Chapter 3

Literature Review

To Do:

* Read through “Team Success” in NVIVO
* Read through “Network Treatments” in NVIVO
* Read and Summarize:
  + Delivering impact research team (Bednarek et al. 2023)
  + Network Interventions (Valente 2012)
* Draft an outline of ideas for the below document
* Add Bland et al., 2005 summary work into work below as noted.
* Norton et al 2017
  + Researched a single discipline of researchers by surveying individuals who were subscribed to a disciplinary newsletter. The survey collected data about the participants’ demographics, details about their experience in the discipline, and questions used to form advice and collaboration networks. Check Out the Metrics!
* Okraku et al 2017

Introduction

~~According to (Love et al. 2021), there's limited research exploring the effectiveness of scientific team support strategies like training and team performance metrics, despite considerable investment in collaborative and interdisciplinary projects.~~  ~~(Love et al. 2021) investigates how scientific productivity, advice, and mentoring networks within an exemplary interdisciplinary scientific team contribute to their success, focusing on the team's training processes and their impact on productivity and expertise. Love et al.’s hypothesis suggests a positive correlation between mentoring, advice networks, and scientific productivity, indicating that these elements are integral to the success of interdisciplinary scientific teams. Love et al. uses mixed methods including SNA.~~

The survey included principal investigators, postdocs, graduate and undergraduate students, and external collaborators (Love et al. 2021). Conducted annually from 2015 to 2019, the survey asked about the extent and type of collaborations, including research publications, scientific presentations, grant proposals, and student committee participation (Love et al. 2021). It also inquired about relationship types like learning, leadership, mentoring, advice, friendship, and leisure activities (Love et al. 2021). [The supplementary material only shows a mid-point survey, which is what SNAP used for the phase one small-teams SNA project (Love et al. 2021).]

The survey data were analyzed using R Studio and UCINET software, with Visone used for visualizations. Three network measures were derived: scientific productivity, mentoring, and advice (Love et al. 2021). These measures were assessed using average degree, in-degree, and out-degree metrics (Love et al. 2021). The study compared advice, mentoring, and scientific productivity networks, predicting a positive correlation (Love et al. 2021). The Quadratic Assignment Procedure was used for statistical significance testing (Love et al. 2021).  
  
Other methods used in this study include case study selection, retrospective team survey, participant observations, interviews, and historical data (Love et al. 2021). The study monitored 25 interdisciplinary teams over five years, recording team outcomes annually (Love et al. 2021). An exemplary team was selected based on interdisciplinary research, team longevity, and fulfillment of the land grant mission (Love et al. 2021). A retrospective team survey was conducted at the study's end, focused on the skills developed by team members and their personal and professional experiences on the team (Love et al. 2021). Participant observations were made at annual retreats and meetings from 2015 to 2019, focusing on interdisciplinary interactions and problem-solving approaches (Love et al. 2021). Interviews with PIs and a historical narrative provided insights into the team's formation and evolution (Love et al. 2021).

1. Scientific Productivity

The team achieved significant outcomes including 33 extramural awards totaling over $5.6 million, 58 peer-reviewed publications with various organizations, 141 presentations, and training for 21 graduate students and 15 postdocs. They also received institutional recognition and various individual honors (Love et al. 2021).

* Individual Productivity
* Research Teams
* Campus-Wide

Productivity: Individual, leadership, and institutional (Bland et al. 2005)

* + What predicts Individual, leadership, and institutional productivity? (Bland et al. 2005)
  + What predicts group productivity? (Bland et al. 2005)

~~Leite and Pinho (2017) outline common inputs and outputs of the research process. Inputs, including human and financial resources, infrastructures, and the body of existing knowledge, lead to outputs ranging from the generation of new knowledge to tangible products like articles, book publications, patents, and training programs for researchers (Leite and Pinho 2017, 94). Leite and Pinho (2017) emphasize that different teams aim to produce different outputs, making measuring productivity challenging. They recommend that the participatory productivity evaluation process be custom-determined by the team and their stakeholder and re-evaluated as the team evolves, emphasizing the importance of dialogue and discussion to foster a culture of continual assessment and improvement (Leite and Pinho 2017, 85–97).~~

~~Network ethnography poses an additional benefit to measuring scientific productivity.~~

~~Leite and Pinho (2017, 95) note that while some researchers worry about the perceived lack of objectivity in qualitative indicators, any indicator can be quantified and analyzed statistically to ensure objectivity.~~

~~In this chapter, I outline SNA metrics that could be used for research network productivity evaluation (RNPE). Examining professional networks such as joint publications, grant proposals, committee involvement, conference participation, and university business becomes a practical approach to measuring scientific productivity.~~

1. Research Team Resilience

In their 2023 study, Bednarek et al. delve into the intricacies of managing grand challenge research teams, emphasizing the need for adaptability in the face of fluctuating activities and team composition. Their examination starts with a comprehensive literature review, followed by an auto-ethnographic analysis of their own interdisciplinary team's experiences (Bednarek et al. 2023). Bednarek et al. offer a process framework for managing research teams effectively over time, with a focus on delivering impactful solutions to grand challenges. Their framework outlines strategies for forming teams, building personal and team commitment, and managing the dynamics of team performance and membership fluctuation. Key elements of the framework include clear communication of impact expectations, fostering long-term, flexible connections among team members, balancing engagement with various outputs, and accommodating team changes while maintaining continuity. This framework aims to provide actionable guidance for researchers, emphasizing the nurturing of individual expertise and passion, collaborative development of overlapping areas of expertise, and fostering supportive team dynamics.

* Durability over time: Roster expansion

Starting with four members in 2004, the team grew to 43 by 2018, including 81 individuals over its 15-year span. Their growth was marked by securing major federal research awards, which allowed for significant team expansion and evolution of projects (Love et al. 2021).

What predicts faculty member satisfaction? (Bland et al. 2005)

* Team member integration

The authors describe the importance of long-term investment in IDR to allow for the development of relationships, trust, and overcoming collaborative obstacles (Lyall and Fletcher 2013). They emphasize the need for research leaders to balance multiple goals and engage with various stakeholders (Lyall and Fletcher 2013).

“The motivation to belong to the academic network is based on the expectation to enjoy a space for sharing and creation of knowledge, which is itself one of the main reasons for collaboration” (Leite and Pinho, 2017, p. 32).

Leite and Pinho (2017) explore the dynamics of interpersonal relationships within academic research teams, emphasizing the crucial role of feeling connected among team members for both personal fulfillment and team resilience. They assert that the desire to join an academic network stems from the anticipation of engaging in a collaborative space for knowledge sharing and creation (Leite and Pinho 2017, 32). Furthermore, they introduce the concept of social and scientific capital within research groups as an invaluable asset that surpasses the sum of its parts. This capital, enriched through internal and external interactions, fosters the use and sharing of knowledge, rooted in relational investments aimed at achieving collective benefits (Leite and Pinho 2017, 32–33).

The success of a team, according to Leite and Pinho (2017, 33–34), hinges on socio-psychological relations that foster a sense of belonging and trust, essential elements in a network where collaborative efforts coexist with competitive undercurrents. They highlight the significance of socio-psychological processes in socializing newcomers, thereby integrating them into the network through mentorship and peer modeling (Leite and Pinho 2017, 34). This integration process is pivotal in building a collaborative research culture where trust patterns and reciprocal exchanges thrive, ultimately contributing to the dissemination of science and ideas (Leite and Pinho 2017, 36–37, 39).

In light of Leite and Pinho’s findings, prioritizing team member integration becomes fundamental in fostering an environment conducive to successful interdisciplinary collaboration. This chapter aims to examine the extent of the pre-existing relationships of GC teams, which will provide a baseline for how the team's relationships evolve with the initiative’s investments.

The team's mentorship model included undergraduates, graduate students, and postdocs, fostering skills like cross-disciplinary communication and understanding of disease ecology (Love et al. 2021). Team members, including faculty, developed and learned from each other, enhancing their scientific roles and interpersonal skills (Love et al. 2021). The average number of mentors reported by team members ranged from 2.4 to 3.1, with graduate students reporting up to 7.7 mentors (Love et al. 2021). Over time, junior scientists migrated to be core members of the scientific productivity network (Love et al. 2021). [Small-teams position in CUPID network]

The advice network within the team was strong, with team members reporting an average of 5.1 to 6.4 advisors (Love et al. 2021). This network evolved over time, with a more integrated involvement of postdocs and graduate students by 2018 (Love et al. 2021). Team members, including faculty, valued the professional and personal support received from these advice networks (Love et al. 2021).

The study found a correlation between mentoring, advice networks, and scientific productivity (Love et al. 2021). Team members reported that being part of the team enhanced their skills, relationships, and professional growth, directly contributing to their scientific success and productivity (Love et al. 2021). Social dynamics are influential in explaining knowledge creation processes (Love et al. 2021). The team’s scientific productivity was driven by their interpersonal relationships (Love et al. 2021).

* Professional growth of individual members: Learning, position

Collaboration is expected to play a role in an individual scientists’ development in scientific, technical and social knowledges and resources (Duysburgh et al. 2012). However, institutional factors require interdisciplinary researchers to plan their personal development more carefully than researchers on a more conventional path (Duysburgh et al. 2012).

<https://docs.google.com/document/d/1s-WAXmc042cVLuB83spK2JH_B5SZo8DE/edit?usp=sharing&ouid=114275839804722059389&rtpof=true&sd=true>

* Leadership and Project Management

The article highlights the need for effective research leadership to develop and nurture interdisciplinary research capacity (Lyall and Fletcher 2013). It discusses the importance of managing complexity and the skill of setting constructive boundaries around research areas (Lyall and Fletcher 2013).

The article discusses the importance of defining and creating the identity of interdisciplinary research units, negotiating multiple identities and roles, and establishing a common purpose (Lyall and Fletcher 2013). It also highlights the need for institutional support and governance structures that accommodate IDR (Lyall and Fletcher 2013).

1. Interdisciplinary Collaboration

* Equitable Inclusion in Interdisciplinary

The team comprised experts from diverse fields like ecology, genetics, and veterinary medicine, involving members from 39 universities, 11 federal agencies, 13 state agencies, and other organizations. This diverse collaboration enhanced their interdisciplinary research capabilities (Love et al. 2022).

1. Fulfilling the land grant mission (Love et al. 2021). [this is like fulfilling the grand challenges mission or BSU campus wide goals]

MISC:   
Okraku et al. (2017) champion a mixed-methods approach, combining ethnography and SNA to track and foster collaboration in emerging scientific fields. This integrative method transcends traditional unidisciplinary collaboration barriers, facilitating interdisciplinary partnerships. SNAP adopts a similar approach, using codes derived from literature (Piqueiras et al., 2023) to analyze data from diverse sources, thereby ensuring comprehensive validation. Berthod et al. (2017) underscore the necessity of synthesizing qualitative and quantitative methods, advocating for a research design encompassing field access, parallel data collection, independent analyses, and integrating findings from both SNA and ethnography.

The development of the Resource Nexus for Sustainability leadership team mirrors the grassroots approach employed by PT2050, bringing together a committed and diverse group of faculty and staff passionate about the GCs and is “tight socially” (J. LaRosa, personal communication, September 25, 2023). In contrast, the formation of the "Healthy Idaho" leadership team was picked by the deans (J. LaRosa, personal communication, September 25, 2023).

Additionally, DRED is invested in leadership development through the Interdisciplinary Research Accelerator (IRA). ~~Interdisciplinary team leads attend “Office Hours,” held by CRCA, where they workshop teaming challenges and receive planned leadership training (J. LaRosa, personal communication, September 25, 2023). During the connective thinking process, team members may assume leadership roles as projects evolve (Disis and Slattery 2010). This aligns with DRED’s approach, where all members are potential leaders and active participants in leadership development, contributing to the project's adaptability and success. LaRosa said in our interview, “It isn't necessarily the lead only who attends Office Hours. Whoever is on the team wants to do that kind of work is invited. We build a more distributed leadership structure this way” (J. LaRosa, personal communication, September 25, 2023). All members are potential leaders and active participants in leadership training, contributing to the project's adaptability and success. This may, in turn, prevent problems arising when leaders need to reduce responsibility or leave their positions (Glied et al. 2007).~~

~~While effective leadership is pivotal in steering interdisciplinary teams towards success, it is equally important to address the practical challenges that arise in collaborative projects, especially in the context of publication and dissemination. Leaders are more successful with project management experience (Sonnenwald 2007) and high levels of organization (Disis and Slattery 2010). Project managers can be added to teams to alleviate burdensome leadership responsibilities (Sonnenwald 2007). Interdisciplinary teams are assigned a project manager who helps relieve the administrative burden of minor tasks (J. LaRosa, personal communication, September 25, 2023). Project management and leadership development include proactive documentation to prevent misunderstandings (J. LaRosa, personal communication, September 25, 2023).~~

These management strategies become particularly crucial when navigating the diverse publication cultures of different disciplines.