Outcome-oriented multi-stakeholder network design: four innovation spaces to accelerate food system transformation

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Multi-stakeholder networks fulfil crucial functions for transforming our food systems in the face of climate change and other global crises, as the COVID pandemic has shown. However, there is scant research on how the form of these networks is connected to particular aims. Based on interviews with leaders or founders of 14 multi-stakeholder networks, we build a framework on outcome-oriented network design: We identify four different network designs, which emerge from a framework of ten design variables, each with different characteristics. We coin these network designs 'innovation spaces' and observe the main challenges and trade-offs among and between different sets of design variables. These, as well as the networks' main trajectories over time, lead us to introduce a simple innovation space grid model along the axes of structure and permeability. Each space accommodates a different type of stakeholder interaction which leads to the desired change dynamics and network goals. The concept of innovation spaces provides a differentiated view with regard to how multi-stakeholder networks innovate and learn. We also identify a space for an as yet neglected group, self-organized social movements. The innovation spaces concept can cater for long-term as well as short-term multi-stakeholder initiatives, and can contribute to reflections on inclusivity and addressing power inequalities. It can help designers and leaders of new and existing networks to take improved decisions on how networks could complement their respective innovation processes, thus accelerating food system transformation.

Keywords: multi-stakeholder processes; networks; experiential learning; scaling; innovation platforms; innovation systems; social movements; food security

1.   Introduction

We need to provide food security for up to 9 billion people in 2050, in the face of climate change and other systemic crises. The needed technologies exist or are rapidly developing (Nayyar, de Cleene and Dreier, 2018; Barrett *et al.*, 2020; Herrero *et al.*, 2020b), but in addition to technologies deep changes in the component parts of the food system are needed, fundamentally reformatting our social and institutional set-ups (Gaitán-Cremaschi *et al.*,

2019; Woltering *et al.*, 2019; Weber *et al.*, 2020). The COVID pandemic, in many ways paralleling the climate crisis in an accelerated way (Manzanedo and Manning, 2020), adds to the urgency of transforming our food systems. How to make such transformative changes happen (Fazey *et al.*, 2018) in an inclusive and sustainable way (Barrett *et al.*, 2020), is a question currently being debated in many global dialogues. There is consensus, however, that the systemic changes needed will require multi-stakeholder cooperation in networks for accelerated learning and change, transcending geographic, administrative or thematic boundaries (Béné *et al.*, 2020; Klerkx and Begemann, 2020; Loboguerrero *et al.*, 2020), and involving societal key actors from research, policy, business domains and social movements (Conway, Masters and Thorold, 2017; Barrett *et al.*, 2020; Herrero *et al.*, 2020b; Klerkx and Begemann, 2020).

The last decade has featured different approaches to multi-stakeholder cooperation in networks, going under different names. For example, from agricultural innovation studies the term agricultural innovation platforms emerged, which link agricultural research to development actors and outcomes, spanning local to national levels (Pérez Perdomo *et al.*, 2017; Sartas *et al.*, 2018; Schut *et al.*, 2019), inducing coupled social, technical and organizational innovations (Kilelu, Klerkx and Leeuwis, 2013) or what has been referred to as 'socio-technical bundles' (Barrett *et al.*, 2020). From the field of socio-ecological system studies, 'transformative spaces' such as Living Labs are increasingly being fostered to support food systems transformation (Gamache *et al.*, 2020; Pereira *et al.*, 2020). These networks emerge mostly at local levels, but often increase their impact by interacting with national innovation systems (Lamers *et al.*, 2017; Sartas *et al.*, 2018) or by connecting with larger, supra-national agricultural innovation systems (Yazdizadeh et al., 2014; Klerkx and Begemann, 2020). With increasing mission-orientation towards agricultural transformation, there is a need to orchestrate strategic portfolios of innovations beyond geographic or administrative boundaries (Klerkx and Begemann, 2020). They thus resemble what have been called global solution networks and cross-sectoral partnerships in business sciences, which promote global governance and capacities for collective change (Glasbergen, 2010; Waddell, 2012; Tapscott, 2014), negotiating with and enacting new roles and responsibilities for governments, private sector, civil society and individual citizens (Tapscott, 2014), for example through inclusive business partnerships (Danse *et al.*, 2020).

As collaborative environments, these multi-stakeholder initiatives provide spaces for experimentation, learning, action and change (Schut *et al.*, 2019; Pereira *et al.*, 2020), in which innovations are seen as interactive multi-stakeholder learning processes (Hekkert *et al.*, 2007). So far, the research community has concentrated on the nature of stakeholder interactions (Glasbergen, 2010) to bring about desired outcomes (Johnson, 1998; Yazdizadeh *et al.*, 2014; Lamers *et al.*, 2017; Sartas *et al.*, 2018; Schut *et al.*, 2019), the types of change they would aspire to (incremental, reforming or transformational) (Waddell, 2012), and the different forms of governance (Provan and Kenis, 2008; Pérez Perdomo *et al.*, 2017), terms of

engagement, institutional arrangements, and facilitation of partnerships (Hartwich and Tola, 2007; Manning and Roessler, 2014; Dentoni, Bitzer and Pascucci, 2016; Lamers *et al.*, 2017; Gliedt *et al.*, 2018).

The right type of governance particularly matters: inconsistencies in networks' objectives with their design can hamper effectiveness by creating tensions (Provan and Kenis, 2008) and trade-offs (Yazdizadeh *et al.*, 2014). Furthermore, multi-stakeholder networks are prone to reflect the same dilemmas and inequalities as the organizations that use them, in terms of dominating paradigms (Pereira *et al.*, 2020), power dynamics (Chavez-Tafur *et al.*, 2020) and inclusion (Provan and Kenis, 2008; Sartas *et al.*, 2018); yet food system transformation is said to require a shift in power structures (Béné *et al.*, 2020; Herrero *et al.*, 2020a; Klerkx and Begemann, 2020; Loboguerrero *et al.*, 2020). Many of these patterns are already inscribed by the design of a network's structure (Pugh and Prusak, 2013), which connects outcomes, dynamics and member behavior to the network's underlying design dimensions. Similarly, Glasbergen (2010) distinguishes between 'psychological spaces' that frame the interaction of members, and 'transaction spaces' that define the rules. However, despite accumulated insights on functions and structures of multi-stakeholder networks (Sartas *et al.*, 2018; Schut *et al.*, 2018), there are still knowledge gaps related to network design**,** such as how different facilitation methods and stakeholder engagement models play out with respect to a network's objectives. Although there is consensus that multi-stakeholder networks can induce structural changes in agricultural innovation and food systems and thus facilitate the design and scaling of appropriate socio technological bundles (Kilelu, Klerkx and Leeuwis, 2013; Lamers *et al.*, 2017; Barrett *et al.*, 2020), we lack an overview of the relationship between network design and achieving a specific mission (such as increasing yields, alleviating poverty, or making food systems circular and climate smart) within food system transformation in an effective and inclusive way (Klerkx and Rose, 2020). We also lack information on how network design affects specific activities aimed at fostering systemic change, such as demand articulation, prioritization and agenda-setting, knowledge generation and brokering, capacity building, resource mobilization and institutional support, market formation, and creation of legitimacy (Hekkert *et al.*, 2007; Glasbergen, 2010; Kilelu, Klerkx and Leeuwis, 2013; Lamers *et al.*, 2017).

Furthermore, we do not know which make-up of stakeholders in a network is most effective in bringing about specific changes (Muñoz-Erickson and Cutts, 2016), how a network learns and innovates, and how it can work most effectively with other networks. At the same time, networks are rarely static but take on different forms at different stages (Pereira et al., 2020; Reypens, Lievens and Blazevic, 2021), either in an iterative, short-term mode (Setola and Leurs, 2014; Lamers *et al.*, 2017) or as a longer-term transformation as part of their maturation process (Creech and Ramji, 2004; Provan and Kenis, 2008).

This all calls for more insights into outcome-oriented network design, which ideally would inform networks' complete lifecycles (Creech and Ramji, 2004) from the design stage (Meyer, 2013; Bourouni, Noori and Jafari, 2015) to its evaluation (Yazdizadeh et al., 2014). Here we unpack the design of several multi-stakeholder networks to examine their workings. We apply an iterative theory-building approach, in which each research question builds on the findings of the previous one. We introduce the term 'innovation spaces' for the different network designs, according to their respective objectives. The detailed research questions were:

- Which different network designs emerge in view of different objectives of multi-stakeholder networks for supporting food systems transformation?

- Which are the respective trade-offs and challenges that need to be considered in designing multi-stakeholder networks in food system transformation?

- How do these network designs change over time, or for short-term purposes?

In answering these questions, we reflect on what network design implies for shifting power dynamics and social inclusion, and how different multi-stakeholder networks connect to facilitate widespread transformative change across actors, levels and themes. The paper is structured as follows. We describe our iterative theory approach in section 2. In section 3, we present our findings related to the three research questions. In section 4, we discuss the usefulness of our findings in the context of food systems transformation. In section 5, we summarize the contribution of our study, highlight its limitations, and outline possible next steps.

2.   Methods

Our study followed the principles of grounded theory about a continuous iteration between theory with empirical findings (Timonen, Foley and Conlon, 2018). In the first phase, we identified the ten crucial design variables and their main characteristics in multi-stakeholder networks related to food systems transformation. To do this we interviewed leaders or founding members of 14 multi-stakeholder networks related to food systems transformation or transformational change. With the study taking place as part of the CGIAR research program on Climate Change, Agriculture and Food Security (CCAFS), half of these multi-stakeholder networks were suggested by CCAFS' partners, based on a first research proposal (Koerner, Dinesh and Nagano, 2020). The other cases were identified via the snowball system, recommended by the first interviewees. The interviews were conducted between March and May 2020. Preliminary results were supposed to feed into regional policy dialogues jointly organized by CCAFS and FAO in June 2020, which limited the scope

Table 1: Multi-stakeholder networks participating in this study

Sector	Multi-stakeholder network	Main thrust	Geo-graphic reach
Aca-deme	Planetary Health Alliance (PHA)	Science-led coalition to advance planetary health research, education and policy.	Global
Civil society	Fridays for Future (FFF)	Youth-led global climate strike movement calling for policy action to keep global warming under 2°C.	Global
Cross-sectoral	Global Alliance for Climate-Smart Agriculture (GACSA)	Multi-stakeholder platform on climate-smart agriculture, catalyzing transformational partnerships.	Global
	GROW ASIA	Multi-stakeholder partnership platform on inclusive and sustainable agricultural development.	Asia, regional
Farmer	North America Climate Smart Agriculture Alliance (NACSAA)	Farmer-led platform for equipping agricultural partners to innovate effective and climate-smart local adaptations	Americas, regional
	World Farmer Organization (WFO)	Advocacy association for farmers' organizations and cooperatives to foster the farming sector at global level.	Global
Policy	ASEAN Climate Resilience Network (ASEAN CRN)	Policy platform for regional exchange on climate-smart agriculture as part of the Association of Southeast Asian Nations (ASEAN).	Asia, regional
	Netherlands Food Partnership (NFP)	Dutch 'backbone organization' supporting Collective Impact Coalitions, towards sustainable food systems and food security.	Europe, national
NGO	Participatory Ecological Land Use Management Association (PELUM)	Network of civil society organizations/NGOs to empower small-scale farmers by and for sustainable land use.	Africa, regional
	Vietnam Union of Friendship Organi-zations (VUFO)	A resource center for the community of international NGOs in Vietnam promoting sustainable development.	Asia, national
Sectoral	Sustainable Agriculture, Food and Environment Platform (SAFE)	Multi-stakeholder public private partnership program to sustainably transform coffee and cocoa landscapes by climate-smart agriculture.	Americas, regional
	Sustainable Rice Landscapes Initiative (SRLI)	Alliance of six partners for the sustainable transformation of rice-based landscapes.	Asia, regional
	Sweet Potato for Profit and Health Initiative (SPHI)	Multi-partner, multi-donor initiative to reduce child malnutrition and improve smallholder incomes through increased sweet potato production and use.	Africa, regional
Thematic	Scale Up Community of Practice (Scale Up COP)	Platform for knowledge exchange among experts and practitioners on scaling up development interventions and impacts.	Global

Source: The authors

(number of interviews) of our study. For selecting the case studies, however, we sought representation across sectors, themes, geographic areas and reach (see Table 1). The interviews were recorded with the participants' permission and transcribed.

To structure the interviews, we used the framework of network design of Pugh and Prusak (2013), which represented the most comprehensive and actionable concept available at the time of this study. Pugh and Prusak (2013) suggested that networks' outcomes would be rooted in the networks' design, with eight crucial design dimensions evoking particular dynamics and thus influencing members' behaviour. These eight design dimensions were originally developed to apply to knowledge networks, but we deemed them useful for structuring our interview guide (Table 2).

Table 2: Semi-structured interview guide

Design dimensions of Pugh & Prusak (2013)	Characteristics of this dimension included in the interview guide for this study
Leaders' shared theory of change	What is the assumption about the change dynamics at work? How do people learn and translate knowledge to action? How do networks model members' desired behavior?
Objectives/ outcomes/ purpose	What are the network's purpose, outcomes and objectives? How are these defined and negotiated with the members?
Role of expertise and experimental learning	How should the organization enable members to be both expert and learner? What learning style is most conducive for experimentation, reflection, experiencing …?
Inclusion and participation	How are members chosen and/or admitted? What are the members' profiles? What are the different levels of commitment?
Operating model	How are decisions made, and what is the role of the public or outside regulators in these?
Convening structures	How are members convened and governed? How do members interact and communicate in these structures?
Facilitation and social norm development	What types of facilitation approaches will be required, from the network managers and from the members? What tone and norms are established how?
Measurement, feedback and incentives	Who defines success, and how is it measured? How does member feedback influence the network? What is the motivation of the participants to join / remain in the network?

Source: adapted from Pugh and Prosak (2013)

To move from these open questions to concrete design variables, we applied a process of theme building, as also described in detail by Haman and Hertzum (2019). We clustered responses into recurrent themes, by grouping key statements and related topics on different PowerPoint slides. This allowed us to view the emerging main themes. In contrast to the framework of Pugh and Prosak (2013) that outlined eight design variables, we identified ten

recurrent themes (i.e. design variables). We then did a cross-interview analysis of how these identified ten design variables played out in the different networks. For grouping and naming these different observed characteristics, we searched for existing terms in literature, which we found mainly in the domains of organisation design and management. Inspired by a similar approach by Dinesh *et al.* (2018), we present in table 3 the ten identified design variables and their characteristics, contextualized with the respective literature.

In the second phase, we looked at the main compositions in which these characteristics occurred. For this purpose, we applied the ten design variables to the 14 studied multi-stakeholder networks, collated their respective observed characteristics into an Excel table, and sorted these for matching values (see complete table in the annex). Thereby, we observed that certain sets of variables were either correlated to the networks' structure (how rigid or flexible it was), their permeability (the ease with which members could enter or leave), or members' interaction. More precisely, it became visible that members' interaction played out in four different compositions of networks' structure and permeability (table 4). We term these four compositions 'innovation spaces' which we present with examples in section 3.1.

At the same time, not all networks featured *all* of the characteristics that we would have expected according to their respective main innovation spaces. In section 3.2, we observe trade-offs, and respectively relationships, between different sets of variables that determined the networks' structure, permeability and members' interaction. We also observed movement between these innovation spaces: networks would develop in time, or would break out into temporary groups, along a certain trajectory, as further described in section 3.3. These findings then led us to visualize related design variables and trajectories in a simple model that accounts for both multi-stakeholder long-term (network) or short-term (break out group) aims, in section 3.4. We shared the results of our study together with a detailed write-up of the respective case studies with all interviewees, and incorporated their feedback, mainly consisting in clarifying details to the respective case studies. These findings fed into a discussion on the theoretical implications of our study (section 4.1), which lead us to reflect on how actors in the different innovation spaces can more effectively work in concert (section 4.2), and how and when multi-stakeholder networks are susceptible for power inequalities (section 4.3).

3.   Findings

3.1   The four innovation spaces – an outcome-oriented design framework

When we applied the ten design variables to the 14 multi-stakeholder networks, four main compositions emerged (table 4). As the study took place in the context of food system transformation, and all studied networks had an explicit mandate for collaborating towards change, we titled each composition with an association of every-day collaborative spaces for

Table 3: Ten design variables of multi-stakeholder networks for (food) system transformation

Design variables	Explanation of observed characteristics and references from literature
Objective	Network's objectives, or functions, should be determined at the very early stages of its establishment (Yazdizadeh *et al.*, 2014). Winter, Bijker and Carson (2017) identify three types of multi-stakeholder networks functional types, that would *develop and drive solutions* through defined systems or *sectors,* integrate these *across sectors*, or convene for sharing and learning. Pettinicchio (2017) further distinguishes social movements into *policy-making* ones, and the ones that *mobilize*, thus paving the ground for *action*.
Commitment	Commitment as a form of behaviour that underlies individual or groups' performance can take on different forms. In task groups, effective behaviour will include task-behaviour or -commitment (Gladstein, 1984). Other forms include commitment to the *topic* (being able to do the same thing elsewhere) or the *organization* (strong commitment to the group) (Krajcsák and Gyökér, 2013). Perceived *self-efficacy*, finally, is related to commitment with rather intrinsic benefits (Lin and Hwang, 2014).
Theory of Change & actors for change	The theory of change visualizes how engagement and learning can enable change towards development outcomes (Thornton *et al.*, 2017). Change is brought about by key intermediaries, that can be linked to different phases of transition (Kivimaa *et al.*, 2017). There are different ways to enact change: Successful innovation teams combine the roles of champions (development of the solutions) and promoters (supporting and advancing the innovation) (Mansfeld, Hölzle and Gemünden, 2010). The adaptation and uptake of the innovations might happen by *pioneers* first, then by their f*ollowers* (Wurzel, Liefferink and Torney, 2019). In public sector organisations, *change management* will range from advocacy and institutional analysis, and imply facilitation and communication of the change processes, while social mobilization rather requires *activists* that reach *a critical mass* (Fuchs, 2006).
Shared vision	A shared vision can be achieved in different ways. For heterogeneous teams that shall solve a complex problem, a shared understanding of the task is crucial (Bittner and Leimeister, 2013). In situations where multiple interpretations are feasible, a shared vision is rather a *constructing process* that adopts and modifies tools and concepts to fit the different contexts (Grossman and Pupik Dean, 2019). In turn, when a group develops a *shared identity*, individuals provide more support to each other and perceive a higher sense of collective self-efficacy (Dick, Ciampa and Liang, 2017). With the aim of empowerment, however, it is equally important to recognize *stakeholders' autonomy* (Doten-Snitker *et al.*, 2021) for a shared vision of change.
Learning style	Kolb (1984) identified four different learning styles, that sequenced as phases of experiential learning would have the strongest learning impact. Janus (2016) further associated a variety of learning tools and methodologies to the different learning styles:

	Accommodating (experience and skills), *diverging* (reflection, taking time for listening, using emotion and imagination), *assimilating* (analysis, concepts and models), *converging* (practical application of concepts and ideas). (Setola and Leurs (2014) used Kolb's concept to visualize creative learning spaces.
Facilitation & Management	With increasing complexity, *collective action* is more unlikely to emerge spontaneously and voluntarily, it has to be *managed* by a third party (Jagers *et al.*, 2020). In turn, *brokering* is rather about bridging existing, different types of knowledge and actors, while navigating the urgent with foresight, and negotiating competing claims (Cummings *et al.*, 2019). The facilitation of social cohesion, again, builds on creating safe spaces with a sense of collective identity and mutual support and tolerance (Fonseca, Lukosch and Brazier, 2019), while an *empowering leadership* rather builds on passion and self-efficacy (Hao, He and Long, 2018). Reypens, Lievens and Blazevic (2021) further coined the term 'hybrid orchestration' for switching between different *facilitation styles*.
Membership profile	The strengths of groups are often measured in the members' closeness to each other, the frequency of their interactions, the transitivity of members' relations, and the how easily non-members can (or not) join this group (Mamadouh, 1999).
Funding	As Sartas *et al. (*2018) stated, allocation decisions of funding can play a crucial role in the development context. In cross-functional teams, competition for resources can be a major impediments (Holland, Gaston and Gomes, 2000), which can be solved by *inbuild funding sources*. Philanthropic *foundations* are private entities that increasingly take on prominent socio-political roles (Jung, Harrow and Leat, 2018). Spaces for knowledge exchange and learning are also increasingly created by the *private sector*, though these do not necessarily act in public interest (Chavez-Tafur *et al.*, 2020). *Self-financing*, especially of non-profit organizations, enables independence from bi- and multilateral *donors* (Sande, 2005) and private sector interests.
Governance	Governance model can be divided into more hierarchical or more *collaborative* ones (Creech and Ramji, 2004). Especially for goal-directed networks accommodating members of distinct identities, strong forms of governance are needed (Provan and Kenis, 2008). The *core-peripheral* structure has a dense, cohesive core and a sparse, unconnected periphery, and is often used for project-based organisations or initiatives, that still need to transfer knowledge from individuals outside the network (Bourouni, Noori and Jafari, 2015). In the hubs and spokes model, in turn, it is rather one organization managing the daily operation, with different partnerships and for a under one umbrella (Creech and Ramji, 2004). *Self-organization* would be at the other end of the spectrum, with individuals organizing their communal behaviour to create global impact by interactions amongst themselves, rather than through external intervention or instruction (Martela, 2019). This governance form is often overlooked in literature, but becomes more important in the concept of social movements, and in the context of an increasingly stratified knowledge society (Fuchs, 2006).

Success definition & measurement	A task force, as examples of goal-oriented team to develop specific solutions, is structured to maximize efficiency and productivity. Thus, the members develop their own *plan of action* and are responsible for its *implementation* (Moore and Kovach, 1988). In turn, networks that have been set up and funded with the explicit mandate to contribute to the *global agenda*, like the SDG or the Paris 2015 agreement (Winter, Bijker and Carson, 2017), will be expected to report on the related *impacts*. Achievements of peer networks and social movements are more difficult measure. Recent attempts rather use assessments as an internal tool for improving performance (Chen and Karbowska, 2018).

Source: The authors

experimentation, learning, action and change. We provide a detailed, practical definition of these innovation spaces in section 3.4.

In the following, we describe the four different innovation spaces that emerged from the design variables' compositions and give examples of how networks either embodied these in the long term, or used them partially in the short term (e.g., as working groups).

3.1.1 The 'lab space' composition

The lab space composition was mostly used to analyse knowledge gaps, address these by experimentation, and turn the results into actionable concepts, which could be applied in a timely way for a new learning cycle or shared among external stakeholders for wider use. The groups that worked most effectively in the lab space had a closed or targeted membership profile, with members being chosen for complementarity. These typically joined up for a shared task, which also required continuity throughout a determined time span. The members' inter-disciplinarity lend itself to groups to innovate and/or demonstrate change across defined systems such as landscapes or value chains. At the same time, forging the collaboration of heterogeneous partners required a strong structure: membership was often formalized by the members' organizations and institutions, with assigned roles and responsibilities of each member. Success was defined with objectively measurable outputs, often laid out in a road map or a protocol to follow. Groups in lab spaces were often organized in a core-periphery model, with an efficient management style for collective action at the core group and a more networked periphery for mandating and sharing. They also often counted on an inbuilt funding mechanism or were organized around one, which seemed to be another decisive factor to keep members' commitment to their task of innovating and demonstrating possible change.

In the short term, lab spaces were used rarely by the interviewed networks. The most prominent example stemmed from Grow Asia, which realized a disconnect between the digital sectors and farmers and organized a design thinking curriculum in which '*digital magicians*', corporates and start-ups spent a week living with farmers in an Indonesian village. Members

Table 4: Four network design compositions

Compositions / Variables	Lab space Composition	Market space composition	Peer space composition	Open space composition
Objectives	Sector development (crops, landscapes)	Cross-sector cooperation	Policy incidence, peer learning	Action support, social mobilization
Commitment	Commitment to task	Commitment to topic	Commitment to group	Commitment to the cause
TOC & actors for change	Innovators & demonstrating change	Pioneers & trendsetting	Change agents & institutional change management	Activists & critical mass
Shared vision	Shared task	Continuous negotiation	Shared identity	Intentionality
Learning style	Conceptualize – experiment	Experiment – experience	Reflect – conceptualize	Experience – reflect
Facilitation & management style	Collective action	Brokering	Social cohesion	Agency, empowerment
Membership profile	Closed or targeted	Open or screened	Closed or targeted	Open or screened
	Continuous	Intermittent	Continuous	Intermittent
Funding model	Built around funding	Mixed (donor, member, foundations)	Foundations, member-funded	Member-funded
Governance model	Chore & periphery	Hub & spokes	Collaborative	Self-organized, individual
	Formal	Formal	(Semi) informal	Informal
Success definition & measurement	Road map	Set by global agenda	Bottom-up	Autonomous
	Measurable outputs	Measurable impacts	Anecdotal outcomes	Voluntary

Source: The authors

could thus obtain a 'much clearer sense of what farmers needed and thought was important' for developing and demonstrating new business cases. 'Really exciting breakthroughs happen when you get two silos to work together.' Networks could also be set up as lab spaces in the long term. For example, the Sustainable Agriculture, Food and Environment (SAFE) Platform was formed in 2016 as an initiative of the Inter-American Development Bank (IDB) Lab for improving the sustainability of coffee and cocoa landscapes in Latin America. The 21 partner

organizations were chosen for their different contributions and have access to IDB funding on different learning levels, provided that they comply with the Platform's rules. The SAFE Platform's knowledge management system ensures that data are collected, analysed and usable for the respective next project funding cycle.

3.1.2 The 'market space' composition

The market space composition was often used to showcase innovations, which could be experimented with and adapted by the more pioneering members while the majority waited for the results, for later application, experience and mainstreaming. Like a 'big tent', members could participate in a multitude of different activities in changing groups. Market spaces attracted a large and wide-spread audience of stakeholders. Thus, typically, membership was open or screened for basic alignment. The shared vision or narrative was subject to continuous negotiation, as cross-sectoral cooperation evolved. At the same time, market spaces were often expected to contribute to goals set by the respective societal or global agenda. For this purpose, they often received (multi-lateral) public funding, tied to delivering measurable impacts on scale. Achieving these across sectors required a formalized membership, endorsed by the members' organizations. Further, market spaces often offered a diversified portfolio of activities, for which they accessed additional mixed funding from foundations, contributions of the financially strong members, renting out services, etc. Accordingly, groups operating in market spaces were often organized in hubs and spokes, with the hubs consisting of the most active, but also financing and agenda-setting members, and the spokes consisting of the more intermittent or 'consuming' members. This set-up required a brokering facilitation style between members that were committed to the topic, not necessarily to action.

Market spaces were often frequented by the different networks in the form of short-term cooperation initiatives or long-term cross-membership. Networks that embodied market spaces often contained a large proportion of different-sized private sector actors. For example, the multi-stakeholder partnership platform Grow Asia provided a pre-competitive space for its 50% private sector members. Launched in 2015 by the World Economic Forum and ASEAN Secretariat, and coordinated by a regional secretariat in Singapore, Grow Asia was set up to contribute directly to Sustainable Development Goal 17 (Partnerships for the Goals), aiming to reach 10 million smallholder farmers by 2020 through inclusive and sustainable value-chains.

3.1.3 The 'peer space' composition

The peer space composition was mostly used for policy incidence or peer learning, and characterized by a reflective and conceptualizing learning style: Groups that inhabited peer spaces had a strong lean towards reflection and dialogue, building an atmosphere of shared identity and long-term personal relationships. Accordingly, groups using the peer space mostly had a closed or targeted and continuous membership profile, facilitating social

cohesion and a commitment from each member to the group. Groups in peer spaces ewre often informal or semi-informal, with collaborative governance structures. Success hinged largely on the capacity of the peers to become change agents for and within their respective institutions. Thus, these processes were rather result-open, with a bottom-up agenda, and measured by anecdotal outcomes. Probably related to that, peer spaces were often supported by foundations or by a stable group of donors with a shared interest in the processes.

Peer spaces were often used by short-term working groups for curating new knowledge products, thus ensuring balanced stakeholder representation and – consensus. They were also the preferred spaces of networks for policy incidence and local translation, as exemplified by the ASEAN Climate Resilience Network (CRN). The ASEAN CRN was founded in 2015 as knowledge exchange network of the research arm of ten ASEAN member countries, to promote climate resilience in the region by building governments' capacities and elaborating shared positions. The facilitation emphasized creating an atmosphere of ownership, trust and fun ('happy family'), in which country representatives were comfortable to learn from each other and take time for consensus building. As an unofficial arm attached to a formal working group of the ASEAN, its members needed to be change agents to navigate and influence national and regional priorities.

3.1.4   The 'open space' composition

The open space composition was characterized by an experiencing and reflective learning style. Members acquired and practiced skills based on their own, often individual, experiences and share these experiences with their peers. As the name implies, these spaces were openly and intermittently accessible by individuals or groups that were not necessarily connected. Rather, members were aligned by their intention and seek action support for social mobilization. Accordingly, the use of these spaces was rather informal and self-organized, with facilitation – if any – aimed at enhancing members' agency and empowerment. Hosts of open spaces often declined external funding offers to remain independent. Members contributed in kind or with their own funds, with occasional fundraising. Accordingly, success was defined in an autonomous way and often not measured systematically. Open spaces were often used by movements, supporting activists to move a critical mass. However, it depended much on the individual's commitment to the cause how much action follows the involvement.

Open spaces were largely used as virtual platforms that made knowledge products publicly accessible, or as online discussion fora. However, we also found one example of a network that fully embodied the design variables of an open space: Fridays for Future (FFF) was initiated by Greta Thunberg and a handful of young activists in 2018 and quickly developed into a global climate strike movement. Its central demands are to achieve the '1.5 °C goal'. FFF joint activists around its core values and supported them to self-organize their own activities, towards mobilizing the critical mass. FFF offered demand-based tool kits and

training for developing knowledge and practical skills. Members connected with each other in open, non-curated channels. FFF emphasized that it is '*not an organization*', and therefore did not need structures and external funding.

3.2   The main trade-offs or challenges within the four innovation spaces

At the same time, we found that not all networks featured *all* of the characteristics of one of the four main compositions. In a complex setting, multi-stakeholder networks often had to navigate the given conditions of their context. We observed trade-offs and relationships between different sets of variables and their characteristics: variables that determined the networks' or groups' structure (how rigid or flexible that was), variables that determined the permeability (the ease with which members could enter or leave), and variables that described members' interaction (table 5). We explain these relationships in the next subsections.

Table 5: Relationships between design variables

Relationships	Design Variables
Structure	Funding model, governance model, success definition & measurement
Permeability	Membership profile: openness & permanence
Interaction	Shared vision, learning style, facilitation & management style
Change dynamics	Commitment, TOC & actors for change

Source: The authors

3.2.1   Change dynamics hinge largely on the buy-in of members' institutions.
How successfully members could enact the respective theories of change was strongly related to the degree of members' individual and institutional commitment, which hinged strongly on the shared vision and the buy in of members' institutions.

Groups in the lab spaces chose their members for certain attributes or contributions. Thus, members inherently shared a vision around the task at hand. However, it was also important that members had the buy in of their organizations, to provide the necessary institutional leverage. As the SAFE management put it: 'These new, game-changing forms of doing things also require new leadership strategies that often challenge existing structures. We need to demonstrate new ways of managing these.' Similarly, the Netherlands Food Partnership (NFP) saw a challenge in institutionalizing its learnings across the different ministerial entities of its consortium. Good practice in both cases was to clearly agree and formalize the roles and responsibilities of each consortium member.

In case of the market spaces, members came from different sectors and had to continuously negotiate their shared vision. For example, private sector corporations which formerly had not seen a stake for themselves in the concept of agro-ecology were enticed by the framing of climate smart agriculture to join the large multi-stakeholder platforms on climate change and

agriculture, such as GACSA and Grow Asia. Although membership in these was formal and reserved for organizations with a credible stake in the topic, the commitment of the individual member organizations was not further specified. Especially in business-oriented networks like Grow Asia this led to a dynamic in which some members pioneered, and the others 'leaned back and watched'. The pioneers, in turn, 'in terms of their career' had to 'take on the risk to prove the value of their investments towards their own organizations', these often being shareholder-driven private-sector companies.

For the peer-networks, the challenge was not so much an internal one, since members had been targeted, and over time even built a shared identity around their vision. It was rather the necessary translation to the external stakeholders that required reframing. For example, the North American Climate Smart Agriculture Alliance (NACSAA) had to first get into 'a conversation about repurposing, revaluing agriculture' in the national, climate change-denying debate, to be able to interact on the policy stage. This was easier for the ASEAN CRN, as network for building capacities of governments and bridging science to policy. Set up as informal arm of a formal body, they could count on the endorsement of members' respective governments but at the same time 'escape the strict protocols' and offer the needed emotional and peer support for their members to become institutional change agents.

In turn, membership in open spaces was rather informal and often on the individual level. For example, FFF explicitly welcomed anyone as an activist, merely 'suggesting some values that are helpful'. How much action followed the involvement depended very much on the individual's commitment to the cause. However, activists shared a strong intention, often expressed by a network's slogan such as FFF's 'I want you to panic!'

3.2.2 *Governance models' trade-off between efficiency and members' interaction*
The extent and intensity of members' interaction also depended largely on the innovation spaces' governance models, which in turn also determined the groups' efficiency. For example, the formal core-periphery set-up of the SAFE platform was praised as being highly efficient by a recent evaluation, because day-to-day decisions could be taken by the small core group with the respective mandate. In turn, members of the periphery stated that they wished for more communication and interaction among each other, which was mostly happening at special occasions organized by the consortium.

A hub-and-spoke structure, as usually featured by market spaces, allowed for frequent member interaction at numerous occasions, but equally allowed the less active members to hibernate. For example, the GACSA had to invest quite some effort to regularly reach out to dormant members. This might also be linked to the GACSA's explicitly 'not having a mandate for action', which GACSA tries to compensate for by 'forging more action-oriented partnerships at regional levels'.

In peer networks, member interaction was at the heart of the business. This put quite some emphasis on the collaborative involvement of all members, which could present a bottleneck if the member-base was growing, for example. The NGO peer-network Participatory Ecological Land Use Management Association (PELUM) solved this issue by using a lab space to develop 'value chain models' that were tested and 'certified by the members' throughout their country chapters (using PELUM as a market space), now being able to offer this model for use by all its members (in the open space).

Some of these collaborative networks also had an informal character, which could both increase or hinder efficiency. For example, when NACSAA built their membership base, they first reached out to farmers organizations. This tied NACSAA up in 'long bureaucratic loops', so that the strategy was changed to reach out to key farmers directly. Informality could thus help as a short-cut to avoid bureaucratic delays. It could at the same time reduce the networks' scope for collective action. For example, the Scale Up Community of Practice (COP) is a professional network open to all individuals and/or organizations across different sectors. Its informality allowed easy access for individuals and organizations alike. On the downside, it did not offer mechanisms for members to cooperate with each other, so that joint action was impeded by member institutions' administrative barriers. As a result, '(…) it has to remain informal, at the goodwill of people, but then there's just so much you can do with that.'

The more open networks tended to be efficient just because no collective action was needed. Driven by intent, however, informal and direct lines of communication facilitated self-organized action. For example, FFF members used group chats in Telegram, where 'you can talk to each and every people or chapters', but 'it is harder to find time in our schedules to go out and find each other. So, we either meet at big strikes, or we are just doing them (ourselves).' However, if self-organization is required in a more formal setting, this can become a bottleneck. The NGO-Resource Center of the Vietnam Union of Friendship Organizations (VUFO) maintained working groups with rotating chairs, which required self-funding by the chairing organizations. The current chairing organization already had to take three turns because of difficulties in finding a successor.

3.2.3 Interaction needs to be facilitated and managed, with time and continuity being crucial aspects

All interviewees agreed that the facilitation style was instrumental in having social norms 'instilled into the networks' DNA', which would require a lot of emotional intelligence from the facilitators. The most important outcomes of good facilitation were trust between the members and their ownership. In lab and market spaces that featured substantial representation of the private sector, facilitation emphasized navigating different interests in pre-competitive spaces. The most important personal traits of facilitators here were being honest, 'speaking the language of the different sectors', and being able to 'wear different

hats.' However, facilitation also needed to allow for the different learning styles. Here, time and continuity were the crucial aspects. In particular, groups in lab spaces relied on their own learning results to feed into action and usually operated in rather tight time frames. For example, the SAFE platform experienced how 'prolonged data collection and reporting delayed the possibility of having data analysed, processed, and insights extracted before the next round of project design and development.' Good practice was to follow a road map or protocol, combined with a facilitation style aiming at collective action. Leaders of market spaces with intermittent and less time-bound member involvement featured more of a brokering role among their most active members. At the same time, these networks often had to demonstrate significant and quantifiable impact to the international community, and many of their leaders intentionally applied additional network or management science to increase the networks' efficiency.

The peer networks, in turn, needed a lot more time to build social cohesion and agree outcome expectations from the bottom up. Facilitation was needed to provide safe peer spaces for the open dialogues and reflections needed, with the specific requirements that the facilitator be non-judging, responsive, and averse to personal or organizational 'grandstanding'. For example, the Scale Up COP thrived especially with the 'friendly and welcoming personalities' of the initiators, which 'did not appear like they want to be the professor. They appear as peers'. However, for these networks' informal membership, ensuring the continuity needed could be a challenge. For example, the ASEAN CRN had to deal with an initially high turn-over of members until the 'trust was earned and the first results delivered', which resulted in a more stable group, which in turn again increased the group's social capital. In contrast, groups in open spaces were neither time-bound nor dependent on individual members' continuity. Their facilitation style emphasized empowering individual members' agency so that these could make their own experiences and reflect on these in an individual or self-organized way. For example, FFF facilitated tool kits and trainings to develop practical skills 'to help you set up your group or chapter. At national level, we're just here to help with some resources.' As a trade-off, this learning- and facilitation style involved ceding control. For example, one of the most important traits of FFF was that they 'no one has power over any other'. For networks that are accountable towards donors, this could be a challenge. The NACSAA, for example, aims to help farmers to set up and lead their own networks, while at the same time needing to report its outcomes. Its response is to invest strongly in farmer leaders' facilitation training and to stick to their 'formation principle to make sure that the leadership is clearly with the farmers, all our conversations are farmer-owned and through the lens of what they need.'

3.2.4 *The structural variables impact on innovation spaces' (in)dependence and members' inclusion*

Networks' funding was strongly correlated with their respective definition and measurement of success, with a strong trade-off between the networks' independence and members'

inclusion. Lab spaces often inherently included a funding member or an inbuilt funding source. Access to that funding was equal for all members, set out in a memorandum of agreement. This and the ambition to advance the topic as laid down in a road map entailed the need for strong output monitoring and reporting. Market places had been set up with especially high impact targets, contributing to the Sustainable Development Goals or the Paris 2015 Agreement. They were thus accountable towards the international (donor) community, which also required strong monitoring and evaluation frameworks and structure. Most had also a diversified portfolio with mixed funding from donors, foundations, and contributions from their more affluent members. These were also the ones most actively involved in agenda-setting.

Peer networks and open spaces had a more bottom-up or even autonomous agenda. Whether they accepted donor funding or preferred to run on donations or membership fees depended largely on the trade-offs between their independence and the inclusion of economically weak members. For example, the Planetary Health Alliance (PHA) decided against membership fees to 'enable participation from the global South.' The World Farmer Organization, as 'the only advocacy organization bringing farmers of the global North and South together', explicitly relied on member fees to protect its 'freedom of expression without consequences'. To ensure inclusion, they set the fee according to countries' income levels. The PELUM again, as agro-ecological peer network with a strong orientation to empower its members, ran purely on membership fees but explicitly offered a service to help members with their own programs' fundraising. In contrast, the movement FFF was completely independent of any funding structure, with activists participating in open spaces on their own accounts: 'We really pride ourselves on the fact we don't need money to do what we do!'

In any case, networks needed to formalize when they received donor money (for example the VUFO, PHA) or when the membership contribution was monetary (for example WFO, PELUM). Only networks like FFF and the Scale Up COP, which ran purely on in-kind member contributions, could afford to remain informal. On the downside, peer networks and open spaces mostly had no rigorous monitoring and evaluation (M&E) systems, so that, as FFF put it, 'sometimes it's hard to keep track of everything that's going on'. This also put more weight on the facilitation style, keeping people engaged by generating and communicating anecdotal outcomes. For the ASEAN CRN, for example, it was one 'manifestation of success' when they managed to 'finally bring agriculture to the UNFCCC international arena (…) and the countries in South Asia are saying: We want to experience what you have, we want to learn from you!'

3.2.5 *Permeability plays a role in members' motivation to engage*
The study revealed that networks were making a continuous effort to keep their members engaged. This required not only knowing their members' needs but also providing appropriate incentives. The motivation to engage and remain in the different networks was closely linked

to the networks' permeability, being the degree of ease with which members could enter or leave the networks.

Closed spaces with targeted members provided intimacy and continuity. This was important for both lab spaces and peer networks, but for different reasons. Members in lab spaces were motivated by being small groups of forerunners that had the opportunity to 'dive into core issues in the industry, such as how to define and promote innovation'. At the same time, this space also required considerable commitment of all members. With everyone having a defined role, the space needed to be closed in the sense that members should not leave the group before the experimental cycle was finished. By grouping around a funding agent or funding source, these networks provided the needed incentive. Impacts at scale, however, would 'depend on the ability to connect to and influence larger, sectoral stakeholder groups.'

Members in peer networks were said to be motivated by a strong sense of belonging and by being heard. As the NACSAA related from its early days: 'So, we asked rural sociologists how we could have a more constructive conversation with the farm community, and they told us we should not talk about these crises affecting the whole planet, but really talk about how farmers are doing. How are they experiencing these real, climate-related challenges?'. The required continuity to achieve consensus by dialogue, combined with an informal set-up, could be a challenge. Members could be motivated, however, by a growing sense of self-efficacy. For instance, in the ASEAN CRN, '… they [the members] were scientists, and now they are transforming into policy makers, they are very excited in seeing how they can make policies …' Good practices, however, were also important here to provide linkages to 'more action-oriented other networks.'

These could be market places or open spaces, which both were openly accessible for members but featured rather intermittent member involvement. However, their strategies to keep members engaged differed. Market places hosted pioneers that were 'driven by purpose', providing and needing an 'awful lot of emotional and personal support', but also needing to prove actionable and low-risk business cases. Less active members were attracted by the 'networking opportunities with the big players' and the potential to 'take home new knowledge that maybe we can apply even beyond [a certain context].' That required network leaders constantly to entice its members to 'provide new inputs, maintaining the network alive'.

Open spaces incentivized their activists to take action by 'encouraging them to do just whatever they want'. As FFF put it, '… a lot of people really resonate with that because they're like, I don't need money, I don't need to be able to work on social media, really? Well. I just need to have the passion to do stuff. I just need to care …' To do so, FFF tailored their support offer to the demand of its activists. For example, they engaged scientists directly in their communication channels and organized expert webinars to socialize climate change

science among its activists, with simple and usable messages. In a useful webinar, the scientists 'did a great job of explaining … that was like amazing and super helpful to know honestly'.

3.3 The main trajectories of network development

During our study, it was repeatedly stressed that 'form followed function': Most networks had a lead time of one to three years, from their initial spark to their official launch. During that time, and also during their life cycle, the networks interviewed were highly responsive to their members' needs, regularly sought their members' feedback, and adapted accordingly. This led to networks changing their course and compositions especially in the early years. We observed two main trajectories:

3.3.1 Developing from lab space compositions into market space compositions:
As an example, the Sweet Potato for Profit and Health Initiative (SPHI) was set up and funded with high impact expectations from the very beginning. However, in its first five-year phase, it operated rather in the lab space, focused on the breeding of a sweet potato variety rich in vitamin A. For the second phase, SPHI transitioned toward the market space, where the achievement of high impact was possible. The major changes were related to increasing the permeability of the network, which also included negotiating a new narrative. Following an assessment that recommended 'women and nutrition as scaling pathway', the SPHI reframed its focus towards income and health.

3.3.2 Oscillating between peer- and open space compositions:
PELUM, as network for non-governmental organizations (NGOs), acted simultaneously as an advocacy organization for its 40% international members and provided action support for its 60% national members. The PHA, in turn, which because of being hosted by the Harvard University was not allowed to act as an advocacy organization, saw its theory of change in supporting 'social mobilizers', although in many other aspects they rather resembled a peer network. As a third example, the Scale Up COP developed a degree of social cohesion that was surprising considering its high permeability. At the same time, members displayed a high intentionality, with many of them having action-oriented backgrounds in the health and education sectors. This was also reflected in the high level of self-organization of the COP's breakout groups.

In turn, trajectories that would change the network structures' flexibility seemed to require more efforts, with rare examples. E.g., the Sustainable Rice Landscapes Initiative (SRLI) was able to function like a peer network in a lab space, drawing on existing good relationships of its six founding members. Broadening their funding - and national member base, however, posed the challenge to upgrade their M&E systems 'without losing the networks' spirit'.

3.4 The innovation space grid - a simple model

As shown in the previous sections, networks respond flexibly to their respective contexts, and will feature different design compositions for their respective long-term outputs, or short-term outcomes. Hereby, they will rarely display all characteristics that are associated to the different innovation spaces. However, when we depict the related sets of design variables in a simple model (figure 1), we can visualize the main design decisions that multi-stakeholders need to consider for interacting effectively and being outcome-oriented, along the two intersecting axes of 'structure' and 'permeability'.
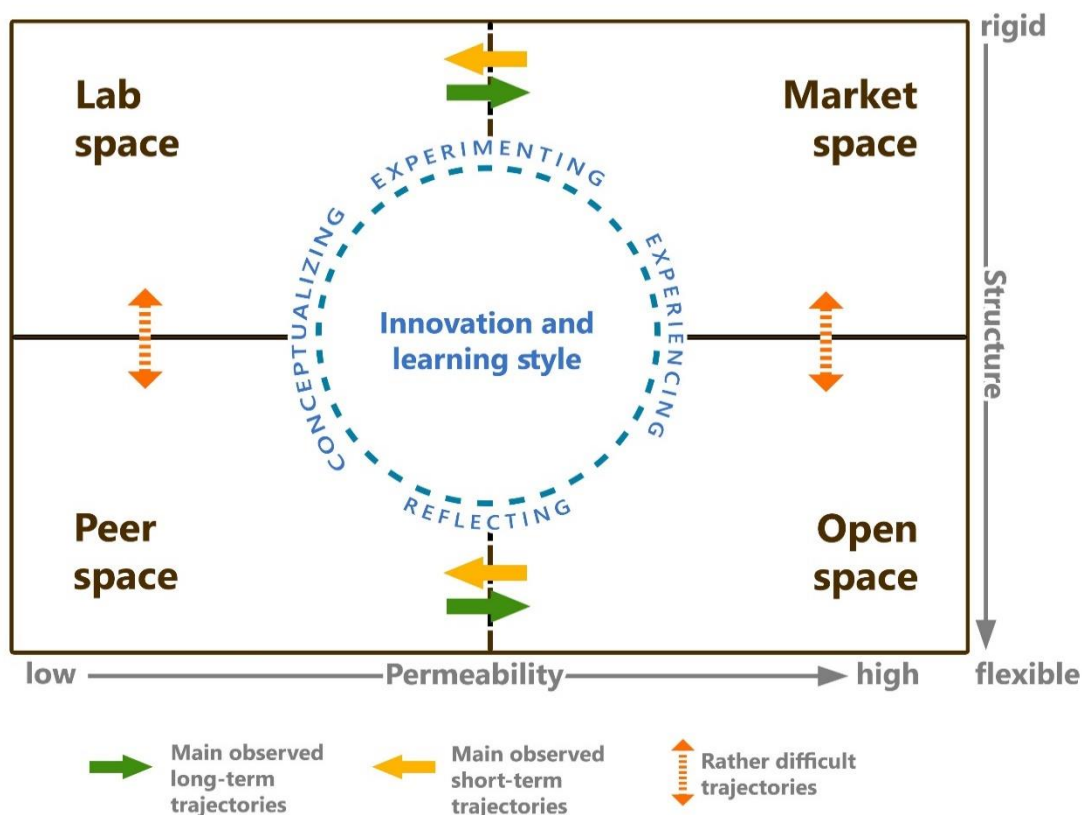

Figure 1: The innovation space grid
Source: The authors

We define these innovation spaces as spaces that facilitate different forms of multi-stakeholder interaction, which are determined by the space's structure and permeability, and bring about the change dynamics that lead to the desired outcomes.

4. Discussion

Our study aimed to understand how networks can be designed in an outcome-oriented way in the context of food system transformation. Our objective was to understand which different

network designs emerged in view of different objectives of multi-stakeholder networks for supporting food systems transformation, what were the respective trade-offs and challenges, and how did these network designs change, over time or for short-term purposes. We now tease out some theoretical and practical implications of our study.

4.1   Innovation spaces as a way to enable differentiated networks to support food systems transformation

Our study identified four innovation spaces, based on the main design compositions in which multi-stakeholder networks innovate and learn in pursuit of their different objectives. These innovation spaces are defined as different forms of multi-stakeholder interaction, determined by the spaces' respective structure and permeability, which bring about the respective change dynamics that finally lead to the desired objectives. Our study confirms earlier research, which already established that the different functions of innovation platforms and systems would be a result of the interaction of their components (Hekkert *et al.*, 2007; Lamers *et al.*, 2017), and that a network's design will engender a certain dynamic and members' behaviour (Pugh and Prusak, 2013). More precisely, the innovation spaces combine what Glasbergen (2010) called 'psychological spaces' for member interaction through 'transaction spaces', defining the rules.

Our study added to this a framework of ten design variables and their respective characteristics for each innovation space. Thus, we establish the link between networks' structural compositions, their facilitation, stakeholder engagement and governance models, and their functions in relation to their respective objectives, which hitherto has not been addressed in the same way in the literature on multi-stakeholder network design (Lamers et al., 2017; Muñoz-Erickson and Cutts, 2016; Sartas et al., 2018; Schut et al., 2018), providing a more differentiated view with regard to different modes of learning and innovation. Each innovation space requires, and/or is required by, radically different facilitation, management and learning styles. These come with trade-offs between sets of variables that define the networks' or groups' structure, their permeability, and the corresponding types of interaction. In the complex reality of food systems transformation, networks will need to adapt to given situations, sometimes involving lobbying, enhancing knowledge sharing, or co-innovation for establishing 'socio-technical bundles' (Barrett *et al.*, 2020), for example. Our suggested framework for outcome-oriented network design helps unpack the tensions and trade-offs that scholars have anticipated in cases where network leaders need to deal with preconditions in the networks' design that might lead to a clash with set objectives (Provan and Kenis, 2008; Yazdizadeh et al., 2014). Below we discuss the main trade-offs identified to illustrate how these could make the participation for different sets of stakeholders less appealing or more challenging.

4.4.1   *'You manage what you measure'*
Spaces with high output or impact obligations feature more effective governance and

management styles and M&E systems. However, these structural variables can be applied quite rigidly or with a lighter touch. For example, in lab spaces, members are expected to achieve a certain output in a limited time. The required commitment to high-intensity interaction will rather be invested by stakeholders with 'skin in the game', as can be found within a certain sector or value chain, for instance. Otherwise, participants run the risk of burn-out (Provan and Kenis, 2008). Market spaces, in turn, accommodate a wide range of actors who have very different individual pathways of pioneering and trendsetting. Their management ensures achieving the collectively shared long-term outcomes by offering a large range of different, often short-term, activities. We thus corroborate the need for more reflexive forms of monitoring (Kilelu, Klerkx and Leeuwis, 2013) in response to filling knowledge gaps about the M&E mechanisms best suited to networks (Sartas *et al.*, 2018; Schut *et al.*, 2018).

4.4.2   *'Nothing substitutes personal interaction'*

Spaces with low permeability feature a continuous membership, which in literature is associated with trust, often in connection with the groups' size (Provan and Kenis, 2008). Applying the innovation space model allows a more differentiated observation. While both lab and peer spaces feature low permeability, trust might be related to the absence of stakeholder competition rather than to the groups' size. Lab spaces, while often including competitive and for-profit actors, select members for complementarity, thus providing at least 'safe enough' spaces (Pereira *et al.*, 2020). Peer spaces in turn consist of homogeneous members, either of different professions, or positioned at similar levels, with no apparent reason to compete. This did not change when peer networks grew to the point that personal interaction was not feasible anymore. In comparison, the more permeable market spaces were often populated by highly competitive sectors, but by nature of their facilitation and management style never required any kind of exposure or disclosure incompatible with their members' competitive nature.

4.4.3.   *'Form follows function'*

Resonating with Provan and Kenis' (2008) notion that a governance structure cannot be 'both stable and flexible', we add that it also cannot be permeable and un-permeable at the same time. Observing the networks' trajectories, as stipulated by Creech and Ramji (2004); Pereira *et al.* (2020); Reypens, Lievens and Blazevic (2021), we found these are indeed predictable from their respective starting points, as stated by Provan and Kenis (2008), in that they changed their permeability (e.g., opening up their membership) rather than their structure. This can pose a challenge when innovation or transformation processes require strategic stakeholder engagement at different points of time or phases of co-development, and with differing intensity (Lamers *et al.*, 2017; Pereira *et al.*, 2020). Once a rigid structure is established, it will be difficult if not impossible to change back (Provan and Kenis, 2008). However, we observed that the spaces with high permeability (market and open spaces) allowed their members to break out into innovation spaces with different structural modalities

for short-term tasks. As such, we confirm that hybrid orchestration between consensus-based and dominating modes (Reypens, Lievens and Blazevic, 2021) is possible, but only for a short time and for a well-defined task.

In the quest to answer our research questions, we built a framework for outcome-oriented network design and modelled a simpler innovation space grid. We found that these also provided useful insights for two important additional questions, which we discuss below: how can networks work in concert for food system transformation, and in a more inclusive way?

4.2 Orchestrating a portfolio of innovation spaces for different elements of food systems transformation

As discussed earlier, different phases of innovation processes can require different sets of actors and functions to be fulfilled (Lamers *et al.*, 2017; Pereira *et al.*, 2020), as innovations need to be bundled with the respective different technological and social changes (Meynard *et al.*, 2017; Barrett *et al.*, 2020). Also, change can have different drivers: a supply push (e.g., by policy or business networks) or a demand-pull (e.g., by social movements and civil society actors) (Klerkx and Begemann, 2020). The COVID pandemic, in many ways paralleling the climate crisis (Manzanedo and Manning, 2020), has shown that transformative change needs to be addressed at many levels, simultaneously designing disruptive solutions (Cankurtaran and Beverland, 2020), engaging local, national and regional governments, civil society organizations and businesses in local experimentation and learning. and getting citizens on board with clear messages (Klenert *et al.*, 2020). We can now associate these processes with lab, market, peer and open spaces.

Our study has shown that it is difficult for networks to move flexibly between the different innovation spaces, unless for short-term purposes. Instead, we have observed that networks are often aware of their limitations and some have connected to other networks that provide complementary functions to support food systems transformation. A complex mission like food system transformation implies strategic portfolios of innovations (Klerkx and Begemann, 2020), and our study shows this can be done successively or synchronously through these different innovation spaces. Lab spaces, designed to develop or demonstrate innovations, could then be associated with living labs (Schaffers *et al.*, 2007) or innovation niches (Kivimaa *et al.*, 2017; Meynard *et al.*, 2017; Pigford, Hickey and Klerkx, 2018). Thus lab spaces can initiate transitions but need to connect to (or develop into) a larger group of sector stakeholders to achieve impact (Schut *et al.*, 2018). The innovations can be negotiated, tested and adapted in market spaces, which need a constant fresh input of demonstrated, actionable innovations, such as low-risk business cases. In turn, they provide the 'big tent' in which to adapt innovations to different contexts and to set trends across sectors. Peer spaces can level the playing field for policy engagement or local translation. In turn, these benefit from examples of 'what works' in the different contexts. Actors in open spaces need reliable facts, simple messages and actionable models for social mobilization. In turn, they can

influence or reflect public opinion by demanding, shaping or resisting change, thus providing the 'demand pull' for policy engagement in both the public and private sector networks.

4.3   Designing innovation spaces for inclusiveness

Networks are inherently political (Glasbergen, 2010), and if the problem solvers in those networks are the same as the problem creators, solutions tend to be repetitive and narrow (Waddock, 2013; Manning and Roessler, 2014) and will remain stuck in current dynamics and paradigms (Chavez-Tafur *et al.*, 2020; Pereira *et al.*, 2020).

By breaking down multi-stakeholder networks into innovation spaces with different sets of design variables, we can identify some design decisions that impact on members' inclusion or exclusion. As already suggested by Sartas et al. (2018), a critical factor is the networks source of funding, which can lead to a dilemma of either crowding out non-affluent members by requiring membership fees and contributions, or alternatively compromising the networks independence. Another important factor is members' capacities, e.g. for securing formal contracts (Lamers *et al.*, 2017). Both factors will affect the innovation processes in all phases and across all innovation spaces, although in different forms. While lab spaces additionally need to watch possible exclusion of poorer country members for a lack of complementing competencies, market spaces are highly susceptible to being ruled by the major agenda-setting and/or funding partners. Breaking out in peer spaces can provide opportunities to mitigate the funding dilemma, for example by actively seeking contributions from and consensus among all participating members, and by keeping ownership of the agenda setting and framing. At the same time, capacities for successfully acting in peer spaces often have to be formed, which again takes time and resources. Open spaces that provide otherwise excluded or unheard actors with the means to connect and act appear under-researched currently.

Such matters of inclusion and exclusion will impact strongly on the power inequalities that are inherent to any multi-stakeholder process (Cummings *et al.*, 2017; Lamers *et al.*, 2017) and that need to be addressed to arrive at inclusive and sustainable food systems (Barrett *et al.*, 2020; Béné *et al.*, 2020; Herrero *et al.*, 2020a; Klerkx and Rose, 2020; Loboguerrero *et al.*, 2020). However, while in the scope of our study we addressed the inclusion of resource-poor members, the scope of our study did not allow deepening on the inclusion of groups such as women, indigenous people, or others who did not have access to the internet at the time when many of the multi-stakeholder initiatives moved to online spaces because of the COVID pandemic. We acknowledge this as a limitation and potential further area for study in section 5.

4.   Conclusion

As multi-stakeholder networks have become increasingly important for accelerating inclusive, equitable and sustainable food system transformation, insights are needed on outcome-

oriented network design that can explain how different actors can come together to innovate and learn. By studying 14 multi-stakeholder networks, we iteratively identified four main innovation spaces for food system transformation, which we call lab -, market -, peer - and open spaces. This concept contributes by expanding the knowledge base of network management, which can help navigate food system transformation. The study provides two major contributions to practice.

First, these four innovation spaces come as compositions of ten design variables and four main characteristics each, which form a novel framework for outcome-oriented multi-stakeholder network design. Although not all characteristics can and need to be fulfilled in each case, this framework can help to identify possible challenges and trade-offs that may emerge, especially with regard to power inequalities and social inclusion. This can assist leaders of emerging or existing networks in working towards inclusive and equitable system transformation.

Second, with the innovation space grid, we have provided a simple model that can be applied not only to the networks themselves but also to any shorter-term multi-stakeholder cooperation, such as when networks facilitate breaking out into smaller working groups. This model visualizes how the innovation spaces intersect along the axes of structure (how rigid or flexible these are) and permeability (the ease with which members can enter and leave), allowing different types of stakeholders' interaction to happen. Because each innovation space requires and enables different facilitation, management and governance styles, which may in turn evoke different change dynamics towards food system transformation, it is not easy for networks or even short-term initiatives to change their form according to any chosen goal. Our study has shown, however, how the different networks and actors in the different innovation spaces may complement each other's respective innovation processes, thus working more efficiently and effectively towards concerted action. Future research could usefully explore in more detail how these complementarities are realized and how multi-innovation space interaction is effectively governed.

A limitation of this study was that we interviewed only the multi-stakeholder networks' leaders or founding members, which was mainly due to the time constraints noted above. Another limitation was that we interviewed only one network that acted as a social movement in the purely open space. Because in the context of food system transformation, social movements are increasingly recognized as critically important actors, we suggest further research and action to explore the considerable potential of open spaces to work towards food systems transformation. Finally, while we were able to address the inclusion of resource-poor members and link it to the trade-off between external funding and independence, the scope of our study did not enable us to go deeper on the inclusion of groups such as women, indigenous people, or others who did not have access to the internet at the time when many of the multi-stakeholder initiatives moved to online spaces because of the COVID pandemic.

These important issues should be subject to further studies on multi-stakeholder network design.

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Annex: Networks' design variables

Network	Objective	Commitment	TOC & actors for change	Shared vision	Learning style	Facilitation & management style	Membership profile		Funding model	Government model		Success definition & measurement	
Mainly lab spaces													
SAFE	Sector development	Commitment to task	Innovators & demonstrating change	Shared task	Conceptualise – experiment	Collective action	Closed or targeted	Continuous	Inbuilt funding	Chore & periphery	Formal	Road map	Measurable outputs
NFP	Sector development	Commitment to task	Innovators & demonstrating change	Shared task	Conceptualise – experiment	Collective action	Closed or targeted	Continuous	Inbuilt funding	Chore & periphery	Formal	Road map	Measurable outputs
Mainly market spaces													
Grow Asia	Cross-sector cooperation	Commitment to topic	Pioneers & trend-setting	Continuous negotiation	Experiment – experience	Brokering	Open or screened	Intermittent	Mixed	Hub & spokes	Formal	Set by global agenda	Measurable impacts
GACSA	Cross-sector cooperation	Commitment to topic	Pioneers & trend-setting	Continuous negotiation	Reflect - conceptualise	Brokering	Open or screened	Intermittent	Mixed	Hub & spokes	Formal	Set by global agenda	Measurable impacts
From mainly lab - to mainly market spaces													
SPHI	Sector development	Commitment to task	Innovators & demonstrating change	Shared task	Conceptualise – experiment	Collective action	Closed or targeted	Continuous	Inbuilt funding	Chore & periphery	Formal	Set by global agenda	Measurable impacts
	Cross-sector cooperation	Commitment to topic	Pioneers & trend-setting	Continuous negotiation	Experiment – experience	Brokering	Open or screened	Intermittent	Mixed	Hub & spokes			
SRLI	Sector development	Commitment to task	Innovators & demonstrating change	Shared task	Conceptualise – experiment	Social Cohesion	Closed or targeted	Continuous	Inbuilt funding	Chore & periphery	In-formal	Road map	Anecdotal outcomes
	Cross-sector cooperation		Pioneers & trend-setting	Continuous negotiation	Experiment – experience	Brokering	Open or screened	Intermittent	Mixed	Hub & spokes	Formal	Set by global agenda	Measurable impacts

Mainly peer spaces													
ASEAN CRN	Policy incidence	Commit-ment to group	Change agents & institutional change management	Shared identity	Reflect - concept-ualise	Social cohesion	Closed or targeted	Con-tinuous	Foundations, donor	Collabo-rative	Semi-informal	Bottom-up	Anecdotal outcomes
NACSAA	Policy incidence	Commit-ment to group	Change agents & institutional change management	Shared identity	Reflect - concept-ualise	Agency, empowerment	Closed or targeted	Con-tinuous	Mixed	Collabo-rative	Formal	Bottom-up	Measurable impacts
WFO	Policy incidence	Commit-ment to group	Change agents & institutional change management	Shared identity	Reflect - concept-ualise	Social cohesion	Closed or targeted	Con-tinuous	Member-funded	Collabo-rative	Formal	Bottom-up	Anecdotal outcomes
VUFO-NGO Resource Center	Policy incidence	Commit-ment to group	Change agents & institutional change management	Shared identity	Reflect - concept-ualise	Social cohesion	Closed or targeted	Con-tinuous	Mixed	Collabo-rative	Formal	Bottom-up	Anecdotal outcomes
Mainly open spaces													
FFF	Action support	Commit-ment to cause	Activists & critical mass	Shared intent	Experience - reflect	Agency, empowerment	Open or screened	Inter-mittent	Member-funded	Self-organised, individual	Informal	Autonomous	Voluntary
Oscillating between peer - and open spaces													
Scale Up COP	Policy incidence	Commit-ment to group	Change agents & institutional change management	Shared intent	Reflect - concept-ualise	Social cohesion	Open or screened	Inter-mittent	Member-funded	Collabo-rative	Informal	Bottom-up	Anecdotal outcomes
	Action support	Commit-ment to cause								Self-organised, individual			
PELUM	Policy incidence	Commit-ment to group	Change agents & institutional change management	Shared intent	Reflect - concept-ualise	Agency, empowerment	Open or screened	Con-tinuous	Member-funded	Collabo-rative	Formal	Bottom-up	n/a

	Action support	Commit-ment to cause	Activists & critical mass		Experience - reflect									
PHA	Action support	Commit-ment to cause	Activists & critical mass	Shared intent	Reflect - concept-ualise	Agency, empowerment	Open or screened	Con-tinuous	Foundations, donor	Collabo-rative	Formal	Bottom-up	n/a