

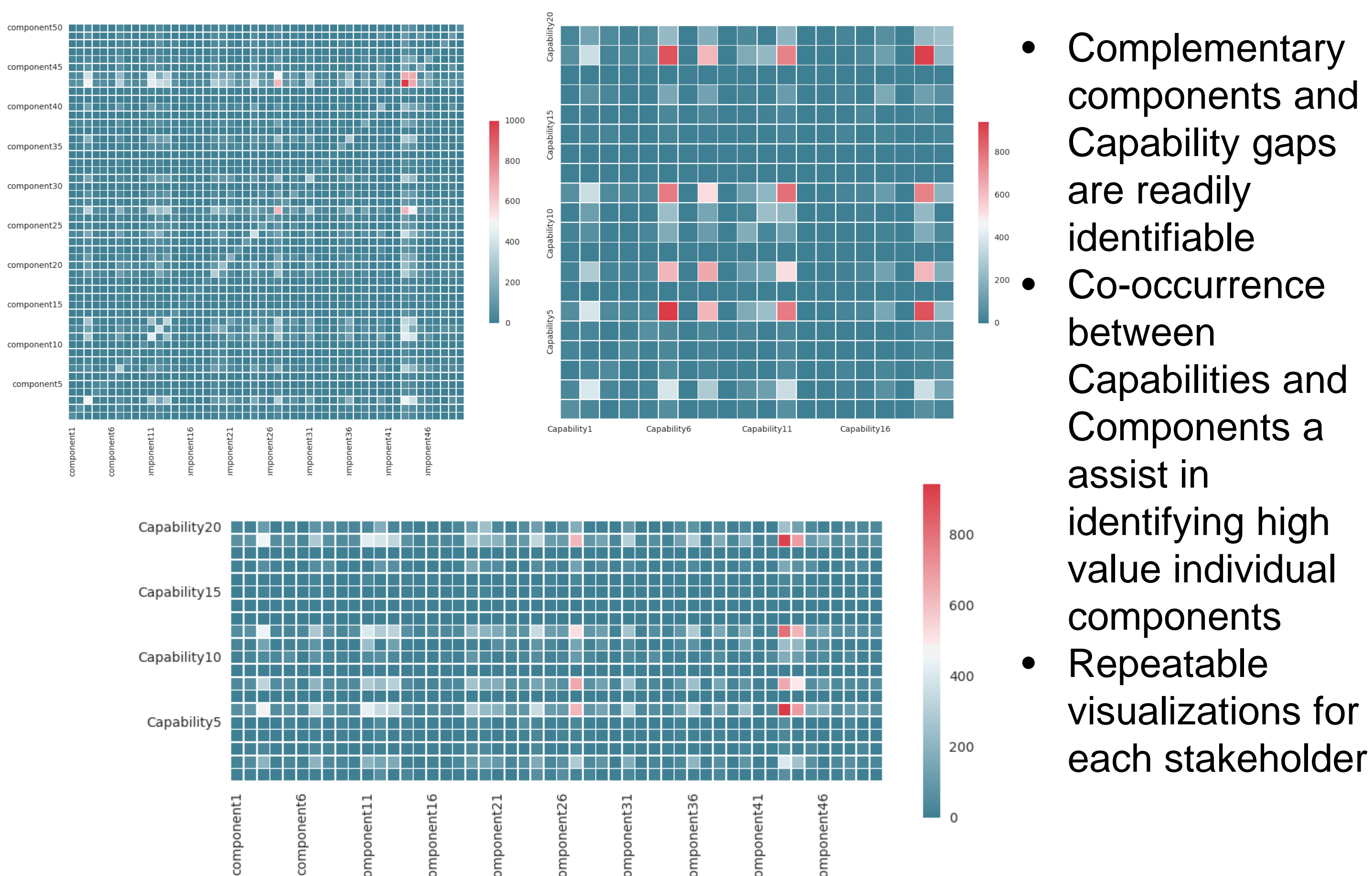
## Research Task / Overview

Management of a portfolio of capabilities, generally realized in a suite of physical systems, is a common problem faced by the agencies and programs within the Department of Defense (DoD). Standardized methods of tackling these problems have been developed over time, with a focus on sound Systems Engineering (SE) principles and tools. Although a standard process is commonly executed in solving these portfolio management problems, a standardized suite of tools is non-existent to support that process. Most often, new tools are developed by each SE team, sometimes leveraging a past tool utilized by the team, but often time not being reused for future efforts.

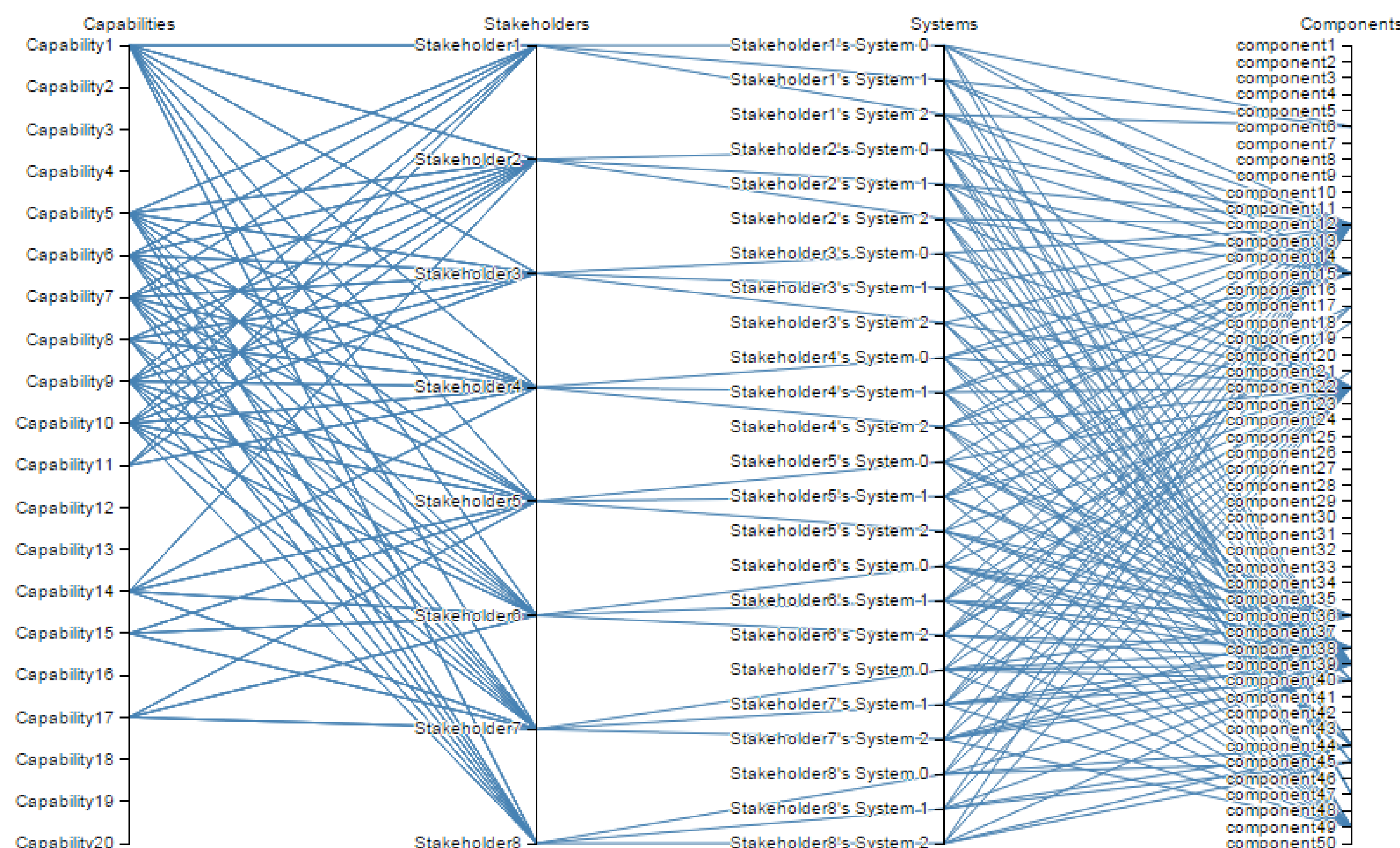
This limited reuse of tools is a primary motivator to the SERC for this research: to capture the standard SE process and develop a toolset which allows analysis teams and Systems Engineers to focus time and effort on the analysis rather than management of tools and processes. In order to inform the prioritization and development of capabilities, SERC worked closely with an ongoing project team: Log IT War Room. In this research task, SERC continued work started under RT-112 to formalize standard methods into a reusable tool architecture, developed within a Jupyter Notebook.

## Data & Analysis

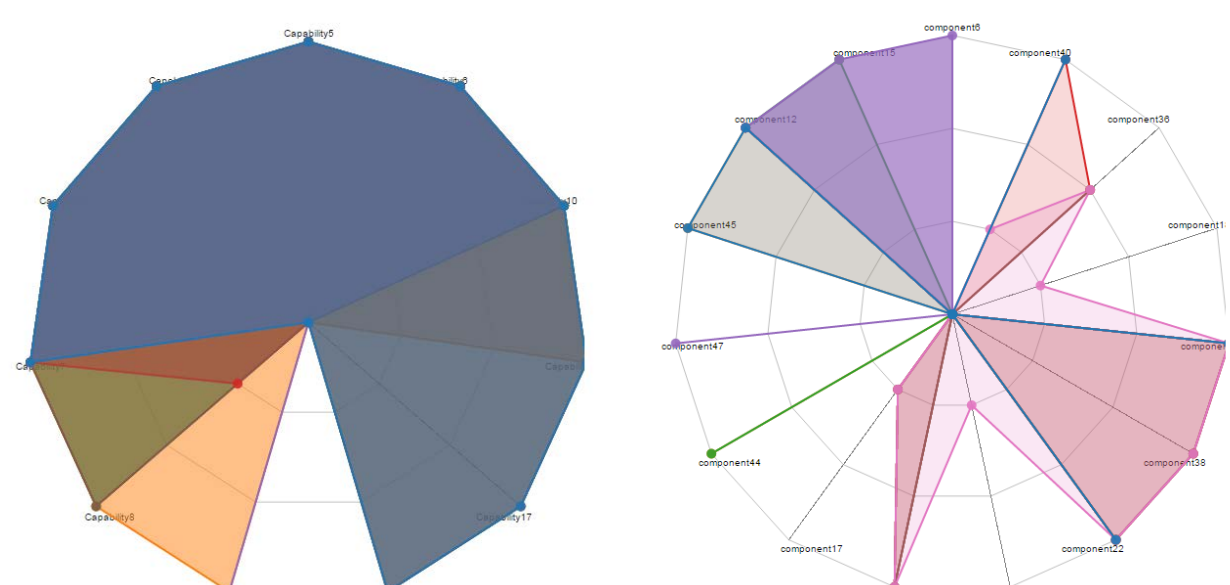
Given that each stakeholder in a sample population is considered valuable, then it stands to reason that components that frequently co-occur for a stakeholder's preferred solutions, they complement each other. The co-occurrence matrix visualizes all of the components simultaneously in order to assist in identify components which provide high value for a stakeholder.



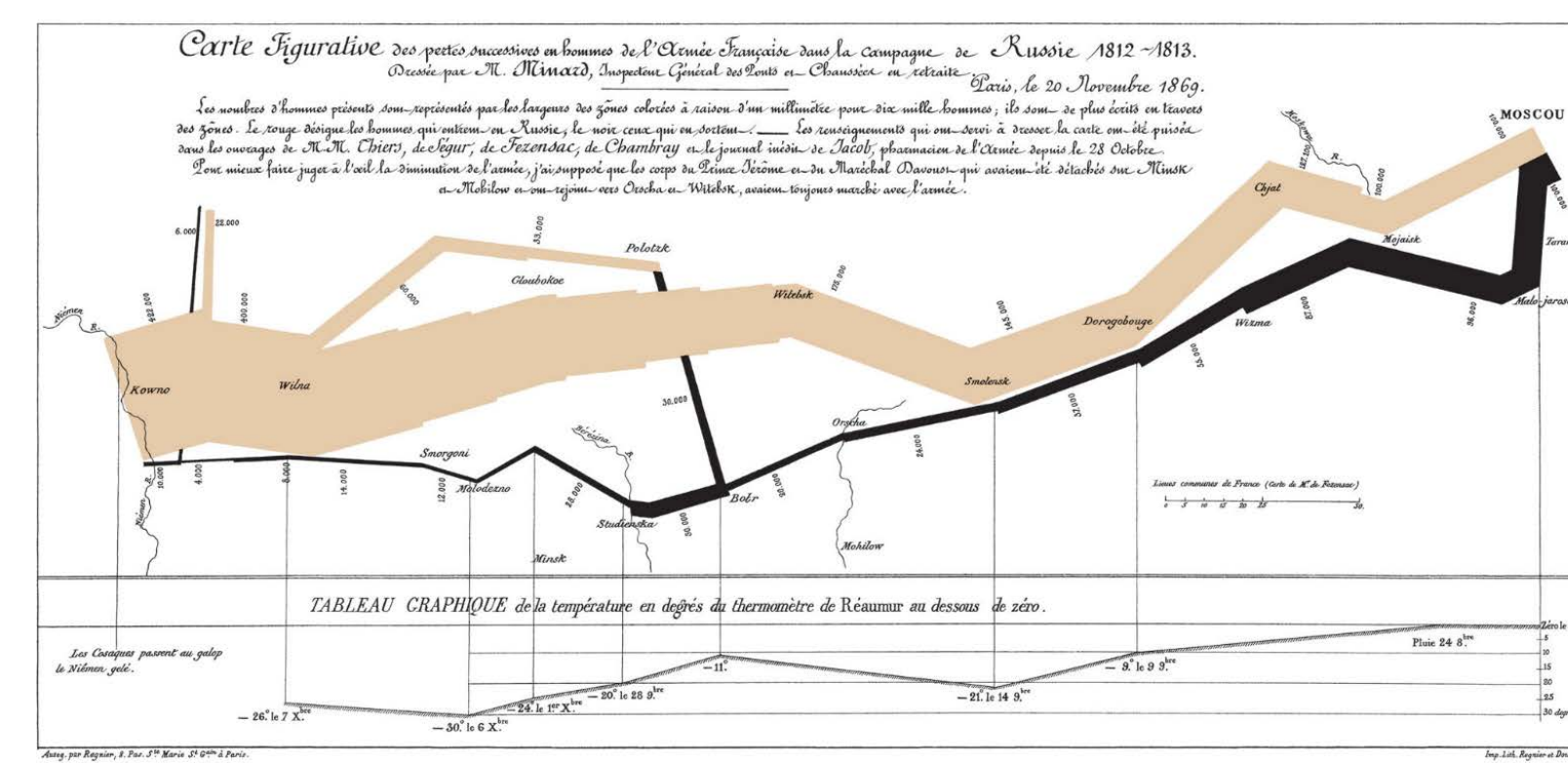
After the process has been followed once, it can be repeated for each stakeholder, to assist in determining commonality in preference.



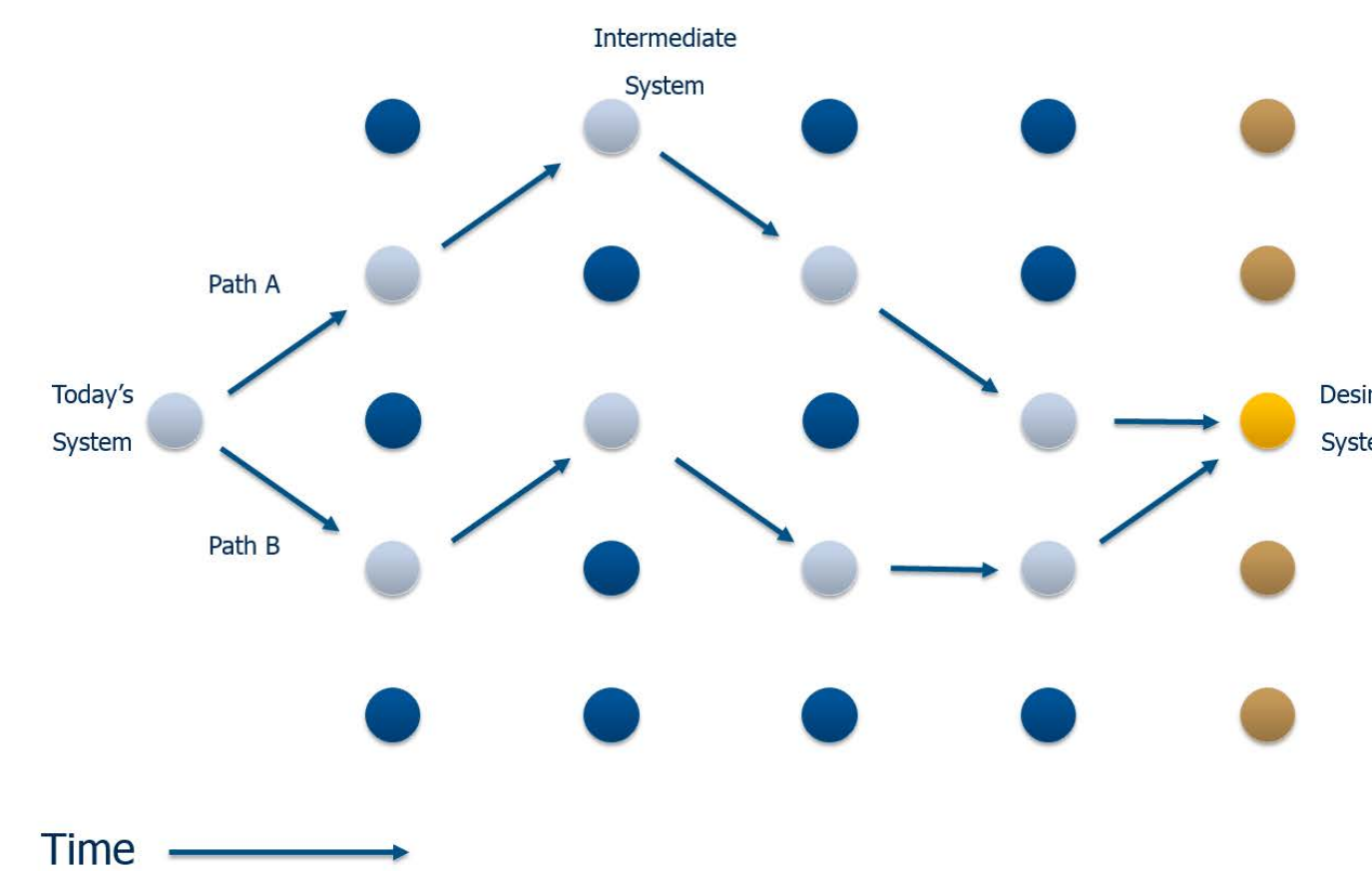
- Stakeholder have to work within the existing set of components
- Even with varying values, stakeholders tend to form "camps"
- Both Component and Capability camps can be identified



## Goals & Objectives



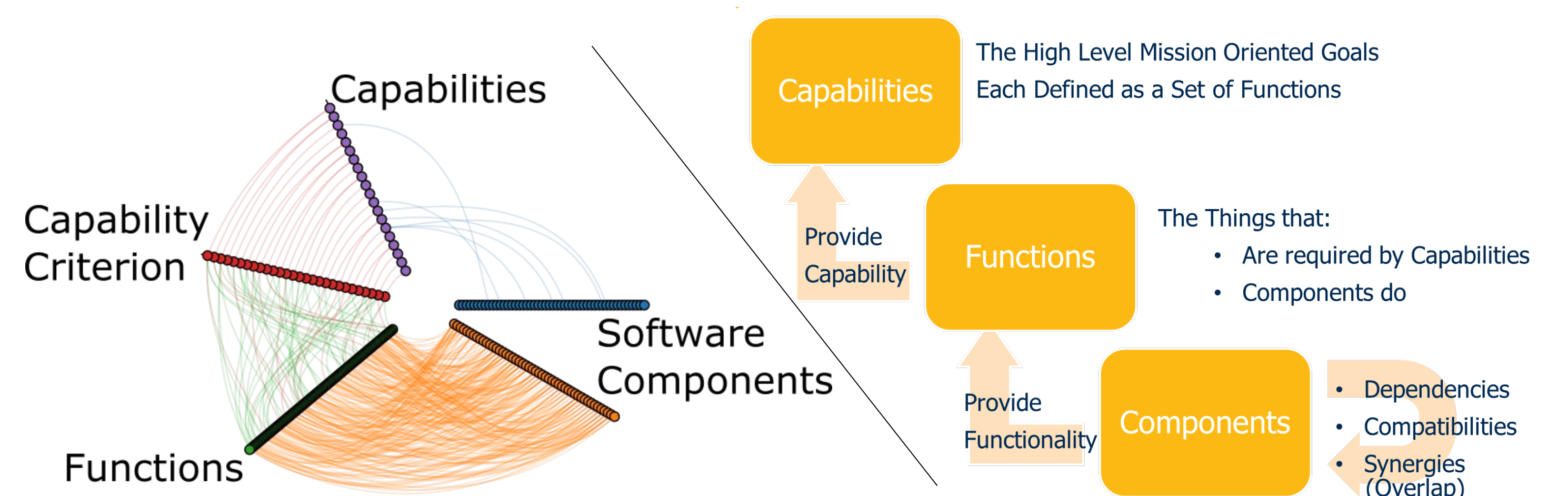
- Development insight visualizations: Napoleon's Russian Campaign of 1812 by Charles Minard
- Support decision making
- Traceability (of decisions and impacts)



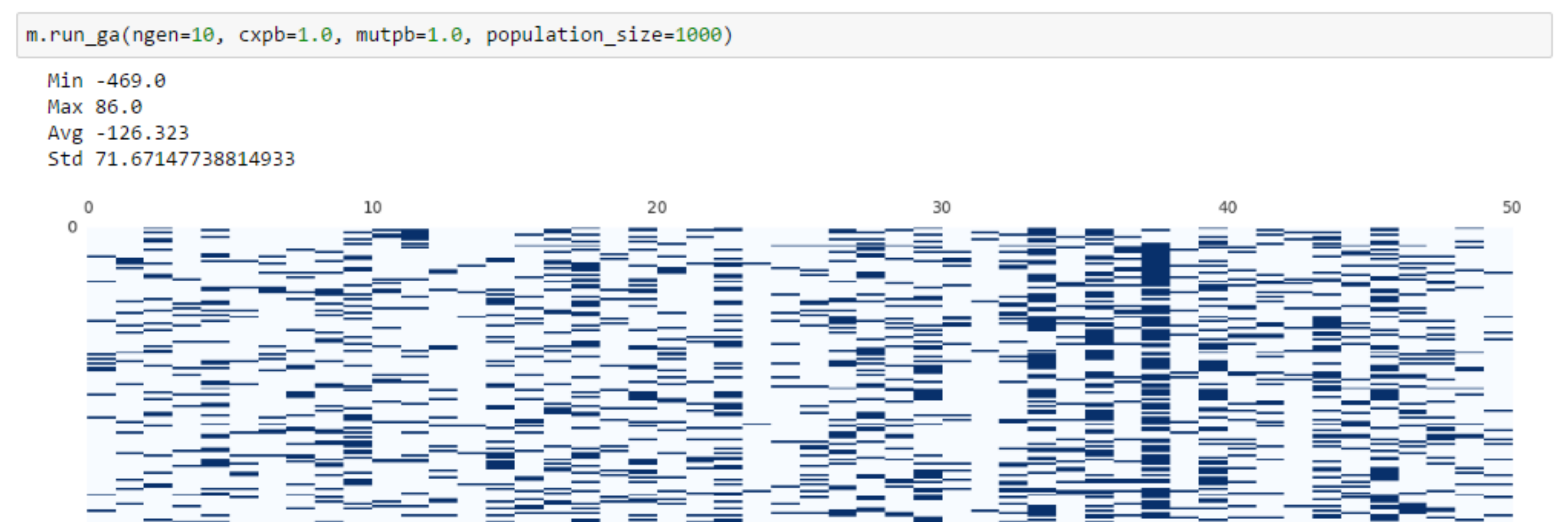
- Capture preferences of multiple stakeholders
- Build consensus across stakeholders through identification of "camps"
- Allow for evolving requirements and objectives
- Ensure there are no lapses in capability coverage

## Methodology

The first challenge in a narrative is to introduce the elements of the story in such a way that all of the relationships between the elements are understood.



Once both the currently established components and the new candidate components for the LogIT system are identified and mapped to their associated functions, it is possible to explore and analyze the combinatorial space in search for the right fit for the LogIT portfolio program needs.



Component combinations are evaluated based on each stakeholder's values and rules individually. Combinations that fair well stick around and influence the next generation. After sampling the space, information about the usefulness of each component and their higher order effects can be extracted.

## Future Research

While this effort has made significant steps towards meeting the top level goals and objects it is not yet complete. Ultimately, this methodology should enable decision makers to quickly make trades and formulate solutions in an intuitive manner. Future research includes:

- The development of algorithms and human interfaces in order to help facilitate the identification of low-hanging value-added options
- The development of a effective user interface (for stakeholders) packaging the methodology into a human digestible form
- The development of the time-domain aspects of long term considerations and planning, to assist in portfolio transformation over time

## Contacts/References

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