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How Collaborative Networks Fail, With the Implications for Participants Learning

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There seems to be a dearth of research addressing network failures and in particular failures in large-scale organizational networks that pursue radical innovation or grand challenges through collaboration. Yet these failures clearly exist with potential learnings for network participants. In this chapter we consider three major network failures that have been identified in prior research and in our own ongoing empirical work. We term the failures *Stalling* - not getting started in collaborative work (Jarvenpaa & Välikangas, 2016a), *Strategizing* using the network opportunistically to serve other goals than what the network was formed for (Grodal & O'Mahony, 2017), and *Siloing* – the network falling short of its collective capacity to learn and innovate due to its lack of connectivity and communication (Leonardi & Bailey, 2017, Powell et al, 1996). After describing these three seminal failures in networks of independent organizations, we consider the implications for network collaboration with high ambition – whether radical innovation or a grand challenge. We ask: what do these failures suggest in terms of network participation that would help contribute to the ambition of the network? What should the individual participants of these large-scale organizational networks mitigate failure and maintain the founding ambition, and the performance of the network? What available models for learning are there for the network participants?

Introduction

Lot of work today takes place in networks, and networks of independent organizations are seen as increasingly necessary to tackle radical innovation or grand challenges. Such inter-organizational networks are seen as vehicles for building participatory, multivocal architectures (Ferraro et al, 2015) or means of gathering substantial financial and human resources for an urgent societal challenge such as an epidemic. Networks are also seen as facilitating experimental action. Yet networks seem easily to fail in their ambition (Grodal & O'Mahony, 2017) or at least be potentially limited by, or dependent on, participant behavior in the network (Jarvenpaa & Välikangas, 2016a, Leonardi & Bailey, 2017, Jarvenpaa & Majchrzak, 2016, Majchrzak et al, 2007).

Reasons for these failures seem to be many. Where multivocality was to be a strength, such diversity may invite a compromise or strategic opportunism (Grodal & O'Mahony, 2017). And networks of loosely coupled independent organizations may lack the ability to broadly learn across organizational boundaries and rather rely on an intermediary's mediation (Perkmann & Schildt, 2015). Such mediation may be necessary to protect intellectual property yet it exacerbates the siloing of knowledge potentially suppressing radical or recombinant discovery. This may also be manifest in distributed experimentation if the lessons learned are not shared across the network but rather remain local information only. Then the network fails to enact its ambitious potential for collaboration (Schrack & Whitford, 2011), a topic Berkowitz and Bor (2018) also note as understudied in terms of an inter-organizational performance or opportunity creation (Jarvenpaa and Välikangas, 2014). Networks

have been noted to underperform (Podolny & Page, 1998) or even fail at their founding, though this too remains understudied (Schrack & Whitford, 2011).

In the tradition of economic sociology, network failures have been attributed to opportunism (Williamson, 1975). Our interest here ranges beyond opportunism to include collaborative learning in “benefit-rich networks” (Powell, et al 1996:139), or rather, the failures in gaining or creating such network benefits. In Schrank & Whitford’s (2011) terms, we focus on network failures that are absolute in a sense that an existing or emergent network may devolve or break up (by stalling) and relative in a sense that the participants exercise opportunistic behavior (by strategizing or by siloing). Beyond these kinds of network failures, Schrank and Whitford (2011) suggest additional ways of networks failing such as a network not appearing where it would be value adding or a network underperforming due to its lacking competences. The causes of these failures may be overlapping to some extent – opportunistic strategizing for a particular benefit may be related to a lack of competences, at least in the short term, necessary to pursue the grand ambition.

Understanding these failures is important in order to avoid them or at least minimize their network impact. Our analysis is at the network level of interorganizational collaboration but we focus on individual participant behavior affecting the network governance and its outcomes. In particular the perspective of network participants mitigating, and learning from, the potential failures should be emphasized.

According to Jarvenpaa and Majchrzak (2016:22): “Several studies... have shown that individuals’ interactions affect interorganizational governance mechanisms.” In their study of dyadic interactions impacting and be impacted by home organization’s controls, self-regulatory capabilities gain importance at the level of dyads of

collaboration while the relationship between the individual and the home organization also matters in terms of knowledge sharing and protecting. Other studies have underlined the importance of knowledge sharing protocols at the level of network collaboration (Jarvenpaa & Majchrzak, 2008). This study of national security professionals emphasizes the importance of participant (mixed) motives for collaboration under distrust. Majchrzak et al (2007) further emphasize how individual action in a natural disaster such as a hurricane propagates at the collective emergency response level: what individuals do, has implications to what the emergency response as a whole is able to accomplish.

We start with the discussion of three types of seminal network failures identified in prior literature. We call these failures seminal as they seem to represent major yet underappreciated ways in which large inter-organizational networks may fail in tackling societal challenges. We are particularly interested in resulting lessons for network participant behavior.

Network Failure in Stalling

The first network failure was observed in large scale research networks seeking radical innovation across a variety of industries (Jarvenpaa & Välikangas, 2016a). We define *Stalling* as the inability to mobilize network participants to embark on network activities due to the ambiguity of its objectives and the radicalness of its mission, such as industry-level business model innovation. The diversity of large-scale networks and their lack of formal organizing elements (Ahrne & Brunsson, 2011) contribute to the difficulty as there is no hierarchical authority to draw on at the

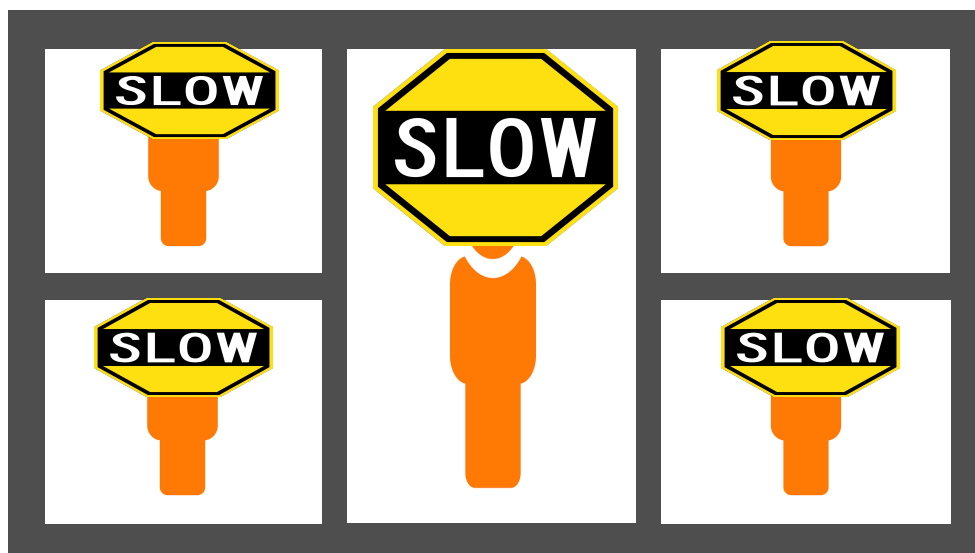
network level. Participants report to their independent organizations. Rules need to be agreed among the participants with diverse interests, and goals are open for interpretation. Furthermore, such a network often lacks capabilities for sanctioning collaboration beyond potentially losing funding.

As Jarvenpaa & Välikangas (2016a) report in a study of a large-scale research networks consisting of academic, industry and research organizations, the network participants were spending a lot of time planning, with no collaborative research getting started. The networks were about to unravel and lose its significant public funding. There were ongoing, continuous negotiations about the concrete objectives and goals of the networks in terms of research outcomes, how to share the value created in the network, and how to share and protect company-specific intellectual property while working together effectively. These were difficult questions to solve in inter-organizational collaboration, and lacking an effective governance structure (Jarvenpaa & Välikangas, 2016a), the networks were stalling, or the joint research activity was not getting started.

Only slowly did the participants learn to develop interactive governing behaviors that filled the governance void across the various research networks. This happened by developing persistent participation that gained peer respect and lateral authority by others in the particular research network, by engaging in rule authoring as a way to solve conflicts related to intellectual property sharing in particular, and by cultivating multivocality to invite company-specific perspectives to value creation and realization while maintaining the openness of the overall network. These interactive governing behaviors allowed the research network participants to move forward and start

engaging in joint research without any authority to dictate and enforce rules from outside and without any single perspective dominating. Without such participant behaviors filling the governance void, the networks would have likely either unraveled (Cassier & Forway, 2002, Jarvenpaa & Majchrak, 2016a), lost their funding from public and private sources, and/or continued to operate non-effectually (Van Kooten, 2000) with a “sense of dissonance” (Stark, 2009) and “disorder” (Browning et al, 1996).

Figure 1. Network Failure: Stalling



Network Failure in Strategizing

This second seminal failure builds on Grodal and O'Mahony (2017)'s research on a national nanotechnology initiative (NNI) that mobilized participants across academia and industry. Nanotechnology futurists also participated. We define *Strategizing* as

the displacement of network mission by near-term local interests and contexts. The original ambition becomes short-changed. This failure is particularly acute as many authors have celebrated such participatory architectures (Ferraro et al, 2015) in addressing critical societal challenges whether curing HIV/AIDS (Maguire, Hardy, & Lawrence,2004), alleviating poverty (Mair et al, 2012), or even improving the sustainability of animal farming practices in developing countries (Kates & Dasgupta, 2007; Weber, Heinze, & DeSoucey, 2008). The network's aspirational nature as spaces where diverse voices can be heard has also been credited as potential for cross-boundary creativity and innovation yet difficulties remain in the implementation of the achieved joint outcomes (Furnari, 2014).

In Grodal & O'Mahony (2017) study, however, the diversity worked to the nanotechnology initiative's disadvantage. While the NNI was able to attract many participants from stakeholder organizations, it seemed to fail in its ambitious mission. Grodal and O'Mahony (2017:1808) describe the failure: "After tracing the evolution of ... goals over time, ...we realized that the grand challenge had gradually become displaced by less ambitious goals. Oddly, this happened after a period of relatively successful mobilization efforts. "

It appears the NNI initiative and network was used for various other strategic goals than the original mission, by means of retrofitting existing, prior-to-the-initiative goals that may have been specific to a particular organization or displacing initiative objectives with shorter term goals. Partially the mission was compromised by applying investment criteria that served a particular organization's funding needs or by taking initiative-independent action.

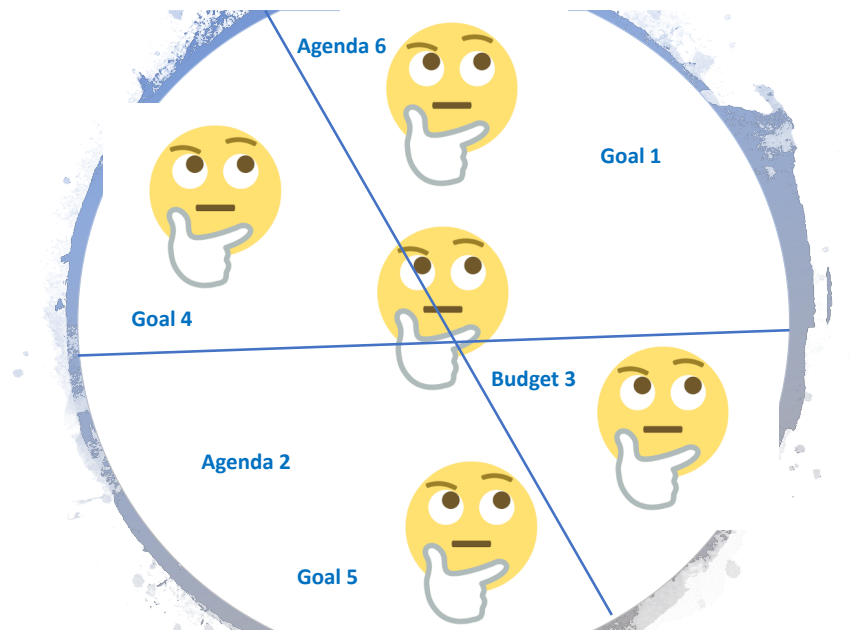
Despite having committed to the network's overall mission, mobilized participants strategized on the basis of their own more immediate interests and financial needs (Granqvist et al, 2013). Hence the initiative was compromised in its overall ambition – “the grand challenge was displaced” (Grodal and O'Mahony, 2017:1817). This is potentially a serious failure to a network that is founded on the premise of an ambitious, radical mission and that justifies resources based on the pursuit of that mission such as molecular manufacturing. This mission becoming bastardized into lower-level community-specific goals for the short-term may not be unique to an initiative such as NNI but rather widespread: innovations become hijacked to serve existing purposes rather than create new opportunity spaces. Existing agendas are attached to new funding schemes and radical goals lose their edge as practical, as urgent issues require immediate tackling (Levinthal & March, 1993).

How to battle the lowering and displacing of ambition? Going underground, in “stealth mode” in order not to draw outside attention, is one approach. However such a strategy usually limits the participation to a small group, often hiding the innovation until it is mature to stand criticism, thus defeating the sought after multivocality and inclusiveness in networks of diverse organizations. Robustness comes in such a case from the focal team stubbornly working on the innovation without much interference from other interests (Moldenhauer-Salazar & Välikangas, 2008) and the very exclusion of potential varied stakeholders –very much the opposite of the kind of robust action aimed for in tackling grand challenges of societal ambition (Ferraro et al, 2015).

A network also evolves in its mission and activities. In a study in biotechnology industry, Powell et al (1996) find the network expanding to absorb new knowledge

and new ambition, “the R&D alliances... being “the admission ticket” (p.143). Individual biotech companies connected to new sources of discovery and gained network centrality. The network is changing its shape as member organizations connect to new members while leaving others behind. While the authors argue that the locus of learning is the network, Powell et al (1996: 142) specify that “Learning occurs within the context of membership in a community and may require different kinds of organizations and organizational practices to access that community.” Hence member organizations, through the serendipities of collaboration and innovation, shaped the network and its defining activities.

Figure 1. Network Failure: Strategizing



Network Failure in Siloing

We define the third seminal failure as *Siloing*: the constraining of a network in terms of its ability to share ideas, knowledge, and work together creatively across the whole network. This may be due to network sparseness, link brokenness, or loose coupling or lack of interactivity in general. Weak links have famously been attributed a role in discovering otherwise unavailable knowledge (Granovetter, 1973), and loose coupling is seen as a potential source of organizational resilience (Weick & Sutcliffe, 2007). However by their nature of distancing network participants from each other, such network characteristics inevitably isolate and slow down communication, sharing and learning across the entire network. The connectivity of a network structure has long been attributed a salient role in communication and sharing (Burt, 2004), idea recognition and implementation (Ahuja, 2000, Obstfeld, 2005), and trust and cohesion (Fleming, Mingo, & Chen, 2007).

Yet beyond structure, individual behavior also matters. Leonardi & Bailey (2017) importantly highlight the role of astute participant behavior in an offshoring engineering network for an automobile manufacturer so that good ideas are recognized and shared as new practices across a company network. Low status consulting engineers were constantly bombarded with similar work from different regional engineering centers and were exposed to deviations from the company standard practices how this work was done in different engineering centers. Rather than using their own experience or rely on the knowledge of the source to make inferences about the quality of deviations in work practices they witnessed, the consulting engineers relied on data driven processes of testing and validation to recognize good ideas. They would then share these learnings of good ideas in staff

meetings when “a manager would prompt sharing by asking in a staff meeting, “Ok, what are key learnings that you have had? The question came with no expectation of immediate applicability and no one formally recorded the responses” (Leonardi and Bailey, 2017, p. 131). The higher status team engineers mentally noted the solutions shared and later when team engineers would face problems, they recall who had mentioned a remedy and then approached the consultant engineer for more information. Idea seeking also took place reactively wherein the team engineer approached the consultant engineer without having heard a solution. Not only did the idea recognition take place in person-to-person exchanges, but so did the idea selling to the other regional centers. It was now the higher level team engineer that used the consultant engineer’s data driven processes to convince the regional centers of the validity of the innovation and present it in the standard work document format.

In terms of collaboration across multiple companies, intellectual property issues gain prominence in joint research activity. Participant organizations may engage in selective revealing thus inviting other organizations to develop complementary products (Alexy et al, 2011), use boundary organizations for knowledge sharing an on as-needed basis (Perkmann & Schildt, 2015) or use technical protocols for modular connectivity such as Application Protocol Interfaces (APIs) commonly used in digital technologies today. Although boundary organizations are used as trusted agents to allow individuals from competing organizations to come together to co-create an opportunity (O’Mahony and Bechky, 2008), it is often only the trusted agent that benefits from the diverse knowledge. Modularity has been noted as a key enabler of sensitive knowledge sharing that pertains to intellectual property (Henkel et al, 2013), and it contributes to creating network structures that isolate parts from

each other yet allow some connectivity. Cross-boundary collaboration research has acknowledged the importance of changing boundaries and objects demarcating such boundaries (Leonardi et al, 2019)

In the authors' research on large-scale networks, sharing while protecting knowledge was important (Jarvenpaa & Välikangas, 2014, 2016a). One of the near-failures of the network was the necessity to share some knowledge for joint discovery but not too much to lose credibility or lose their private appropriation. It was difficult however to know which knowledge was going to be important, hence modularizing knowledge was not particularly helpful, and indeed could have been detrimental to joint discovery work that requires intense interaction to generate new combinations of knowledge. Siloing took place but it was overcome in part by interactive governing behaviors that the participants skillfully developed and astutely applied (Jarvenpaa & Välikangas, 2016a). The participants also utilized different revealing strategies (Jarvenpaa and Välikangas, 2014). One strategy was to protect company context: discuss research issues at a sufficiently high problem level to mask any one company's strategic context. The second strategy was to protect strategic intent. This involved breaking work into tasks to be reported at different meetings times or focusing on an iterative process (rather than the objective) such as a lean startup or agile development methodology. The third strategy was to protect company-related technological or business problems or solutions. This revealing strategy involved taking research into a neutral context or perhaps engaging in an experimental or simulated context. Such strategies kept collaboration going when sharing sensitive knowledge was necessary while protecting it at the same time. Yet, siloing may also limit the amount of collective learning in a network, suppressing its resource efficiency and joint creativity (Lewis and Herndon, 2011).

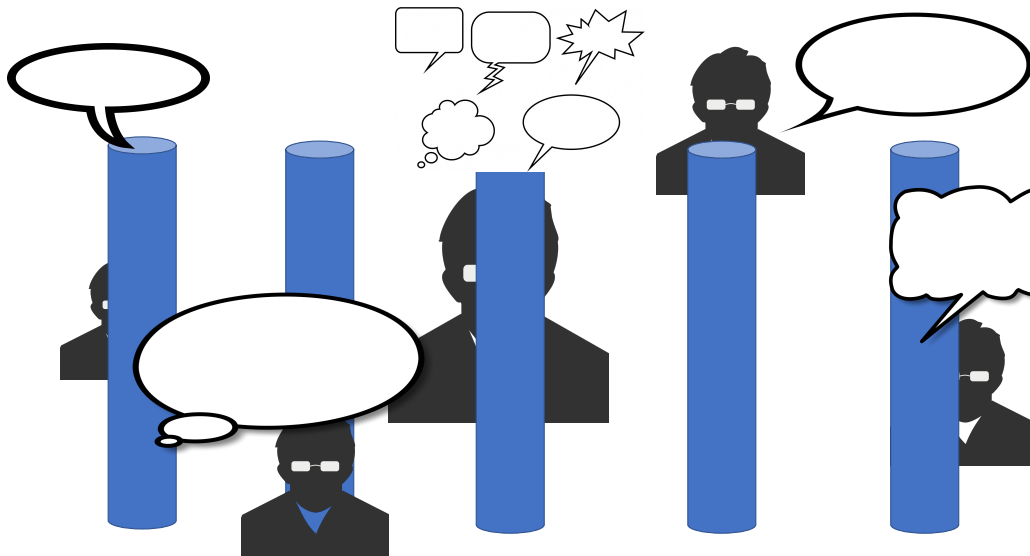
To overcome Siloing, there may be structural solutions at the network level: various social media applications may bring together otherwise unconnected people yet the applicability of these kinds of “dating” applications may remain to be seen in the context of collaborative research for scientific or industry purposes (Leonardi & Vaast, 2017). Leonardi and Bailey (2017) found digitalization help in accessing new ideas regardless of location and time. While digital technology may make opportunities visible, the individuals who bridge structural holes have an important, influential role in a network. Leonardi & Bailey (2017) suggest individuals positioning themselves in structural holes may be important sources of innovation whereas selling the ideas to others might require a different kind of network membership. Leonardi & Bailey (2017) attribute successful selling of ideas to the ability to link new ideas to existing work problems, convincing engineers to try the idea and then codifying these ideas into standard work practices. This required, in Leonardi & Bailey (2017) description, careful network articulation. The practices of proactively sharing and reactively seeking good ideas were used to articulate different networks in person-to-person exchanges that then jointly resulted in ideas to becoming codified as organizational knowledge. While their study took place within a particular automotive manufacturer, its offshoring created a cross-border network that underlined the skill of individual participant behavior in succeeding against the expectations that such developing country offshoring centers cannot possibly innovate. The work sent to these centers was siloed as to fit the (inaptly) perceived role of a low competence. The authors (Leonardi & Bailey, 2017: 117) cite a US automaker:

“We send a fair amount of engineering work to our captive offshore center in India. Engineering work is high skill, but we usually send the lowest value work there. We don’t expect people offshore to innovate because we don’t

really give them anything to work with. The value of off- shoring comes from doing it quickly and cheaply. That's it.”

Despite the quality of the work assigned and the expectations of not innovating, the individual participants in the engineering network were able to identify innovation opportunities and communicate new practical solutions to the global network. The network would have performed at a much lower level of innovation should the participants themselves have lacked the astuteness of innovating against the biased management expectations. Here participant emotions also count. Jarvenpaa and Majchrzak (2016:14) suggest emotional valence can suggest a need for a change in interaction. Such emotion may indicate that “home organization knowledge is not being shared in a manner to move the project forward as rapidly as expected or that the individuals are sharing organizational knowledge in a manner suggesting that the possibility of sensitive knowledge release has increased. Thus, sensing of changes to emotional valence in oneself as well as in the other becomes essential.”

Figure 3. Network Failure: Siloing



Lessons for Network Participation and Models of Learning

In light of these seminal failures, how should network participants contribute to the network to maintain its radicalness and grand ambition? We have observed a number of network failures or near-failures. The participants are shaping network yet also being shaped by the network (Tasseli et al, 2015, Powell et al, 1996).

We start with observational lessons from empirical studies (Jarvenpaa & Välikangas, 2014, 2016a,b). To combat the failure of Stalling, network participants in a large-scale national innovation network did learn to interactively and astutely govern their knowledge sharing behaviors. Participants used tactics such as temporal distancing – “if I share this knowledge, does it matter in a few years’ time?” – and strategic revealing – “I will share the result but not why the result is of strategic importance to our company”. Thus the participants engaged in strategic behavior that enabled the joint research to progress. The participants learned to combat network failure by doing, engaging in experience that produces the possibility for learning (Argote &

Miron-Spekter, 2011:6): “Experience interacts with the context to create knowledge”.

This knowledge signifies learning.

In addition, in the various research networks we studied, participants radically changed their pace of working together (Jarvenpaa & Välikangas, 2016a, 2016b). From a calendar-driven planning cycle where meetings took place as scheduled, the network participants adopted a way of working that was much faster and more immediate. Inspired by agile software practices, the pairs of researchers were expected to embark on a joint project in three-month Sprints. Results were reported afterwards at regular intervals. This change in temporal entrainment charged the collaboration and allowed it to get kick-started. The lesson learned is thus using time as a network governance tool – accelerating and potentially slowing down joint activity to benefit from temporal entraining (Orlikowski & Yates, 2002).

Strategizing may not be something that can be eliminated at the network level as participants will always have local goals and interests beyond the collaborative effort. However, making the joint ambition very concrete, attractive and measurable – such as landing a man to the moon – may prevent compromising and displacement.

Another example is food waste and loss, which can be measured in precise reduction (Gibbert et al, forthcoming). For example the Swedish furniture retailer IKEA has started weighing food waste in its cafeterias around the world to set exact weight goals for allowed waste. Having individual participants, whether NASA engineers or IKEA customers, face up to the particular goal in a personal manner – my specific contribution to the moon mission or waste reduction in grams - might offer a starting point.

The recent events with the Covid-19 pandemic can also speak to the power of a clear goal. Worldwide, science organizations race to develop a vaccine or a drug. In the *New York Times*' opinion piece of "Can 'Team Science' Yield a Covid-19 Treatment?" Ajay Nirula, vice president for immunology at Lilly Research Laboratories, chronicles how Xin Yin, a researcher in the Immunity and Pathogenesis Program in Sanford Burnham Prebys Medical Discovery Institute in California, and his supervisor, Sumit Chandra, together with 29 co-authors around the world have undertaken a "technological tour de force" testing 12,000 drugs and identifying 30 that appear to stop the virus from destroying human cells according to a paper under peer-review. The research collaboration is noted for its speed:

"... how Chanda's lab went from a text message on a train platform to a handful of strong drug candidates in four months required as much cooperation as it did machinery. The collaborations they formed, spanning multiple unrelated institutions, are unusual in the competitive world of drug development. "These networks we've set up are all ad hoc, calling up a friend of a friend and putting it together," Chanda says. "My hope is that we take the infrastructure we've built in an ad hoc way and reinforce it so that it will be there for the next time. There will be a next time."

In this hopeful case for developing a treatment, it was the individual research actions, together with the compelling joint goal to find an effective response to the pandemic that mattered in a network of inter-organizational collaboration, between colleagues and friends. The learning model can be seen as that of imagining and extrapolating possible futures while learning from scarce experience (March et al, 1991). Strategies for such learning include experiencing the scarce experience as richly as possible, for example from multiple perspectives and aspiration levels; simulating experience based on near-failures or incidents that almost happened and by building possible scenarios. In the case of 'Team Science' scarce experience was harnessed in an open innovation approach.

Of course not all grand challenges can be detailed in terms of their accomplishment or their solution is not obvious, the solution being perhaps the very objective of the network to define. Climate change is one such example. Despite the concrete goal of keeping the temperate increase under 2 C, it has been very difficult for the world community, and climate networks despite their mobilization, to reach consensus on the measures to be taken, thus frequently compromising and displacing the reduction of CO2 emissions. Järvi et al (2018:1532) suggest reinforcing the jointly agreed goal during the process of collaboration. Building on their suggestion, perhaps such goal reinforcing can take place at the level of individual participant as well, not just at the level of new member organizations.

“While a common goal has been formulated in the preparation of a research program, that common goal needs to be reinforced when the knowledge ecosystem is exploring new knowledge in the identified knowledge domain. This means aligning with, updating, and/or broadening the common goal as needed—in other words, the knowledge domain is reconfigured and reframed. For example, new members can join the knowledge ecosystem, but their activities and interests must be aligned with the identified knowledge domain.”

How such reinforcing can battle goal displacement, remains an open question in light of Grodal and O’Mahony (2017) study. Nevertheless, Järvi et al (2017) provide a good reminder for participants to pay attention to the need of reinforcing the initial ambition by integrating new participant goals into the overall mission (rather than vice versa). Burgelman (1983) call such activity strategic forcing where new ideas challenge the company strategy as they become integrated.

A further practical lesson can be drawn from the current COVID-19 pandemic. Again temporality may offer a possible starting solution. What cannot be done over decades, may be possible in an extremely short time, by accelerating the response.

The analog here being that it has been difficult for many organizations to shift their work remotely or adopt digital technologies, something that took place almost overnight at the eve of the declaration of the pandemic. This is aligned with Ahuja et al (2012) suggestion of incorporating time in network studies. Similar to Stalling, participant behavior that might be conducive to climate change negotiations is to make a demand to agree on something in a very rapid time schedule, every three months, and declare their commitment or pledge, no matter how small. This way the network might accomplish something incrementally yet rapidly (Pisano, 2020). The lesson for participants is to think of ways in which their individual action, together with other participant actions, may accumulate into larger outcomes. For example, the research networks studied in Jarvenpaa & Välikangas (2016a) used various templates that categorized research results into customer insights or technological innovation. Such framing and combining allowed participants to make potentially emergent new business model visible.

Participant behavior that appears effective to battle Siloing may be the kind of network articulation that took place in Leonardi & Bailey (2017). In Leonardi & Bailey's (2017) telling, an offshoring network was effective in sharing and developing new ideas and turning them into effective practices crossing structural holes and the sparsity of the network. The network became newly articulated due to careful innovation practices of the offshoring labor. Offshoring places, surprisingly, became innovation hubs. The participants learned to position and act in structural holes, gaining access to important information in part through digital technologies, and then sell their ideas to the broader company network in a cohesive and value adding manner. The learning model is one of piloting and experimenting (Pisano, 1994), and learning from deviating experience. Pisano (1994:85, 99) suggests that where there

is strong enough (scientific) evidence, learning can take place outside the final use environment (in laboratories, for example) and hence implementation can be accelerated.

The lessons here are particularly pertinent to a global network inside a company but apply more broadly in inter-organizational networks when participants learn to navigate the lack of formal governance mechanisms (Jarvenpaa & Välikangas, 2016a), exhibiting interactive governing behaviors in persistent participation, rulemaking and multivocal expression constitutive of the network rationale. See Table 1 for a summary.

Table 1. Participant Strategies in Combatting Network Failures with Learning Implications

Potential Network Failure	Strategies for Participant Behavior for Combatting Failures	Potential for Participant Learning	Available Learning Model
Stalling	Interactive governing behaviors; Faster and/or iterative pacing (as in agile methods)	Participant engagement in a situation of no external authority; New ways of joint working	Learning by doing (Argote and Miron-Spektor, 2011)
Strategizing	Articulating a concrete objective; Openly committing to the radical mission	Simulating scarce experience; Learning from scenarios and other tools for imagining futures	Doing-for-learning (March et al, 1991)
Siloing	Astute participant behavior across structural holes;	Extrapolating from deviations observed	Learning before doing (Pisano, 1994)

	Protecting knowledge while sharing	through experience; Piloting and experimenting	
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Future Research Opportunities

What future research opportunities yield from our focus on participant behavior in inter-organizational networks through failure? Important research questions focus on individual participant behavior in inter-organizational networks. What motivates participants and allows the kinds of behaviors that are network-supporting rather than network-failing, and even greatly accelerate network collaboration to the extent described in “Team Science” experience? Jarvenpaa & Majchrzak (2008) found mixed motives in their study of collaboration among national security professionals, agents and spies alike. There may be a professional incentive to participate in a network to learn, either at the level of an individual as in a study of the security professionals or at the level of a company as in Powell et al (1996) biotechnology industry study seeking innovation. Beyond professional incentives, existing researcher relationships may be leveraged as in the Team Science experience.

To prevent the network from failing or underperforming, however, researchers may look into possible background questions such as the stake that the individual participants have vested in the network. Jarvenpaa & Valikangas (2014, 2016a, 2016b) emphasized the importance of the large-scale networks as national innovation projects, thus potentially shaming the participants should the networks fail or at least make it difficult to participate in the follow-up research projects due to negative peer evaluation. Whether the participants engage in a network to promote

positive outcomes or prevent negative ones may matter for participant behavior (Das & Kumar, 2011). Promotion orientation may allow for tolerance of others' opportunistic behavior, thus potentially leading to goal displacement and derailment of the network mission (Grodal & O'Mahony, 2017).

Further, self-regulation, and particularly emotion regulation, has been found to play a role in knowledge sharing and protecting (Jarvenpaa & Majchrzak, 2016). What is the role of emotions in grand challenge-addressing networks where potentially a lot is at stake in terms of society's problems and solutions? Could emotions combined with cognition create fuel for networks being able to sustain their ambition level? Or perhaps an emotional commitment takes away from the scientific rational? Grodal and O'Mahony (2017:1818) draw attention to the appealing to emotions when enlisting members to the grand challenge networks: "These enlisting strategies attract proponents to the field, while skeptics remain unconvinced." In any case the interaction between participants and their emotions should be part of the network failure analysis of the microfoundations of "hot cognition" (Hodgkisson & Healey, 2011). Furthermore, the relationship between a network participant and the home organization would benefit from further study. Jarvenpaa & Majchrzak (2016) found inconsistencies between home organization controls and network availabilities affecting participation negatively. How can these asymmetries be addressed by skillful behavior of the individuals? Beyond knowledge sharing and protecting in research networks, how do participants regulate governance through their individual and interactive behaviors? We have started answering the question and made some practical recommendations but a lot remains to be done.

Conclusion

Large-scale networks are attracting large resources, financial and otherwise. Thus studying such inter-organizational networks is important (Berkowitz and Bor, 2018) as such networks influence their surroundings and direct economic and societal priorities (Berkowitz and Dumez, 2015). Should such large resource aggregations fail at learning effectively, or possibly prevent non-member organizations from learning optimally (Jarvenpaa & Välikangas, 2016b), is also a concern of societal and economic progress.

We focus on network failures in this article as we are increasingly concerned that the large-scale networks may not live up to the potential they are founded. Inter-organizational collaboration may never form as a live network, Stalling. Lot of time is spent on requisite planning, little time on advancing the cause or pursuing a purpose, or doing joint research. Or the ambition may be severely compromised, some evidence of such failure is available in prior research in Strategizing as discussed earlier. The network may thus perform in a much lower level than expected or founded upon. To reach ambitious goals, collective learning may be needed. Such learning may be compromised if the network, Siloing, does not develop a dynamic knowledge sharing structure where knowledge can be differentiated, exchanged and jointly built on. Critical knowledge may remain stranded by network boundaries, structural holes, or hubs acting as communication filters.

Therefore it is crucial for network participants to understand that their astute and even perhaps somewhat altruistic (or common good) behaviors may help contribute to creative mission collaboration and avoidance of mission depreciation or derailment. Jarvenpaa & Macjhzak (2016:24) speak of individuals “artistically

adjust[ing] to the complexity, emergence, and adaptation required in interorganizational collaborations.” We conclude with an emphasis on participant behavior as crucial for network learning in particular in networks of independent organizations of scant formal structures for managing or directing. We propose different learning models from prior literature that could inform such participant learning. Learning is particularly important as failures of networks may be costly but to some extent invisible if the network never truly forms or remains short of its ambition. At the same time, such networks may indeed remain crucial for solving some of the grand challenges the society currently faces.

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