

**Identifying Pathways of Thriving Open Source Chapter Communities Through Interactive
Management Research**

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Abstract

Open Source Software (OSS) communities are vital to digital transformation, yet many in the Global South struggle with sustainability due to limited resources, infrastructure, and institutional support. In this study, we investigated pathways for creating thriving OSS chapter communities with Open Source Community Africa (OSCA) leaders, using Interactive Management Research (IMR). More specifically, we facilitated a one-day workshop with fourteen chapter leads who identified eight factors of thriving chapter communities (diversity of folks in the community, funding for events, good onboarding process, ability to build sustainable projects, opportunities for the community members, community gatherings and events, presence and safety to share, learn, and grow, and existence of relevant learning resources) and identified the interdependencies among the eight through Interpretive Structural Modeling.

According to the perceptions of chapter leads, diversity, safety, gatherings, and funding form the foundation for effective onboarding and sharing of learning resources, which in turn enable sustainable projects and opportunities for community members. We conclude by providing practical strategies for OSS community building, demonstrate IMR's utility, and advance theory on collective intelligence in resource-constrained contexts.

Keywords: collective intelligence, Interactive Management Research, participatory action research, open source software communities, Africa, Global South

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Introduction

Despite the growth of Open Source Software (OSS) communities in the Global South, especially in Africa, many struggle to sustain their technical and social infrastructures, though not for lack of interest (Gillwald et al., 2022; Hossain, 2021). Such communities face widespread barriers across OSS in general: attracting participation, managing burnout, planning events, securing funding (Eghbal, 2016, 2020). Additional challenges include: access to knowledge, device access, intermittent electricity and internet, regulatory and banking obstacles (Gillwald et al., 2022). Despite the rapid growth of OSS use and creation, there exists a critical need to better understand how African OSS communities navigate both *global* challenges in sustaining participation and infrastructure, and *region-specific* challenges such as limited access to resources, connectivity, and institutional support.

Central to this study are critical questions facing not only the African OSS communities but also the broader field of collective action and grassroots technological innovation. Open source communities are increasingly foundational to digital transformation across the continent, yet the pathways by which local leaders can foster group thriving, sustainable organizational change, and the spread of impactful practices remain underexplored. The issue has immediate social importance: thriving OSS communities contribute directly to local economic development, digital inclusion, and the cultivation of technical skills among youth and professionals. Weaknesses in leadership capacity, group cohesion, and sustained motivation among volunteers can undermine these vital social goals, perpetuating dependency on external innovations and exacerbating inequalities in the digital domain. Understanding what helps—or hinders—African OSS communities to thrive therefore holds both practical and societal relevance.

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As such, this study maintains three main purposes: practically, methodologically, and theoretically. Practically, the purpose of this study is to understand the pathways for creating a thriving open source chapter community, particularly for select chapters of the African OSS community, Open Source Community Africa. Methodologically, the purpose of this study is to demonstrate the utility of a collective intelligence method, Interactive Management Research (Warfield, 1976). Finally, the theoretical purpose of this study is to contribute to ongoing literature in Collective Intelligence as a burgeoning area of interdisciplinary research. In what follows we theoretically situate this study within literature on collective intelligence, motivation and learning in OSS, and OSS in the African context. We then detail our methodology, results, and discussion of relevant findings and implications.

Literature Review

The study of collective intelligence (CI) is a burgeoning interdisciplinary field seeking to understand how groups of individuals act in ways that appear more intelligent than any single member alone (Malone, Laubacher, & Dellarocas, 2009). Given the interdisciplinarity of CI, intelligence is broadly defined and traverses both the natural sciences (Couzin, 2007) and social sciences (Wooley et al., 2010). For example, early examples of collective intelligence include families (Malone & Bernstein, 2015), armies (Pentland, 2014), and companies (Malone et al., 2009), but the field has gained new urgency and novelty with the advent of large-scale, technology-mediated collaboration (Malone et al., 2009), animal behavior (Couzin, 2007), and human-computer interaction (Nielsen, 2012). For the context of this study, we are particularly interested in the collective intelligence of groups of people aiming to co-create pathways for a thriving community.

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A central focus of collective intelligence research is the study of groups. Woolley, Aggarwal, and Malone (2015) highlight that a team's collective intelligence is a much stronger predictor of performance than the abilities of individual members. Furthermore, key variables influencing group collective intelligence include: social sensitivity and communication (Woolley et al., 2010), cognitive diversity (Aggarwal & Woolley, 2013), transactive memory systems (Argote & Ren, 2012), and group learning (Argote, 1999; Edmondson, 1999). For this study, we are particularly interested in the process of group learning and how groups collaboratively learn with the intention of their learning informing action.

Learning is both a process and an outcome of collective intelligence. It encompasses changes in group cognition, routines, and performance as a result of experience (Argote, 1999; Fiol & Lyles, 1985). There exist two main types of group learning: a) knowledge acquisition and b) process improvement. *Knowledge acquisition* occurs when groups learn relevant expertise, how to use tools, and how to coordinate activities. *Process improvement*, on the other hand, is focused on how groups refine their methods of collaboration, communication, and decision-making. As demonstrated through the method of this study, Interactive Management Research, we place heavy focus on group learning for processual improvement.

Additionally, when understanding group learning, one must explore motivation. Motivation is also a critical driver of collective intelligence, particularly in contexts where participation is voluntary or not directly incentivized, such as OSS communities. Drawing on self-determination theory (Deci & Ryan, 1985), studies have shown that contributors to collective (i.e., open source) projects are motivated by both intrinsic factors (e.g., enjoyment, learning, personal challenge) and extrinsic factors (e.g., career advancement, reputation, monetary rewards) (Bitzer et al., 2007; Hars & Ou, 2002; Lakhani & Wolf, 2005; Roberts et al.,

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2006). More specifically, OSS developers often report contributing to the inherent satisfaction of problem-solving and the opportunity to learn from peers (von Krogh et al., 2012; Ye & Kishida, 2003). In the context of this study, we pay close attention to motivators for open source chapter leads in facilitating collaborative learning and strategic planning.

Finally, sustainable OSS projects require not only motivated individuals but also supportive institutions and practices that reinforce participation. This attention to institutional support is particularly true in the Global South context where OSS communities have motivation yet lack the institutional resources (Gillwald et al., 2022; Hossain, 2021). As such, Studying OSS through the lens of collective intelligence can yield insights into the mechanisms of group learning, the interplay of motivation and social practice, and the design of systems that harness distributed expertise for innovation and problem-solving. Research of Global South open source software communities, especially within the African context, offers a rich context for research on group communication, motivation, and learning. Given the Global South context that is overly under-resourced, under prioritized, and often ignored, our research aims to address the practical purpose of understanding the pathways for creating a thriving open source chapter community, particularly for select chapters of the African OSS community, Open Source Community Africa.

In what follows, we detail and demonstrate a method for collaborative learning and participatory action research, Interactive Management Research (Warfield, 1976). From the study, we aim to understand the pathways for creating a thriving open source chapter community, particularly for select chapters of the African OSS community, Open Source Community Africa. Furthermore, we demonstrate the utility of Interactive Management Research (Warfield, 1976) to generate and analyze data that contributes to the ongoing literature in Collective Intelligence as a burgeoning area of interdisciplinary research.

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Methods

Open Source Community Africa (OSCA)—a non-profit social movement for teaching open source software (OSS) and building OSS community—holds successful events throughout the continent via local chapters and an annual general festival in Nigeria. OSCA’s flagship annual event, the Open Source Festival, attracted more than 2,000 participants, plus global speakers, and donations in 2023. After funding cuts led to the cancellation of the 2024 Open Source Festival, our team led a workshop at the conclusion of OSCA’s Sustain Africa and Chapter Leads Summit to share knowledge and plan for thriving open source communities in the upcoming year.

As an umbrella organization, OSCA can only provide limited support to local OSCA chapters throughout Nigeria, Kenya, Uganda, Cameroon, Togo, Zambia, Uganda, and Mauritius. Most OSCA chapters struggle to attract contributors, fund their activities, and advertise their projects. These constraints leave local chapters’ efforts invisible (D’Ignazio & Klein, 2020; Geiger et al., 2021), thereby perpetuating the difficulty of attracting contributors and funding. Co-organizing events with these chapters also proves difficult due to the intermittency of electricity and internet, and flights cost as much as those to Europe. Nevertheless, African OSS communities remain important for the occupational learning (Fang & Neufeld, 2009; Kaynak, 2024) necessary to sustain human infrastructures and create benefits that extend to everyone.

Such challenges highlight a crucial need for validated techniques for creating OSS communities that are thriving, energized, and actively learning (Spreitzer & Sutcliffe, 2007). Communities in other contexts have used a participatory learning technique called Interactive Management Research (IMR; Warfield, 1976) to solve collective management problems. For example, communities have developed vision statements for American Indian Tribes (Broome,

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1995), plans for peace-building in Cyprus (Broome, 2004), Irish wellbeing (Hogan et al., 2015), and European ocean literacy (McCauley et al., 2019). But to date, IMR's implementation has focused on co-located communities instead of regionally distributed OSS communities, particularly in resource constrained settings like the Global South. Here we detail the research methodology used with OSCA chapter leads.

Procedures

Interactive Management Research (Razzante et al., 2023; Warfield, 1976, 1994) is a grounded, participatory action research method that aids groups in designing action plans aimed to address a pressing collective issue. The collective issue for the workshop—as named by OSCA leadership—was how to create thriving open source chapter communities. With this context, the IMR process unfolded in five main steps: 1) generate ideas in response to a guiding question, 2) select a subset of the ideas (i.e., Factors) that are most salient to the group, 3) create a flowchart structure that represents the participants' perceived steps for addressing the issue, 4) engage participants in a discussion about the flowchart and modify if necessary, and 5) create an action plan based on the results. In what follows we detail the five steps along with data generated by participants.

Step 1: Generate ideas. The first step of IMR is for participants to generate solutions in response to the guiding question: “In your experience, what are key factors of a thriving OSS community?” There exist various ways to generate responses to the guiding question: in-person workshops, online asynchronous surveys, choosing pre-identified solutions from literature, subject matter experts, leadership, etc. For this study, we used already-recorded responses from a previous online asynchronous survey distributed to OSCA members (see Bighash et al., Under Review). One of the questions from the survey asked OSCA members to respond to the

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following question: In your experience, what are the key factors of a thriving OSS community?

In total, 451 participants generated 145 original responses. Responses ranged from a macro-level focus (e.g., a unique community culture) to the micro-, intrapersonal level (e.g., presence of devoted members). We used these 145 ideas in step 2 of IMR: select a subset of the ideas for structuring in step 3.

Step 2: Select a subset of ideas (factors). The second step involved participants reducing the 145 original ideas to the eight most important Factors to be used for structuring in the next step. We recruited 16 chapter leads to take part in a day-long IMR workshop.¹ Given the limited amount of time with participants, we decided to break the selection of subset Factors into two parts. For the first part, we administered an online asynchronous survey and asked participants to filter through the 145 ideas generated from step 1 and to vote for their top 20 ideas. Participants reduced the 145 ideas to their collective top 25 through voting. We then used these 25 ideas at the beginning of the in-person workshop.

The second part of selecting a subset of ideas involved chapter leads reducing the 25 ideas—as identified in part one—to eight Factors to be used in step 3. This second part was conducted at the in-person workshop in July 2024 after previewing the agenda for the day (see Table 1). Of the 16 chapter leads recruited for the IMR workshop, 14 attended the full-day session.

The first workshop exercise began when Rob instructed participants to vote for their top 6 ideas from the 25 vote-getters from part one. The 25 ideas were posted on paper around the room and participants were given stickers to use as their method of voting. Voting involved

¹ The IMR workshop was part of a larger mixed-method longitudinal experimental design study involving 36 total chapter leads. We randomly selected participants for their participation in either the IMR workshop or a traditional workshop to compare the efficacy of each toward inspiring action for creating thriving chapter communities. Those that could not attend Sustain Africa nor the Chapter Lead Summit were placed in a third control group.

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participants walking around the room and placing stickers on their top ideas—with one vote allotted per idea.

Table 1

Agenda for the IMR Workshop

Workshop Component	Details
Opening	Remarks by OSCA co-founder, Samson Goddy.
Introductions	Chapter leads & Rob introduced themselves.
Review Context Statement	“Open Source Community Africa (OSCA) is invested in creating the conditions for thriving open source software chapters. Our aim in this workshop is to identify key conditions of a thriving OSS chapter community and a pathway for building thriving chapters.”
Objective Reminder	Participants were reminded that the goal was to identify key conditions of a thriving OSS community and pathways for building thriving chapters.
IMR Steps	Step 1: Generate ideas for thriving OSS communities (145 ideas generated; already completed). Step 2: Reduce the list to eight most important factors. Step 3: Use Interpretive Structural Modeling (ISM) to map interdependencies among factors. Step 4: Discuss and interpret ISM model’s meaning and significance for OSCA chapters.
Recap	Rob reminded participants of step 1 and the asynchronous voting from step 2 (part one).

As a result of the voting process, participants perceived the following as the top eight Factors for creating a thriving open source community: (1) diversity of folks in the community, (2) funding for events, (3) good onboarding process, (4) ability to build sustainable projects, (5) opportunities for the community members, (6) community gatherings and events, (7) presence

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and safety to share, learn, and grow, and (8) existence of relevant learning resources (see Table 2). To help the group become more familiar with the Factors, Rob instructed participants to pair up, clarify a distinct Factor, then present the factor and clarification back to the group. These top eight vote-getters and their clarifications were then used for structuring in step 3.

Table 2

Participants' eight Factors of a thriving OSS chapter community and their clarifications

Factor	Clarification
Diversity of folks in the community	A gathering of people from different backgrounds, genders and technical capability.
Funding for events	Money to support open source chapter efforts (programming, events, coordinating, project management, marketing, food, etc.).
Good onboarding process	A series of steps that a new member should go through to understand the vision, purpose, goals, and setting clear expectations whilst providing necessary resources for this person to thrive.
Ability to build sustainable projects	A project that solves a local or international problem that is scalable and maintainable.
Opportunities for the community members	Opportunities a thriving OS community has to gain (job roles, mentorships, career development, resources, etc.).
Community gatherings	Periodic events to learn, inspire, and build.
Presence and safety to share, learn, and grow	Creating a safe space for everyone to feel comfortable to contribute in any way possible.
Existence of relevant learning resources	Helping new and old contributors/members to get up and running seamlessly with such community projects.

Step 3: Identify a pathway for creating a thriving OSS chapter community. To know the top eight perceived Factors is valuable information on its own. However, step 3 helped participants define the interdependencies among the eight Factors. Defining the perceived

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interdependencies is what helps a group create a sequential action plan. The tool we used for helping the group understand the perceived interdependencies was Interpretive Structural Modeling (Warfield, 1976).

Interpretive Structural Modeling (ISM; Warfield, 1976) is a computer-based software program that uses transitive logic through a matrix to reflect how a group perceives the relationship among the eight Factors. Rather than focusing on all Factors at the same time, ISM isolates two Factors in the following question: “In the context of creating a thriving OSS chapter community, does [Factor 1] significantly promote [Factor 2]? Participants were then to choose [yes] or [no] (see Figure 1).

The screenshot displays a software interface for Interpretive Structural Modeling. At the top, a header reads "In the context of creating a thriving OSS chapter community". Below this, a question is presented: "does [Factor 1] significantly support [Factor 2] ?". Factor 1 is "Diversity of folks in the community (1)" and Factor 2 is "Funding for events (2)". A blue arrow points from Factor 1 to Factor 2 with the label "significantly support". At the bottom of the interface, there are two buttons: "YES" (highlighted with a green border) and "NO" (highlighted with a red border).

Figure 1. Screenshot of the Interpretive Structural Modeling software interface.

The statement aimed to accomplish two goals. First, participants were reminded of the context: creating thriving OSS chapter communities. Second participants were encouraged to focus on whether Factor 1 *significantly supported* Factor 2. The significantly supporting relationship encouraged participants to look for two relationships: a) whether Factor 1 supported Factor 2, and b) whether that relationship was significant or not. Another way to help

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participants think of a significantly supportive relationship was to imagine the yes/no question on a scale of 1-5 with 5 being significantly supportive and anything below as merely supportive or not supportive at all. Selecting [yes] to only significantly supportive relationships helped the ISM software program create a flow of influence using transitive logic.

The ISM software then introduced relational questions for each of the eight Factors to understand how the group perceived the relationship among the eight. This process continued until all interdependencies were explored directly or through logical deduction resulting in a flowchart (see Figure 2). In the case that two Factors significantly support one another, the ISM software reflects this mutual relationship by pairing the Factors in the same box.

In addition to the flowchart itself, qualitative discussion was generated when participants deliberated on whether to say [yes] or [no]. A [yes] was only recorded in the ISM software program when the group had a 2/3rds majority vote. After a [yes] was selected, Rob asked participants to share why they perceived the relationship as significantly supportive. If the group reached less than a 2/3rds majority, we would pause voting and hear from one [yes] and one [no] before voting again. The group re-voted with the simple majority as the final response. As a method, Interactive Management Research, when used for group learning, is focused on the deliberative process. All participant commentary was audio-recorded, transcribed, and anonymized for data analysis.

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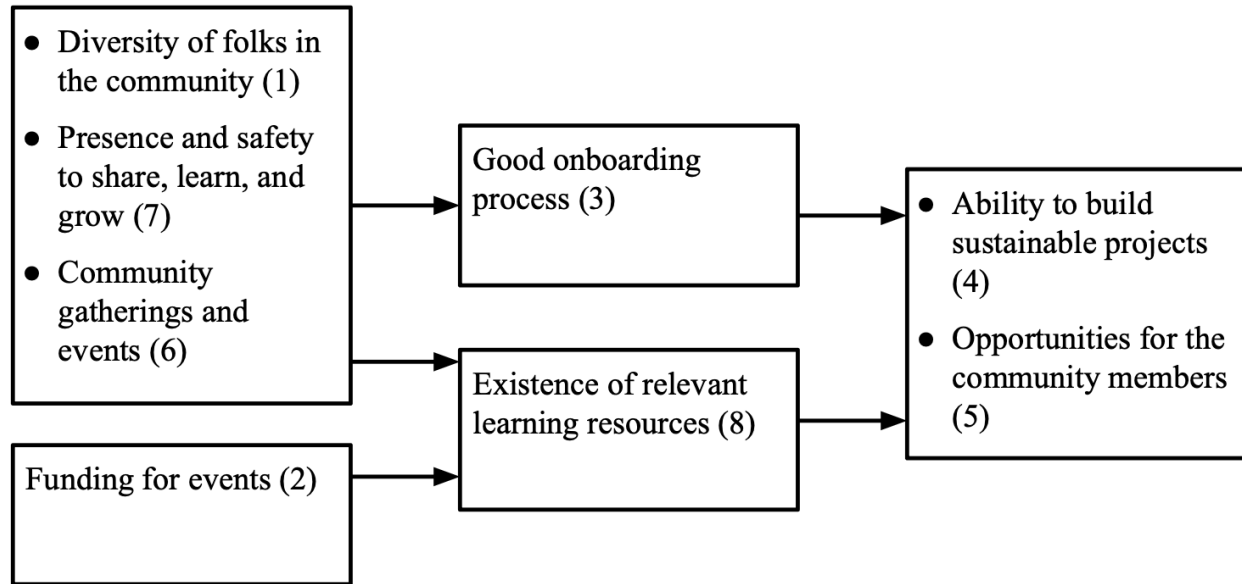


Figure 2. Interpretive Structural Modeling flowchart. Arrows indicate the perceived flow of influence from one Factor to the next.

Step 4: Member reflections. Whereas step 3 required participants to think granularly about two Factors at a time, the member reflection in step 4 encouraged participants to evaluate the larger picture of what they created in the flowchart. The member reflection began with Rob leading the group through a “walk”—or interpretation—of the flowchart followed by the participants’ reflections, requests for modifications, or further interpretations given the deliberation process. Time for member reflections was important for two main reasons. First, member reflections allowed for quick feedback among participants. Such feedback was helpful when interpreting the findings of the flowchart. Second, it offered participants the opportunity to amend the flowchart if they believed the flowchart mis-represented their thinking, although that was not the case. All member reflections were audio-recorded, transcribed, and anonymized for data analysis.

Step 5: Action planning. The final step of IMR involved the group designing an action plan based on the collective perceived interdependencies among the eight Factors presented in

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the flowchart. For the action planning process, Rob asked each chapter-lead to consider a year-long initiative for creating a thriving chapter community when it came to their own chapter. Chapter leads created 1-2 posters of content that they then presented to their peers. All participant commentary was audio-recorded, transcribed, and anonymized for data analysis. Although the efficacy of participants' plans is insightful, that data is beyond the scope of this particular study and is reserved for a follow-up study using a mixed-method experimental design.

Data Analysis

The Interactive Management Research method created various data points (audio recordings, hand-written posters, the ISM flowchart, etc.). For the scope of this study, we only used the ISM flowchart and transcripts of audio-recordings in the data analysis phase. The process of data analysis occurred in three layers. First, and foremost, the flowchart created by participants through Interpretive Structural Modeling is the central data output from the ISM portion of IMR. We first analyzed the flowchart to interpret its meaning as a stand-alone data source.

The second layer consisted of using "linkage rationales" (Razzante et al., 2020) to further interpret participants' qualitative comments during the deliberative process. There are three types of linkage rationales: a) general linkage rationale (a [yes] rationale from one Factor to any Factor in the flowchart), b) adjacent linkage rationales (a direct [yes] rationale from one Factor to an immediately succedent Factor), and c) inter-thematic linkage rationales (used only when combining multiple flowcharts into one aggregate flowchart) (see Table 3). For this study, we exclusively used *adjacent linkage rationales* to isolate participants' comments to explain why one Factor significantly promotes a succeeding Factor.

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Table 3

Linkage rationale definitions and examples

Linkage Rationale	Definition	Example from Figure 2
General	<i>Any</i> [yes] rationale that connects one Factor to any other Factor in the flowchart, regardless of position.	(2) Funding for events → (4) Ability to build sustainable projects
Adjacent	A <i>direct</i> [yes] rationale that connects one Factor to an immediately succeeding Factor in the flowchart.	(2) Funding for events → (8) Existence of relevant learning resources
Inter-Thematic	Any [yes] rationale between Factors from different themes. Only used when combining multiple flowcharts into one aggregate metastructure.	Not applicable. See Razzante et al., 2020 for examples.

The final layer included a phonetic-iterative analysis (Tracy, 2020) of participants' member reflections and action plans. More specifically, we analyzed participants' audio transcripts using descriptive codes (Wolcott, 1994) and process codes (Charmaz, 2008) as primary-level codes in the first coding cycle to capture initial descriptive patterns. We then refined primary-level codes into more abstract secondary-level codes through subsequent cycles that integrated theory, reflexivity, and practical significance. The themes we produced through our data analysis demonstrated how participants *intended* to use the flowchart data to drive their strategic planning efforts for the upcoming year. In what follows we provide the results across all three layers of data analysis.

Results

This study aimed to help chapter leads answer the following research question: What are the pathways for creating a thriving open source chapter community? It is important to remember

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that the following results reflect participants' *collective perception* and are not generalizable to every open source community. In other words, a different set of participants may have created a unique set of Factors and/or identified a uniquely distinct relationality among Factors. In what follows, we share the results as generated by the 14 OSCA chapter leads who took part in the IMR workshop.

Interpretive Structural Modeling Flowchart

According to the chapter leads' ISM flowchart, participants perceived the strongest Factors for creating a thriving open source chapter community to be: (1) diversity of folks in the community, (7) presence and safety to share, learn, and grow, (6) community gatherings and events, and (2) funding for events. The presence of these four Factors increases the likelihood that chapters would present (3) a good onboarding process and (8) maintain an existence of relevant learning resources. Such resources and onboarding experience increases the likelihood that chapters maintain an (4) ability to build sustainable projects and provide (5) opportunities for the community members.

Another way to interpret the flowchart is by beginning with the end. If chapter communities want the ability to build sustainable projects and provide opportunities for the community members, chapters—according to the participants' perceptions—should first consider their onboarding process and existing learning resources. Without a good onboarding process or learning resources, chapters may experience challenges of getting people to join communities with the creation, maintenance, and sustaining of open source projects. In other words, onboarding and learning resources are the conduits between getting people to join chapters and the sustainability and growth of chapters and their members.

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Whereas the flowchart shared a high-level snapshot of chapter leads' perceived pathway for creating a thriving open source community, their linkage rationales are what provided more nuance. In the following section, we provide commentary from participants themselves to help analyze what the flowchart means through their experience and expertise.

Linkage Rationales

Participants engaged Interpretive Structural Modeling in step 3 to locate interdependencies among Factors—providing qualitative rationales for [yes] responses. These “linkage rationales” (Razzante et al., 2020) helped make sense of the flowchart through the participants' own words. In total, the participants generated 37 adjacent linkage rationales. In this second layer of analysis we used the 37 rationales to further interpret the flowchart in Figure 2.

According to participants' perceptions, the pathway to a thriving open source chapter community begins with who is in the room. (1) A diversity of folks in the community sets the stage for every subsequent layer of community-building. Participants described how diversity shapes the earliest interactions a new member has with the community, particularly during onboarding. As M3 shared, “part of the onboarding process is you want to consider everybody that is coming to your community.” M7 elaborated on this point, explaining that, “What gets me to join a particular community is basically diversity.”

Furthermore, a diversity of folks in the community requires leaders to redesign onboarding processes that are more flexible, more accessible, and more aligned with a wider range of contributors. As M11 highlighted,

I believe if you have a diverse community, people coming from the north, people coming from the south and east, people who are more experienced than you, people who are new

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to good the onboarding process would be much more inclusive, and it would be able to introduce everyone and get started in your community.

Without such cultural awareness, an onboarding process risks leaving people behind in recruitment, onboarding, or during organizational socialization.

(7) The presence and safety to share, learn, and grow emerged as another foundational layer. Participants described safety not just as a feeling, but as an enabling condition—one that determines whether members engage in the first place. M18 emphasized this connection when they said, “human beings by their nature are social animals, we tend to gravitate towards where other people are going. And we tend to find safety and security like in groups.” M6 echoed this point stating, “if the community is not safe or it doesn't support learning or growth, we can never even join the community and try to have an onboarding process.”

Yet the influence of safety extends beyond onboarding. It also shapes how learning happens and whether members feel confident to explore what the community has to offer. As M5 explained, “when you have members that are willing and feel safe to share, learn, and grow together, it significantly supports that [collective learning].” In this way, safety invites people in and supports people in their development journey. A thriving community does not just attract diverse people; it ensures members feel secure enough to participate, grow, and contribute meaningfully.

Also of high influence, (6) events and community gatherings serve as key mechanisms for facilitating both diversity and safety—both in person and virtually. As M18 shared, gatherings and events are the gateway to socialization within a community, “But I don't think you can just decide to wake up one morning and say I should join a community. Someone has to introduce you to that community and it's usually through events and gatherings.” Once members

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join a community, participants identified events as the entry point for sharing resources and building connections. For example, M12 noted, “if you're having a community call every week to onboard new people—that also can count that as a gathering—you'd be able to get feedback [on if] it was clear to the members.” M11 affirmed that “events allow people to meet... It's one of the best ways to attract diversity.”

The combination of diverse community gatherings with the safety to express vulnerability shapes how new members show up and how they begin to learn. When it comes to funding, however, participants recognize its influence, yet are not convinced it is the only necessity for a thriving community. As demonstrated by M18's comment, funding is important, yet also not required for building thriving communities and projects: “I also think funding is necessary, what keeps a project going, it is important, but I think whenever you're starting a project, it's not about the funding, it's about the goals and mission.” This sentiment is echoed by M7, “I feel you need to have a strong rationale to get funding, or you need to have those goals and expectations before you can get funded for events.” At the same time, however, funding is supportive for people needing to travel to events. M11 shared that, “So I think when there is funding for more events, people are able to come together to have more events.” Where funding has its strongest influence is bringing people together to share relevant learning resources.

With (3) a good onboarding process and the (8) existence of relevant learning resources in place, the pathway then shifts toward sustainability and further opportunities for growth. Participants described onboarding as the place where members first gain clarity about how to contribute to projects (4). As M7 reflected on the current IMR workshop,

We felt safe and we felt that our ideas were welcome, and that's why it has provided this opportunity. Maybe this project could expand, get funding, and—of course—as part of

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the opportunities we defined here, one of those [opportunities] could be mentorship and learning.

M2 added that onboarding can be a place to highlight opportunities: “I think opportunities need to be existent before and during the onboarding process. You need to be communicating to the new members coming in.” And once in the community, opportunities keep members excited and motivated. As M6 highlighted, “by having opportunities, it kind of motivates your community members to contribute to projects.”

In turn, the (4) ability to build sustainable projects and (5) opportunities for the community members are the perceived by-product of a good onboarding process and the existence of relevant learning resources. As M13 described, “we give them a lot of learning resources and share other tools for them to thrive. I think that's what a community is all about.”

M8 added the function of sharing such resources when it comes to project maintenance,

Learning resources support sustainability in that people are able to learn even when you're not there. You don't need to be physically present or hold gatherings as long as they have the learning resources...that project will be sustainable.

These comments point to an important insight: sustained contribution does not emerge from passion alone; it is scaffolded through processes of orientation, education, and support.

Opportunities for the community loops back to reinforce project sustainability.

Participants noted that when people gain something meaningful—like a job, mentorship, or skill development—from the community, they are more likely to give back. These comments suggest a thriving open source chapter community is cyclical instead of a linear pursuit of progress. That is, a thriving open source chapter community begins with inclusion and safety, deepens through learning and contribution, and thrives when members have access to real opportunities for their

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own development and growth. Those opportunities, in turn, build loyalty, leadership, and long-term sustainability, especially when members re-integrate their own growth into their communities. In short, the pathway to a thriving OSS chapter community is not linear; it is iterative, relational, and deeply rooted in human connection.

Reflections and Action Planning

The final layer of analysis involved referring to participants' member reflections and action plans. Here we present four themes of participants' action plans: a) cultivating inclusive participation through diversity and safety, b) structuring developmental pipelines through onboarding and learning, c) building partnerships and programs to sustain projects and create opportunity and d) institutionalizing feedback loops and adaptive planning. When reading, it is important to remember that these are intended plans and not verified evidence that the plans, if enacted, create thriving open source communities.²

Cultivating participation through diversity and safety. Participants' strategic planning efforts revealed that the pathway to a thriving open source chapter began with an intentional focus on cultivating inclusive participation. The first priority for many chapter leads was increasing the diversity of who is in the room and fostering a climate of psychological safety. Participants frequently cited these two factors as foundational—both for ethical reasons and for their influence on the other elements of the flowchart. For example, M18 recognized that the current membership of their chapter was overwhelmingly male, attributing this to both cultural norms and structural barriers. Yet, instead of accepting this as a fixed condition, M18 outlined a strategy to pilot women-only events aimed at increasing participation among women. Similarly, M6 and M5 described plans to formalize their chapters' codes of conducts as a way to create

² We are conducting a follow up longitudinal mixed-method study to assess the efficacy of these plans and the actions taken by chapter leads for creating thriving communities.

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safer and more inclusive environments where members can contribute without fear of shame or exclusion.

In addition to inclusive event planning and policies, M1 emphasized creating a safer chapter atmosphere through clear communication norms. For M15, this process was built into a year-long strategic cycle that started with creating a diverse leadership team, followed by building communication channels, and ultimately implementing activities that reflected the makeup and needs of the community. M14 added another layer by describing a welcoming protocol in which newcomers receive an email that introduces the community's values and norms, including its stance on diversity and inclusion. Such culture-building is certainly a technical component of onboarding, yet also extends to create such a safer and more inclusive cultural atmosphere for current and future members.

Finally, several participants linked safety and inclusion directly to language and accessibility. M7 and M13 described efforts to localize learning content in their chapter to ensure that non-English speakers could fully participate in their chapter's programs. Language accessibility was central to their effort to include a wider range of participants. This is especially important for a continent with over 2,000 spoken languages. In these examples, we see how participants drew directly from the flowchart logic: that diversity and safety are not only desirable, but necessary preconditions for effective onboarding, meaningful participation, and long-term sustainability. In short, the community cannot thrive until everyone feels they belong.

Developing members through onboarding and learning. Once participants identified who is in the room and how to create a safe and inclusive climate for engagement, they turned their attention to how members grow. Onboarding and learning resources emerged as key mechanisms for member development. Nearly every chapter described a need to reevaluate or

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redesign their onboarding process to make it more structured, inclusive, and reflective of the different skill levels within the community. This was not surprising given the heightened attention onboarding received during the ISM voting process. For example, M11 provided a vision in which onboarding becomes a tiered, step-by-step experience aligned to a member's current ability; whether they were a total beginner or an experienced contributor. M12 similarly planned to review and revise onboarding guidelines, ensuring that the code of conduct was understandable and that resources were easy to access.

Participants also expressed the need to design onboarding as an ongoing process rather than a one-time event. M5 explained that their chapter's current onboarding process was limited to adding new members to a WhatsApp group. In response, M5 planned to develop onboarding documents and integrate new members sooner and more intentionally. An additional strategy from M15 involved framing onboarding within a three-phase strategy for the year: 1) establish structure, 2) implement activities, and then 3) evaluate the impact of those efforts. For this M15, onboarding was about integrating people into the developmental pipeline of the chapter in addition to welcoming people into the chapter.

Finally, participants emphasized the need for high-quality, relevant, and accessible learning resources. M8 proposed the creation of learning tracks that map out pathways from beginner to expert in different domains such as Python, project management, and technical writing. M13 and M7 described plans to create centralized hubs—through Discord or Google Sites—where members could access curated content in various languages. These efforts reflected a shared belief that thriving communities need not only motivation but also support to turn motivation into development opportunities.

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Building partnerships to sustain projects and create opportunity. Participants also focused their attention on the development of meaningful projects and the creation of opportunities for members beyond the chapter community. Many viewed project work as both the integral work of the community yet also the bridge to professional advancement. For example, M6 described focusing on projects that directly respond to local communities' challenges. One such project presented was to help students secure internships by compiling a vetted list of tech companies and contacts. M5 shared that their chapter had already launched a GitHub repository for first-time contributors, offering members a structured and low-barrier way to contribute to open source. M11 framed projects as a natural outcome of community growth. That is, once members demonstrated competence in project-building, they hoped the member would engage less-skilled members in mentorship relationships. In this case, opportunity would come from within the community,

Participants framed opportunity as both a motivator and a reward. M13 underscored the importance of spotlighting active contributors in order to incentivize participation: "those other persons [will] know that when you participate, there are opportunities for you." This sentiment was echoed by M14, who envisioned partnerships with companies that could offer financial support, internships, and job placements for chapter community members. Finally, partnerships were not limited to funding. Many chapter leads saw collaboration as essential for extending the chapter's reach and ensuring the sustainability of their work. M9, M12, and M3 planned to build alliances with local tech organizations and peer communities in order to gain access to resources such as subject matter experts.

Formalizing chapter assessments and adaptive planning. Finally, participants recognized that a thriving chapter is not a fixed destination but a continuous process of

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development. Multiple chapter leads articulated strategies for revisiting and revising their plans on a regular basis. M15, for example, broke the year into three four-month cycles with the final cycle explicitly dedicated to evaluation and reflection of the plan. M11 similarly proposed a semi-annual review process to assess whether the planning strategies were working and/or evaluate on what needed to be changed.

Participants also planned to gather feedback directly from members as a way of sourcing input and cultivating more involvement. M1 shared their intent to host virtual check-ins that would offer a platform for members to share updates on their contributions and own personal/professional development. Additionally, M12 described plans to facilitate "community calls" that would function both as social check-ins and strategic touchpoints. These feedback mechanisms were designed not only to improve programming but to keep the community emotionally connected to its goals. Finally, M5 shared that they planned to learn from what other chapters were doing and adjust accordingly. Such chapter-to-chapter exchange fosters shared learning and co-development across the larger OSCA community.

As intended, the IMR workshop encouraged participants to actively engage the flowchart in their action planning. The action plans were directly influenced by the flowchart generated by ISM. Furthermore, rather than understanding the flowchart as a static representation of their thinking, they also used it as a guide. In other words, participants treated the flowchart as a roadmap to follow, test, and improve. In this way, participants not only used the flowchart to guide the following year, they also created the conditions to evolve it over time.

Discussion

This study maintained three main purposes. Practically, the purpose of this study was to understand the pathways for creating a thriving open source chapter community, particularly for

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select chapters of Open Source Community Africa. Methodologically, the purpose of this study was to demonstrate the utility of a collective intelligence method, Interactive Management Research (Warfield, 1976). Finally, the theoretical purpose of this study was to contribute to ongoing literature in Collective Intelligence as a burgeoning area of interdisciplinary research. In what follows, we share contributions for each then conclude the study with limitations and recommendations for future research.

Practical Contributions

The perceived pathway for creating a thriving OSS chapter community—according to participants of the IMR workshop—begins with diversity and safety, deepens through learning and contribution, and thrives when members have access to real opportunities for their own development and growth. Prior research identified two core types of group learning: knowledge acquisition and process improvement (Argote, 1999), both of which were essential to chapter leads' action plans.

First, for *knowledge acquisition*, participants framed the community gatherings of diverse folk and safety to engage one another as the foundation for knowledge acquisition (Argote, 1999; Fiol & Lyles, 1985). That is, members cannot learn unless they feel safe to be vulnerable to share, learn and grow. This is important because discourse surrounding diversity, equity, and inclusion is under scrutiny, especially in resource rich countries like the United States. The silencing of diversity, equity, and inclusion initiatives can result in groups, such as OSCA shying away from seeking to create a diverse and inclusive community. Without this foundational context, the perceived likelihood of a thriving chapter community suffers because people may not feel safe to gather in a community to share, learn, and grow publicly.

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Second, for *process improvement*, participants' ability to work and learn together was reflected in their aspirations to redesign onboarding processes, create development tracks, and establish more frequent chapter check-ins. This is especially important for digitally-based chapter communities that may not have the mechanisms for getting together to co-design strategic action plans. As demonstrated by this study, participants generated great ideas regarding their chapters' onboarding plans as a result of the process of IMR. As reflected by the ISM flowchart, a good onboarding process and the existence of relevant learning resources are the conduits to get from diverse community gatherings to building sustainable projects and offering opportunities for community members. In short, if an OSCA chapter community wants to build thriving chapters, leads also need to consider how their onboarding and resources support such thriving.

Methodological Contributions

Interactive Management Research (Warfield, 1976) is a useful method for collective intelligence research, especially when seeking to conduct participatory action research. This study demonstrated how IMR is well-suited for facilitating group learning with the intention of collective action planning. This demonstration is especially relevant to the collective intelligence literature where coordinated planning efforts is a central area of study (Argote, 1999; Edmondson, 1999). The method intentionally activates group learning processes through its multi-step process of idea generation, prioritization, voting, interdependency exploration, and shared meaning-making. Each stage invites members to contribute unique knowledge and perspectives, recall shared histories, and co-construct a re-presentation of how change can happen within their chapter communities.

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More than a method for participatory action research (Razzante et al., 2023), IMR fosters what Edmondson (1999) calls, “team learning behaviors.” Team learning behaviors is a process for uncovering assumptions, testing ideas, and aligning on action. Particularly unique, IMR materializes the perceived interdependencies among Factors through the generation of a shared artifact (the ISM flowchart) that participants can use to guide strategy. This is especially important for geographically distributed OSS communities, where members work in silos.

Theoretical Contributions

Finally, this study advances collective intelligence theory by demonstrating how OSS communities generate process-level improvements and inspire collective action planning. Much of collective intelligence literature has focused on high-performing teams or digitally networked crowds (Malone et al., 2009; Malone & Bernstein, 2005; Wooley, 2010; Wooley 2015). This study, however, points to the potential for the continued study of group learning processes (Argote, 1999) that is slower and more deliberative. More specifically, the ISM flowchart and the dialogue it generated served as a snapshot of one group’s collaborative learning for process improvement. Participants did not just name what constitutes a thriving community, they negotiated how each Factor interrelates, which Factors supported one another, and where intervention is most strategic.

Additionally, this study also affirms the broader collective intelligence literature on motivations. More specifically, chapter leads demonstrated both intrinsic motivators (e.g., a desire to teach, grow, solve problems, etc.) and extrinsic motivators (e.g., job pipelines, industry connections, mentorships, etc.). Furthermore, the self-determination theory motivators of competence, autonomy, and relatedness (Deci & Ryan, 1985) resonated for OSCA leads in building competent OSS members who can thrive in their own roles, all while giving back to

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their chapter and local communities. This study, however, also highlighted how motivation alone is insufficient in resource-constrained environments. For example, communities must actively create the institutional, relational, and educational infrastructure that allows motivation to materialize into action.

Conclusion

This participatory action research study—using Interactive Management Research (IMR)—aimed to support the organizing efforts of Open Source Community Africa (OSCA) as chapter leads sought to identify pathways for creating a thriving open source chapter community. Through the collaborative learning process of IMR, participants generated a perceived roadmap and action plan for their individual chapter communities. The collective roadmap included a focus on establishing: a diversity of folks in the community, presence and safety to share, learn, and grow, community gatherings and events, and funding for events as a primary focus with a good onboarding process and providing relevant learning resources as subsequent conduits for building thriving communities where members can build sustainable projects and develop personally and professionally through opportunities. Given participants’ perceived pathways for creating thriving open source communities, we recommend the reader consider a few limitations and areas for future research.

Here we provide three limitations of this study. First, although this study provided in-depth insight into the unique experience and perceptions of a single group of chapter leads, the data and findings are only representative of the 14 chapter members that participated in the IMR workshop. The data produced from the study may be different with a separate sub-set of OSCA chapter leads. Second, the data produced a single snapshot of the participants’ perceptions one day in late July of 2024. The participants’ perceptions of what constitutes a thriving open source

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chapter community may change over time, yet this study fails to account for that possible change. A third and final limitation is that of the 14 participants, only two were outwardly presenting women. The 2:12 gender dynamic ratio of women to men is representative of the STEM fields in general and of open source software groups specifically. A diverse gender representation of participants may influence the collective perceptions of what constitutes a thriving chapter community.

Finally, we provide three areas for future research. First, this study offered a snapshot of how chapter leads perceive the relationship among the eight Factors presented in Table 2. One area for research is to revisit the same chapter leads a year later and conduct the process again after having attempted to implement their action plans. This follow-up study would offer insight into if/how the group's perceptions changed over time. Second, a follow-up study would benefit from assessing if/how the action plans were implemented through field observations. Such observations would provide insight into how chapter leads used data from the workshop—if at all—to inform their efforts to create thriving chapter communities. Finally, a future study would benefit from assessing, quantitatively, the chapter members' and chapter leads' perceived efficacy of their chapter's ability to build a thriving open source community. Questions about goal and process clarity, group success/failure, and commitments to organizational change, individual thriving, and intrinsic/extrinsic motivators would provide great insight into the lasting impact of the IMR workshop.

References

- Aggarwal, I., & Woolley, A. W. (2013). Do you see what I see? The effect of members' cognitive styles on team processes and performance. *Organizational Behavior and Human Decision Processes*, 122, 92-99.
- Argote, L. (1999). *Organizational Learning: Creating, Retaining, and Transferring Knowledge*. Kluwer.
- Bighash, L., Mahari, T., Meluso, J., Raheem, S., & Razzante, R. (Under Review). How African open source software community members thrive: The role of communication visibility and community identification. Manuscript submitted to *Journal of Computer-Mediated Communication*.
- Bitzer, J., Schrettl, W., & Schröder, P. J. (2007). Intrinsic motivation in open source software development. *Journal of Comparative Economics*, 35(1), 160-169.
- Broome, B. J. (1995). The role of facilitated group process in community-based planning and design: Promoting greater participation in Comanche tribal governance. In L.R. Frey (Ed.), *Innovations in group facilitation: Applications in natural settings* (pp. 27-52). Cresskill, NJ: Hampton Press.
- Broome, B. J. (2004). Reaching across the dividing line: Building a collective vision for peace in Cyprus. *International Journal of Peace Research*, 41(2), 191-209. doi: 10.1177/0022343304041060
- Charmaz, K. (2008). Grounded theory. In R. M. Emerson (Ed.), *Contemporary field research: Perspectives and formulations* (2nd ed., pp. 81–110). London, UK: Sage.
- Couzin, I. D. (2007). Collective minds. *Nature*, 445(7129), 715. <https://doi.org/10.1038/445715a>

THRIVING OPEN SOURCE COMMUNITIES

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum Press.

D'Ignazio, C., & Klein, L. F. (2020). *Data feminism*. MIT Press.

Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, 44(2), 350-383.

Eghbal, N. (2016). *Roads and bridges: The unseen labor behind our digital infrastructure*. Ford Foundation.

Eghbal, N. (2020). *Working in public: The making and maintenance of open source software*. Stripe Press.

Fang, Y., & Neufeld, D. (2009). Understanding sustained participation in open source software projects. *Journal of Management Information Systems*, 25(4), 9-50.

Geiger, R. S., Howard, D., & Irani, L. (2021). The labor of maintaining and scaling free and open-source software projects. *Proceedings of the ACM on Human-Computer Interaction*, 5(CSCW1), 175:1-175:28. <https://doi.org/10.1145/3449249>

Gillwald, A., Johnson, D., Cloete, L., Hadzic, S., Kiden, S., Rens, A., & Phokeer, A. (2022). *African open source digital infrastructures: Evaluating the landscape*. Research ICT Africa.

Hars, A., & Ou, S. (2002). Working for free? Motivations for participating in open-source projects. *International Journal of Electronic Commerce*, 6, 25-39.

Hogan, M. J., Johnston, H., Broome, B. J., McMoreland, C., Walsh, J., Smale, B.,...Groarke, A. M. (2015). Consulting with citizens in the design of wellbeing measures and policies: Lessons from a systems science application. *Social Indicators Research*, 123, 857-877. doi: 10.1007/s11205-014-0764-x

THRIVING OPEN SOURCE COMMUNITIES

Hossain, Z. (2021). *African open-source digital infrastructures: Evaluating the landscape*.

Research ICT Africa.

Kaynak, E. (2024). Leveraging learning collectives: How novice outsiders break into an occupation. *Organization Science*, 35(3), 948-97

Lakhani, K. R., & Wolf, R. G. (2005). Why hackers do what they do: Understanding motivation and effort in free/open source software projects. In J. Feller, B. Fitzgerald, S. Hissam, & K. R. Lakhani (Eds.), *Perspectives on Free and Open Source Software* (pp. 3-22). MIT Press.

Malone, T. W., Laubacher, R., & Dellarocas, C. N. (2009). Harnessing crowds: Mapping the genome of collective intelligence. *MIT Center for Collective Intelligence Working Paper*.

Malone, T. W., & Bernstein, M. S. (2015). *Handbook of collective intelligence*. MIT Press.

Nielsen, M. (2012). *Reinventing discovery: The new era of networked science*. Princeton

University Press. Markus, M. L. (2007). The governance of free/open source software projects: Monolithic, multidimensional, or configurational? *Journal of Management and Governance*, 11(2), 151-163.

McCauley, V., McHugh, P., Davison, K., & Domegan, C. (2019). Collective intelligence for advancing ocean literacy. *Environmental Education Research*, 25(2), 280-291.

Pentland, A. (2014). *Social physics: How good ideas spread—the lessons from a new science*. Penguin Press.

Razzante, R., Broome, B., Tracy, S. J., Hogan, M., & Chawla, C. (2020). Co-Constituting pathways of an inclusive workplace: A participant generated methodology. (Doctoral dissertation). Available from ProQuest dissertations and theses global database. ProQuest Number: 27955759.

THRIVING OPEN SOURCE COMMUNITIES

- Razzante, R., Hogan, M., Broome, B., Tracy, S. J., Chawla, D., & Skurzak, D. (2023). Interactive management research in organizational communication. *Management Communication Quarterly*, 37(4), 971-984. DOI: 10.1177/08933189231159386
- Roberts, J. A., Hann, I., & Slaughter, S. A. (2006). Understanding the motivations, participation, and performance of open source software developers: A longitudinal study of the Apache projects. *Management Science*, 52(7), 984-999..
- von Krogh, G., Haefliger, S., Spaeth, S., & Wallin, M. W. (2012). Carrots and rainbows: Motivation and social practice in open source software development. *MIS Quarterly*, 36(2), 649-676.
- Warfield, J. N. (1976). *Societal systems: Planning, policy and complexity*. New York, NY: Wiley.
- Warfield, J. N. (1994). *Science of generic design: Managing complexity through systems design*. Ames: IA: Iowa State Press.
- Wolcott, H. F. (1994). *Transforming qualitative data: Description, analysis, and interpretation*. Thousand Oaks, CA: Sage.
- Woolley, A. W., Chabris, C. F., Pentland, A., Hashmi, N., & Malone, T. W. (2010). Evidence for a collective intelligence Factor in the performance of human groups. *Science*, 330(6004), 686-688.
- Ye, Y., & Kishida, K. (2003). Toward an understanding of the motivation of open source software developers. In *Proceedings of 2003 International Conference on Software Engineering* (pp. 419-429).