informed from previous research (Benzies et al., 2024; Cunha et al., 2024) and a Social Innovation Impact Measurement Consensus Conference in 2024. In advance of that event, a scoping review of literature on social innovation measurement was undertaken as a key knowledge input to planned discussions aimed at generating a consensus among academic researchers and expert practitioners about measuring outcomes and impacts of social innovation initiatives. Feedback from conference participants on that input highlighted the need to produce a consensus in research teams on the choice of concepts and definitions guiding knowledge syntheses such as scoping reviews before embarking on the search, screening, and synthesis of the targeted knowledge base.

Drawing on these earlier efforts, this study involves two scoping review teams, one focused on qualitative studies and the other on quantitative ones, who will follow formal JBI (Joanna Briggs Institute) guidance on scoping reviews (Peters et al., 2020a; Hagg et al., 2018). For the quantitative scoping review, the research purpose is to identify what instruments are used to measure outputs, outcomes, and impacts of social innovation initiatives, what dimensions of social innovation are being measured, and what are the characteristics of the instruments, with the goal of guiding selection of the most appropriate instruments for evaluating social innovation. For the qualitative scoping review, the research purpose is to identify what frameworks, concepts, and theories of change or transformation are most relevant for measuring social innovation and how are they influenced by the nature and level of social innovation eco-system (e.g., micro, meso, or macro).

Establishing consensus regarding definitions of central concepts is identified as a central objective of scoping reviews. The purpose of this paper is to describe the development and application of a novel approach to achieving definition consensus amongst social innovation experts by modifying and integrating Delphi and decision tree methods and reporting on outcomes of the consensus process.

## 3 Method

### *3.1 Selection of Experts*

Experts in this study were carefully selected for their level of expertise and experience (Hanafin, 2004), and were chosen based on the following criteria:

- Recognized expert by peers in the field of social innovation, with a strong publication record
- Familiar with reliability and validity of measures of social innovation (quantitative team)
- Familiar with theories/concepts related to evaluation of social innovation (qualitative team)

- Familiar with scoping reviews
- Familiar with or be willing to learn Covidence software

The six experts were geographically dispersed and based in countries that included Canada, USA, Germany, and Portugal. While the experts were familiar with each other, some had worked together on earlier research which established the basis for the scoping reviews. Despite each expert's busy academic schedules, all voluntarily accepted invitations, and with the expectation of scholarly publications arising from the study, contributed to a collective common interest in achieving definition consensus (e.g., Roubens, 1997).

### *3.2 Consensus Facilitation*

The study employed an external academic consultant as project manager who was responsible for developing and facilitating the consensus process. Using a trained facilitator to plan the process and lead conversations to get to a decision is often suggested in consensus building (Innes, 2004), with an unbiased mediator considered to be highly important to resolution of conflict (Susskind et al., 1999). The study sought to gain buy-in from all experts regarding the consensus process and to ensure that all perspectives and opinions were presented and discussed. Not all experts were well versed in Delphi and decision tree methods; therefore, an introductory document was sent to each expert beforehand, which offered an explanatory guide for experts on the consensus process.

### *3.3 Delphi-Decision Tree Method*

Table 1 highlights the novelty of the consensus method developed for the study, comparing it with traditional Delphi and decision tree methods (e.g., Humphrey et al., 2017; Custer et al., 1999; Ludwig, 1997). While an open-ended questionnaire is the cornerstone of soliciting opinions in the traditional Delphi (Custer et al., 1999), this study deploys a modified decision tree to solicit initial opinions from experts on their preference of definitions from a set of pre-selected options, which were determined through a previous scoping review process. A total of 32 definitions for eight concepts related to social innovation were provided to experts for ranking in order of preference (e.g., 1st choice, 2nd choice, 3rd choice).

**Table 1: Comparison of Traditional and Modified Delphi-Decision Tree Methods**

| **Traditional Methods** | **Modified Methods** |
|---|---|
| **Delphi**: Identify the research problem | Confirm definition of social innovation to guide scoping reviews |
| Complete a literature search | Complete systematic review to identify key concepts and definitions to be used in scoping reviews (for social innovation measurement) |
| Develop a questionnaire of statements | Develop guidance for experts on consensus process; 8 concepts and 32 definitions were generated from the systematic review |
| Conduct mail or email questionnaire | Email guidance to experts and request |

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| rounds | initial opinions on choice of concepts and definitions |
| Provide individual and/or group feedback between rounds | Group discussions recorded and transcribed to allow experts to reflect on results from previous round before next round |
| Rely on quantitative feedback to experts | Rely on qualitative feedback, with quantitative feedback secondary |
| Summarize findings | Summarize results |
| Repeat until best possible level of consensus is reached, general agreement is reached of a substantial majority and/or a pre-determined number of rounds are completed | Repeat until full consensus is achieved (on definition of social innovation to be used in both scoping reviews) |
| **Decision-Tree:** Start with a high-level question | Start with set of pre-selected options (8 concepts, comprising 32 definitions) |
| Problem of externalizing intrinsic knowledge and every-day know-how in the form of a decision tree | Build on previous knowledge (systematic review) to establish baseline decision tree |
| Add 3–6 top-level branches for major alternatives | Experts rank options (1st, 2nd, 3rd choice) and/or suggest alternatives for next Delphi round |

Our study differs from the traditional Delphi method in several areas. We sought to achieve full definitional consensus, facilitated by a participatory decision-making process (Le Pira et al., 2017), rather than seeking general agreement of a substantial majority (Kanniyapan et al., 2019). We did not use anonymous voting between rounds (Dalkey, 1969), due to the nature of the question being asked (e.g., choice of definitions) and the small size of the expert cohort (n=6), and sought to rely more on qualitative feedback and group discussion to increase experts' understanding of others' positions (Dalkey and Helmer, 1963), and to actively encourage all biases and opinions to come to the fore for consideration and discussion (Devaney and Henchion, 2018).

The study did not deploy statistical methods often used in Delphi studies, given the small size of the expert cohort and provision of pre-selected definition options for the experts (Giannarou and Zervas, 2014). Instead, our study used simple aggregate measures of preference, as it was not necessary to measure the distance or similarity between their preferences. and we would rely on open discussion amongst experts to achieve full consensus.

Figure 1 shows the decision tree structure developed for the study, which established baseline consensus data from experts who were asked to rank-order 32 definitions for 8 concepts related to social innovation (with a decision tree for each concept). Experts could also recommend other definitions and indicate their preference to further discuss inclusion of concepts or definitions.

**Figure 1: Decision Tree Structure for Definition Consensus**

Each expert was asked to email their results to the study consultant who tabulated the results using an Excel spreadsheet, as it offered a simple, comparative format which identified each expert's choices, their suggested alternative definitions and additional comments. Given the task and familiarity of experts with each other, it was decided that response confidentiality was not necessary, allowing for transparency of results, which aided in discussions.

Results of a Delphi study can be complex to communicate (Jorm, 2015), and the consultant recorded, transcribed, and analyzed discussions between Delphi rounds. Informed consent was undertaken and approved by all experts in the recording and use of communication data. Qualitative Delphi studies utilize thematic analysis in order to identify the consensus opinions or themes (Brady et al., 2016), and for this study, a thematic analysis and mapping process was adopted to analysis transcribed data to highlight how definition consensus was achieved, and to classify the types of agreement/disagreement (e.g., normative, descriptive, methodological, scope, or pragmatic) by topic area (Howell et al., 2017). We classified the most common themes and identified the most common types of agreement/disagreement amongst experts in Round #2 and then compared transcripts from Round #2 and #3 discussions to identify consensus changes, omissions, new decisions, and any shifts in stance amongst experts. Outputs were then examined by reviewing the transcripts, and data was organized by the study consultant for presentation back to the experts for further discussion and feedback.

## 4 Findings

### *4.1 Baseline Results: Round #1*

Six experts from the two scoping review teams were brought together to undertake one of the first tasks of a scoping review, which is to clarify key concepts and definitions (Tricco et al., 2016: Peters et al., 2020b). Table 2 summarizes baseline results from Round #1, showing each of the 8 concepts, number of definition choices, and decision tree results.

**Table 2: Decision Tree Consensus Process: Round #1 Results**

| **Concept** | **# of Definitional Choices** | **Initial Results** (1st, 2nd, 3rd choice requested, with the option of providing an alternative definition) |
|---|---|---|
| Social Innovation | 7 | ▪ 1st choice: #6 (n=4); followed by #4 (n=1)<br>▪ 2nd choice: #4 (n=2)<br>▪ 1 expert did not rank, suggesting an alternative definition |
| Social Economy | 3 | 1st choice: #1 (n=4); followed by #3 (n=1) & #2 (n=1)<br>2nd choice: #3 (n=4)<br>1 expert only ranked a first choice, offering an ive definition |
| Citizen Science | 3 | ▪ 1st choice: tie between #2 (n=3) and #3 (n=3) & #2 (n=1)<br>▪ 2nd choice: #3 (n=3)<br>▪ 1 expert commented on the choice of definitions |
| Transformative Innovation | 3 | ▪ 1st choice: #4 (n=4)<br>▪ 2nd choice: #5 (n=3)<br>▪ 1 expert offered an alternative definition<br>▪ 2 experts commented on the choice of definitions |
| Sustainability Transitions | 4 | ▪ 1st choice: #2 (n=3); followed by #1 (n=2)<br>▪ 2nd choice: #1 (n=2)<br>▪ 1 expert offered an alternative explanation<br>▪ 1 expert commented on interpretation, use of definition for this concept |
| Social Entrepreneur | 5 | ▪ 1st choice: #1 (n=4); followed by #4 (n=2)<br>▪ 2nd choice: tie between #3 (n=2) and #5 (n=2)<br>▪ 1 expert offered an alternative definition<br>▪ 1 expert commented on whether the definition is in reference to the actor (social entrepreneur) or the process (of social entrepreneurship) |
| Regional Innovation Systems | 4 | ▪ 1st choice: tie between #2 (n=2) and #3 (n=2)<br>▪ 2nd choice: tie between #3 (n=2) and #1 (n=2)<br>▪ 1 expert offered comments and alternative |

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| | | definition<br>▪ 1 expert commented on considering the definitions used by economic development agencies |
| Societal Outcomes | 3 | ▪ Most frequent 1st choice: #1 (n=4)<br>▪ Most frequent 2nd choice: #2 (n=3)<br>▪ 1 expert asked to include only 2nd paragraph of choice #2<br>▪ 2 experts only ranked their first choice:<br>▪ 2 experts offered comments and alternative explanations<br>▪ 1 expert suggested definitions used by economic development agencies |

Table 2 shows that definitional consensus was close to being achieved in several concepts, such as 'social innovation' and 'citizen science,' while other concepts, such as 'societal outcomes,' generated considerable debate regarding choice of definition. A third choice for rank-order was not used by experts for any of the concepts, rather, alternative definitions were favored by experts.

A written summary of results was provided to the experts by the consultant via email, which included an Excel spreadsheet showing the raw data and alternative definitions and comments offered by the experts. In the email, the experts were asked to review and reflect on the results from Round #1, and a meeting was held to discuss findings.

### *4.2 Delphi Rounds*

Figure 2 uses a flowchart to show the results of the Delphi process. Definition consensus was achieved for all eight original concepts after three rounds, with Experts agreeing to omit three of the eight concepts (Citizen Science; Transformative Innovation; and Regional Innovation Systems). One observation regarding choice of definitions is preference for alternative definitions compared to the definitions provided. Of the seven alternative definitions suggested by experts in Round #2, four of these definitions ended up being chosen in Round #3.

**Figure 2: Delphi Round Outcomes from Definition Consensus Process**

Table 3 shows key themes arising from the Round #2 expert discussion, along with categorization of the types of agreement/disagreement, discussion examples, and initials of those experts most prominent in the discussion.

**Table 3: Delphi Round #2: Summary of Expert Discussion**

| **Key Themes** | **Theme Summary** | **Type of Agreement/Disagreement** | **Examples from Discussion** |
|---|---|---|---|
| Social Innovation Definition | Two polar positions: remove normative language ("better," "just," "sustainable,") to keep a neutral definition vs | Normative vs descriptive (primary); Methodological (implications for inclusion/exclusion and measurement) | Agreement for descriptive framing & concern over normative bias (PM, JT, KG, SW, JC) |

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| | language that signals values & impacts | | |
| Use of Feature-based Framework | Strong, widespread support for checklist approach as practical solution to reconcile breadth & specificity | Methodological/pragmatic consensus, viewed as a compromise between neutrality & useable inclusion rules | PM (preference for 'must-meet' criteria), SW, KG, JT, JC (concern over a broad framework) |
| Measurement Logic | Agreement to focus on outcomes, not outputs; disagreement on how to treat impact (attribution vs contribution) | Methodological (causal inference, feasible indicators); pragmatic (what the review can realistically capture) | KB, JT, PM (agreement to focus on outcomes); JT (prefers attribution logic although recognizes difficulties); KG (practitioners use contribution); JC (should distinguish time horizon) |
| **Inclusion/exclusion of concepts:** | | | |
| Citizen Science | Decision to exclude concept | Full consensus from experts to exclude | |
| Transformative Innovation: | Some experts see it as overlapping with social innovation; others see it as distinct and potentially useful | Conceptual/scope disagreement (when to treat as separate vs. descriptor) | JT, KG (treat concept as an outcome); PM, KB (worry about search-string implications) |
| Sustainability Transitions: | Agreement that it should not be restricted to environmental dimension | Normative vs definitional nuance and scope | KB, JC, JT, DN (favor broader social-econ.-environmental framing) |
| Regional Innovation Systems | Some experts want to drop or subsume concept as it lacks an explicit 'social' | Scope/contextual disagreement | JT (sees value for spatial/context indicators |

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| | focus | | |
| Social Entrepreneur | Agreement to distinguish actor (social entrepreneur) from process or mindset (social entrepreneurship); | Conceptual agreement (clarifying labels) with minor definitional nuance (e.g. role of 'novel,' etc.) | JC, SW, JT, KG (support of separation of 'social entrepreneur' and 'social entrepreneurship' |
| Practical Considerations (related to Scoping Review criteria) | Agree on procedural steps; finalize workable definitions; solicit grey lit., practitioner tools | Procedural/pragmatic consensus | Experts supportive of operational plan |
| Concerns about Vagueness and operationalization | Worry that broad or too-neutral definitions will include irrelevant items; worry that value-laden definitions will exclude legitimate instances | Methodological and pragmatic (how to balance sensitivity vs. specificity) | KB, PM, DN, JC (voiced examples of problems encountered in prior scoping review sweep |

Results presented in Table 3 reflect the level of complexity in achieving definitional consensus that asked experts to consider multiple definitions that aligned with the requirements of a scoping review. Highlighted challenges include use of normative vs. descriptive language, neutral vs. usable inclusion criteria, measurement challenges (e.g., outcomes vs. impacts), and how definitions will align with the logistics of a scoping review.

Table 4 presents further insights from the Delphi Round #2 discussion, highlighting the contentious themes, their importance to the definition consensus process, and examples of comments from the experts.

**Table 4: Delphi Round #2: Discussion Theme Classifications and Examples**

| **Contentious Themes** | **Importance of Definitional Consensus (as it applies to a scoping review)** | **Examples from Discussion** |
|---|---|---|
| Decision about Normative vs. Descriptive Definitions | Affects inclusion-exclusion criteria, measurement approach, and whether unintended outcomes are captured | "skip the 'better' because its normative;" "innovation…comes loaded with a normative connotation" |
| Need for Descriptor-based | To help screen diverse literature, permits neutrality | "drop-down list of must-meet criteria…instead of a single |

| | | |
|---|---|---|
| Framework or Checklist | while still narrowing scope | prescriptive definition" |
| Measurement Logic | Determines feasible indicators, search terms, and what can be claimed from evidence; need to know what to measure | "if we opt for an attribution logic, we would then also need counterfactuals" |
| Scope & Boundaries of Concepts | Drives screening decisions, and whether to treat concepts as descriptors, separate definitions, or to exclude them | 'how do these concepts overlap or differ from 'social innovation;" do we really need this definition in our toolkit?" |
| Scales & Levels of Context Sensitivity | Reference to scale (e.g., micro, meso, macro) affects classification and measurement and which indicators apply | "how do we grasp the spatial dimension?"; "social innovation can be at the micro, meso, macro level" |

The normative vs descriptive theme was the most prominent contentious issue amongst the experts in Round #2. There was strong agreement to address methodological and practical issues in choosing definitions, with most experts voicing concerns over scope and overlap of related terms, resulting in three of eight definitions being omitted for Round #3, as shown in Figure 2. The experts largely converged on a pragmatic compromise, to adopt a neutral, descriptive core set of definitions augmented by a checklist of characteristic to operationalize inclusion. This resolved some methodological disagreements while leaving the question of how to treat impact attribution (of social innovation) for Round #3 of the Delphi process.

Table 5 highlight changes, omissions, new decisions, and any shifts in stance amongst experts by comparing transcripts from Delphi Rounds #2 and #3. Opinions by experts in Round #2 can be characterized as exploratory, deliberative, and dialogic, with experts raising concerns and providing examples in debating definitional choices. Delphi Round #3 was more editorial and structured in attempting to achieve full definition consensus, with tentative consensus on several concepts having been achieved in Round #2.

**Table 5: Consensus Shifts between Delphi Rounds #2 and #3**

| **Topic** | **Round #2 Discussion** | **Round #3 Discussions** |
|---|---|---|
| Social Innovation | Heated debate: normative ("better, just sustainable") vs neutral/descriptive; consensus for a descriptor checklist | Shows movement towards adopting an alternative descriptive core while preserving provenance of normative options |
| Descriptor/Checklist Approach | Proposed as practical compromise. Need to operationalize inclusion criteria in deciding on definitions | More explicit recommendation to distill characteristics of definitions to operationalize inclusion (e.g., cross-sectoral collaboration, multi-level outcomes, changes in social relations) |

| | | |
|---|---|---|
| Normative vs Descriptive Definitions | Unresolved tension, most experts seeking neutral definitions for operational reasons, and 2 experts wanting to retain value terms | Tension acknowledged and resolved by adopting a hybrid, descriptive definition of 'social innovation.' Definitional descriptors favored to capture values, with modifications to other definitions |
| Measurement logic (within definitions) | Strong debate on attribution vs contribution. Agreement to focus on outcomes. Time horizon distinctions urged by most experts. | Consensus to include 'impacts' and to add it to the concept title, but debate on attribution not fully resolved. |
| **Inclusion/Exclusion of Concepts** | | |
| Citizen Science | Experts questioned relevance of concept, consensus to exclude | Confirmation of Round #2 recommendation to exclude. |
| Transformative Innovation | Concerns regarding how to judge 'transformation.' Most experts see overlap with definition of 'social innovation.' | Full consensus to exclude concept. |
| Sustainability Transitions | Debate over environmental vs. social/economic facets. May be useful as a descriptor definition. | Consensus to adopt most preferred definition with modifications, which frames sustainability as a characteristic likely to appear in indicators. |
| Regional Innovation Systems (RIS) | Concern amongst experts that RIS literature lacks 'social' focus. Candidate for exclusion. | Further discussion on relevance of concepts, resulting in full consensus to exclude. |
| Social Entrepreneur | Debate over separating 'actor' (entrepreneur) vs 'process' (entrepreneurship). Novelty requirement and exact wording needs to be finalized. | Full consensus to prioritize process and adopt preferred definition for social entrepreneurship |
| Practical Considerations (Scoping Review criteria) | Need to finalize workable definitions and ensure practical measures | Definitions finalized, with some further discussions required to aid in screening of titles/abstracts in scoping review |

Debate amongst experts in Round #3 centered once again on normative versus descriptive considerations and resulted in pragmatic compromises on a descriptor/checklist approach to ensure that definitions could be operationalized with regards to screening for social

innovation outcome and impact measures. Opinions by experts in Round #3 reflected greater awareness of the need to align definitions with 'practical' scoping review considerations. After completing the definition consensus, scoping reviews teams progressed to the next phase of the study, which included completing scoping review protocols, inter-rater agreements and screening of titles and abstracts.

## 5 Discussion

Definition consensus is a noted prerequisite when undertaking scoping reviews, and for this study, was challenged by the number of concepts and definitions to review, the complexity of the subject under study, and the make-up of the expert group (international qualitative and quantitative scholars). Literature suggests that the consensus objective should define consensus process design (Innes and Booher, 1999). For this study, experts were asked to converge on a set of definitions for social innovation, a contested and evolving subject. This objective informed a consensus process design which integrated the procedural aspects of modified Delphi and decision tree methods and generated a powerful social coordination mechanism. Establishing baseline consensus data using a decision tree method allowed experts to familiarize themselves with the consensus task while identifying areas of agreement and disagreement prior to engaging in the Delphi process.

Adapting traditional consensus methods is particularly relevant when attempting to define complex subjects, such as social innovation. Allowing experts to recommend other definitions and provide comments on their decisions facilitated greater commitment amongst the experts to the consensus process, as each of these alternatives was discussed and considered during the Delphi group discussions. Unlike traditional Delphi methods, our study did not require that all experts reach the same judgement on definitions but rather that a maximum level of convergence was achieved (Niederberger and Köberich, 2021). As well, experts were not asked to revise their judgments or "to specify the reasons for remaining outside the consensus" (Pfeiffer, 1968: 152). Instead, experts were given the opportunity throughout the process to make further clarifications of both the information and their judgments of the relative importance of definitional characteristics.

Findings show experts actively engaged in a social learning process through the Delphi rounds, which may not be obvious if assessing changes in quantitative scorings alone as with traditional Delphi methodologies (Devaney and Henchion, 2018). Our study showed that statistical measures may not be necessary when the consensus task is well established, the expert sample is small and familiar with the consensus subject, and a combination of individual and group consensus activities are deployed. The study suggests that anonymity of parties in achieving consensus, often a characteristic of traditional Delphi methods (Putora et al,. 2014, Powell, 2003), may be counterproductive for a complex subject such as social innovation. In-depth discussion after each of the Delphi rounds, followed by a summary report that included full transcription of the discussions, allowed experts to provide input, interact with others, and acknowledge one another's viewpoints, which promoted mutual understanding of the diverse range of concepts and definitions.

The paper makes several contributions to the study of consensus methods in the social sciences.. The study offers a detailed, empirically-based assessment of how consensus actually forms in practice. In general terms, the study finds support for a pragmatist sociolinguistics perspective of consensus, as an iterative cycle of inquiry, comprising an initial proposal, critique, refinement, and finally, stabilization (e.g., Von Der Gracht, 2012). Similarly, the study finds that consensus emerges through iterative interaction rather than deduction (Timmermans and Tavory, 2012).

The study also finds support for a communicative action perspective, whereby the creation of a supportive social capital setting, oriented towards mutual understanding and transparent communication, can facilitate the conversion of individual expertise into collective intelligence (Van der Kroon et al., 2002; Habermas, 1985a). High levels of trust, sincerity, and openness between and amongst experts and with the consensus facilitator/moderator (study consultant), along with the moderation of discussions, were identified as important contributors in achieving full consensus after three Delphi rounds. The make-up of the expert cohort, carefully selected for their level of expertise and experience (Hanafin, 2004), and familiar with each other, were also contributing factors. All of the experts knew each other from discussing and debating social innovation measurement at the aforementioned consensus conference, and some had collaborated on social innovation-related research projects.

A number of recommendations are suggested from this study. One recommendation is to define the consensus objective in advance. For this study, the requirements of the scoping review required full consensus, which was agreed upon by the experts and achieved after three Delphi rounds. Another recommendation is to record, transcribe, and summarize discussions throughout the consensus process, which was identified by experts as a helpful contribution for clarifying their opinions and reflecting on those of others. This allowed for easier thematic classification and analysis of narrative data and increased transparency of the consensus process to better facilitate discussion and communicate results. Recall of expert comments is also helpful in highlighting semantic traits of the subject under investigation.

One limitation of the study is that there was no pre-test of the methods. The definition consensus requirements in this study also involved few parameters and a small number of users (experts), requiring limited data analytics. Should the consensus process require more complex parameters and a larger number of experts, the result may be too complex for practical interpretation. Achieving definition consensus was also informed by requirements of a scoping review study, which introduced particular themes within the consensus process that may not be generalizable to other study contexts.

## 6 Conclusion

The paper offers a novel approach to achieving definition consensus amongst a panel of international experts engaged in scoping reviews. The integration of modified Delphi and decision tree methods and moderation of the consensus process can facilitate a unanimous authentic commitment by experts to understanding each other's perspectives, knowledge, and interpretations in light of the shared goal of achieving consensus.

Undertaking a thematic and descriptive analysis of the consensus process can generate a level of data transparency and process detail that addresses some of the criticisms made of consensus methods. While consensus methods provide structure, they are insufficient without a supportive social capital setting. Consensus design should include process guidance for experts that establish high levels of social capital at the outset, which will be particularly relevant when seeking consensus for complex or contested subjects.

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