

The 5 Rs Case Study: Applying a Systems Thinking Tool to Facilitate Multi-Stakeholder Collaboration and Advance Transportation Safety

Addressing complex problems like transportation injuries requires collaboration among multiple individuals and organizations (including community organizers, government agencies, lawmakers, and research institutions). However, collaboration can be challenging. Each individual and organization has its own needs and priorities. Furthermore, organizations often have unequal levels of resources and different views on the nature of the problem. For these reasons, to create successful partnerships, collaborations need to develop a shared understanding of the system they are embedded within and an appreciation for each other's perspectives and roles in the system. Systems thinking tools, like the 5 Rs, offer a simple but structured way to facilitate this.

What is the 5 Rs framework?

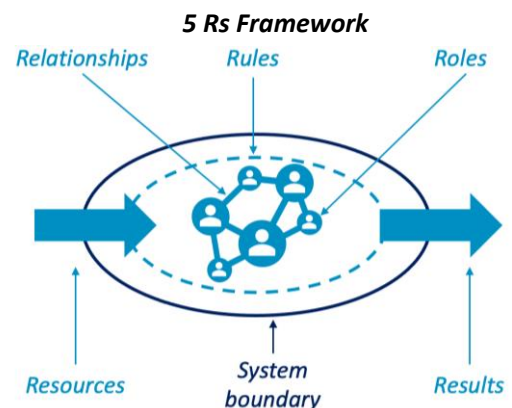
The 5 Rs framework identifies and prompts stakeholders to describe and understand critical aspects, or dimensions, of a system they may be working in, namely the **Results, Roles, Relationships, Rules, and Resources** surrounding their work. These key aspects influence the way the system works to generate outcomes we observe (e.g., transportation injury and death).

Specifically, **"Results"** represent meaningful outcomes of the current system or desired end states a group would like to achieve. **"Roles"** are the functions that different stakeholders (including individuals and organizations) perform within the system (or as part of efforts to change the system). In the area of transportation safety, an important result might be the number of fatal traffic injuries, while a meaningful role might be a state health department establishing a surveillance system to track traffic injuries and deaths.

"Resources" include assets (e.g., individuals, organizations, policies, as well as the physical and social environments) that are needed for the system to work and/or to create change. For example, the availability of funds to repair rural roads or the presence of safety advocacy organizations can be assets for change.

"Rules" represent formal and informal norms, as well as regulations, incentives, and expectations that influence the results of the system by shaping roles, influencing resource availability, and affecting relationships. For instance, state infrastructure laws can influence the way money can be spent on road improvements or repairs.

Finally, **"Relationships"** refer to the interdependencies among roles, resources, and rules that affect the results of the system. A relevant example in the area of transportation safety might be degree to which state laws (rules) allow for community input (resources) in the way funds (resources) are used to upgrade current infrastructure (resources).



Normally, the 5 Rs framework is used in the context of a group activity involving individuals and organizations collaborating in a particular space. In this work, participants are first asked to define the **“boundary of the system,”** that is, to clearly specify the problem and context on which they are focusing. For example, participants might choose to focus on reducing child and adolescent pedestrian injuries in City X over a 5-year period (therefore clearly specifying the “what”, the “who”, the “where”, and the “when”). After that, participants are asked to sequentially brainstorm about each one of the Rs to develop a deeper understanding of the inner workings of the system. Participants can think through the Rs in any order, but some might find it easier to start from the Results as this can help center the discussion and set the “boundary.”

It is often useful to employ guiding questions to initiate group discussions around each one of the Rs. These questions can be about both the current state of the system (e.g., what results are we observing now?) and potential strategies for system strengthening (e.g., what relationships do we need to foster, and which resources do we need to secure, to achieve change?). For instance, in the case of Results, relevant questions include “What are some system-produced results that could be the focus of change efforts?” or “What positive results should the new system produce?” You can find a complete list of relevant questions for each R in the accompanying 5 Rs How-to Guide.

Why is this helpful?

The 5 Rs framework helps participants think about the key objectives and goals that they want to achieve as part of their collaboration and identify stakeholders that need to be engaged. In addition, it can help them consider resource availability, system norms, and key relationships among stakeholders as they begin strategic planning. Because it is usually used in the context of a group activity, the 5 Rs framework can also contribute to a more honest and transparent partnership. Through discussion, stakeholders can overcome assumptions about the needs, roles, and priorities of their partners. Finally, the 5 Rs are an efficient and relatively fast way to develop an initial understanding of the system. Preliminary findings from this exercise can then be used as a starting point to delve deeper into each of the Rs using other systems thinking tools. For instance, Causal Loop Diagramming and Balance of Petals Diagramming can be used to explore Relationships in more depth, while System Support Mapping can yield useful insights around Roles and Resources. You can find more information about these tools in the other case studies included in this toolkit.

Real-World Example

We applied the 5 Rs framework during a virtual 4-day statewide Leadership Team Institute aiming to support local teams working to reduce traffic-related deaths and injuries in different parts of the state. This event brought together 8 local teams, which included stakeholders ranging from planners and engineers to community organizers and public health experts.

We used the first of the 4 days to set the stage for the work. On the second day, we focused on using systems- and equity-aware thinking to help refine community-specific goals around transportation safety. We started with a group discussion about the structural factors that contribute to a disproportionate burden of traffic injuries among lower-income groups and racial minorities. After that, we introduced the 5Rs framework and created virtual breakout rooms so that local teams could brainstorm about the Rs within the context of their own communities.

We sent each local team a link to a Jamboard whiteboard. Jamboard is available through Google’s G suite and allows simultaneous editing of an online whiteboard. Although we chose Jamboard, other online tools (e.g., Mural, Zoom’s whiteboard, Miro) offer similar functionalities. We asked participants to focus exclusively on Results, Rules, and Relationships, paying particular attention to equity within each of these. Once participants finished discussing these first three Rs within their local teams, they were asked to share and discuss with the wider group, paying particular attention to the equity implications of each R (i.e., what results would be more effective in reducing disparities?). At the end, we asked local teams to refine their team transportation safety-related goals based on the insights from this exercise.

On the third day, we started by highlighting the importance of collaboration to achieve systems change. We then explained how exploring the remaining two Rs (Roles and Resources) and re-examining Relationships could provide useful insights into how to initiate or strengthen collaborations by identifying key assets, stakeholders, and interdependencies that need to be leveraged for success. Again, participants were asked to discuss these Rs within their teams before sharing with the wider group.

What did the 5 Rs reveal?

As mentioned above, each of the 8 participating local teams applied the 5 Rs to their own community. Although there were similarities across teams, each team gained insights specific to their local contexts. Taking this into account, we focus our description on the findings from a team working in a racially diverse, rapidly growing midsized city (City X).

For City X's team, meaningful **Results** were centered around prevention of traffic-related fatalities and injuries; a general reduction in traffic speed within the city limits; an increase in biking, walking, and transit use; and greater responsiveness to community needs. Important **Rules** to achieve these results included, among others, requirements for (new) streets and developments to accommodate different modes of transportation (including transit, walking, and biking), stricter enforcement of speed limits and no parking on bike lanes, and the use of city/county/state logoed vehicles as "behavior modelers" for safe driving standards.

Given the need for cross-sector collaboration to advance transportation safety, this team identified the need to involve multiple stakeholders to fulfill different **roles**. These included city/county/state transportation and planning agencies and policy makers (for rule setting), schools, disability and safety advocacy organizations, victims of traffic crashes or their families, as well as the media (for awareness raising). In addition to these stakeholders, multiple **Resources** were considered important, including sufficient funding for biking/walking and public transit infrastructure, technical/research expertise to introduce evidence-based policies and evaluate them, and time and skills to undertake true community engagement (see Jamboard screenshot below).

Finally, in terms of **relationships**, City X's team highlighted how the degree to which planning decisions respond to community needs and input directly impacts community trust and

cohesion (and how critical this was to achieve their equity-centered results). Furthermore, the team emphasized the need to develop fluid relationships with specific community groups, funders, and decision makers, as this was essential to ensure the success of the transportation safety collaborative.

Next steps

5 Rs insights across the 8 local contexts were synthesized to better understand the system dimensions affecting transportation-related injuries and deaths in different communities. The tool provided a structured way to advance conversations about priorities and next step actions focused on equity-centered results.

Conclusions

The 5 Rs framework is a tool that offers a simple but structured way to explore the key dimensions of a system. It can be used to start developing a consensus understanding of the system and problem and to brainstorm about the key objectives and goals of a collaboration. In addition, it can help identify (additional) stakeholders to engage, critical resources to obtain, key relationships to form or leverage, and important rules to consider.

This tool is often used as a first step for a diverse group of partners to help gain a more in-depth sense of the inner workings of a system and to discuss the prioritization and potential design of system strengthening interventions.



The 5 Rs How-To Guide

What is it?

- A 5-question framework to help us understand the broad “system” around an area of work, such as a Vision Zero or Safe System-related initiative, to inform strategic planning and action.
- Helps individuals or groups define meaningful measures, ensure engagement of all relevant stakeholders, and design action that is mindful of available resources, rules (e.g., constraints, norms), and key relationships. Supports individuals in describing these key features of the current system and/or a system they might want to create.

Why do we use it?

- To guide individual brainstorming, idea synthesis, and group discussion about a new initiative coming together or to support strategic planning and action in a current initiative.
- To help a group of partners with knowledge about different parts of the system develop a shared understanding of the system and context.
- To help pinpoint opportunities we might not have considered (e.g., resources, potential relationships) for our initiative and potential pitfalls early on (e.g., rules, relationships).
- To improve decision-making and inform action with a more holistic view of the system around a complex area of work (e.g., transportation safety).

How to walk through a 5 Rs brainstorming session

1. On a white board, with paper, in a Google document (or other shared document), or in a Jamboard (or other

electronic tool), create 5 distinct spaces/pages for brainstorming. On each space or page, write one of the following Rs:

RESULTS	ROLES	RESOURCES
RULES	RELATIONSHIPS	

2. On the first page or in the first space (for RESULTS), individually or as a group, place sticky notes or jot down notes to brainstorm on the following probe:
 - RESULTS: what are the meaningful outcomes that would indicate success for your initiative or area of work? Think broadly about what REALLY matters in this work.

Once brainstorming is complete, it can be helpful to group sticky notes or ideas into themes. You should then decide together (if working with a group) on the measure or theme that you feel is most important to the group. This will anchor brainstorming around the remaining 4 Rs.

3. With the selected Result, next place sticky notes or jot down notes to brainstorm on the remaining probes on each of their pages or distinct spaces:
 - ROLES: who are the stakeholders that affect or are affected by changes in the key result or outcome?
 - RESOURCES: what resources exist—including people, organizations, policies, strategies, physical and social environment—to create change in the result/outcome?
 - RULES (formal and informal): what are the policies, laws, traditions, and norms that impact or could impact the key outcome or result?

- **RELATIONSHIPS:** what are approximately 3-4 critical relationships that affect or are affected by the focal outcome—could be relationships between people, groups, organizations, the environment, etc.?
4. As with the first R, spend some time grouping themes that emerge from the remaining Rs.

Table 1 provides transportation-related examples for each R and guiding questions to use during brainstorming and during debriefing sessions after working through the 5 Rs framework.

Completed brainstorming frameworks should be used to:

- Discuss consolidated results, using the guiding questions below as a starting point. As a group, discuss what is missing, prioritize results to focus on, identify/prioritize resources, relationships, rules to change. Weave these findings into your strategic planning process or action plans.
- Keep this as a living brainstorming tool—ask stakeholders who may join an initiative/group to add their perspective.
- Return to the 5 Rs periodically to reflect on how the system is changing, allowing you to step back and inform discussion about new priorities and action, as needed.

TABLE 1. The 5 Rs Framework for Exploring Transportation Safety “Systems”

Specific R and Definition	Transportation-related Example	Guiding Questions to Inform Brainstorming & Discussion
RESULTS are the meaningful outcomes that would indicate success.	<p>An increase in the number of people with accessible and affordable access to transit.</p> <p>An increase in the proportion of back seat car passengers wearing a seatbelt.</p> <p>A decrease in impaired driving.</p>	<p>What are the most meaningful indicators or signs of success?</p> <p>What are some system-produced results that could be the focus of change efforts?</p> <p>How are results evaluated or measured?</p> <p>What positive results should the new system produce?</p> <p>How will the new results be evaluated or measured?</p>
ROLES are those affecting or affected by changes in the key results. They are the functions that actors (individuals, organizations, and other entities) play in a system.	<p>A state health department working to establish a traffic injury surveillance system.</p> <p>Local zoning officials working to establish presumptive parking requirements for new developments.</p>	<p>Who are the people or groups of people that affect or are affected by these results?</p> <p>What roles are actors performing? Are any performing multiple roles?</p> <p>Are there any roles that seem to be missing?</p> <p>What roles will actors need to perform in an improved system?</p>
RESOURCES are what exists—including people, organizations, policies, strategies, physical and social environment—to create change.	<p>Affordable housing advocates.</p> <p>Street design guidelines.</p> <p>Tools for authentic, equitable community engagement.</p>	<p>What resources are being used in the system?</p> <p>Are there resources needed that are missing, insufficient, or can be more equitably distributed?</p> <p>What resources are available that can help improve results?</p>

TABLE 1. The 5 Rs Framework for Exploring Transportation Safety “Systems” (continued)

Specific R and Definition	Transportation-related Example	Guiding Questions to Inform Brainstorming & Discussion
<p>RULES are the regulations, policies, incentives, norms, and expectations that shape the ways that a system operates and therefore shape the key results. Rules can shape roles, impact availability and access to resources, and affect relationships. Rules can be formal or informal.</p>	<p>Local street design standards.</p> <p>State infrastructure funding laws.</p> <p>Norms related to driving a few mph above the posted speed limit.</p>	<p>What rules affect the way the system functions? What rules affect results?</p> <p>What are the relevant formal and informal rules?</p> <p>What rules are needed for the system to function effectively and produce desirable results?</p> <p>How effectively are rules enforced?</p> <p>How equitably are rules enforced?</p>
<p>RELATIONSHIPS are the interdependencies between two or more factors associated with the result. They could exist between people/roles, between roles and resources, or between rules and resources, etc.</p>	<p>Distances between affordable housing and transit, biking and walking networks, employment, and essential services.</p> <p>Coordination between transit and car-sharing services and alcohol-serving establishments.</p>	<p>What are the important relationships that exist in the system between roles or other factors (e.g., roles and resources)?</p> <p>How strong are the relationships among people and groups working on the problem?</p> <p>Are there relationships that are missing, weak, or unnecessary?</p> <p>What types of relationships would need to exist to improve the system?</p>

Goal and Action Alignment Mapping Case Study: Applying a Systems Thinking Tool to Facilitate Multi-Stakeholder Collaboration and Advance Transportation Safety

Cross-sector collaboration (involving government agencies, community organizers, lawmakers, and research institutions) is necessary to address complex problems like transportation injuries and deaths. Yet, collaboration is often hard. Each individual and organization has its own priorities and needs and faces unique challenges and resource constraints. They might also have pre-existing relationships with each other or with unrelated entities that can help or hinder work. For these reasons, to create successful partnerships, potential partners need to understand the larger system they are embedded within. Systems thinking tools, like Goal and Action Alignment (GAA) Mapping, offer a simple but structured way to facilitate this.

What are Goal and Action Alignment Maps?

They are a systems thinking tool to help us understand what motivates (potential) partners to work together, and what they already do/might do to help advance an initiative. By doing so, they help stakeholders better connect with one another in potentially new and powerful ways.

GAA Maps are usually drawn as part of a group activity in which a coalition of partners working on a common initiative explore how the individual work of partners (or potential new partners) relates to the common goals of the coalition.

As a first step, the coalition members identify the **three most important goals of the coalition**. After that, each coalition partner (or potential partner) completes their own map, identifying **three core objectives of the individual work of their organization** as well as the **three main challenges that their organization faces** when trying to

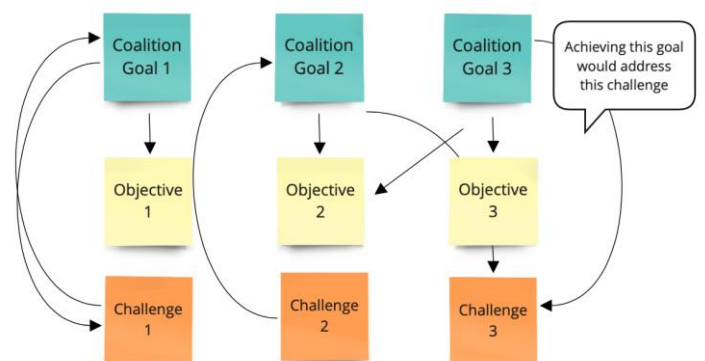
achieve those core objectives. Then, each partner (or potential partner) draws arrows that document:

- how the coalition goals affect the objectives and challenges of their individual organization (arrows from the teal boxes to yellow or orange boxes) and
- how their work on the objectives and challenges of their individual organization impacts coalition goals (arrows from yellow or orange boxes to teal boxes).

These arrows should be annotated to provide additional details about the nature of the relationship.

The diagram below shows the basic structure of a GAA Map. The three most important goals of the coalition are listed at the top (in teal). Below them, individuals or organizations write down their specific core objectives and challenges (in yellow and orange, respectively). After that, they draw arrows that represent the connections between goals and objectives/challenges and annotate them.

Basic Structure of a Goal and Action Alignment Map



GAA Mapping in Action

By comparing GAA Maps across individuals and organizations that are part of a coalition (or considering joining it), we can shed light on win-wins between individual partners and the broader coalition, motivating action and change. Furthermore, by identifying areas of potential friction (e.g., coalition goals exacerbating organization-specific challenges), this exercise can help organizers learn how to introduce changes in the coalition to better accommodate existing and potential partners.

Why is this helpful?

GAA Maps are a structured and systematic guide to help us understand what motivates partners to work with us, and what they already do/might do to help a group's efforts.

Importantly, this approach does not require everyone to care about the same things. All partners can collaborate (and contribute to different coalition goals) as long as being part of the coalition does not interfere with their objectives or exacerbate their challenges.

Furthermore, because GAA maps are usually drawn as part of a group activity, they can contribute to creating a more honest and transparent coalition or group. Through discussion, participants can overcome assumptions about the objectives and challenges of their (potential) partners.

Real-World Example

We used GAA Mapping during a virtual workshop aiming to understand how a diverse group of stakeholders (including government agencies, public health experts, researchers, and community organizations) could work to reduce traffic-related injuries and deaths in a large metropolitan county. Some of these stakeholders had been collaborating for some time but wanted to reassess the state of their partnership and understand how they could start collaborating with additional partners to expand the coalition.

With this in mind, they set aside time for a larger discussion among current and potential new partners to: 1) illuminate the network of partners that could help support comprehensive work to reduce traffic-related injuries and deaths, 2) uncover motivations on why or how diverse partners might want to get involved, and 3) identify future areas for partnership and program work. In the following sections, we describe how the GAA Mapping process contributed to achieving these objectives.

To set the stage for this work, we first provided participants with a brief introduction to systems thinking. We explained how systems thinking can help us move away from a traditional road safety approach centered around modifying behavior at the individual level to a systems approach that focuses on structural factors that affect injury and death risks. We also emphasized the importance of considering the wider system in which collaborations are embedded and how system thinking tools can help us understand partnership networks as a “whole.”

We then introduced GAA Maps as a tool that allows us to explore how to make collaborations more successful by uncovering areas of alignment and potential friction between the goals of the coalition and the work of individual partners.

First, we asked participants to agree on the three main goals of the coalition. Second, we asked participants to draw their GAA individually. As we were working online, we sent participants a link to Miro, a free online platform that allows users to work collaboratively on a virtual whiteboard. (Several other tools, including Google's Jamboard, Mural, and Zoom's whiteboard have similar functionalities.) The whiteboard on Miro was prepopulated with a GAA Map outline for each participant (similar to the diagram shown above). This outline included virtual sticky notes on which participants could write down their organization-specific objectives (yellow stickies) and challenges (orange stickies), below the agreed-upon coalition goals (teal stickies).

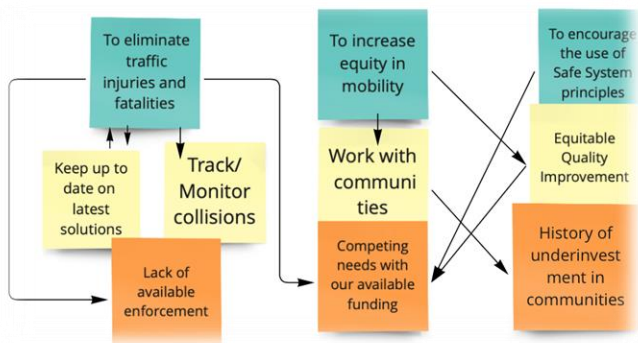
We gave participants some individual time to work on their own GAA Map. Once they were done, we asked them to share their maps with the wider group and to review others' maps. While listening and reviewing, participants were encouraged to reflect on what their organization could do differently to support the shared goals of the coalition or how the wider coalition or specific partners could support their own objectives or help them with their own challenges.

What did this exercise reveal?

Initial group discussions among current (and potential) partners allowed us to identify three key goals for the coalition. These included **eliminating traffic-related serious injuries and fatalities**, **increasing healthy and equitable mobility** for all, and ensuring that **Safe System principles are built into transportation planning efforts**.

Individual GAA Maps provided rich information about the synergies and potential areas of friction between these coalition goals and the work of individual organizations. The diagram shown below, drawn by a participant working

at the County Road Services Division, provides a good example. Two of the Division’s objectives are keeping up to date with the latest evidence on road safety and tracking and monitoring collisions. These objectives are directly related to the coalition’s goal of eliminating traffic injuries and deaths. The Division could gain access to new knowledge and/or collision-tracking evaluation expertise through the coalition. In addition, the Division could support other partners working towards this goal (e.g., by sharing evidence or best practices with other partners). The diagram also revealed potential synergies between the Division’s justice and community engagement objectives and the coalition’s equity goals.



In this case, a history of underinvestment in vulnerable communities (and potentially related mistrust) represented a shared challenge for both the Division and the coalition; working on increasing county equity and mobility around transportation safety through the coalition would also help advance the Division’s work in this space.

Synthesizing data across individual GAA Maps also provided rich insights. Individual organizations could offer a great deal of support to help the coalition meets its goals. This included access to up-to-date evidence on road safety

interventions, technical expertise on data analytics, planning guidance, and experience with effective community engagement and centering equity in evaluation and implementation work. In turn, the coalition’s ambitions could help individual partners meet some of their objectives. The coalition could facilitate dissemination of (new) evidence and best practices across partners and provide access to expertise in data generation and evaluation. Moreover, forming part of the wider coalition made it possible for some organizations to achieve their objectives to collaborate across sectors, to amplify the impact of their work and messaging, and to provide a platform for more effective community engagement, advocacy, and legislative efforts.

Conclusion and Next Steps

GAA Mapping is a systems thinking tool that offers a structured and systematic way to better understand how work by individual partners could contribute to the achievement of the larger group or coalition’s goals and how the group or coalition could help support individual partners’ objectives (or address their challenges).

The initial insights from the GAA can enable participants to start developing more concrete action plans to collaboratively achieve coalition goals while supporting individual partners. At the same time, it can help individual organizations gain a better understanding of their role in the system and make it easier for potential new partners to decide whether to join the coalition by articulating what they can offer and what benefits they might receive.

Goal and Action Alignment Mapping How-To Guide

What is it?

- A mapping tool that allows people to see how they are embedded within a larger system that includes shared goals, illuminates win-wins between themselves and partners, and can help motivate action and change.
- A tool to help make explicit how different stakeholders individually connect to some common goals (i.e., how the goals of the initiative specifically link to the goals of their organization), what unique assets stakeholders can each contribute to the initiative, and what win-wins exist between stakeholders.

Why do we use it?

- To help align stakeholders (e.g., agencies, community groups, nonprofit partners) around some common agreed-upon goals.
- To help organizers learn how to better approach different types of stakeholders when planning for and implementing a program or initiative.

How to create a Goal and Action Alignment Map

1. Define the initiative or program you want to focus the alignment work around (e.g., could be a new initiative or an initiative that needs reinvigorating).
2. Select which approximately 3 results/ outcomes are most important for the initiative or program, and place these 3 results/outcomes on teal stickies (e.g., to reduce injury and death, to increase the physical health of the community).
3. Lay out about 3 yellow stickies under the teal sticky notes, and under those, 3 orange stickies. Duplicate this grid of 3 x 3 stickies several times, such that each person has the



same 3 results/outcomes on teal stickies but blank yellow and orange stickies to individually fill in.

4. Identify potential partners who are/could be engaged in the initiative and ask each partner to complete a 3x3 map/grid of stickies.
5. On the yellow stickies, ask each partner to write about 3 mission critical objectives that their organization is working toward (i.e., what the partner is trying to achieve within their organization each day). Write one idea per sticky note.
6. On the orange stickies, ask each partner to write about 3 pain points or challenges that their organization is facing. Write one idea per sticky note.
7. Next, ask the partner to draw connections/arrows from the teal sticky notes to the yellow and orange sticky notes to illustrate how achieving the 3 goals that the larger

initiative is working on could help them achieve their mission critical objectives or pain points. Annotate each connection.

- Finally, ask the partner to draw connections/arrows from the orange and yellow sticky notes into the teal sticky notes to illustrate any work they are already doing within their organization (to address challenges or achieve their mission critical objectives) that could also help support the goals of the larger initiative. Annotate each connection.

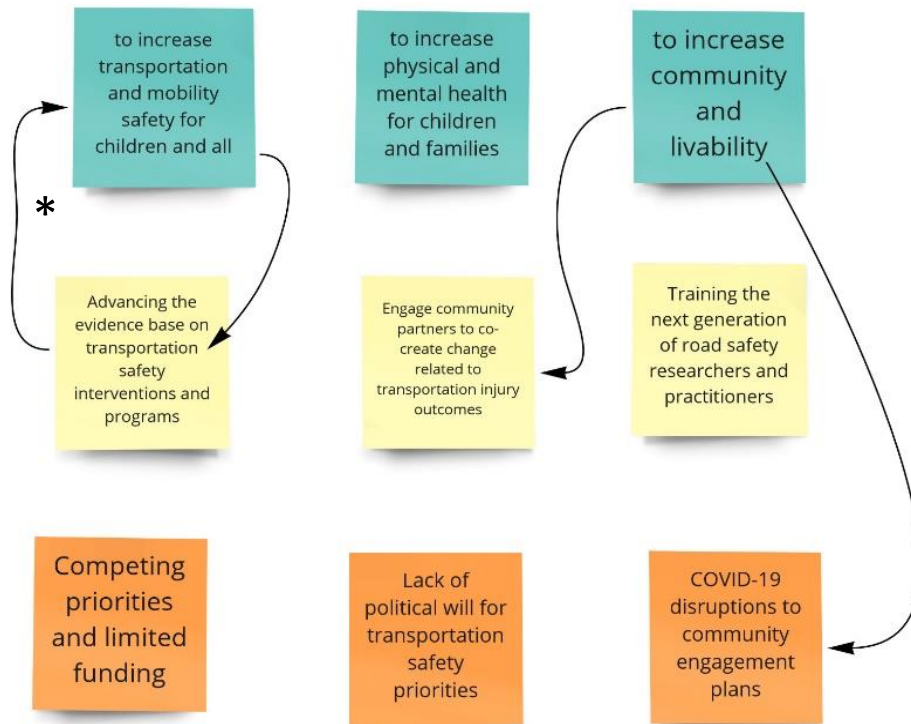
These maps can inspire discussion around:

- Are there any core results that we haven't yet identified stakeholders around (i.e., that "touch" the outcomes/results we care about)? Are there additional partners we should be reaching out to?
- How did different partners connect to these outcomes (i.e., through a connection from the teal outcomes to the yellow objectives or orange pain points)—any surprises or

considerations for how similar partners in your community might connect to these outcomes?

- What sorts of actions/resources are different partners thinking they could provide to help achieve the target outcomes (i.e., arrows into teal sticky notes)—any surprises or takeaways for how other partners in your community/network might help?
- Within the potential actions suggested, can we identify any partnership synergies—where one partner might be able to support or augment another partner's potential actions? (This could involve supporting programming, data collection, partnership development, etc.—any pairings that could help individual organizations' work but also move forward the larger initiative?)

Example Goal and Action Alignment Map



* Annotation for connection: "Could use a curriculum our organization has developed related to transportation safety as a starting point for tailoring to school officials."

System Support Mapping Case Study: Applying a Systems Thinking Tool to Facilitate Multi-Stakeholder Collaboration and Advance Transportation Safety

Multi-stakeholder collaboration (involving community members, advocacy groups, government agencies, and research institutions) is necessary to address complex problems, like transportation injury. However, cooperation among diverse stakeholders is often hard. Individuals and organizations have their own priorities. They also have different levels of resources, as well as different levels of understanding regarding other stakeholders' roles and priorities. For these reasons, to create successful collaborations, stakeholders must first be understood within the broader system in which they work. Systems thinking tools, like System Support Mapping, offer powerful, yet simple, approaches to systematically increase our understanding of the system of stakeholders (and their actions) working on complex problems, and can ultimately help us make our collaborations more effective.

What is a System Support Map?

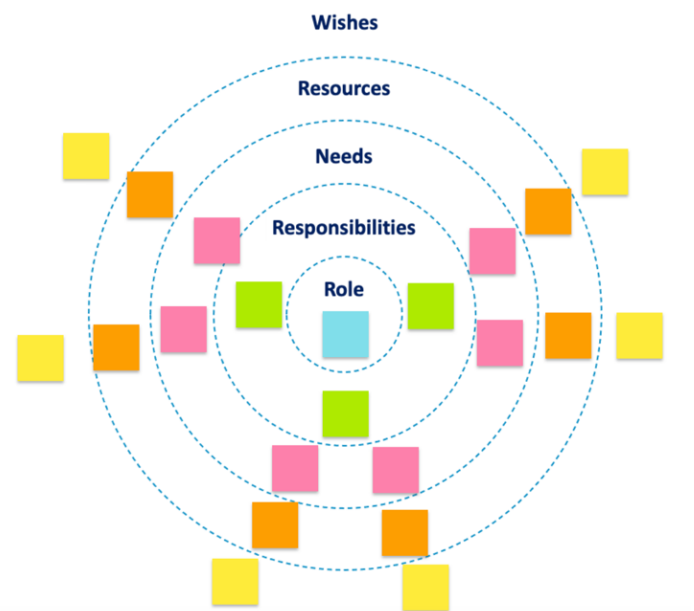
A System Support Map (SSM) is a diagram used to clarify what is needed to help individuals or organizations fulfill their role within a specific system or collaboration (e.g., a Vision Zero initiative).

SSMs are usually drawn individually by participants in a group activity. First, participants are asked to summarize their **role** in a single word or short phrase. After that, in a circle around their role, they list their main **responsibilities** as part of their role. Participants then write down (in concentric circles) what they **need** to fulfil each one of these responsibilities and the specific **resources** necessary to meet those needs (mentioning both resources that are currently available and those that are not). The difference between needs and resources is subtle but important.

Needs refer to general requirements such as time, money, or information, while resources are more precise (e.g., the specific dataset from which information is extracted). A SSM usually includes two or more needs for every responsibility and at least one resource per need.

Finally, in the outermost circle, participants can include their **wishes**. Wishes can be specific (referring to improvements to current resources or desires to obtain new ones) or be more general, briefly describing strategic goals or proposals to address unmet needs.

System Support Map Framework



Why is this helpful?

At the individual level, drawing an SSM can help participants systematically assess the extent to which they are being supported in their roles (and critically think about ways to improve this support). In addition, by reviewing other people's maps, participants can gain a better understanding of what they can personally do to support the work of other stakeholders in the collaboration.

At the interpersonal level, discussing SSMs as a group can encourage small "c" collaborations within the wider partnership. For example, a participant might find out their partners have resources they are lacking (and vice versa). At the larger (i.e., big "C") collaboration level, SSMs can spur strategic discussions about how to better support collaboration "wishes" or goals across agencies or organizations. Lastly, synthesizing data across SSMs can help show the degree to which different responsibilities converge (or not) into a common wish/desire across people and organizations (or how a single wish relates to different resources, needs, and responsibilities across people and organizations).

Real-World Example

We used SSMs during a virtual workshop aiming to reinvigorate a partnership between two organizations working on safe and active transportation in California: Organization A is a nonprofit engaging communities across the state to promote active and safe transportation, while Organization B is a university-affiliated transportation safety research institute. These organizations had already been collaborating for several years but wanted to assess the state of their partnership to facilitate strategic planning and strengthen collaboration.

With this in mind, we facilitated a series of group discussions with aims that included clarifying current agency responsibilities, needs, resources, and wishes within current collaborative work and determining future responsibilities, needs, resources, and wishes needed to successfully expand their collaboration and achieve future collaboration goals.

In the following sections, we describe how SSMs contributed to achieving these aims. [Two other systems thinking tools, the 5 Rs and the Balance of Petals, were used to support meaningful discussion within these sessions as well. Please see related handouts for an overview of these distinct but complementary tools.]

System Support Mapping in Action

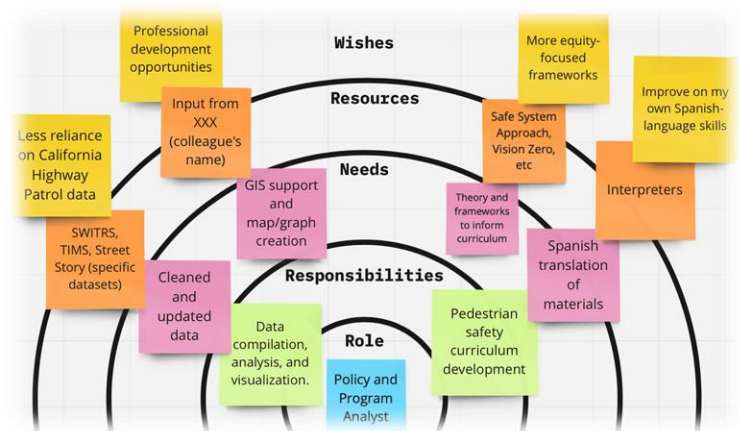
At the beginning of the workshop, we provided participants with a brief overview on systems thinking. We highlighted the importance of considering partnerships as a whole (i.e.,

comprising multiple interconnected stakeholders and components). We also explained how system thinking tools can help show the relationships between these components and how partnerships behave as systems.

We then asked participants to focus specifically on what they needed to succeed in their role and achieve the aims of the collaboration (i.e., broadly, to promote active and safe transportation across California).

We introduced SSMs as a systems thinking tool to facilitate this discussion. Because we held the workshop virtually, we used a free online platform called Miro to create the SSMs, as this platform allows participants to simultaneously work on a digital whiteboard and observe all SSMs created in one space. Although we chose Miro, other online tools (e.g., Google's Jamboard, Mural, Zoom's whiteboard) offer similar functionalities. We sent participants a link to a prepopulated Miro whiteboard that included an SSM outline (like the one shown on the previous page) for each participant (along with some extra virtual "sticky notes" in case participants needed them).

A snapshot of the top of one participant's SSM is shown below. Participants were first given some individual time to work on their own SSM. After that, they were asked to share their maps with the wider group and to review others' maps. While listening and reviewing, participants were encouraged to reflect on what they (or their organization) could do differently to support the collaboration, to consider whether they could follow up with specific people to share (or request) a certain resource, and to think about needs or issues that needed to be tackled by the collaboration as a whole.



What did the SSM reveal?

In addition to facilitating a better understanding of what participants needed to succeed in their roles and fulfill their responsibilities at the individual level, the SSM generated rich information to facilitate opportunities for both small

“c” collaborations between individuals and strategic thinking at the larger partnership level.

Small “c” collaborations

The SSMs revealed multiple ways in which participants could help other individuals (either within their organization or the other organization in the collaboration). For example, some staff at Organization A indicated a desire for more opportunities for access to cutting-edge research and information exchange opportunities to push their community-based work into innovative, new directions. Staff at Organization B noted resources they had at the university on innovative community engagement models and their access to several timely webinars in this space. This alignment between the wishes, resources, and needs between individuals in the collaboration can spark conversations about potential mutually beneficial small “c” collaborations and assistance that can be provided within and across organizations.

Strategic big “C” collaborations

Organization A’s wishes revolved around **collaboration** (e.g., establishment of additional long-term multilingual partnerships), **grant funding** (e.g., including greater alignment between community needs and funding opportunities, better coordination between the grant writing process and the development of grant-funded programs, and multi-year funding), and **internal organizational development** (e.g., staff professional development, in-house human resources support, and improved invoicing procedures).

Many of Organization B’s wishes were similar to those reported by Organization A, revolving around **grant funding** (e.g., diversification of funding streams, development of mini-grants for community-led efforts, and greater flexibility in the ways funds could be spent) and **organizational development** (e.g., including better coordination across

departments and internal communication processes and opportunities for professional development, specifically around data visualization, social justice, Spanish-speaking skills, and story-telling capabilities).

Comparing wishes across organizations makes it possible to identify overlapping and/or complementary wishes. For example, grant funding emerged as a clear area of strategic interest for both organizations, representing a potential key collaboration goal. More specific areas of potential alignment can be easily observed with more detailed review of Organization A’s wishes (e.g., alignment of funding with communities’ needs) and Organization B’s wishes (e.g., mini-grants for communities). Similarly, Organization B’s desire to develop capabilities to better assess community needs can support Organization A’s wish to establish long-term partnerships with additional community groups.

Next Steps

A thorough analysis of the similarities, differences, and potential synergies of wishes across organizations (along with the insights from other systems thinking tools) can facilitate the refinement of specific collaboration goals and notable areas of opportunity. SSMs can then be synthesized to understand the specific resources, needs, responsibilities, and roles that can help support each of those goals.

Conclusion

SSMs are a simple yet powerful tool to understand what individuals and organizations require to succeed in their roles and fulfill their responsibilities. Comparing SSMs across individuals and organizations can also encourage cooperation both within and across organizations. Lastly, and most importantly, by stimulating comprehensive and “big picture” thinking around needs and desires, SSMs can facilitate fine-tuning of common strategic wishes that can drive partnership efforts and future collaborative action.

System Support Mapping How-To Guide

What is it?

- System support maps are used to understand the role an individual or organization plays in a system, their responsibilities or objectives/goals, needs for meeting each responsibility, resources used to support needs (and notes on whether these resources are helpful), and wishes for being better supported or better supporting the system.

Why do we use it?

- To help networks of partners across organizations, or within an organization, understand the system of work supporting a goal/initiative and what can be done to strengthen this system.
- To help identify explicit opportunities to work together more effectively toward current or future goals.

How to create a System Support Map

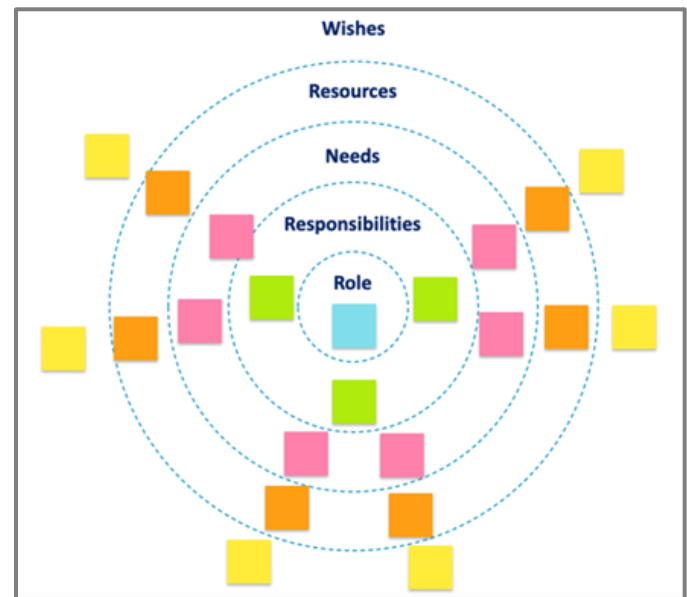
1. Select the focal initiative, collaboration, or goal for the purposes of the mapping exercise. Are you focused on strengthening the system around a collaborative initiative that several organizations are involved in, or maybe strengthening a team within an organization?
2. Draw a series of four nested circles as shown to the right to create a map. Create a map like this for each organization/agency involved, if mapping for an initiative, or each individual, if mapping for a specific team within an agency (i.e., you may need to duplicate this map several times).
3. The four nested circles separate the five key domains of the System Support Map: the role, responsibilities,

needs, resources, and wishes of the person/organization completing the map.

4. Place sticky notes within each domain/circle and complete as follows for each person/organization engaged in the initiative or collaboration:

ROLE

- When you think about the work that you are a part of within the agency/initiative/collaboration, how do you define your role in 1-4 words? Write this on one BLUE sticky in the middle.



RESPONSIBILITIES

- What are your most important **responsibilities** in this role?
- Identify the **approximately four most important responsibilities** you currently carry out with respect to this collaborative work.
- Write each **responsibility** on a GREEN sticky in the next ring.

NEEDS

- What do you **need**?
- For each responsibility, what do you most need to succeed (in general terms – time, patience, knowledge, access to information about X, etc.)? Write each **need** on a PINK sticky.
- **There are two stickies for ‘needs’ per each responsibility** – but please add additional stickies if you think of more than two needs for any given responsibility. Every discrete need should get its own sticky!

RESOURCES

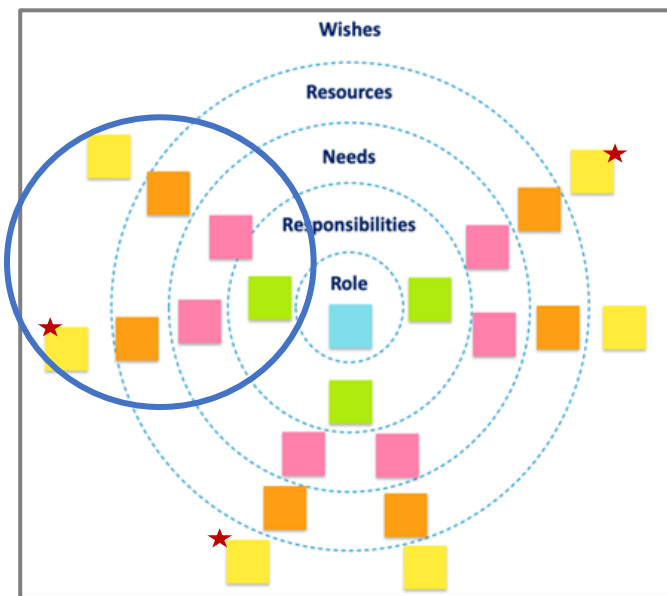
- What **resources** currently exist that you have used to meet your needs?
- For each need, what specific resources have you tried in the past? For example, if you need data, then document the data sources that are available to you. Write each **resource** on an ORANGE sticky.

WISHES

- Finally, what do you **wish** for?
... to improve any resource you use or address any unmet need?
- Write each **wish** on a YELLOW sticky. Consider highlighting or denoting (e.g., with a star) the approximately three wishes that would be most valuable to support you in your work.

These maps can inspire meaningful, action-oriented discussion:

1. Have each person share and talk through their map. As you listen to or review others’ maps, record 1-3 things that **you or your organization could do differently** to better support the work of this collaboration.
2. As you listen to or review others’ maps, record 1-3 things that **you would like to follow up on with specific individuals/organizations** (small “c” collaborations, e.g., to share a resource you heard them describe needing or vice versa).
3. As you listen to or review others’ maps, record items (e.g., wishes, needs) that you **feel are important to do but are too big for any one individual/organization** to address, which the larger collaboration/team might need to tackle as a whole.



Note: For each responsibility (green sticky), we want to ‘push out’ to the two pink, two orange, and two yellow sticky notes to brainstorm needs, resources, and wishes that correspond to that specific responsibility.

Finally, remember to denote (e.g., with stars) the approximately three wishes per map that you want to focus discussion around for increased support.

Balance of Petals Case Study: Applying a Systems Thinking Tool to Facilitate Multi-Stakeholder Collaboration and Advance Transportation Safety

Tackling complex problems, such as transportation injury, requires collaboration across multiple individuals and organizations (including community members, government agencies, lawmakers, and research institutions, among others). Although collaboration is essential, it can be challenging. Each stakeholder has their own priorities, needs, resources, and pre-existing commitments and relationships with other stakeholders. Therefore, successful collaboration must be understood and supported within the broader context of systems of interdependent stakeholders. Systems thinking tools, like the Balance of Petals tool, offer a simple and structured way to increase our collective understanding of this larger system to make collaboration more effective.

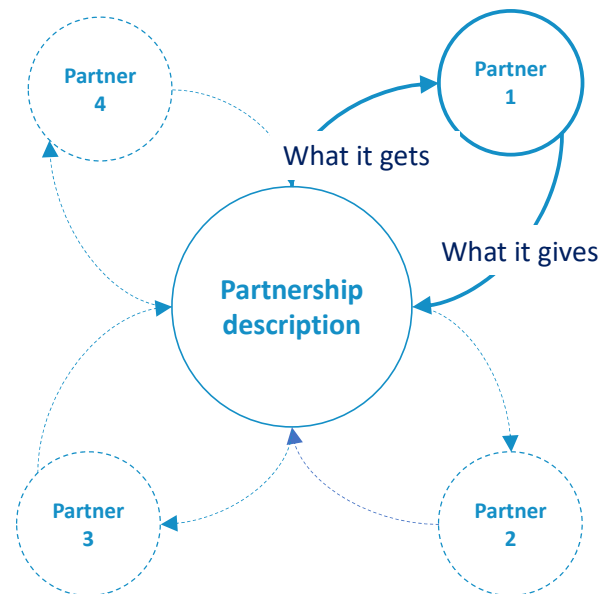
What is the Balance of Petals tool?

The Balance of Petals tool is a framework that can help clarify the role that different stakeholders play in supporting an initiative, as well as the value that the initiative brings to each one of them. These diagrams are usually drawn collaboratively as part of a group meeting. First, participants together agree on a short phrase that describes the purpose of the collaboration (or one of its goals). After that, in a circle around this short phrase, they list the different stakeholders that are (or could be) part of the collaboration. Participants are then asked to draw two arrows connecting each partner to the initiative description. One arrow goes from the partner to the initiative description, representing what the initiative needs (or will need) from the partner, while the other arrow goes

from the initiative to the partner, indicating the value that the collaboration brings (or will bring) to that partner.

Once the Balance of Petals diagram is complete, it allows participants to easily understand what each of the partners “gives to” and “takes from” the collaboration. It also makes it easy to identify imbalances in the system (e.g., partners that support the initiative but do not get value from it), helping spur conversations to ensure sustainable collaborations.

Balance of Petals Framework



What did the Balance of Petals reveal?

The Balance of Petals diagramming revealed a high degree of alignment between what each organization obtained (or could obtain) from the collaboration and what each organization gave (or could give).

Organization A provided community engagement expertise, as well as access to bilingual (English-Spanish) speakers to Organization B, which wanted to gain access to information on local needs and establish connections with communities. Organization A also offered planning, program development, and training expertise and experience working with several community vendors, helping Organization B understand practical barriers on the ground and establish mechanisms to facilitate the translation of research into practice. In turn, Organization B brought not only political clout and a strong academic reputation and credibility, but also technical skills and access to subject matter experts. This aligned with Organization A's desire to leverage the partnership to learn more about the latest advancements in active transportation science, programs, and policy. Furthermore, resources and money available through Organization B helped meet Organization A's funding needs and desire to create jobs. The discussion allowed the organizations to develop a common understanding of the "gets" and "gives" in their transportation collaboration and to uncover assets that could be better leveraged to develop future goals and expand their work together.

Next Steps

A balance between what each organization gives (or wants to give) to and takes (or hopes to obtain) from the partnership is important. However, this balance is not enough to make a collaboration successful. The "gets" and "gives" need to be operationalized into concrete action plans. With this in mind, we asked participants to use the insights from the Balance of Petals diagram to discuss supports needed to collaborate better together now and in the future as they work toward additional shared goals. We used an additional system thinking technique (System Support Mapping) to foster this discussion around tangible next steps in supporting their current and future collaboration. If you want to learn more about System Support Mapping, you can read the System Support Mapping-specific case study and how-to guide included in this toolkit.

Conclusion

Collaboratively creating Balance of Petals diagrams can not only help show what different stakeholders contribute to and gain from a partnership, but also assist in the development of future collaboration goals that meet partners' needs and ensure a partnership is effectively leveraging the unique assets and contributions of each partner. This and other systems thinking tools offer simple yet powerful ways to systematically analyze relationships and design strategies to strengthen them.

Balance of Petals How-To Guide

What is it?

- A systems thinking tool used to brainstorm and document what, specifically, is needed from stakeholders to support an initiative, such as a Vision Zero or Safe System-related initiative, as well as what about the initiative brings value to each stakeholder.

Why do we use it?

- For encouraging assessment of the balance of need/benefit among all partners in an initiative to motivate investment, pinpoint partner assets, and ward off partner burnout.
- For understanding the balance between value derived from an initiative and costs associated with participation to sustain partnerships and maximize impact.
- For identifying imbalances in partnerships and beginning conversations on what can be done to "balance those petals."

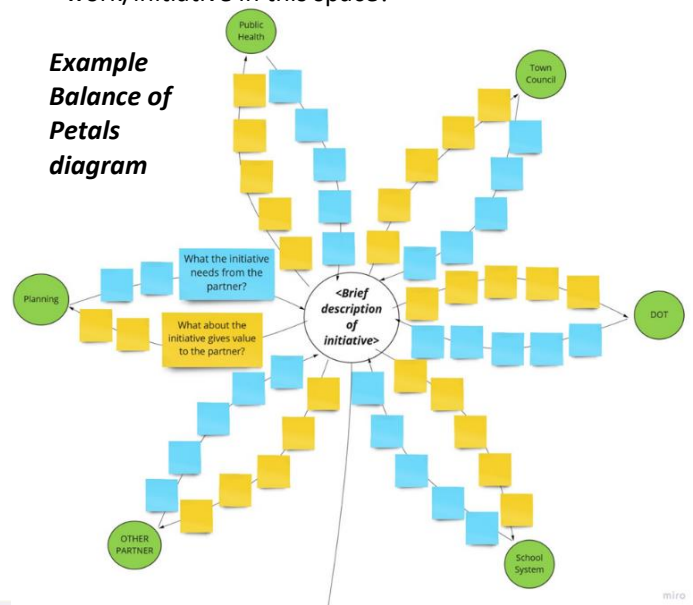
How to create a Balance of Petals diagram

1. Write a simple description of your initiative in the center.
2. In a large ring around the outside edge of the paper, describe all partners (current or future) as well as any stakeholders who will need to buy into/not undermine your work.
3. Draw two arrows connecting each stakeholder/partner to the initiative—one pointing to the stakeholder and the other pointing to the initiative.

4. On the arrow pointing to the stakeholder, ask the stakeholder to describe what the value of supporting the initiative is for them/their organization. Include as many benefits as you can (one per sticky note).
5. On the arrow pointing from each stakeholder to the initiative, ask the stakeholder to brainstorm on what specific assets/resources the stakeholder provides/could provide to the initiative. Ask them to include as many resources and specific assets as they can (one per sticky note).

This diagram can inspire discussion around:

- Which stakeholders are engaged and need to be engaged for your work together to succeed?
- What do you need from each and what can each provide? (E.g., political support, data, funding, effort – be specific and complete.)
- What does each stakeholder have to gain from your work/initiative in this space?



Causal Loop Diagramming Case Study: A Participatory Systems Thinking Tool to Understand Interconnected Factors that Affect Transportation Safety and Inspire Collective Action

Finding solutions to complex problems (such as traffic injuries and deaths) requires multi-stakeholder collaboration, including community members, advocacy groups, government agencies, and research institutions. Furthermore, to inform unified action, collaborating stakeholders need to develop a shared understanding of the set of interconnected factors (i.e., the “system”) that contributes to the problem. However, both cooperation and the creation of a common view of issues at hand can be challenging. Different stakeholders have different priorities. They also have different levels of resources and views about the nature and causes of the problem. Moreover, there is often disagreement regarding the adequacy and feasibility of different solutions.

In this context, participatory systems thinking tools, like group-based Causal Loop Diagramming, offer powerful approaches to develop a common understanding of the interconnected factors that affect complex problems and design solutions that leverage collective action.

What is a Causal Loop Diagram?

Causal Loop Diagrams (CLDs) are visual aids that show how multiple components of a system are interrelated and interact to cause a certain problem. CLDs are often drawn collaboratively as part of a group activity to help develop a shared understanding of how system components interact to drive observed trends.

CLDs include four key elements: variables, arrows, polarities, and feedback loops. **Variables** are nouns or short phrases that represent system components or factors that can go up or down over time. For example, in the context of safe and active transportation, walking and cycling injuries

or traffic density might be important variables of interest that can increase or decrease over time.

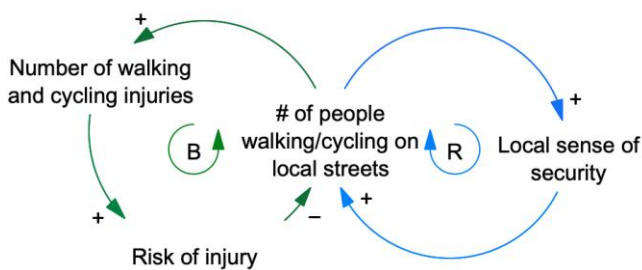
In CLDs, variables are connected by **arrows**. The directions of the arrows are important. An arrow going from variable A to variable B indicates that a change in variable A causes a change in variable B (and not the other way round). For instance, an increase in traffic density will cause more pollution, but increased pollution will not necessarily lead to more traffic.

Another important characteristic of the arrows in a CLD is their **polarity**. The polarity of an arrow represents the nature of the relationship between the two variables connected by that arrow. A positive polarity indicates that the two variables move in the same direction. For example, in the diagram on the next page, we can observe that when the “local sense of security” in a community goes up, the number of pedestrians/cyclists goes up (or when the “local sense of security” goes down, pedestrian and cyclist activity goes down). In contrast, a negative polarity represents the opposite scenario; the two variables move in the opposite direction (e.g., an increase in injury risk leads to a decrease in the number of pedestrians/cyclists or a decrease in injury risk leads to an increase in pedestrian/cyclist activity). Usually, a “+” sign or an “S” (i.e., same direction) is used to denote a positive polarity, while a negative polarity is represented by a “-” sign or an “O” (i.e., opposite direction).

Lastly, in a CLD, variables can form **loops**. This occurs when a series of interconnected arrows starting at one variable eventually leads back to this initial variable (see the diagram on the next page). Feedback loops can be reinforcing (R) or balancing (B). Reinforcing loops produce virtuous or vicious

cycles (i.e., an initial change in any variable within the loop leads to changes in the same direction in that same variable, all else held equal). For example, in the hypothetical example diagram below, if more people start walking/cycling, other potential residents will have a greater sense of security and might start walking/cycling too, reinforcing that behavior. In contrast, balancing loops resist change (i.e., an initial change in a variable leads to a compensating change in the opposite direction in that variable). For instance, in the figure below, we might hypothesize that an increase in the number of pedestrians/cyclists can lead to an increase in the number of injuries, leading to an increase in perceived (and real) risk. This could, in turn, lead to a decrease in local walking/cycling, all else held equal.

Basic Structure of a Causal Loop Diagram



Why are CLDs helpful?

Because they are usually completed as part of a group activity, CLDs support development of a shared understanding of the most important factors governing the dynamics of the system or problem under study. In addition, through multi-stakeholder discussion, they can assist in the discovery of important perspectives that had not previously been considered or potentially important factors that might not be measured in research.

CLDs can also help us identify loops that should be supported to promote sustainability in beneficial outcomes. For instance, based on the diagram above, we might want to think of ways to foster a local sense of security that keeps that reinforcing loop activated and results in a sustained increase in local cycling and walking.

Finally, and relatedly, CLDs make it easier to discuss the potential impacts and unintended consequences of proposed interventions. For example, a short-term media campaign to increase local walking and cycling might initially increase the number of people walking/cycling on local the streets. However, in the absence of infrastructure improvements and other changes (e.g., speed management), it might lead to an increase in injuries and fear of cycling/walking in the area, which could hinder future active transportation efforts.

Real-World Example

We used causal loop diagramming during a virtual workshop with organizations working to reduce child and youth pedestrian crashes and deaths in a large metropolitan area in the northeastern United States. These organizations (which included state planners, engineers, and community-based advocacy groups) had been collaborating for some time on Vision Zero efforts in the city. With a persistent and tragic problem of child and youth pedestrian injuries in their city, they specifically sought to come together to better understand contributing factors and mechanisms driving the problem, as well as to begin discussions around potential collective action that could be taken to increase their collective impact. Below, we describe how CLDs contributed to achieving these objectives.

CLDs in Action

We started the workshop with a brief introduction to systems thinking. We explained how systems thinking can help us better understand complexity and system behavior and facilitate cross-sector collaboration. We then introduced CLDs as a participatory systems thinking tool that facilitates stakeholder collaboration to develop a shared understanding of the dynamics driving a particular problem.

Informed by recent data analyses on contributing factors to child pedestrian injury in their city (and due to time constraints), we entered the workshop with an initial CLD, or “seed structure” for the diagram. We walked through the components of a CLD and the initial diagram that had been developed by the facilitation team as a starting point for discussion.

Using Miro (although several other tools, including Google’s Jamboard, Mural, and Zoom’s whiteboard functionality could also be used), we marked up the diagram and took notes on the discussion, grouping themes. We specifically asked participants what was missing, what was incorrect, and what should be removed. Using this discussion, the CLD was then iterated, updated, and reflected back to the group once more for additional edits. A QR code that links to a downloadable version of the final, simplified CLD and an overview of the process and key findings is included below.



What Did the CLD Reveal?

Drawing and refining the CLD together enabled participants to explore the different factors affecting child and youth pedestrian injuries at the local level, as well as the interconnections between them. For example, the CLD shed light on how a car-dominant culture directly contributes to increasing the number of injuries by promoting more vehicle use and higher speeds and decreasing the likelihood of drivers stopping for pedestrians. It also illustrated how this culture indirectly affects injuries by decreasing political incentives for investments in safer pedestrian infrastructure. Furthermore, participants revealed how the interconnections between variables formed feedback loops. For example, one feedback loop identified was how the increase in the number of injuries leads to a decrease in community trust in the government, which in turn hinders community involvement in efforts around pedestrian infrastructure improvements, leading to more injuries over time.

After having the opportunity to reflect on the diagram as a group, participants were asked to identify the variables that may have the greatest impact on the dynamics of the system (and therefore the greatest potential as intervention targets). Attendees ranked **speed**, **roadway design**, and **pedestrian infrastructure** as the biggest contributors to child and youth pedestrian injuries. In parallel, **focusing resources on marginalized communities**, **outreach to co-create community change around transportation safety**, and **traffic calming and roadway design improvements to reduce speed** were seen as key actions that could be taken to reduce injuries and that could

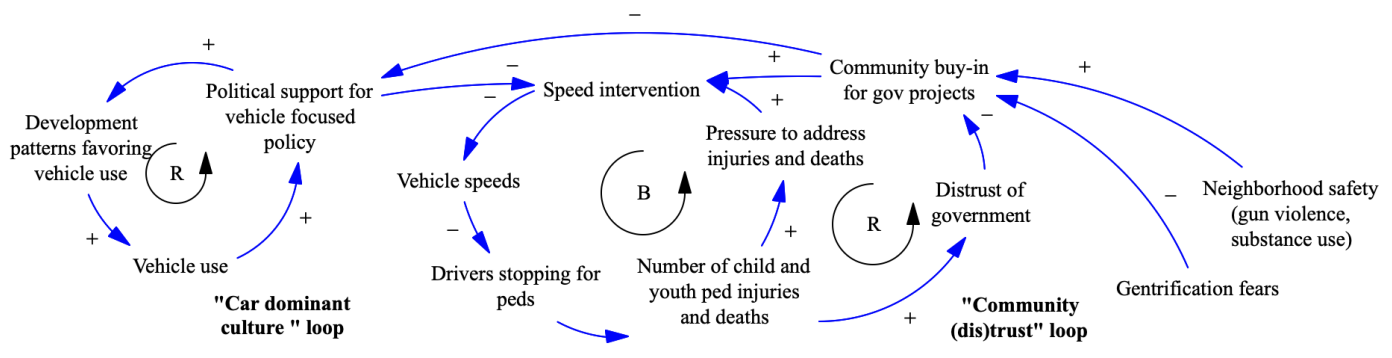
also potentially build off of efforts that participants had been engaged in.

Because speed was perceived as both a key influencing variable and a feasible target for intervention, we decided to delve deeper into how a potential speed reduction intervention would affect (and be affected by) the wider system. To do that, we constructed the simplified CLD shown below. In this diagram, we can observe that **community buy-in** and attention to **wider community issues like government distrust, general safety, and gentrification fears** (which in turn affect buy-in) are essential to increasing the effect of a speed reduction intervention. This is due to two reasons. First, community buy-in is necessary to deactivate the reinforcing “car-centered culture” loop on the left side of the diagram, which acts to hinder speed reduction efforts. Secondly, if wider community issues are ignored, community buy-in will decrease even if previous community-led interventions had contributed to decreasing injuries. Therefore, continuous activation of the “community trust” loop to support speed management efforts will require efforts to authentically gain community support.

Conclusions and Next Steps

CLDs are a powerful tool to facilitate group understanding and discussion of complex systems. The diagrams drawn during this session not only helped facilitate a common understanding of the mechanisms driving child and youth pedestrian injuries, but can also allow stakeholders, and the wider community, to discuss and explore the effects (and unintended consequences) of potential solutions. This can, in turn, help ensure that strategies are collectively selected and designed to maximize impact.

Example Causal Loop Diagram focused on speed and speed-related intervention



Causal Loop Diagramming How-To Guide

What is it?

- A diagram that clearly depicts how multiple factors in a system may interact to cause an outcome (e.g., road traffic crashes).
- Used to help better understand and disentangle the complexity surrounding specific problems or issues to inform action planning.

Why do we use it?

- To help understand a complex system from a variety of perspectives—to enrich our understanding of the factors working together to create problems.
- To identify “vicious cycles” and other circular relationships that perpetuate problems, or “virtuous cycles” that we can leverage to create beneficial change.
- To help identify and expand thinking on potential points of action (or “leverage points”) within a system.

How to create a Causal Loop Diagram

There are several ways to approach causal loop diagramming, depending on the goals of the group and number of people involved. Several documents available from the Systems Thinker (www.thesystemsthinker.com) and Scriptapedia can help provide additional step-by-step guides. Here we briefly discuss a very general framework that could be used to conduct causal loop diagramming:

1. Define the problem that you or your group is interested in understanding better. In other words, what is happening over time that you are concerned about (e.g., pedestrian deaths increasing)? Draw or plot this problem over time, using either real data or by approximating the trend.
2. Begin to brainstorm on important factors potentially related to this problem (e.g., related factors that may be changing over time). These could be factors like changes in vehicle miles traveled over time, changes in vehicle size, changes in impaired driving, etc.
3. Using these brainstormed factors, begin to build a causal loop diagram (or a “dynamic hypothesis”) to help understand the factors that may be contributing to the change in the core trend that you are concerned with (from step #1).

To construct this causal loop diagram, use the following fundamental building blocks:

- Variables: Important factors in the system. These factors can increase or decrease over time (e.g., vehicle trips).
- Arrows: Connections between variables, denoting that one variable is causally connected to another variable (e.g., Crashes \longrightarrow Injuries).
- Polarities: Notes the specific type of relationship between two causally connected variables. A “+” polarity or an “S” indicates that the two variables change in the same direction, all else held equal. A “-” polarity or an “O” indicates that the two variables change in the opposite direction, all else held equal (e.g., Crashes $\xrightarrow{+}$ Injuries, or “more crashes lead to more injuries” and Safe walking infrastructure $\xrightarrow{-}$ Pedestrian crashes, or “more safe walking infrastructure leads to fewer pedestrian crashes”).
- Feedback loops: Closed loops of causal connections that either reinforce change (a reinforcing loop) or resist change (a balancing loop). A reinforcing loop includes 0 or an even number of arrows with a “-” polarity, and a

balancing loop includes an odd number of arrows with a “-” polarity. See the figure below for an example.

Using these building blocks, express stories and hypothesize about relationships between variables related to your core trend. Write your core variable (from Step 1) in the middle of your paper/board and consider the causes and consequences of change in that variable. Challenge yourself or others to consider the ripple effects of causal actions. Instead of stopping at X causes Y, ask but what does Y cause and does that turn back around to affect X?

Use variables, arrows, and polarities. When you identify a closed chain of connections (as shown in the figure below), label this as a feedback loop with a “B” for a balancing feedback loop or an “R” for a reinforcing feedback loop.

- Using the diagram, you can begin to discuss your hypotheses about the factors interacting to cause your problem (and perhaps use it as a forum to discuss competing hypotheses within your group). The diagram should also be used as tool to expand thinking about potential opportunities for action.

These diagrams can inspire discussion:

- With this larger perspective of the system, ask partners to think carefully about actions (approximately 3) that they feel are most important to consider.
 - Consider consulting the Levels of Leverage framework to support brainstorming on impactful actions (see: <https://donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/>).
- Recognizing that different partners touch different pieces of the system, challenge partners to consider which actions they could work on at this point. And given connections to other system elements, with whom do they need to work to ensure efforts are successful?

Example reinforcing and balancing feedback loops

