Explicating coordination and learning opportunities in a complex stakeholder ecology

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1. Introduction: The alignment challenge in a complex funder alliance

Complex societal change calls for many stakeholders to come together, find common positions and align their strategies and activities. For foundations this means that most significant societal challenges cannot be addressed effectively with the resources of only a single foundation. An uncoordinated approach taken by different foundations to the same challenge is unlikely to create the necessary critical mass, momentum and scalability that is necessary for sustainable change.

That is why philanthropies increasingly try to build alliances to address major challenges in a coordinated manner. The coordination may take the form of a jointly funded regranting intermediary or a shared back office or alliance secretariat where effective strategies are developed and deployed, synergies across funders are aimed for, and learning across grants and grantees is fostered.

A stakeholder ecology involving funder alliances and intermediaries tends to be complex:
Usually multiple funders of different sizes, from philanthropy, industry or government, with their own specific objectives and theories of change may fund an intermediary calling for different interaction and reporting formats. Some funders may have staffing limitations; others may aspire to an operational leadership in the field. This creates a major alignment challenge among funders.

Relationships between intermediaries are complicated by funding dependencies or by competition for funding from the same funder. "Leverage" of funding may take the form of aligned funding where a new funder of a theme decides to fund a grantee directly but in a complementary or supporting way to an existing strategy. If this frees up funds or increases the success probability of an initiative such aligned funding is as useful as funding that flows directly through the books of an intermediary. However, current reporting systems tend not to show such leverage via alignment despite its importance.

Grantees usually receive funding from multiple sources, sometimes involving funding directly from a funder and at the same time indirectly via an intermediary. This need not be a bad practice per se and will often arise from unsynchronized decision-making cycles or different desires for control at different organizations. Such complex funding flows call for a cumulative tracking of funding that extends to the stakeholder ecology beyond the bilateral grant tracking.

A stakeholder ecology comprises political, social and cultural contexts which may be different for different stakeholders. That is why a full view of a stakeholder ecology should not only map out financial flows and dependency but also information flows, and strategic and cultural assumptions, value choices, and political contexts of stakeholders.

The boundaries of a stakeholder ecology are never well-defined as social change mostly happens in indirect and systemic ways. Given the fuzzy boundaries of stakeholder ecologies the complexity increases as different ecologies command different levels of funding – and with funding tends to come a sense of direction or priorities.

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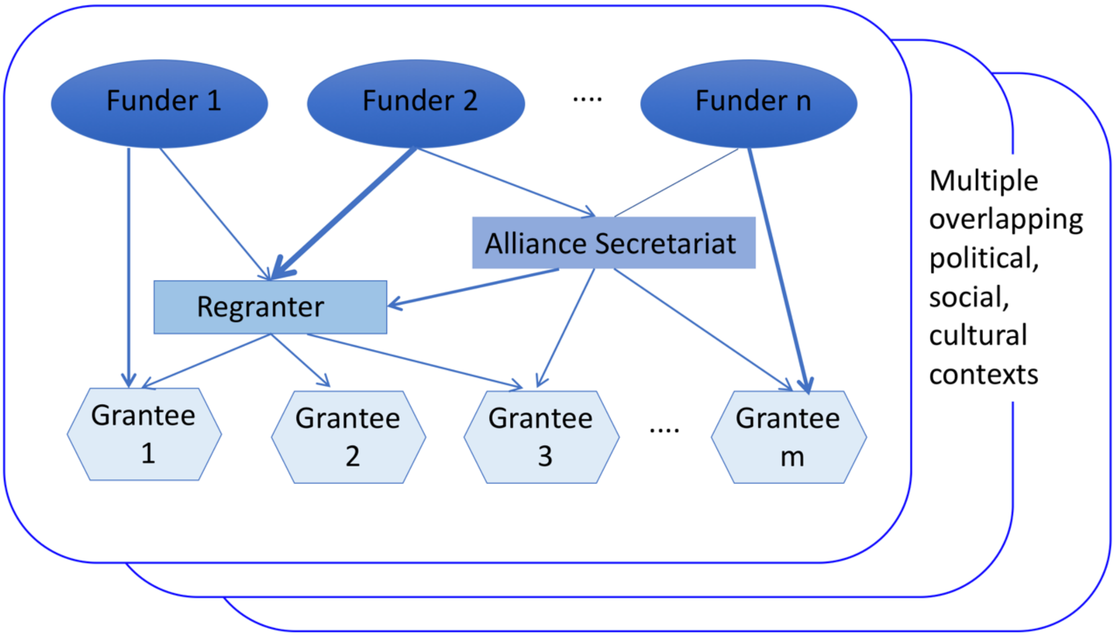

Figure 1: Complex funding structures in a stakeholder ecology

These complex characteristics of a stakeholder ecology as summarized in figure 1 clearly point at the limitations of taking a transactional and linear view of funder alliances and intermediaries. Rather one needs to develop a deeper understanding of the network quality and dynamics. A key question is how to document synergies and the coordination quality in the stakeholder ecology. To answer this question it is first of all important to capture the activities/grants in a common representation and to identify dependencies, complementarities and coordination quality of grants.

This note summarizes an approach where graph theory and big data tools are employed for representation and analysis of a network of grants. To that end grants, grantees and funders are represented as nodes in a network or graph where edges indicate financial flows or similarities of activities. With the help of such network representation and analysis concepts like the centrality of a network can be measured to identify partitions or segments of the network. Big data tools and natural language processing are used to identify similar grants automatically.

The data used in this paper are descriptions of environmental, conservation and climate change grants that were scraped from the websites of the Hewlett Foundation, the Packard Foundation, the Oak Foundation, and the Children's Investment Fund Foundation in July 2018. The web scraping resulted in a data set of 3113 grants to 948 with a total funding of $2,625 billion.

2. Representing the funder alliance as a stakeholder ecology of funders, grantees and grants

The basic idea for this project stems from a TED-talk by Eric Berlow[2] where he shows examples of simplifying complexity by representing a complex network of relations and dependencies as a graph with nodes and edges.

[2] https://www.ted.com/talks/eric_berlow_how_complexity_leads_to_simplicity

There exists a rich body of mathematical theory called graph theory to study network structures where the objects or nodes are connected by edges.[3] Such graphs can be used to model and analyze many types of relationships in biology, physics, social and information systems. Graphs can be enumerated and segmented; the density of connections between objects can be analyzed; the distance between objects across the network can be measured. Most importantly, graphs can be visualized in two or three dimensions which usually allows to capture the structural essence of a network quickly and intuitively.

Nodes and edges may have attributes. For example, the size of a node can be defined to represent a budget of a grant or the funding amount of a foundation. Or the color of a node can be used to designate an initiative or region.

A funding ecology of funders, grantees and grants can then be represented as nodes of a graph with the size of the node proportional to the amount funded. Edges represent funding relationships. By assigning weights to the edges of the graph one may want to capture the coordination quality between organizations.

Additional edges can be added based on additional relationships, e.g. the similarity of grants or the use of a similar approach or the same targeted audience. Different colors can denote different types of edges.

A network of these relationships between funders and grantees and/or grants can also be visualized using different layout options to provide a sense of coordination needs in the stakeholder ecology.

- A random layout places the core nodes randomly and may give a sense of the complexity of the stakeholder ecology in the absence of systematic coordination.
- A Fruchterman/Reingold or Kamada/Kawai layout creates a force-directed graph[4]. Force-directed graph drawing algorithms draw graphs in an aesthetically pleasing way. Their purpose is to position the nodes of a graph in two-dimensional or three-dimensional space so that all the edges are of more or less equal length and there are as few crossing edges as possible, by assigning forces among the set of edges and the set of nodes, based on their relative positions, and then using these forces either to simulate the motion of the edges and nodes or to minimize their energy. If appropriate input data are available, weights of the edges between nodes can be chosen to represent the coordination intensity or transaction cost.
- A spring-centrality[5] layout applies a centrality algorithm to highlight partitions of the network. In graph theory and network analysis, indicators of centrality identify the most important edges within a graph. Applications include identifying the most influential person(s) in a social network, key infrastructure nodes in urban networks, and super-spreaders of disease. Centrality concepts were first developed in social network analysis, and many of the terms used to measure centrality reflect their sociological origin. In this application the central nodes and edges point at the “coordination hotspots” where major learning opportunities and synergies exist.

Once a network representation of the funding ecology has been set up, the dependence of different grantees on multiple funders can be analyzed. The number of funding relationships of a grantee, i.e. the degree of the grantee node, gives a first indication of coordination needs across funders. In an uncoordinated stakeholder ecology or a loosely coupled funder alliance it is not always obvious to funders which grantees are effectively receiving funding from multiple funders. This first type of

[3] https://en.wikipedia.org/wiki/Graph_theory
[4] https://en.wikipedia.org/wiki/Force-directed_graph_drawing
[5] https://pdfs.semanticscholar.org/presentation/3e68/2da8cf06fa788aa356d5da94082a1cee647f.pdf

analysis allows to zero in quickly on areas where explicit funder coordination and division of labor may make sense.

3. Scraping grant descriptions from foundations' websites

Grant descriptions were scraped from the following web sites in July 2018:

- Hewlett Foundation - Environment program (https://hewlett.org/grants/?sort=date&grant_programs=21943)
- Packard Foundation – Conservation and Science program (https://www.packard.org/grants-and-investments/grants-database/?grant_keyword=&program_area=Conservation+and+Science&award_amount=All+Amounts&award_year=All+Years)
- Children's Investment Fund Foundation (CIFF) - Climate change program (https://ciff.org/grant-portfolio/list/?region=&programme=climate-change, https://ciff.org/grant-portfolio/closed/?region=&programme=climate-change)
- Oak Foundation – Environment program (http://oakfnd.org/grant-database-env.html)

For each grant the following attributes were collected:

- Identifier – The grant identifier has to be unique across all grants.
- Program – Each grant belongs to exactly one program or initiative.
- Grantee – Big international NGOs may show up with different national subsidiary names.
- Funder – In the case of CIFF a grant may have multiple funding partners. For this exercise the funding amount of the grant is assigned to CIFF as there is no information available on the split of the budget across partnering funders.
- Funding – The funding amount here is always in $US.
- Purpose and Description – The purpose and description of the grant provide a short and longer summary of the grant. As foundations provide different levels of detailed information on grants the purpose and description texts of the grants were combined in the later analysis to ensure that each scraped grant has at a minimum some characterizing text field.

A more sophisticated data set would ideally include additional attributes of the grants, specifically an extended view on related funding sources, a classification of targeted actors and audiences, a taxonomy of methods and approaches, and a classification of geographies and scopes of initiatives as described in figure 2.

However, it is not easy to get multiple funders to agree on such a shared taxonomy of grant attributes and to ensure proper data collection.

That is why big data tools were applied to categorize grants and analyze grants for similarity. All analyses were conducted with the help of a typical big data toolset: Python Jupyter notebook for scripts, Pandas for data import and cleaning, Networkx for network representation and analysis, Python-louvain for centrality analysis, NLTK for natural language processing, and Bokeh for interactive visualization.

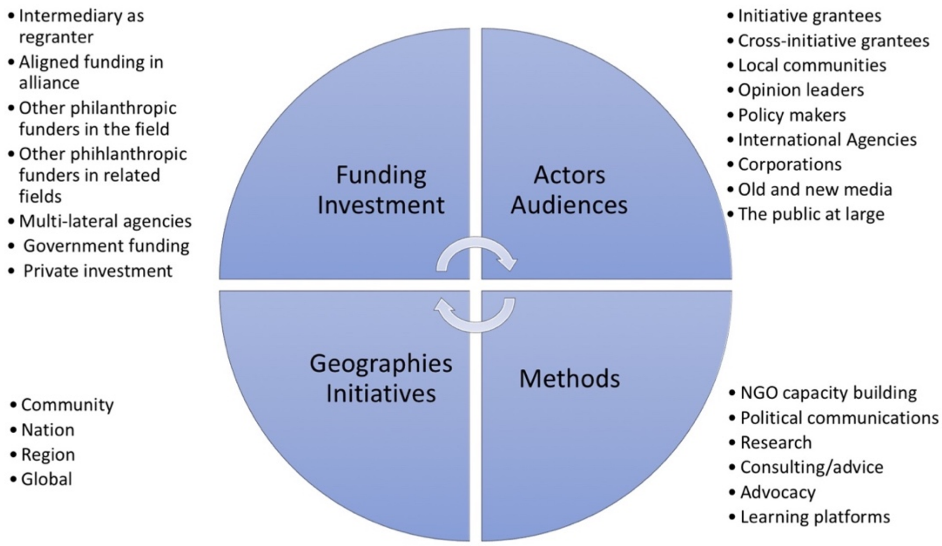

Figure 2: Multi-dimensional taxonomy of grants

3. Funder-Grantee-Grant network segmentation

A force-directed graph visualization allows to identify "hotspots" of coordination by segmenting the graph. The following example shows the grant structure in one region of the sample data set. The blue nodes are funders, the red nodes are grantees and the green nodes are grants.

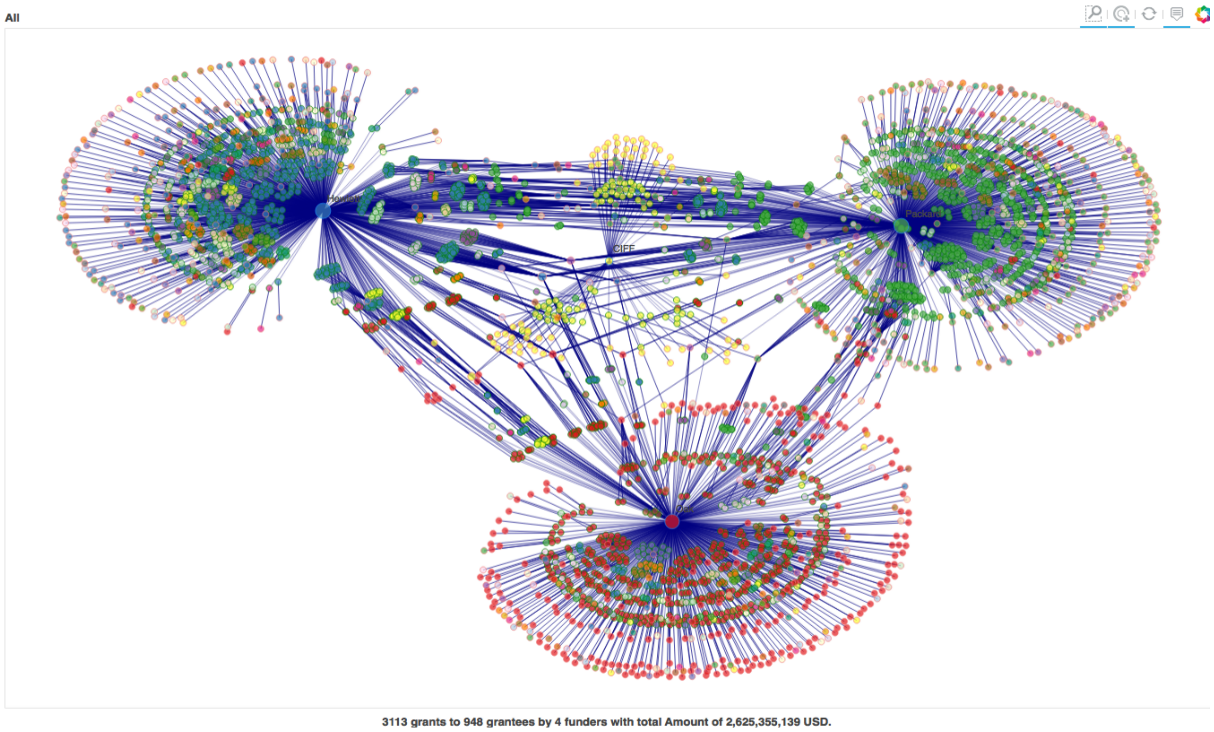

Figure 3: Structure of stakeholder ecology based on financial flows only

As indicated above, financial flows are only the most obvious attribute of funder-grantee relationships which of course happens to be captured in all grant management systems. A more realistic analysis of the learning opportunities and coordination needs would be possible if attributes as suggested in figure 2 could be included in the definition of relationships/edges. Additional edges can be added based on other relationships like learning opportunities, same audiences, or shared methods.

In the absence of such attributes one can use the grant descriptions to identify similarities across grants. As these relationships tend not to be explicitly captured in most grant management systems, the similarity of grants can be analyzed with the help of natural language processing algorithms.

Specifically, a bag of words excluding so-called stop-words in each grant's purpose and description texts can be extracted for each grant and the words then weighted according to their importance in the corpus of all words from all grants by calculating the term frequency-inverse document frequency (tf-idf).[6]

Then the cosine text similarity between the tf-idf-weighted bags of words can be calculated as an indicator for textual proximity of the grant descriptions. By choosing higher thresholds for the cosine similarity one can define textual proximity more rigidly.[7]

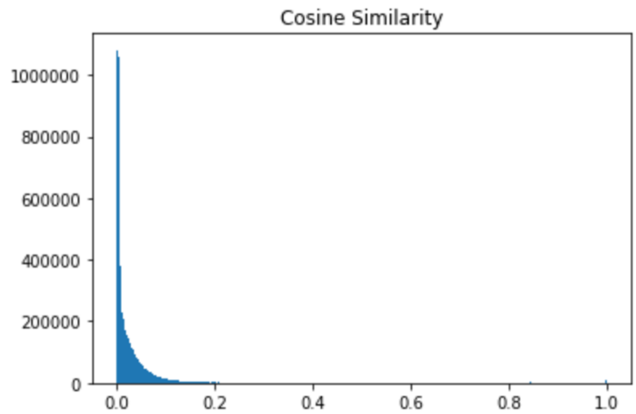

Figure 4: Cosine similarity distribution for scraped grants

For a threshold of 0,3 we obtain 13009 additional relations between grants based on a rather strict definition of similarity. For a threshold of 0,2 we obtain 32117 similarities.

Applying again the spring-centrality layout to the augmented network which now includes additional relations between similar grants shows a better picture of the true coordination needs and learning opportunities in the stakeholder ecology as shown in figure 5.

[6] https://en.wikipedia.org/wiki/Tf–idf
[7] https://en.wikipedia.org/wiki/Cosine_similarity

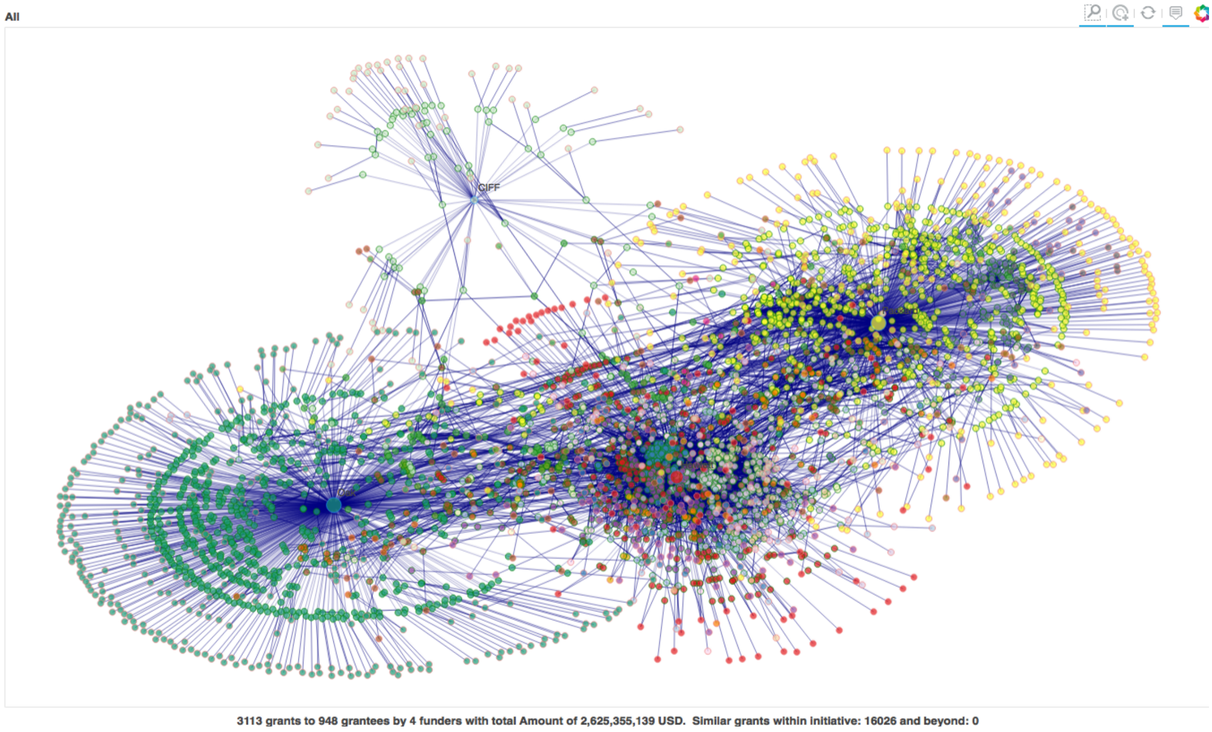

Figure 5: Grant structures including grant similarity linkages

Rendered on a computer these visualizations are interactive. Hovering over a node allows to show the node's attribute information. One can also zoom in on different segments of the network to better understands the coordination needs and synergies.

Such a network representation and cosine similarity analysis also provide an elegant way to check new projects proposals against existing grants in the ecology. Calculating for a new project the cosine similarity with the existing grants in the data set and sorting the results provides a list of existing grants ranked by similarity with the new proposal. That way a program manager or grantee manager could easily address the questions whether a new project is reinventing the wheel or whether a new project would benefit from learning lessons from previously closed grants. In the absence of a good overview over the stakeholder ecology these highly relevant questions more often than not remain unanswered.

4. Conclusion

The similarity analysis of grant descriptions shows a large number of relevant grant relationships that cut across programs and initiatives. Thus, the approach taken supports a perspective that cuts across the typical silos of programs which so often limit the effectiveness of philanthropic interventions. Put differently, a network representation of grant structures allows to include more and more linkages across silos or perspectives which in turn is the basis for robust systemic thinking.

The approach described in this paper with the example data scraped from the websites of four major environmental and climate change funders may motivate other funder alliances and intermediaries to structure and collect grant data in such a way that modern big data tools can be applied for visualization and analysis. Explicating the complexity of stakeholder ecologies with the help of network representations and then using algorithms to visualize and better understand the underlying structures can be a useful step in addressing the challenges of overcoming silo thinking and moving towards more systemic change.

Given the reluctance of foundations to share data and the difficulties of managing complex funder alliances the challenges of implementation are likely to be more cultural than technical. However, in a world where big data approaches are increasingly powerful to support learning across boundaries it would be a lost opportunity if philanthropy did not include these data driven approaches to coordination and learning in their strategies and operations.

References

Johannes Meier, *Resonance in a Stakeholder Ecology: Working Effectively with Intermediaries* , Summary of study for the Oak Foundation, October 2017, http://oakfnd.org/assets/resonance-in-a-stakeholder-ecology.pdf

Code repository at https://github.com/jmeier1963/grantecology