

RESEARCH PAPER

Method to integrate asynchronously produced individual influence maps into an extrapolated population influence map following the face-to-face stage of a structured democratic dialogue

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Abstract

We present a method that broadens the application of structured democratic dialogue (SDD). After completing the final stage of the SDD process, during which the participants explore collectively and synchronously possible influence relations between ideas using the interpretive structural modelling (ISM) algorithm, they continue the ISM process individually and asynchronously. Their respective adjacency matrices (AM) are integrated into a population AM (pAM) that reflects their least agreement denominator. The pAM is sent back to them in a few iterations, asking them to explore influence relations between additional ideas. This procedure eventually produces a model, which depicts their ‘extrapolated’ or ‘computed’ collective wisdom. The method has been applied in two projects. Participants who responded to a requested assessment (via a Likert scale) indicated that the extrapolated influence maps created asynchronously made sense.

KEYWORDS

asynchronous interpretive structural modelling, collective wisdom, computational wisdom, stakeholders, structured democratic dialogue

1 | INTRODUCTION

The systemic methodology known as structured democratic dialogue (SDD) has been widely popularized as an effective process capable of managing complex socio-technical and corporate challenges. The influences on the early development of SDD were from systems engineering (Sage, 1977). Applications in policy and planning started in the early 1970s by the Warfield Group, which also coined the term interactive management to describe their process (Broome, 1997; Broome & Keever, 1989; Warfield, 1976; Warfield & Cardenas, 1994). As initially perceived, a typical process is specifically designed to assist heterogeneous groups in dealing with complex

issues in a reasonably limited amount of time (Banathy, 1996; Warfield & Cardenas, 1994). Over the past few decades, quite a few publications describe and discuss the process and its scientific grounding and report hundreds of applications (e.g. Bausch & Flanagan, 2013; Christakis, 2004; Christakis & Bausch, 2006; Christakis & Harris, 2004; Christakis et al., 1999; Cisneros & Hisijara, 2013; Flanagan, 2020; Flanagan & Christakis, 2009; Hays & Michaelides, 2004; Laouris, 2012; Schreiberman & Christakis, 2007). The authors' group alone has applied the SDD process in more than 100 different contexts,¹ including peace and conflict resolution (Laouris, 2004; Laouris, Michaelides, et al., 2009; Laouris, Erel, et al., 2009; Laouris et al.,

2015); discovering and collectively agreeing on research agenda priorities, thus influencing European Commission funding (Laouris & Michaelides, 2007; Laouris et al., 2011, 2017; CARDIAC²); capacity building of youth and civil society^{3,4}; reforming and bridging gaps in education and democracy (Laouris, 2015; Laouris & Laouri, 2008; Laouris & Romm, 2022; Laouris et al., 2010); and response to the COVID-19 outbreak in Africa (Laouris et al., 2022). More recently, the SDD has been proposed as a problem structuring method (PSM) within the repertoire of operational research (OR) tools (Laouris & Michaelides, 2018; Laouris & Romm, 2022). The exposure within OR practitioners will surely further widen the breadth and scope of applications.

SDD applications have been traditionally implemented using a face-to-face model, typically referred to as G1: 1st Generation consisting of four key stages (see Figure 1) culminating in producing an influence map (IM; examples in Figures 3, 4, 6 and 7). This IM represents the group's consensus and supports stakeholders in designing and implementing further actions. About 15 years ago, the authors' group began experimenting with hybrid models in which synchronous face-to-face stages (especially the clustering and mapping) were combined with preceding (e.g. collecting and clarifying ideas) or in-between (e.g. submitting votes) asynchronous virtual processes (see examples in Christakis, 2007; Laouris & Christakis, 2007; Laouris & Michaelides, 2007; Laouris, Michaelides, & Sapio, 2008). In these 2nd Generation (G2) models, the participants were required to perform specific tasks individually and asynchronously. For example, they were requested to submit their ideas before their first face-to-face session to reduce the time spent at the launch of an SDD to review and focus on the problem and internalize the triggering question (TQ). They might have also been required to submit further clarifications to their contributions or

votes. Such models reduce the time for which all participants must be engaged synchronously. In some of the above applications, the clustering stage might have been either partially or totally assigned to a smaller group, thus saving additional hours of synchronous work by the whole group. In what is referred to as G3 (3rd Generation) applications, also the face-to-face stages of clustering and mapping have been conducted virtually using videoconferencing. In two historic examples, the Agoras community conducted the 'Obama Vision'⁵ to anticipate challenges newly elected Obama would be facing in his presidency and the 'Planetary Dialogue'⁶ in honour of Hasan Özbekhan's vision for a bottom-up democracy. Even the facilitators were in different locations (Michigan, USA, Crete and Cyprus). More recently, the authors began to conduct totally virtual SDDs referred to as G4 or 4th Generation.⁷ Although we still lack rigorous evaluations assessing the degree to which the quality of entirely virtual dialogues might be compromised, the digital era and the Covid-19 pandemic impose enormous pressure to consider them as the new standard.

Whereas each SDD model might have different strengths and weaknesses, a few are shared by all (for critical discussions, the interested reader can refer to chapter 7 in Romm, 2010). For example, a successful implementation always depends on its compliance with principles, referred by the SDD community as laws (Requisite Variety, Ashby, 1958; *Requisite Parsimony*, Miller, 1956; Warfield, 1988; Requisite Saliency, Boulding, 1966; *Requisite Meaning*, Peirce's law, Turrisi, 1997; Requisite Autonomy in Decision, Tsviacou, 1997; Requisite Evolution of Observations, Dye & Conaway, 1999; Requisite Action, Laouris, Laouri, & Christakis, 2008). The quality of the deliberation during key stages (especially clustering and mapping; see Section 2) must be evaluated when new models are tried. The performance of each model must be

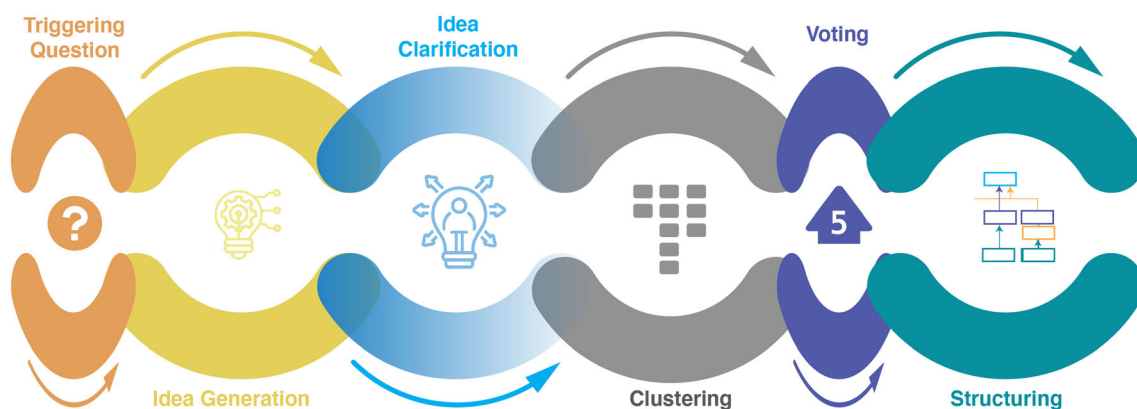


FIGURE 1 Stages of a typical SDD [Colour figure can be viewed at wileyonlinelibrary.com]

assessed for possible violations of the above laws or deterioration of the quality of the deliberation (see, e.g. Steenbergen et al., 2003, or Fulwider's, 2006 discourse quality indices). Quality assurance is pivotal for (i) achieving a state of mutual trust, which is a prerequisite for committing to subsequent collective action; (ii) the outcome to be accepted by actors (e.g. decision- or policymakers) who have not participated in the process; and (iii) securing the long-term commitment not only of the participants but more importantly of the managers and institutions who have sponsored it.

Secondly, a typical SDD engages the participants in a demanding process for 6–16 h. The IM they produce reflects their collective consensus and wisdom. Still, more importantly, it guides them in generating a shared narrative about the challenge under examination and identifying the most effective points for intervention. When the IM is sparse in density, or the number of ideas in lower levels is small, or some root ideas turn out to be impractical⁸ (i.e. irrelevant or less feasible to address), or they have been already identified by decision-makers (who might have even taken or planned appropriate measures), the participants (and their sponsors) are left with limited options for designing effective interventions. The cost–benefit might turn out unfavourably. Thirdly, when one takes into account that a typical SDD requires approximately 200 person-hours (e.g. 20 individuals committing 8–16 h) to produce 50–100 ideas and apply rigorous processes that facilitate divergent and convergent thinking to converge and discover a minimal number of ideas that have the greatest influence (i.e. represent the root causes of the problem at hand or provide the greatest leverage to achieve a systemic change), it is imperative that they produce something that would be easy to explain and convincing when lobbied to outsiders. The richer the final IM, the greater the chances for third parties to trust and adopt the recommendations emerging from the SDD process.

In this paper, we propose an extension to the SDD process, which, we claim, could alleviate some of the above limitations. Our approach broadens the application of SDD by reducing the time (and consequently the cost) required to produce richer IMs. The final stage of the SDD, during which participants explore collectively and synchronously possible influence relations between ideas, is extended by adding a few iterations of asynchronous sessions during which each participant carries on independently. The process eventually produces an IM that depicts an *extrapolated collective perspective*. The method has been applied in two projects. Participants who responded to a requested assessment (via a Likert scale) indicated that the extrapolated IMs created asynchronously made sense.

2 | METHODOLOGY

The stages of a typical face-to-face (or also virtual) SDD application are shown in Figure 1.

During the last stage of the face-to-face process (called *structuring* or *mapping*), the participants construct their IM with the support of the interpretive structural modelling (**ISM**) algorithm. The algorithm selects pairs of ideas and presents them to the participants in an *influence question* like the generic example shown here. The facilitator mediates their deliberation encouraging them to share their justifications for the existence or absence of an influence relation. Only when the supermajority (either 2/3 or 3/4 as decided by the participants) vote for a 'yes' an influence relationship is recorded. This pairwise exploration of the influence of one idea on another gradually produces a digraph we call IM, which resembles a tree. The ideas that end up at the root of this tree correspond to the most effective leverage points. Addressing them produces effective actions to work out their complex situation and provides a maximum return. In other words, this 'map' represents their collective consensus on how to move forward. In this process, the stakeholders are not burdened with keeping track of the bigger picture because the ISM algorithm manages the mechanical logic of how their decisions fit together. As we explained in Section 1, the number of pairwise comparisons that can be examined during the face-to-face stage is sometimes limited because of time constraints. The following section describes the mathematical background of the method.

2.1 | Method of constructing an extrapolated group IM

The ISM algorithm uses the adjacency matrix (**AM**; a binary square matrix) to represent influence relations between pairs of ideas. When there is a '1' in a cell (i, j) , it means that the participants have debated and voted in favour of a relation between i and j by a great majority. However, it can also be the case that a '1' is depicted using inductive logic such as: If element i influences element j and element j influences element k , then we insert a '1' at the cell (i, k) . The application of this procedure results in a so-called reachability matrix (**RM**). Thus, the otherwise exhausting task of comparing hundreds of pairs is simplified by the transitive logic of the ISM algorithm. The purpose of the present text is not to explain the algorithm in detail (for a recent review and evaluation, the interested reader may refer to Laouris & Dye; in preparation). Still, the critical message is that it performs in the background various matrix transformations to

compute the shortest path to complete the inquiry process. The resulting AM can easily be converted to other types (i.e. reachability, hierarchical, condensation and skeleton matrix) to derive the IM. Our method takes the (enriched) AM produced asynchronously by each participant as input and computes a population adjacency matrix, pAM_1 , where p stands for ‘population’ and ‘ $_1$ ’ represents the first iteration of this process. The pAM_1 represents the least agreement denominator of the participants after the 1st iteration. This pAM_1 is returned to the participants with the instruction to continue structuring additional ideas using pAM_1 as their new starting point. This process is repeated a few times until a sufficient number of ideas are integrated into the model. The selection of how many and which ideas to structure is decided by the entire group during their last face-to-face session. This procedure eventually produces a model, which, we claim, depicts their ‘extrapolated’ or ‘computed’ collective wisdom. The following formulas elucidate the process.

Let

$$I_k, I_{k+1}, I_{k+2}, \dots, I_{k+n} \quad (1)$$

be the additional ideas that the subgroup of participants is assigned to structure.

$$AM_{1,1}, AM_{1,2}, AM_{1,3}, \dots, AM_{1,m}, \dots, AM_{n,m} \quad (2)$$

be the adjacency matrices with $AM_{1,1}$ the one constructed during the first iteration by Participant 1, $AM_{1,2}$ the one constructed by the second participant during the first iteration, $AM_{1,m}$ the one constructed by the m th participant during the first iteration and $A_{n,m}$ the adjacency matrix constructed by the m th Participant during the n th iteration of the method.

Then

The population adjacency matrix, pAM_1 , during the first iteration is calculated as follows:

In the first step, we conduct matrix addition to calculate pAM_1' .

$$pAM_1' = A_{1,1} + A_{1,2} + A_{1,3} + \dots + A_{1,n} \quad (3)$$

In the next step, the elements (i, j) of pAM_1' are replaced with ‘0’ or ‘1’ depending on whether element (i, j) satisfies the following condition.

$$A(i,j) = \begin{cases} 0, & i,j < GM \\ 1, & i,j \geq GM \end{cases} \quad (4)$$

where

$$GM = \left[\frac{((\text{great majority}) \times (\text{number of participants}))}{(\text{number of participants})} \right] \quad (5)$$

The value of (great majority) is decided by the group. In the arena, practitioners use two-third or three-quarter majority. The resulting matrix, pAM_1 , is returned to the participants for a few more iterations until the final pAM_n emerges.

$$pAM_n \text{ ‘Extrapolated/computed’ collective wisdom} \quad (6)$$

The final pAM_n is entered as input to the second part of the ISM algorithm⁹ to calculate the final ‘Extrapolated/computed’ IM.

As a side note, the diagonal is not affected by the procedure as its elements satisfy the above condition and will therefore return to either ‘0’ or ‘1’ depending on which connotation was originally used for the elements in the diagonal.

3 | RESULTS

The following sections present the results from two cases in which the new method has been applied. The first dialogue was commissioned by the Cyprus Greens Party, who were interested in identifying the reasons for their low success in elections. The second application was conducted with young researchers from the School of Education of the University of Cyprus, who were interested to learn more about the SDD methodology. The purpose of their dialogue was to identify obstacles that limit learners from benefiting maximally from their educational institutions despite their learning differences.

3.1 | Case 1: SDD with the Cyprus Greens Party

The SDD was implemented at the party’s headquarters in three face-to-face sessions totalling 9 h and 45 min on 11 September (3 h), 26 September (3 h and 15 min) and 12 November (3 h and 30 min) of 2013. During their first session, the 13 participants generated 89 responses to the TQ: ‘What are the reasons that although many citizens appreciate and respect the ideas of the Movement of Environmentalists, they are not involved and do not support with their vote when needed?’ Despite the strict instructions that no questions or clarifications were allowed during this stage, the participants could not refrain from asking each other for at least a quick

clarification. In their second session, the participants clarified and subsequently clustered the 89 ideas in 13 categories (Figure 2) and were then asked to choose their Top 5 and submit their votes by email before their final session. In their concluding face-to-face session, they managed to structure (staying 30 min longer than scheduled) the 14 ideas that received two or more votes to produce the IM shown in Figure 3.

In total, the participants have invested 126.75 person-hours in face-to-face deliberations and approximately 6.5 asynchronous person-hours (i.e. 13 participants each

investing 30 min on their own to choose their Top 5 ideas). During the concluding face-to-face narrative discussion (i.e. following completion of the synchronous sessions), the participants reported that they were satisfied with their work and felt empowered to tackle the challenges. A few of them, who were fascinated with the methodology and who were wondering how the IM would have evolved if they had more time, were offered the option to continue the mapping asynchronously with our new method. Five participants conducted three iterations to produce the IM shown in Figure 4. The emerging

1 Πλατιάσαμε	2 Κομματοκρατία	3 Κατεστημένο	4 Επικοινωνία – Προσέγγιση	5 Ρουσφέτι	6 Αρνητική αντίληψη
#1: Ενώ είμαι συνειδητά οικολόγος, δεν με πείθουν επί του θέματος	#2: Το σύνδρομο της χαμένης ψήφου	#3: Κομμάτι του συστήματος	#5: Παρόλο που θεωρητικά είναι οικολόγοι δεν τους έχουμε εντοπίσει και προσεγγίσει προσωπικά	#8: Δεν βλέπουν να έχουν οποιοδήποτε όμωο και προσωπικό κέρδος	#6: Δεν τους έχουν σε υπόληψη
#4: Ενώ ανοίξαμε κατάστημα για ορθοπεδικά παπούτσια τώρα είμαστε πολυκατάστημα	#9: Μικρό κόμμα μικρό εκτόπισμα	#10: Δεν προτείνει ριζικές αλλαγές	#7: Έλλειψη συναισθηματικού δεσμού με τους πολίτες	#20: Δεν σάζουμε κόσμο	#11: Έχουν έλλειψη πολλαπλών ικανών προσώπων
#16: Ο τρόπος που εκφραζόμαστε δεν ταιριάζει στο προφίλ ενός πράσινου ψηφοφόρου	#15: Κομματική πώληση	#19: Σκέφτονται ότι δεν θα αλλάξει κάτι	#21: Δεν γνωρίζει κάποιον/α για να τον φέρει κοντά	#41: Η οικολογία έχει κόστος	#14: Δεν τους γουστάρουν
#27: Συχνά πυκνά λαϊκίζουμε	#17: Πρώτα ψηφίζουν για Κυπριακό και οικονομία και μετά για οικολογία	#60: Ο Περδίκης δεν έχει χρησιμοποιήσει ποτέ την ασυλία του για να 'καρφώσει' διεφθαρμένους πολιτικάντιδες ή δικηγόρους	#26: Άγνοια περί οικολογικής πολιτικής ώστε να εκπληθθούν οι θέσεις του κινήματος	#43: Δηλώνουν τα οικονομικά τους στοιχεία	#23: Δεν έχουν πείσει ότι μπορούν να κυβερνήσουν ή να επιλύσουν σοβαρά προβλήματα
#47: Συχνά δεν διαφέρουμε από το ΕΥΡΩΚΟ	#18: Φαί να φάμε εν έχουμε τ'ράι ρεπάνια για την όρεξη γυρεύουμε	#66: Δυσκολία στον επηρεασμό πολιτικών αποφάσεων	#37: Οι νέοι δε μας γνωρίζουν - τραναχτή απουσία από τον ιστοχώρο	#61: Δεν υπάρχει δυνατότητα για ρουσφέτι	#29: Θέσεις 'αερολογίες'
#75: Διήθηση σκοπού με τη παράλληλη προσπάθεια πάνω σε πολλά θέματα	#25: Προσκόλληση στο κόμμα που παραδοσιακά ψηφίζει η οικογένεια		#40: Ασυμφωνία ιδεολογιών πολιτών με οικολόγους και το αντίθετο		#35: Θεωρούν ότι οι οικολόγοι δεν θα έπρεπε να ήταν κόμμα
	#35: Θεωρούν ότι οι οικολόγοι δεν θα έπρεπε να ήταν κόμμα		#42: Αδυναμία να αντικρούσουμε/αντιμετώπισουμε υπόσκαψη	#69: Έλλειψη ταύτισης με το μέσο πολίτη	#39: Νομίζουν ότι μας 'ξέρουν'
	#45: Οριζόντια ψήφος	#80: Είναι κόμμα που δεν συμμετέχει στη κυβέρνηση διαχρονικά	#44: Δεν με συγκινεί η ιστοσελίδα τους	#72: Έλλειψη στενής επαφής με το ευρωπαϊκό οικολογικό κίνημα	#51: Το περιβάλλον δεν θεωρείται πολιτικό θέμα
	#46: Επισκόπηση από τις μεγαλύτερες πολιτικές δυνάμεις		#56: Δεν καταφέραμε να κάνουμε την οικολογία 'ιν'	#83: Μπορεί να εκτιμούν και να σέβονται τις ιδέες αλλά διαφωνούν.	#68: Απουσία πολυπροσωπίας
	#57: Πρώτα η ανάπτυξη και μετά το περιβάλλον		#63: Κακή εικόνα λόγω των ευρωπαϊκών πράσινων	#86: Ανεπαρκές μάρκετινγκ	#82: Οι πολίτες κατηγορούν τους οικολόγους για θέματα που δεν ευθύνονται
	#58: Κομματικοποίηση				#84: Δεν είναι αρκετά όμορφοι
	#74: Κατευθυνόμενοι πολίτες				
7 Οργάνωση/Συμπεριφορά	8 Εσωτερικές Αδυναμίες	9 Στιγματισμός	10 Απαξίωση	11 Σύστημα	12 ΜΜΕ
#11: Έχουν έλλειψη πολλαπλών ικανών προσώπων	#26: Άγνοια περί οικολογικής πολιτικής ώστε να εκπληθθούν οι θέσεις του κινήματος	#28: Θεωρούν ότι στιγματίζονται όταν εκφραστούν ανοικτά ότι ανήκουν στο χώρο των οικολόγων	#32: Προτιμούν να απέχουν	#22: Δυσλειτουργικό και βραχυκυκλωμένο πολιτικό-οικονομικό σύστημα	#36: Μη επαρκής προβολή των θέσεων μας από τα ΜΜΕ
#13: Απουσία υλοποιήσιμων χρονοδιαγραμμένων παραδοτέων	#31: Έλλειψη οργάνωσης και αφοσίωσης από τους οικολόγους	#30: Απαθείς, άβουλοι πολίτες	#38: Απαξίωση της πολιτικής ζωής στην Κύπρο γενικά	#33: Η ποιότητα της παιδείας μας δεν ενθαρρύνει πολιτική σκέψη και ανησυχία	#48: Κακή δημοσιογραφία
#24: Δεν έχουν χρήσιμες μετρήσιμες δημοιουργικές και μόνιμες προτάσεις - λύσεις	#49: Εντύπωση ανυπαρξίας δράσεων	#52: Θα τύχουν εμπαιγμού από τον κύκλο τους	#78: Πολιτική άγνοια από τους πολίτες	#34: Απουσία οικολογικής παιδείας στα δημοτικά	#53: Νόμος περί ΡΙΚ - αρραστημένο νομοθετικό πλαίσιο
#31: Έλλειψη οργάνωσης και αφοσίωσης από τους οικολόγους	#50: Έλλειψη δημοιουργικότητας στη προσέλκυση νέων μελών και συμμάχων	#64: Μέτριες και μη πειστικές προεκλογικές εκστρατείες οικολόγων λόγω οικονομικών		#55: Η οικολογία είναι άγνωστη στην Κύπρο	#76: Παραπληρο-φόρηση πολιτών
#42: Αδυναμία να αντικρούσουμε/αντιμετώπισουμε υπόσκαψη	#62: Δεν είμαστε φρέσκοι πλέον	#71: Έλλειψη δυναμικών ενεργειών του κόμματος (π.χ διαδηλώσεις)		#59: Έλλειψη ενεργών πολιτικο-ποιημένων πολιτών	#81: Κακή προβολή από τα ΜΜΕ για το έργο των οικολόγων
#54: Αδυναμία προβολής της ποικιλίας της θεματολογίας του κινήματος	#79: Προσωποποίηση του κινήματος	#73: Απουσία οικολογικού ακτιβισμού και πρωτοτυπίας		#67: Παγκοσμιοποίηση - απασά τη προσοχή του κόσμου από τα τοπικά	#85: Η σχέση με τα κανάλια
#65: Έλλειψη πόρων	#88: Η απάντηση ίσως να βρίσκεται σ' αυτούς που απεχώρησαν από το Κίνημα				#87: Έλλειψη ενημέρωσης και πληροφόρησης από ΜΜΕ για οικολογικά θέματα
#70: Έλλειψής τοπική οργάνωση	#89: Λόθος βασική φιλοσοφία-μικρός πιθανός αριθμός ψηφοφόρων				
#77: Αδυναμία να δώσουν λύσεις σε ποικίλα προβλήματα-μονοθεματική αντίληψη					
					13 Ιδεολογία
					#40: Ασυμφωνία ιδεολογιών πολιτών με οικολόγους και το αντίθετο

FIGURE 2 Categories produced by the Greens Party project (in the original Greek language) [Colour figure can be viewed at wileyonlinelibrary.com]

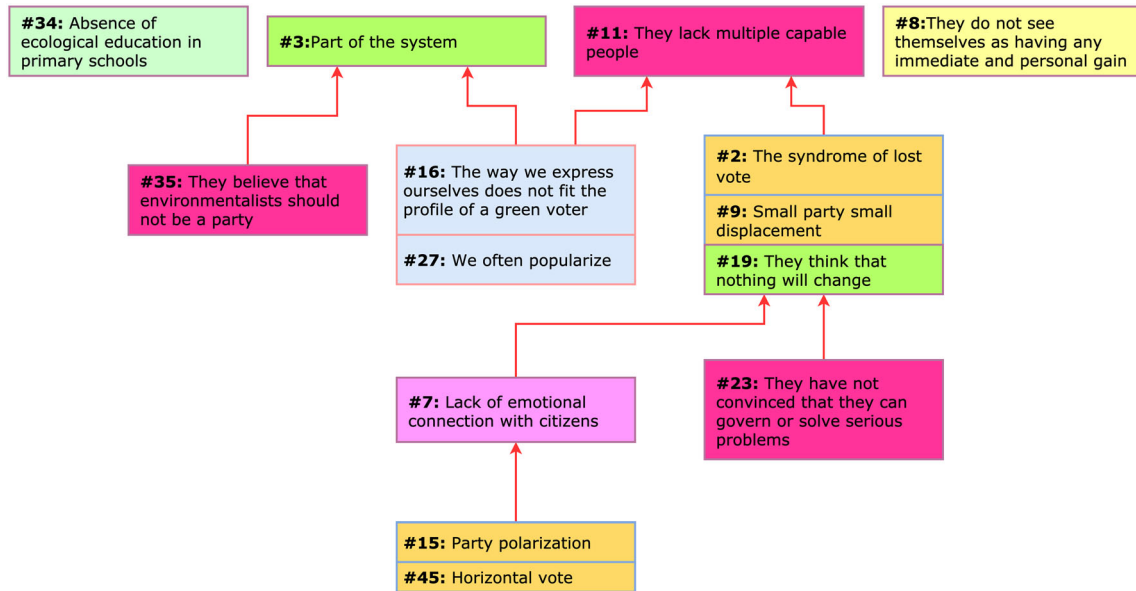


FIGURE 3 Influence map produced at the conclusion of the face-to-face process of the Greens Party project [Colour figure can be viewed at wileyonlinelibrary.com]

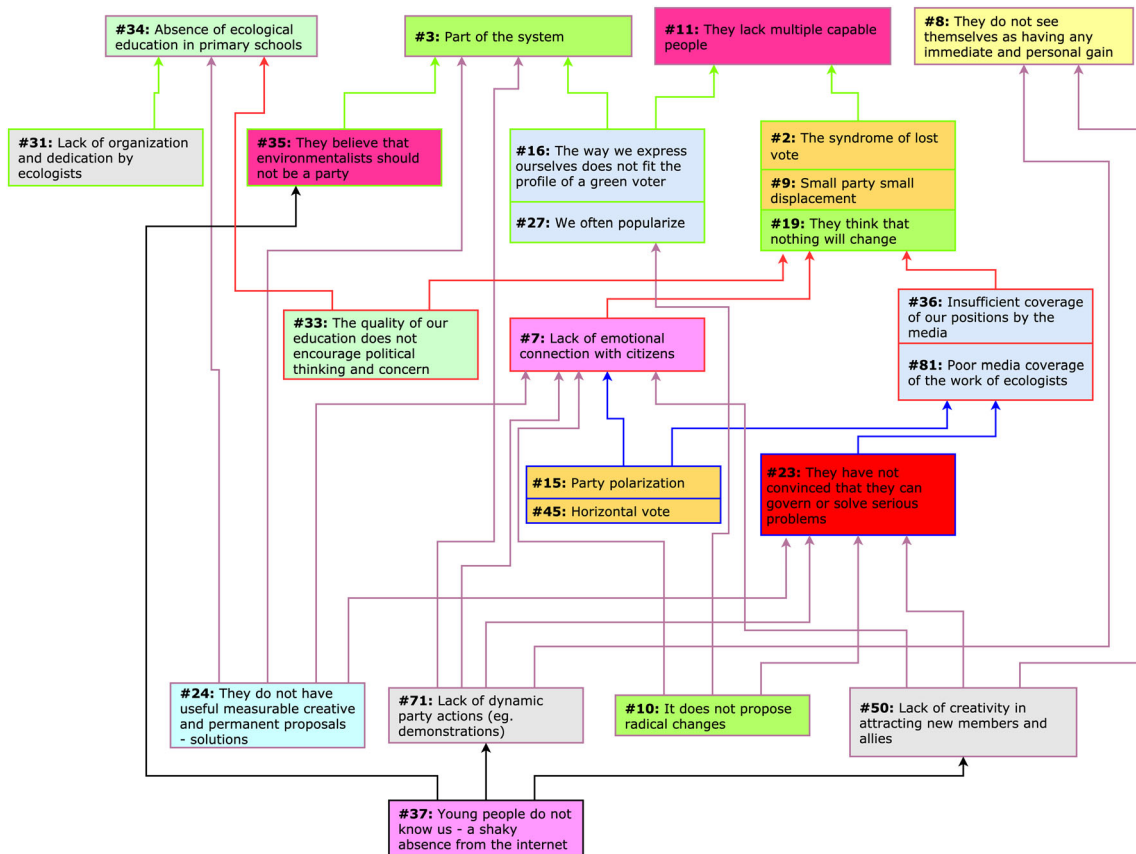


FIGURE 4 Influence map produced after the application of the new method. The colours of the boxes correspond to the cluster. The border colours of the boxes at each level and all arrows leaving from that level have the same colour to improve readability [Colour figure can be viewed at wileyonlinelibrary.com]

IM was enriched with the inclusion of 13 additional ideas. However, what was most striking was that five ideas made it to the root of the map. None of these five ideas had any influence on the previous root ideas (i.e. there are still no ideas pointing towards ideas #15 and #45). However, they all feature three or four outputs pointing towards ideas higher on the map.

Also, two previously unconnected ideas (i.e. #34 and #8) are now connected, which means the participants discovered their respective inhibitors.

The eight participants, who did not contribute to the asynchronous phases, were asked to provide their individual assessment (using a 1–10 Likert scale, where 10 = *the MAP could have been my own*) regarding the degree to which they felt that this extrapolated map made sense to them and included new elements and connections which they perceive as ‘correct’ and ‘making sense’. The average score was .87 ($n = 7$; i.e. only seven responded), which means that almost 90%, of those who responded, have assessed the map as ‘it could have been their own’. We elaborate on the significance of these results in Section 4.

3.2 | Case 2: SDD at the University of Cyprus

The second SDD was implemented, in collaboration with the University of Cyprus, in the context of ‘Unified e-Hoop approach to learning differences’, a European Lifelong Learning project. The 12 participants, who were advanced students engaged in research from the School of Education, interacted in two 3-h sessions face-to-face on 8 and 25 of February 2014. The TQ was: ‘What are the typical obstacles that limit learners from benefiting

maximally from their respective educational institutions despite their differences?’ During these 6 h (in total, they have invested 72 person-hours in face-to-face interactions), the young researchers generated and clarified 50 ideas and clustered them into seven categories (Figure 5). Because of time constraints, they only managed to structure six of them to produce the IM shown in Figure 6. At the end of the process, the participants wanted to make more efficient use of their investment. First, they have decided to compile the clarifications of their ideas into a collectively authored booklet. The author created a google doc with their 50 ideas in separate pages and invited all to edit their own and make suggestions for edits in the ideas of others. The final document was formally published by Future Worlds Press and is available online.¹⁰

The project aim was to acquaint the students with the SDD methodology and did not require the production of a comprehensive IM. However, because some of the students expressed interest to continue the mapping, they were offered the option to do it asynchronously with our new method.

Five of the 12 young researchers continued structuring ideas with fewer votes. After two iterations, the IM evolved to the richer diagram shown in Figure 7.

The final IM was sent to the entire group for their comments and assessment using the same approach as above. Only nine of the 12 participants responded (including the five who conducted the asynchronous phase). The average score was .9 ($n = 4$; i.e. calculated only for the four who did not participate in the asynchronous sessions), which translates to recognizing the extrapolated IM produced by their classmates to a high degree as ‘their own’. The importance of this result is discussed in the following section.

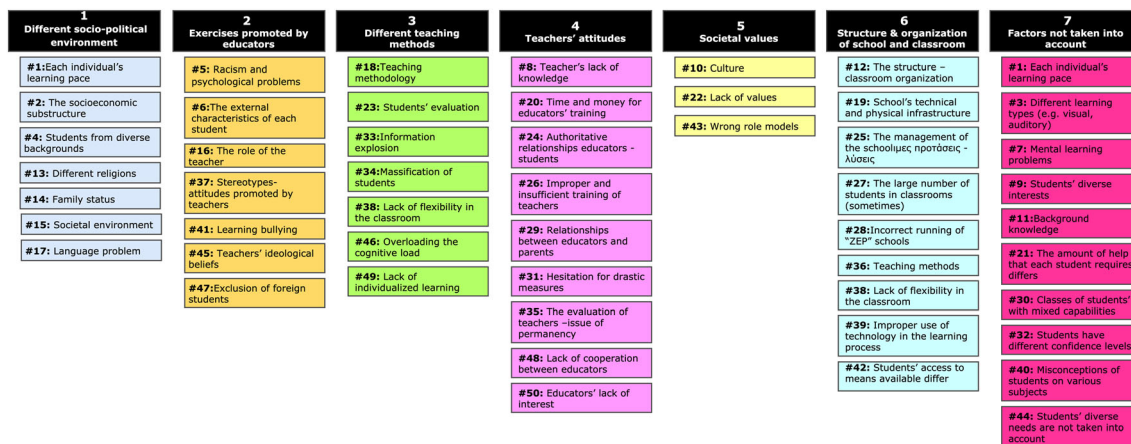


FIGURE 5 Categories produced by the participants of the e-Hoop project [Colour figure can be viewed at wileyonlinelibrary.com]

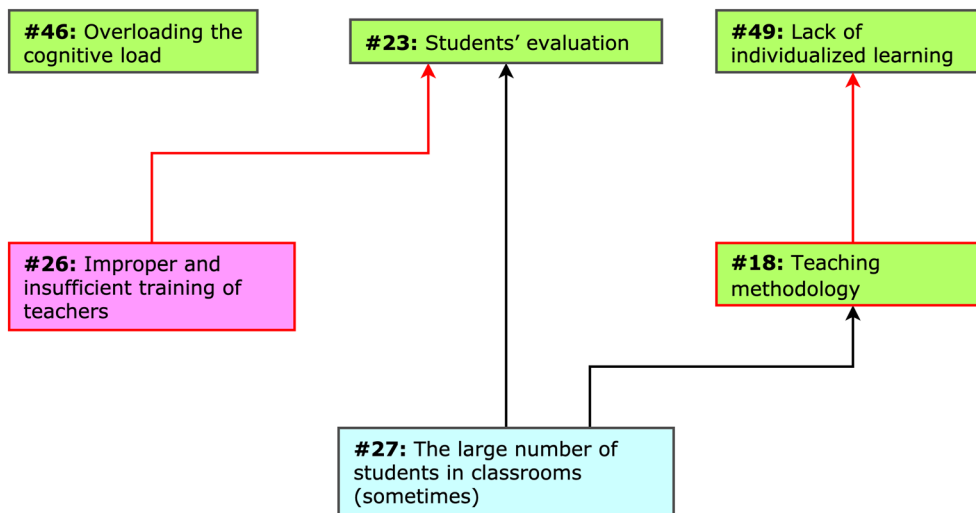


FIGURE 6 Influence map produced at the conclusion of the face-to-face process of the e-Hoop project [Colour figure can be viewed at wileyonlinelibrary.com]

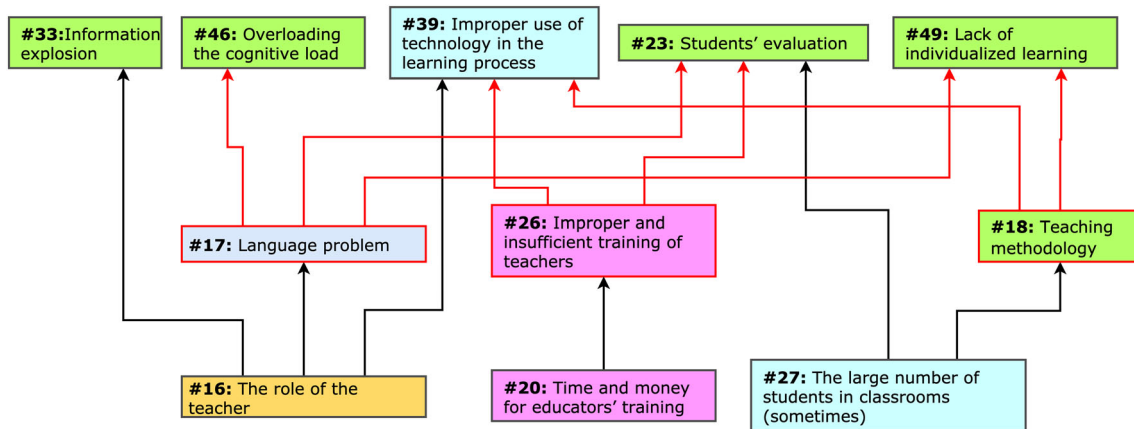


FIGURE 7 Influence map produced after applying the new method in the e-Hoop project. The colours of the boxes correspond to the cluster. The border colours of the boxes at each level and all arrows leaving from that level have the same colour to improve readability [Colour figure can be viewed at wileyonlinelibrary.com]

4 | DISCUSSION

The purpose of this project was to investigate the feasibility of continuing the structuring stage of an SDD by inviting all or a subgroup of the participants to continue asynchronously and independently to structure more ideas in the IM. The method has been tried in two projects. About one-third of the participants continued the process individually and structured additional ideas in both cases. The resulting map was enriched from 14 to 23 ideas in the first case. The second case study enriched the map from 6 to 11 ideas in the second case study. Thus, in both cases, the stakeholders have almost doubled the number of ideas in the IM. More importantly, in both cases, the participants assessed the resulting IMs with approximately 90% as ‘making sense’ and ‘it could have been my own’. Future research should probably refine the questions to participants from groups where

extrapolated maps have been created. We suggest the addition of a question that asks more directly whether ‘the newly included elements and their connections *made sense*’ and whether they ‘felt that the extrapolated IM offered enriched (i.e., better than the original map) guidelines for action or intervention’.

With the new method, the participants were allowed to continue individually, at their own time (i.e. asynchronously), to explore influence relations between additional ideas. The entire group has decided at the end of their respective final face-to-face stage whether and which ideas they would like to examine further. The authors suggest that the selection could be based on different criteria such as (i) continue with already selected ideas, which were not structured because the time run out; (ii) offer a second option for voting in which participants are given three stickers and are invited to choose between all (including those that received zero votes

earlier) ideas that have not been already structured; and (iii) a short open discussion where participants offer their justification why a particular idea should be included based on its potential to end up at the lower levels. Whatever the selection method, those with the top group preference, or a subset of them, can be chosen for processing in the subsequent asynchronous stage.

4.1 | From the first to the second versions of the IM

In both cases, the enrichment of the IM was noticeable, in terms of adding more factors to the structure. Unfortunately, the authors did not offer space for comments during the post-asynchronous phase evaluations. Future applications should include not only more targeted questions but also option for comments. Nevertheless, the most significant contribution of the new method is that extending the mapping stage increases the chances that deeper inhibitors or drivers may be discovered. In the case of the Greens Party, the obstacles that emerged at the root of the IM by the end of the face-to-face session were #15: Party polarization and #45: Horizontal voting. The asynchronous session did not reveal any obstacles that lie below these two (i.e. influencing these two). However, five new obstacles made it to the root of the IM with connections to ideas lying above them: #24: They do not have useful measurable creative and permanent proposals–solutions; #71: Lack of dynamic party actions (e.g. demonstrations); #10: It does not propose radical changes; #50: Lack of creativity in attracting new members and allies; #37: Young people do not know us—a shaky absence from the Internet.

In contrast to the previous two root obstacles, these five are more specific and easier to tackle. In other words, applying the new method revealed more tangible leverages. The stakeholders may now design more specific and realistic actions to address these challenges.

In the case of the e-Hoop SDD, #27: The large number of students in classrooms (sometimes) was the sole root obstacle identified at the conclusion of the face-to-face session. With the extended asynchronous mapping, two further obstacles appeared at the root, namely, #20: Time and money for educators' training; #16: The role of the teacher. The identification of these additional obstacles equips the educators with more leverages and arguments in designing effective interventions.

The second advantage of the new method is that the extended mapping process may reveal leverages on previously unconnected ideas. For example, in the Greens Party SDD, two ideas remained unconnected at the end of the face-to-face stage: #34: Absence of ecological

education in primary schools and #8: They do not see themselves as having any immediate and personal gain. With the application of the new method, three ideas were discovered which have a connection to #34. One of them (#33: The quality of our education does not encourage political thinking and concern) might not be easy to tackle, but the other two (#31: Lack of organization and dedication by ecologists and #24: They do not have useful measurable creative and permanent proposals–solutions) pinpointed to organizational weaknesses that could be addressed. Similarly, with idea #8 (They do not see themselves as having any immediate and personal gain), two other obstacles were identified, which could contribute towards alleviating it: #50: Lack of creativity in attracting new members and allies and #71: Lack of dynamic party actions (e.g. demonstrations). Similarly, in the e-Hoop SDD, the previously unconnected #46: Overloading the cognitive load now has two possible leverages: Addressing #17: Language problem and #16: The role of the teacher.

4.2 | Pros and cons

To the pros, one should appreciate that a much richer IM can emerge. Consequently, the chances of discovering deeper root causes or driving ideas or discovering relations with previously unconnected ideas increase. More importantly, the enrichment of the IM presents additional leverages for deciding and designing plans. Notably, the nearly doubling in structured factors is associated with a minimal increase in cost. Also, stakeholders who did not participate in the process may find it easier to buy-in a more extensive IM richer in options. At the same time, the latter may also turn into a disadvantage. Because only a fraction of the participants constructs the enriched IM, even the remaining group members may be reluctant to accept it and design interventions based on it. Whether the final IM will enjoy higher or lower acceptance by the entire group is an open question that requires further investigation. The authors have formulated a hypothesis that is discussed in the next section.

Lastly, the asynchronous stage is not a discourse in the classical sense. Hence, the Steenbergen et al. (2003) Dialogue Quality Index (DQI) cannot be used because the asynchronous mode of mapping does not offer any means to assess most of the seven criteria. Specifically, participants do not have an opportunity to provide arguments or counterarguments or justify their choices. Consequently, there is no measure for the content or depth of such arguments. However, all participants do enjoy an equal opportunity for making contributions.

There is empirical evidence¹¹ that whenever a smaller group assumes responsibility to perform a task on behalf of the entire group, they often ask themselves, ‘how would X vote on this?’ These observations require formal documentation. This could be done by observing and listening to arguments that make reference to absentees but also with post-event questionnaires asking participants whether they had consciously tried to take into account how in their opinion another person would have argued or voted. In any case, practitioners may wish to consider advising subgroups engaging in completing a clustering or structuring process to demand more scrutiny, try to be more considerate towards the opinions and sensitivities of those who are absent and accept a ‘yes’ only when there is almost unanimity.

Fulwider (2006) extended Steenbergen’s et al. DQI adding three more categories: agreement/disagreement, narrativity and attempts to learn. Obviously, narrativity (i.e. number of references to personal experience) and attempts to learn (i.e. questions asked and answered during the process) suffer during the synchronous mapping.

4.3 | Compliance with dialogical design science requirements

The global community of SDD practitioners has set standards for recognizing a dialogue as ‘structured democratic’. The implementation must comply with the seven laws imposed by dialogical design science (see Section 1). In the following, we discuss the possibility that any of these laws might be compromised by applying our method. Four of them do not come into play when using the method and cannot compromise the process. Ashby’s law of *Requisite Variety* is violated when certain points of view or types of observers are excluded. In our case, the participants who continue the process are the *same or a subgroup* of those contributing in the previous stages. Also, the law of *Requisite Parsimony* (attributed to Miller) is not compromised because it requires the process to respect the cognitive limitation of the participants. The approach used to continue the structuring individually is precisely the *same* as when conducted in a group. Tsivacou’s law of *Requisite Autonomy* can also not be compromised because the participants run the pairwise comparisons individually without the presence of a moderator or any others. According to Christakis and Bausch (2006), a dialogue meets the requirements of Boulding’s law of *Requisite Saliency* when each observer is offered ample opportunity to clarify the meaning of their observation or when participants consensually create clusters of similar observations. As these two processes occur

before applying the new method, Boulding’s requirement does not come into play.

Let us next examine the law of *Requisite Meaning* (attributed to Peirce). This law demands that the ‘design process free its participants to express their ideas in their own words and symbols’, as long as they clarify the meaning satisfactorily to the others. One could argue that this law cannot be substantially compromised because clarifications take place predominantly during the clarification and the clustering stages, which are conducted synchronously. However, this law has the obvious (normative) intent to ensure that people listen carefully to the constructions that others have created on their own terms while allowing these to be expanded/ revised via the dialogical process. It is usual that during the exploration of a possible influence between two ideas, the participants go back to request clarifications regarding the meaning of an idea before they can decide. It is, therefore, plausible that the law of requisite meaning is compromised when people examine those relations individually without having the opportunity to request further clarifications or listen to other participants’ justifications in favour or against a relation.¹² After all, the externalization and manifestation of individual cognitions might influence and be influenced by the cognitions of others. Such reciprocal influences between the participants’ minds might contribute towards strengthening and/or revisiting existing cognitions or developing new ones. Along the same line of arguments, one could argue that the law of *Requisite Evolution of Observations* (attributed to Dye) is also compromised. According to this law, the process of searching for influences that one idea might have on another helps participants assign priorities based on influences rather than popularity. Furthermore, as the observers learn how their statements relate to one another, evolutionary learning occurs.

Although not properly documented in the literature yet, observations from 100+ cases, reveal that during the first half of the structuring stage, the participants discuss longer, request more specific clarifications, or demand refinements, or attempt to highlight distinctions than during the second half. The quantitative aspects of this are reflected in the number of factors structured during each subsequent hour of the process and can thus be easily assessed. Furthermore, various SDD facilitators (personal discussions between the author, Dye, and others) have observed that after the participants structure about 10–12 ideas, they begin to offer more specific *pro-Yes* or *pro-No* arguments based on what has already been discussed before, thus helping the group respond faster to the Yes/No question. The authors have hypothesized that participants gradually develop a ‘shared mental model’, which subconsciously helps them make decisions faster.

Indeed, following the evolution of their justifications and corresponding judgements, one feels that she/he can almost predict how the group will decide.

Future research should examine the type of clarifications, demands for refinements or distinctions, but also the quality and specificity of the arguments offered during the first versus the second part of the structuring process. One could also try to inquire whether participants felt they could 'predict' how people would reason in regard to their way of considering influence relations but also examine whether they could indeed 'predict' the outcome of the voting. Although these aspects require further research, and the hypothesis regarding the 'gradual development of a shared mental model' remains to be tested, we postulate that the degree to which these two laws are compromised is bounded on the grounds explained above.

At last, because the Law of Requisite Action is satisfied when the process complies with the other six (see Laouris, Laouri, & Christakis, 2008, p. 340), it might be compromised to the degree that the other laws are compromised.

To summarize, we have provided a critical review for how and to what degree requirements imposed by dialogical design science could be compromised with the application of the proposed method. We argued that four of them do not come into play using the method and can therefore not compromise the process. However, the application of the proposed method could compromise Requisite Meaning and Requisite Evolution of Observations. The question is whether the benefit of producing a richer influence map with less time and money investment supersedes the possible loss in dialogue quality. Further research is needed to quantify and assess 'dialogue quality'. In the end, however, it is up to the community of practitioners to weigh, for each occasion, the pros and cons of extending the structuring stage of the SDD using the proposed method.

5 | CONCLUSIONS AND SUGGESTIONS FOR FUTURE DIRECTIONS

This paper has described the application of a method that enables participants of face-to-face SDD sessions to continue asynchronously to explore influence relations between additional ideas selected by the entire group. The new method makes it possible to enrich the IM with more ideas without requiring all participants to engage in a synchronous session. The advantages include the following: (i) Deeper root causes or driving ideas may be discovered; (ii) the enrichment of the IM offers more leverages for deciding and designing plans;

(iii) stakeholders who did not participate in the process may find it easier to buy-in; (iv) higher return on investment; (v) the process may reveal leverages on previously unconnected ideas; and (vi) enables SDD sponsors to benefit from richer results with limited additional cost. The limitations include the following: (i) The reliability of the findings requires further testing, because the number of participants in both cases was less than usual (typical is 18–20, whereas in our examples were 13 and 12, respectively); (ii) the full group might be reluctant to accept the resulting IM and design interventions based on it, because only a fraction of the participants construct the extrapolated IM; (iii) the unavailability of the author of a statement to offer additional clarification, refinement or helping making distinctions, might be decremental to dialogue quality; and (iv) the absence of interactions makes it challenging to develop metrics for assessing discourse quality.

Future applications should probably refine the questions to participants from groups where extrapolated maps have been created. We suggest the addition of both closed- and open-ended questions that inquire directly whether and to what degree 'the newly included elements and their connections made sense' and whether they 'felt that the extrapolated IM offered enriched guidelines for action or intervention'. Future research could test the hypothesis that a 'shared mental model' is developed after a dozen or so inquiries regarding possible influence relations. This could be done by (i) examining the type of clarifications and demands for refinements or distinctions made during the first versus the second part of the structuring process; (ii) examining the quality and the specificity of the arguments offered during the first versus the second part of the structuring process; (iii) inquiring whether participants felt they could 'predict' how people would reason in regard to their way of considering influence relations; or (iv) asking participants to 'predict' the outcome of the voting (in addition to offering their own vote). Future research could also attempt to develop metrics to quantify and assess 'dialogue quality'. This could be done qualitatively by asking participants to narrate if they felt that they were in 'dialogical' engagement and to explain why if so.

We suggest that more iterations in the application of the method could produce richer IMs without significantly compromising the quality of the outcome. In the examples presented in this paper, those engaged in the asynchronous phases were expected to continue the structuring process from the point at which it was left during the synchronous phase, and they were asked to structure the same (additional) factors and in the same order in three (first case) or two (second case) iterations. Their individually produced IMs, as these are depicted by

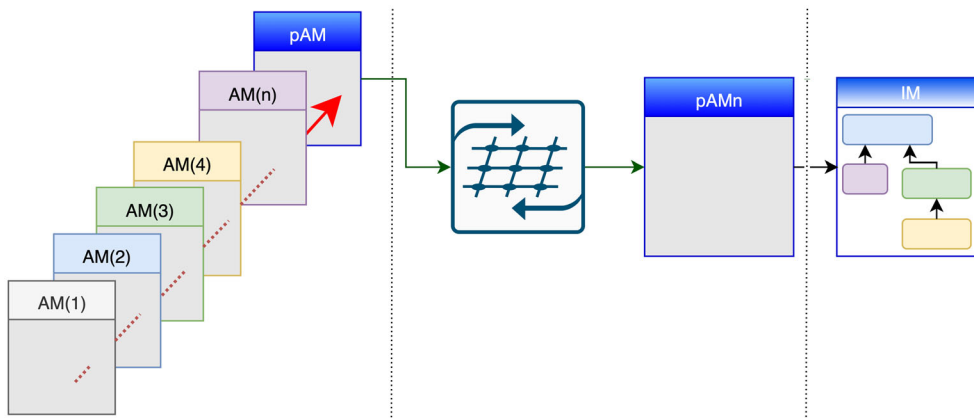


FIGURE 8 Individually produced AMs are superimposed using matrix addition (left). The process is repeated in iterations (right) until a final population AM is produced, which is then used to generate a richer IM [Colour figure can be viewed at wileyonlinelibrary.com]

their respective AMs in Figure 8, were superimposed (left side) to produce a ‘population’ pAM using the same logic as during a face-to-face ISM process; that is, an influence relation is ‘passed’ when 75% or more of the values at the location of each AM are ‘1’. Future applications could allow participants to choose and structure as many factors as they wish and also engage them in as many iterations as they are willing to be engaged. This will require the development of new mathematical methods to deal with matrices of unequal sizes.

In conclusion, the explosive use of virtual technologies, combined with increasing demands for identifying effective solutions at a fraction of the time and cost, will stimulate further innovations in the theory and practice of SDD.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in the organization’s open Future Worlds’ wiki at https://www.futureworlds.eu/wiki/SDDP_Greens_-_Cyprus and more specifically also in the

PDF report: https://www.futureworlds.eu/w/1/7/77/Oikologoi_report_2013_AK_YL_Edits081221.pdf.

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ENDNOTES

- www.futureworlds.eu/wiki/Chronological_List_of_SDDPs_by_Future_Worlds_Center_and_Associates
- <https://www.futureworlds.eu/wiki/CARDIAC>
- <https://www.futureworlds.eu/wiki/MeDevNet>
- https://www.futureworlds.eu/wiki/UCYVROK_-_Uniting_for_Citizenship_and_Participation
- The triggering question was: ‘In the context of Obama’s vision for engaging stakeholders from all walks of life in a bottom-up democracy employing Internet technology, what factors do we anticipate, on the basis of our experiences with SDDP, will emerge as inhibitors to the actualization of his vision?’ https://www.futureworlds.eu/wiki/2008_Historic_Virtual_SDDP
- The Triggering Question was: ‘In the context of Obama’s vision for engaging stakeholders from all walks of life in a bottom-up democracy employing Internet technology, what factors do we anticipate, on the basis of our experiences with SDDP, will emerge as inhibitors to the actualization of his vision?’ https://www.futureworlds.eu/wiki/Planetary_Dialogue_SDDP
- See, for example, https://www.futureworlds.eu/wiki/Addressing_Racial_Economic_and_Educational_Inequalities_through_Our_University_Network
- A striking example was when a participant proposed ‘international collaboration’ as a ‘research agenda’, and this idea made it to the root. The fact that it was not a research agenda made it impractical for the stakeholders to act upon it. See p. 17 in https://www.futureworlds.eu/wiki/SDDP_CARDIAC_II:_Influence_Tree_for_the_Road-map_on_inclusive_HCI_research_and_development_priorities_for_WP3
- From the adjacency matrix, one can calculate the reachability, hierarchical, condensation and eventually the skeleton matrix. The latter corresponds to the influence map.
- https://www.futureworlds.eu/wiki/E-Hoop_SDDP_Cyprus

- ¹¹ In a number of cases (e.g. in Laouris, Y., & Michaelides, M. [2007]. Report on Identifying Actions that Push the Development of Practical Applications in the COST219ter Community. COST219ter network), the pressure of time, or the departure of some participants before the clustering or the structuring process was completed, forced the organizers to continue with a smaller number. In such cases, they observed that the remaining participants referred a lot to absentees saying, for example, 'X would have argued that' or 'would have voted this way'.
- ¹² The IdeaPrism app offers some remedy through its option to revisit other participants' contributions by watching their recorded video clarifications or to submit questions requesting specific clarifications.

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