USAID
FROM THE AMERICAN PEOPLE

System Pathways Mapping Toolkit

USAID/Uganda Feed the Future Market System Monitoring Activity

May 2022

ABOUT THE MARKET SYSTEMS MONITORING ACTIVITY

The USAID/Uganda Feed the Future Market System Monitoring Activity (MSM) applies principles from systems engineering and supply chain management to develop methodologies and tools that can be used to assess the impact of market facilitation activities. The Activity is implemented by the Humanitarian Supply Chain Lab at the Massachusetts Institute of Technology (MIT) in partnership with The George Washington University (GW).

CONTACT INFORMATION

msm-uganda@mit.edu
https://humanitarian.mit.edu/

DISCLAIMER

This report was prepared for the United States Agency for International Development (USAID) under contract number AID-OAA-A-12-00095. The authors' views expressed in this publication do not necessarily reflect the view of USAID or the United States Government.

CONTENTS

1 INTRODUCTION

1.1 PURPOSE

This toolkit provides an introduction to the System Pathways Framework and is a step-by-step guide to creating a system map. The System Pathways Framework was developed by the USAID/Uganda Feed the Future Market System Monitoring (MSM) Activity. It was adapted from causal loop diagrams and other system dynamics tools with modifications to make these tools accessible to development practitioners and applicable to environments with limited data. Details about these modifications are discussed in a paper published in the journal *Production and Operations Management*, which is open-access and available at https://onlinelibrary.wiley.com/doi/abs/10.1111/poms.13492. We encourage you to read this paper to learn more about the theoretical foundations of the approach.

This toolkit will provide you with knowledge of the basic building blocks needed to create your own system map. We invite you to review our second toolkit, the System Pathways Measurement Toolkit, for a discussion of our methodology for developing indicators to assess the health and status of a system.

1.2 WHY SYSTEMS THINKING?

"Systems thinking" is a powerful framework for grappling with complex problems. The approach is employed for the design of spaceships, bridges, the Internet of Things, and countless other complicated and unwieldy projects. Within the international development community, the relevance of systems thinking is growing as donors and practitioners seek ways to create lasting results in the context of complex social, cultural, and economic forces. There is increasing recognition that such long-term outcomes are usually products of underlying systemic change, and therefore difficult to achieve with temporary programming that targets only one specific element.

This shift toward systems-focused and facilitative practices underscores the growing need for approaches to designing, monitoring, and adapting interventions that account for systemic complexity. Inspired by systems engineering, the MSM team has developed a methodology that combines systems thinking principles with the needs of development practitioners. This toolkit is a guide to understanding and applying our methods.

This mapping framework adapts and operationalizes key concepts from the systems literature as a basis for understanding, analyzing, and measuring complex development systems combined with our extensive sectoral and field research. The framework is based primarily on systems engineering approaches: it uses simple visual constructs to represent system components and the relationships between them while capturing the complexity of feedback structures and interrelated pathways. A pathway of components shows how an intervention can directly or indirectly impact a key outcome. The way that components overlap and interact can be explicitly represented using this framework. The framework is especially salient when visualizing the work done by multiple organizations within the same system. Interventions that overlap or affect the same Key Outcome (an important or desired outcome for the system, which we will discuss in detail later) can be easily identified for areas of collaboration.

Example 1.1: System Mapping in Action: Agricultural Market Systems Workshop
In 2017, USAID/Uganda hosted the Uganda Agricultural Market Systems Workshop in Kampala, Uganda where, over three days, 168 participants composed of USAID implementing partners, the Ugandan Government, donor agencies, farmers, and private sector companies convened for a discussion on this methodology and its potential applications. After learning the basic building blocks of the methodology, participants were introduced to a draft map of the full agricultural market system. They applied the methodology to identify missing components of the system and clarify the interconnections between system elements. The system map was updated to reflect the feedback that was received during the workshop. The map of Uganda's agricultural market system, now completed, has been used by USAID to identify priority investment areas and the leverage points in the system where their interventions will be most successful. To read more about this workshop, please view the workshop report at https://humanitarian.mit.edu/wp-content/uploads/2019/07/AMS_Report.pdf.

The resulting system maps act as a basis for various types of analysis in order to assess and measure systemic change. The System Pathways mapping framework enables engagement by a diverse set of stakeholders and is widely adaptable to different structures and contexts. The maps create a shared platform for discussing activities, interventions, and results with stakeholders, including NGO/donor partners, the private sector, the government, and other beneficiaries. As a visual representation of a system, the maps allow every stakeholder to identify how their activities influence the broader system and their potential opportunities for collaboration between actors. The main contributions of the system mapping methodology are to bring together the advantages

of different existing approaches: the ability to capture and analyze complexity using systems approaches in a simple and unified framework that is accessible to development practitioners. Figure 1 shows an example system map of Uganda's agricultural finance sector (we will explain the meaning of the different shapes and colors later in this toolkit).

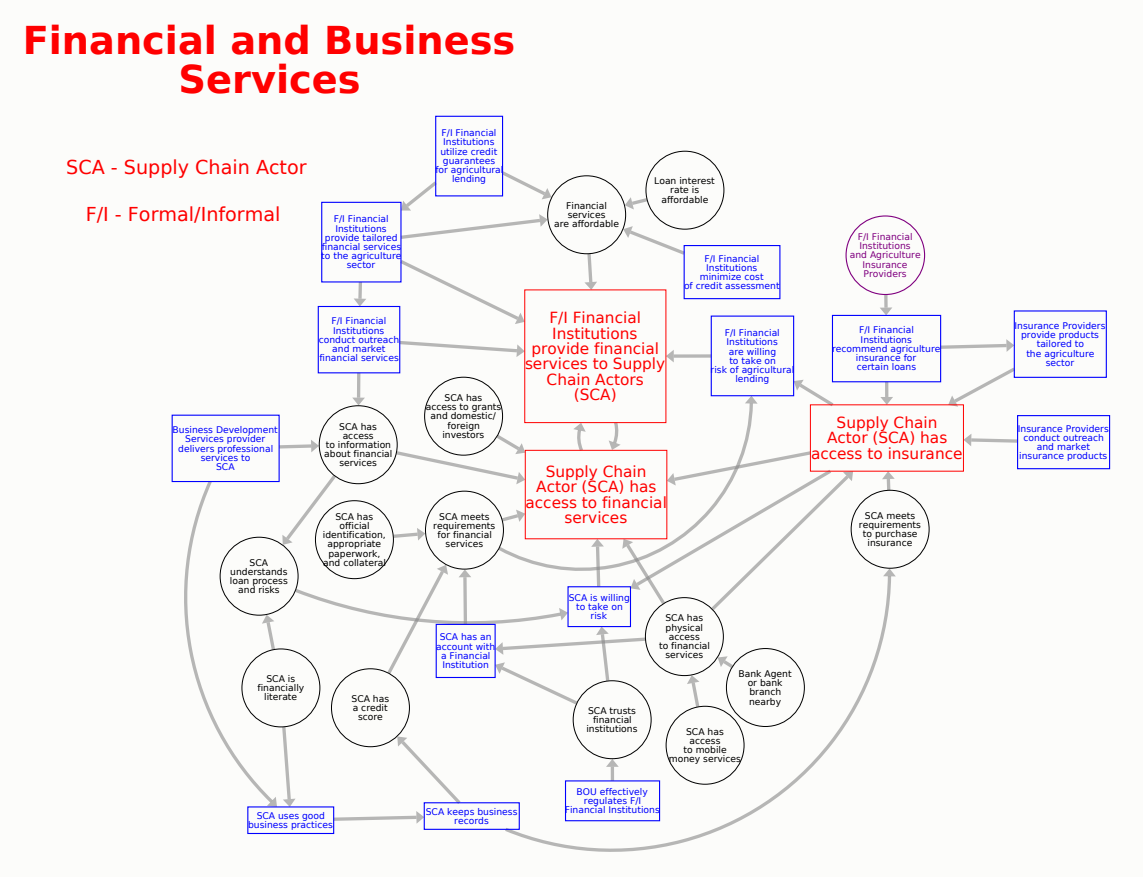


Figure 1: An example system map depicting Uganda's agricultural finance and business services sector.

As you become more familiar with this methodology, you may notice parallels to other frameworks, such as results chains. Results chains, such as the one shown in Figure 2 are used by USAID to graphically represent theories of change. Pathways are analogous to results chains. In systems mapping, a grouping of connected elements showing the connection from an intervention to a Key Outcome (red box) is called a "Pathway," as shown in Figure 3. Both frameworks can be used for root cause analysis and working backward to understand how elements in the system enable other elements.

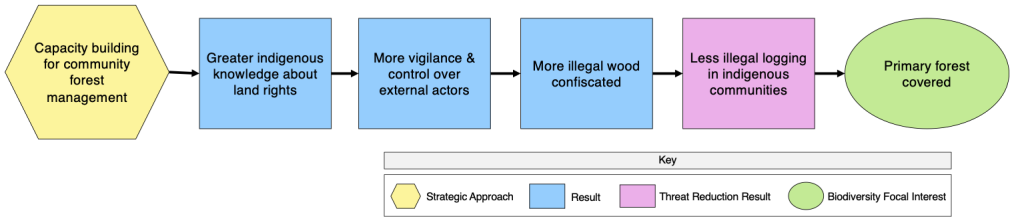


Figure 2: An example of a results chain. Source: "Using Results Chains to Depict Theories of Change in USAID Biodiversity Programming" available here.

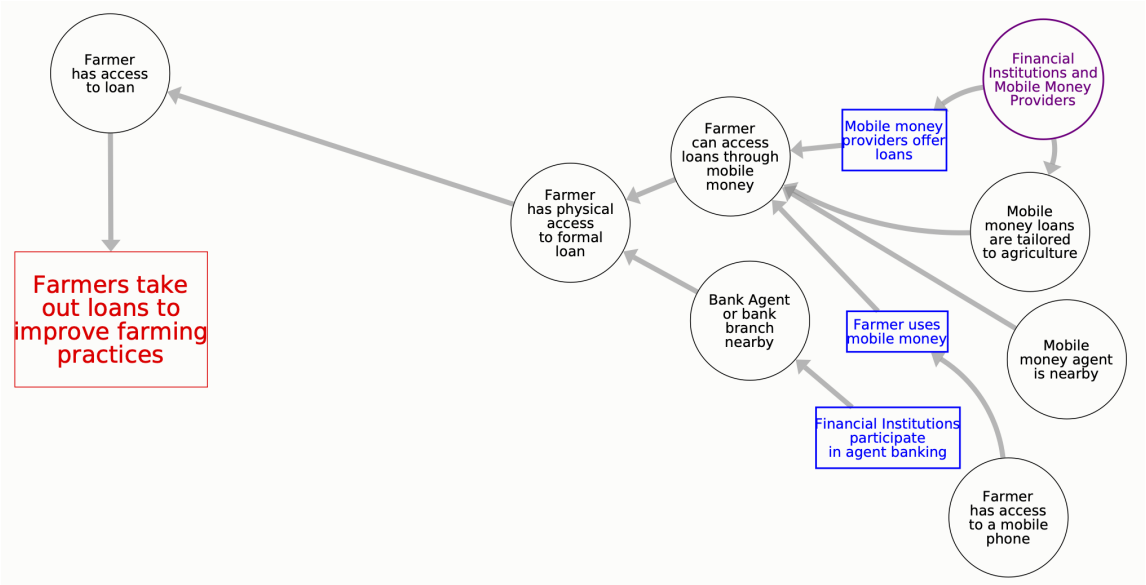


Figure 3: An example of a Pathway on a system map.

The mapping approach presented here was developed and validated within the context of USAID's Feed the Future Value Chain (FTF-VC) project in Uganda. As such, the examples in this toolkit focus on the agricultural market system in Uganda. Nevertheless, this framework can be applied to map countless systems.

1.3 THE ROLE OF MAPPING

A system map can be used to understand almost any type of system. There are many different ways to determine the boundaries of a particular system. A market is a system,

an industry is a system, a region is a system. A sector and a government agency are also systems. All of these concepts can be broken down into smaller components and mapped out using our methodology.

Who is a system map useful for?

- Government
- Industry
- Donors/NGOs
- Development practitioners

What can I do with a system map?

- Visualize complex system dynamics using a simple and flexible tool.
- Engage stakeholders.
- Measure the status of the system.
- Identify leverage points.
- Identify diagnostic indicators.

What can I make a system map of?

- a market
- an industry
- a region
- a sector
- a government agency

What is unique about the System Pathways mapping approach?

- Helps visualize complex processes
- Allows for the measurement and monitoring of multiple interconnected pathways enabling a result
- Creates a shared platform for discussion with stakeholders

Equipped with a system map, users are empowered to carry out a range of tasks:

- System maps allow users to **visualize complex system dynamics** using a simple and flexible tool. High-level insights gained from the system map are accessible to a wide audience and can identify areas of the system that need further analysis.

- A system map can be a valuable tool to **engage stakeholders and support more focused collaboration** around particular system elements. The map acts as a catalyst for stakeholders to identify where their understandings of the system differ, and serves as documentation of the collective understanding of a system. Not only are stakeholders communicating when developing a system map, but they are deepening their collective understanding of the system.
- Practitioners can use a system map to **measure the status of the system**. By linking data to corresponding map elements, users can see the broader picture of the system health. Over time, this can show how a system is changing and whether interventions are working. For more information, see the System Pathways Measurement Toolkit.
- System maps can also assist practitioners in **identifying leverage points**. By explicitly visualizing multiple pathways and connections enabling the same Key Outcome, opportunities for intervention can be identified. These leverage points act as a list of feasible system entry points.

Example 1.2: System Mapping in Action: Karamoja Livelihoods Cluster Collaboration Our team was engaged by USAID/Uganda to develop two market system maps for the Karamoja Livelihoods Cluster, a group of activities working to promote household resilience and sustainable livelihoods in the Karamoja region. We created a "zoomed-in" map that focuses on the supply chain for iron-rich beans in two districts. We added the Cluster's interventions to this map (shown in green in the figure). The map was then used by the activities to identify overlaps in scope and find opportunities for layering and collaboration, based on which activities are working on the same or adjacent elements. This example is discussed further in Section 6.4.1.

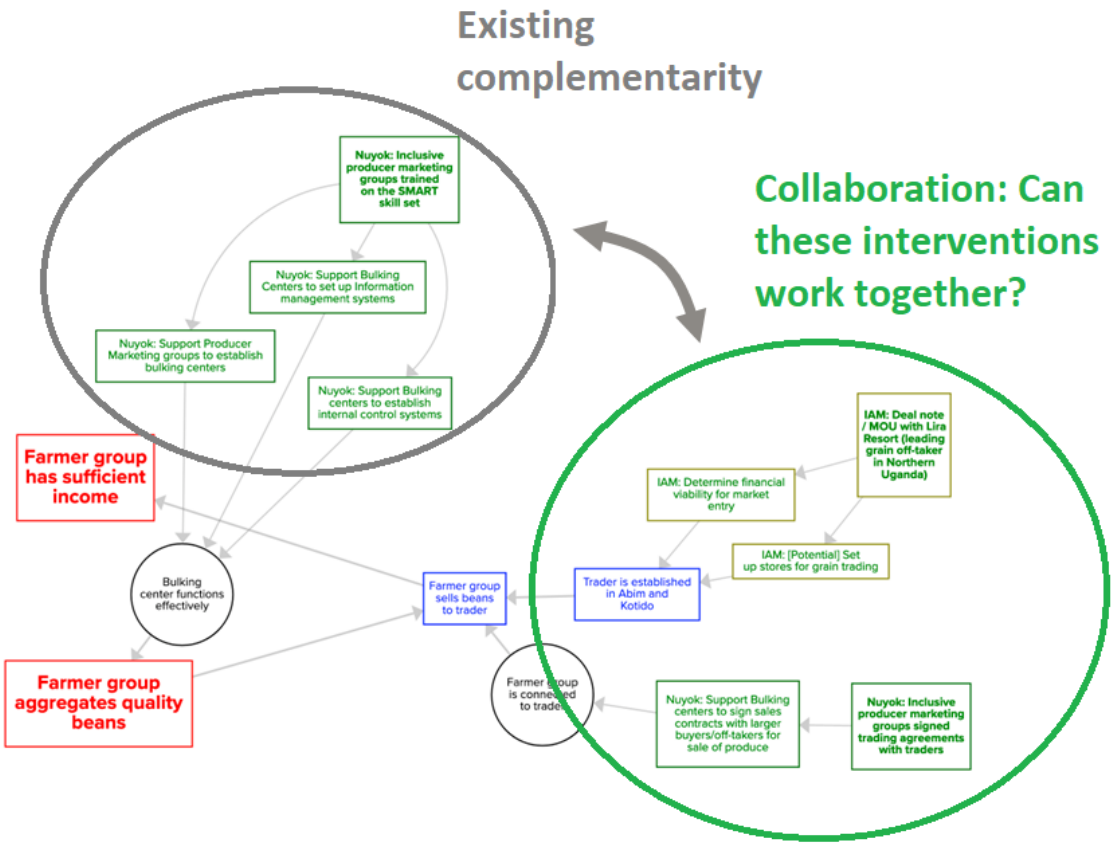


Figure 4: An example of a system map being used to foster greater collaboration in Karamoja, Uganda.

To read more about this work, please visit https://humanitarian.mit.edu/karamoja/.

The table below outlines the various applications of the System Pathways Framework across the USAID program cycle:

Area	Applications
Planning	• Visualize a system and how a particular intervention fits in • Link results chains/logframes to the broader system • Articulate dynamic hypotheses about system change
M & E	• Assess system "health" or status • Identify and measure indicators of systemic change • Assess impact using diagnostic indicators/identify spillover effects
Collaboration	• Develop a common understanding of the system across stakeholders • Identify opportunities for collaboration and complementarity • Identify overlaps in scope/potential for layering
Learning	• Identify gaps in understanding of the system or in available data • Prioritize which knowledge gaps to address first • Deep dive study on a particular component of the system
Adaptation	• Identify barriers to system change/drivers of unexpected results • Assess resilience of system (such as market or household) • Rapid evaluation of impact of a system shock • Identify adaptive behavior changes to promote resilience
Activity design	• Identify Key Pathways to change and reinforcing feedback loops • Identify and prioritize leverage points/opportunities for intervention

We hope that you will find that creating a system map is a valuable exercise, given its broad applicability for development practitioners - for learning, collaborating, adapting, measuring, planning new activities, and so much more.

1.4 STRUCTURE

The toolkit is organized with the following structure:

- **Section 1: How to Interpret a System Map**
  - Builds intuition for the basic components of a system map
  - Introduces how to read a system map
- **Section 2: Understand the Building Blocks**
  - Goes into further detail about the building blocks that make up the System Pathways mapping approach

    - Discusses the various elements used to create a system map (Key Outcomes, Behaviors, Relationships, Conditions, and Interventions)
- **Section 3: Build a Basic System Map**
    - Helps readers identify Key Outcomes
    - Guides readers through building their own system map
    - Discusses how to bring stakeholders together to iterate on a system map
- **Section 4: Organize a Complex System Map**
    - Presents the broad organizational structures of system mapping
    - Discusses the concept of subsystems
    - Guides readers through organizing their own map into subsystems
- **Section 5: Uncover Insights Using System Maps**
    - Introduces the concept of leverage points and identifying opportunities for intervention
    - Demonstrates how system maps can be used for collaboration, learning, adaptation, and responding to system shocks
- **Appendices:**
    - Presents a variety of tools to help practitioners apply these methods.

1.5 ABOUT THE MSM ACTIVITY

The USAID/Uganda Feed the Future Market System Monitoring Activity was created to develop tools and approaches for understanding system-level change in development programs. These tools enable USAID/Uganda and other Missions to incorporate systems thinking and systems tools into development programming, based on principles from systems engineering and supply chain management. The Activity designed these tools and approaches to be accessible to development practitioners and to apply both across the USAID program cycle and to individual project and activity implementations. The System Pathways Framework, developed by the Activity, allows practitioners to create their own system maps and measure system-level indicators, which can be used for

communication, intervention design, Collaboration, Learning, and Adaptation (CLA), and system-level Monitoring and Evaluation (M&E).

In Uganda, the Activity's work helped the Mission fully embrace a systems perspective for the Feed the Future portfolio, informed their strategic approach for activity design, and helped structure their thinking on identifying new opportunities for intervention. The Activity also provided insights into the agricultural market system through deep-dive studies, focusing on topics such as access to finance and smallholder farmer market access. The Activity operated from 2016 to 2021 and was a joint initiative of the Humanitarian Supply Chain Lab at the Massachusetts Institute of Technology and The George Washington University. This project was supported via a buy-in from USAID/Uganda through the Higher Education Solutions Network (HESN).

While using this toolkit, please feel free to reach out to the MSM team at msm.uganda@mit.edu with any questions or feedback.

2 READ: HOW TO INTERPRET A SYSTEM MAP

Objectives: Learn how to read and interpret an existing system map that was built using the System Pathways Framework.

Prerequisites: Understand the purpose of a system map (review Section 1).

Products: None.

Key takeaways:

- System maps represent the ideal system state, at a certain level of abstraction.
- System maps are made of several essential building blocks.
- Connections do not imply causality, but rather one element enabling another.
- Start with Key Outcomes, and trace a Pathway to this outcome by asking **"What enables this?"**

2.1 INTRODUCTION

As discussed in Section 1, a system map is a powerful tool for visualizing the components of a complex system and capturing how different parts of the system are interconnected. To ensure that the map is both readable and easy to interpret, we developed a set of universal **mapping conventions** for the various components of the system map. Each system is unique, but the System Pathways Mapping Framework uses these conventions that make it easier for practitioners to quickly and easily understand the maps.

2.2 READING A MAP: THE BASIC BUILDING BLOCKS

Despite their complex appearance, system maps are digestible once you understand the basic components. That is the purpose of this section - to briefly explain each of the components of these system maps. At its core, a system map is a web of elements and

connections. Every element is a component of the larger system, and every connection (arrow) indicates an **enabling** relationship that occurs between elements. While it is possible to read a system map without distinguishing these elements, knowing what the different types of elements represent is important to fully understand and interpret a system map. In this section, we will learn the basics of how to read a map; in the next section, we will discuss the elements in detail.

Example 2.1: A Sample Map As our example for this section, we will use a map of Uganda's agricultural market system. Before diving into the details, take a look at the map as a whole in Figure 5. At first glance, you can see that the map is organized into separate "chunks", each of which is a cluster of elements. These are called **Subsystems**, and they are our first building block.

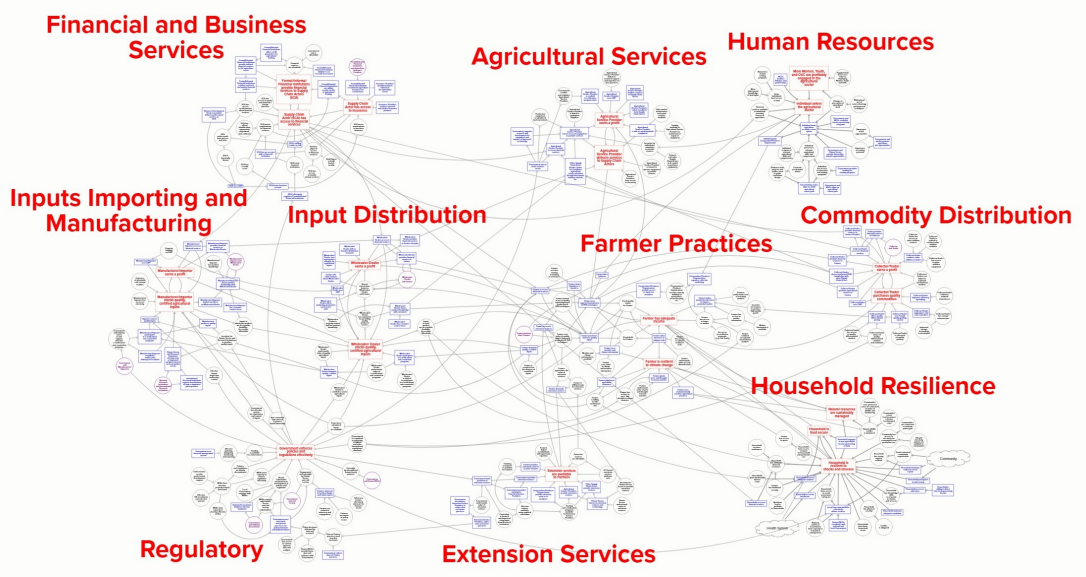


Figure 5: A system map of Uganda's agricultural market system.

2.2.1 SUBSYSTEMS

Subsystems are smaller pieces of the system. These smaller groups of elements represent a specific conceptual or thematic subset within the overall system, and allow for

the system to be broken down in a manageable chunks. Not every system map is broken down into Subsystems, but in larger systems they are often essential for managing complexity.

Example 2.2: Understanding Subsystems The map we saw in Figure 5 has ten Subsystems, each of which is labeled in red. These Subsystems each represent a discrete concept within the system, but they are all interconnected as well. Figure 6 below shows an example of one of these Subsystems: "Financial & Business Services", which is located in the top left-hand corner of the agricultural market system map.

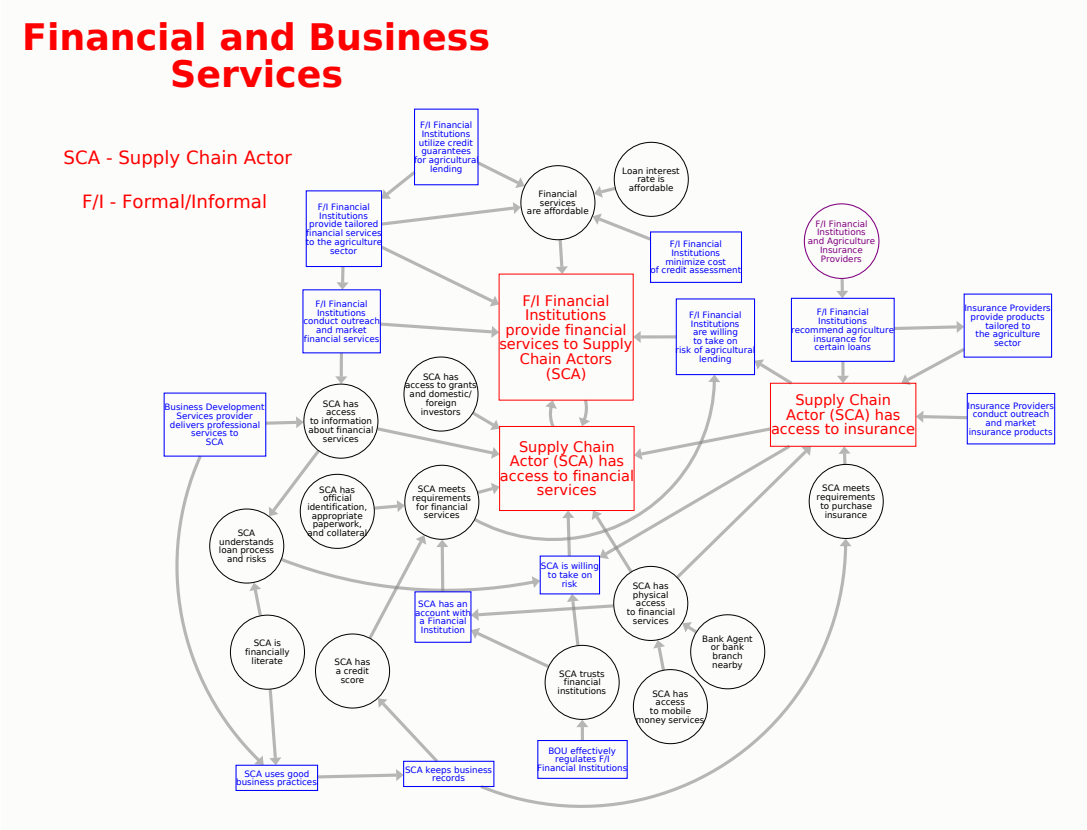


Figure 6: The "Financial & Business Services" Subsystem within Uganda's agricultural market system.

2.2.2 KEY OUTCOMES

At the core of every System Pathways map you will find one or more **Key Outcomes**, designated by a red box with red text. These elements represent an important or desired outcome for the system. Key Outcomes are the first element that you will add to your system map, and will likely be the easiest elements to identify. Key Outcomes are a distinguishing feature of our methodology, and they enable practitioners to easily translate their results chain onto their system map, ensuring that all the elements on a map somehow enable the overarching development objective to be achieved.

Example 2.3: Finding Key Outcomes on a System Map The red borders and text of **Key Outcomes** make them easy to spot, even on a large and detailed map. On those larger system maps, there will likely be several Key Outcomes, each representing a different sector or development objective.

Figure 7: The three Key Outcomes within the "Financial & Business Services" Subsystem.

2.2.3 CONNECTIONS

The next essential building block in a System Pathways map is the **connection**. As discussed in Section 3.3, a connection (arrow) between two elements means that the first element **enables** the second. Directionally, the arrowhead will point towards the second element (i.e. the one being enabled).

2.2.4 BEHAVIORS, RELATIONSHIPS, AND CONDITIONS

Almost every system can be represented as a combination of three kinds of elements: Behaviors, Relationships, and Conditions. In the development context, the state of any system can be represented as the product of many different actors engaging in Behaviors (some kind of action or nonaction), which are influenced by the Relationships

that the actors have with one another, and are constrained or shaped by the Conditions in the system.

For example, if our "system" is a country's Ministry of Health, the state of the system could be the performance of that Ministry at a particular moment in time - how much of the budget has been spent, or how close it is to meeting health targets. This system state is influenced by the behaviors of various actors: the Ministry employees, doctors and other medical professionals, patients, lawmakers, lobbying groups, etc. The behavior of a particular actor may be influenced by a relationship: for example, a doctor who is connected to an employee at the Central Medical Store may have better access to supplies, making it easier for them to stock their clinic. Finally, the actors' behaviors may depend on certain conditions of the system, such as whether the Ministry has received enough funding or where clinics are located.

Conditions function as **assumptions or components of the system that are taken as "given"**. Some are truly immutable, such as the weather or the location of rivers (for the most part, though technically these can change). Some are taken as given for a particular system, such as the existence of funding or infrastructure. It would be possible to represent the behaviors, relationships, and conditions that enable these conditions (e.g. funding for a ministry is not a given, it is allocated through a specific process that is the product of many different behaviors).

2.2.5 PATHWAYS

A Pathway is **a chain of elements linked by connections that often ends at, and collectively enables a Key Outcome**. They describe a logical series of behaviors, relationships, and conditions that can affect change in the system. Thus, Pathways are similar to logframes and results chains that are commonly used to describe development theories of change. When combining the collective efforts of various development activities, Pathways provide useful structure for the interrelated elements that form a larger system. As indicated by the name, Pathways are one of the most important organizational components of our methodology. Pathways will be further discussed in Section 3.6.

2.3 BRINGING IT ALL TOGETHER

Choose a Key Outcome that you want to expand upon first. We will trace its connections backwards through the elements to understand what directly and indirectly enables this Key Outcome within the system. As you follow these connections from element to element, you are asking the question **"What enables this?"** Think of it as a kind of root cause analysis: to understand why the system functions the way it does, you need to understand what the elements are, and how they enable each other.

We'll set the larger map aside for now and focus on a small chain of elements. This collection of elements is a "Pathway," analogous to a results chain.

Example 2.4: Finding Enabling Elements From the set of Key Outcomes in this system, let's say that we are interested in better understanding what series of elements can lead to our Key Outcome of farmers taking out loans to improve farming practices. We look at the elements which have connections pointing in toward this outcome. A connection (arrow) indicates that the element it starts at **enables** the element that it points to. These connections are show in Figure 8. There are two elements which have connections pointing into the Key Outcome: the Condition "Farmer has access to loan" and the Behavior "Farmer seeks loan to improve farming practices."

Figure 8: The two elements that directly enable the Key Outcome "Farmers take out loans to improve farming practices."

Example 2.5: Build the Chain Let's look at the Condition "Farmer has access to loan." We trace backwards via the connections and see the elements that **enable** a farmer having access to a loan. We can identify those enabling elements by looking at their connections. Any element that is directly connected to and pointing towards "Farmer has access to loan" is an enabling element. While we build this chain, we can discount the elements that are being enabled by "Farmer has access to loan." Figure 9 shows all of the elements that are connected to "Farmer has access to loan."

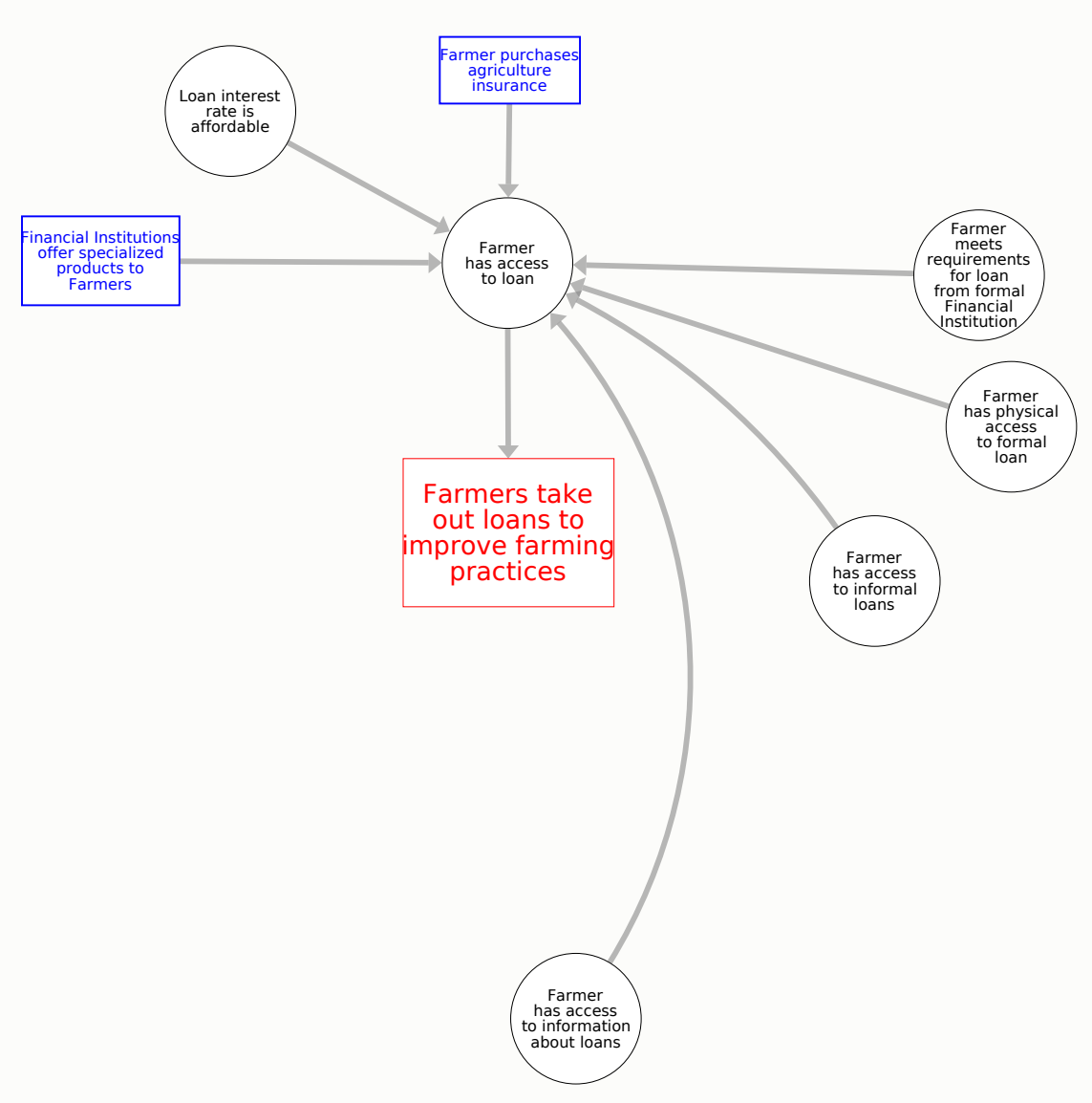


Figure 9: The set of elements connected to "Farmer has access to loan."

The elements that you add to the map will all enable *something*, so choosing one element as your starting point and working outwards will help make the map-building process more manageable. At a certain point, you will determine that you have reached the boundary of your scope - the elements that will form the boundary will likely be too specific or less important to the system as a whole. The chain of elements that you

just created, which are all related to your starting element, make up a **Pathway**. Learn all about Pathways in Section 3.

Through this exercise, we've oriented ourselves on the map and found a key outcome we are interested in understanding more. We traced back a chain of elements we are interested in to get clarity on one way to enable the outcome. We have a better understanding of how this small part of the system works and what connections exist. Even though most of the elements in our chain (except for "Farmer has access to loan") do not directly impact the key outcome, we have now visualized the path through which they indirectly enable the outcome. One of the valuable features of system maps is being able to visualize these indirect connections. This example practices asking "What enables this?" and helps build intuition for how to understand the connections between elements.

Of course, this is only a single pathway. There are several others which enable this key outcome. Within this subsystem, there are more key outcomes which have more pathways. Reading a map in the way demonstrated here can help you to find connections and overlaps between these pathways. This will improve your understand of the interconnectedness of the system.

Fundamentally, system maps represent how the building blocks we have reviewed all interact in order to produce a particular system state. Almost all of the maps built using this framework are made up of pathways (with some larger systems made up of subsystems, that are themselves made up of pathways), and the pathways are made up of behaviors, relationships, and conditions that enable each other. Now that you know the basic building blocks, you can read a system map. Start by finding a key outcome, then work backwards to trace a pathway. Once you have identified one pathway, you can look for others, and in this way get a sense of how the system functions.

3 UNDERSTAND: LEARN MORE ABOUT MAP ELEMENTS AND STRUCTURE

Objectives: Learn in detail about the specific types of elements that make up the system map.

Prerequisites: Understand the purpose of creating system maps.

Products: None.

Key takeaways:

- There are five different types of elements on a system map: **Key Outcomes, Behaviors, Conditions, Relationships, and Interventions**.
- Element types are differentiated by their **shape and color**.
- Components are linked using **connections** to represent an element that **enables** another element.
- Elements can be grouped into pathways, loops, and subsystems to add structure to the map.

3.1 MAPPING 101: REPRESENTING REAL-WORLD SYSTEMS

As discussed in Section 1, a **system map** is a powerful tool for visualizing the components of a complex system and capturing how different parts of the system are interconnected. System maps create a shared platform for discussing activities and results with USAID stakeholders, including NGO/donor partners, the private sector, the government, and other beneficiaries. As a visual representation of a system, these maps allow each stakeholder to identify how their activities influence the broader system and present opportunities for collaboration between actors. The system maps are intended as a tool for the broader USAID community, particularly for developing new monitoring, evaluation, and learning techniques.

As discussed in the last Section, to ensure that the map is both readable and visually appealing, we developed a set of universal mapping conventions for the various components of the system map. Each system is unique, but the System Pathways mapping

conventions make it easier for practitioners to quickly and easily understand the maps. These conventions will be discussed throughout this section.

At its core, a system map is a web of elements and connections. Every element is a component of the larger system, and every connection indicates an **enabling** relationship that occurs between elements. While it is possible to read a system map without distinguishing these elements, knowing what the different types of elements represent is important to fully understand and interpret a system map.

A system map reflects:

- the **ideal** status you desire or expect to see in the system, including **key system outcomes**
- the pathways that **enable** (or constrain) those outcomes

The level of detail of a map is up to those who create it and how they intend to use it. For example, a map used to initiate discussion with stakeholders can be less detailed than one that is being used to identify opportunities for new interventions. Ultimately, a map is an abstracted reflection of reality and cannot encompass every component or every pathway.

When viewing any system map, remember that:

1. **A system map represents the ideal state**. We recommend that development practitioners build system maps that represent the **ideal** system state, acknowledging that the current system state will not match. Thus, the map represents the **objectives** of the system. Ask yourself: "How is the system *supposed* to work?" For example, Ugandan farmers would largely benefit from purchasing agriculture insurance, but insurance uptake is virtually nonexistant. On our system map, this concept is articulated by the map element "Farmer purchases agriculture insurance", as that Behavior represents the ideal state. Depending on the scenario and specific system priorities or objectives, "ideal" can take on several meanings:
    - the most efficient system
    - the most sustainable system
    - the system that produces a particular outcome the fastest

    Most theories of change are built around an assumed ideal state that a project or intervention hopes to achieve, such as a well-organized agricultural market

system. The map depicts how the system will need to function in order to produce this outcome or system state in the *ideal* way.

2. **Connections do not represent causality.** A connection (arrow) implies that the first element **enables** the second element; the success of the first element makes it possible (or more likely) for the second element to exist/occur. For example:
    - Trained medical personnel being available locally **enables** communities to operate health clinics (makes it possible).
    - A farmer will find a way to transport their produce to local markets, but having paved roads **enables** them to do so (makes it more likely).
3. **Mapping requires abstraction.** Each system map will represent a particular context or system at a different level of abstraction. Some maps will 'zoom in' further than others, representing the system in more detail, while others maps will have a more high-level scope that focuses on a few important concepts.
4. **No system map is truly exhaustive.** Each map is built on a set of implicit assumptions that set the scope of the map. The map will rarely capture every single component of a system. In most cases, the scope of the map will depend on the context. In some countries, electricity can be more or less taken for granted; in other countries, it may be important to specify that "Reliable electricity supply" is an important enabler of other elements.
5. **System maps are dynamic.** The map should evolve and expand as the system and/or the system objectives change.

To operationalize the map-building process in context, we will also be tracing an example from our own system map of Uganda's agricultural sector. This example highlights the system elements that enable farmers to earn an adequate income. We call this the "Farmer Practices" subsystem. If you would like to follow along with the example on Kumu, you can find the map here: USAID Uganda Agricultural Market System Map. Kumu is the online mapping software that we use for our system mapping. It is free to use and will help make your mapping experience easier, especially as your map begins to grow. See System Pathways Toolkit Annex for our comprehensive Kumu user guide.

Going Deep 3.1: Representing the "Ideal" System Why represent the ideal, instead of the reality or the system as it is now? One of the most useful applications of system maps is for root cause analysis - understanding how a particular outcome or system state is produced. For example, you may want to understand why there is a

persistent shortage of teachers in a particular region; by creating a map of how the system "should" work, you can identify where reality is falling short (such as a lack of funding for teacher salaries or a perception that the area is insecure). We have found that it is easier to identify how the current system is falling short and where interventions are needed by working backwards from the ideal state.

There may be different thresholds for determining what the "ideal" looks like for a particular system. The ideal could be a near-term goal, such as representing the state of the system in 18 months if a particular set of interventions are successful. The ideal could also be medium-term, such as the ideal state of the system in 5-10 years. For a particular health system, for example, perhaps the ideal is a functioning system that delivers basic services, as a near- or medium-term goal, as opposed to a system that meets the standard in OECD countries, which may be a longer-term goal. Ultimately the "ideal" you choose to represent depends on the particular context and how you intend to use the system map - what you are interested in representing or analyzing. The system map itself, along with root cause analysis or monitoring the system to understand how it deviates from the "ideal," will change depending on which "ideal" you choose to represent.

This of course assumes that we know what the ideal state is. In some cases it might not be known, or there may be more than one acceptable future system state. In these instances, the map can represent the current reality instead. It may also be more useful in certain circumstances to represent the current state, in order to visualize how the system is working now. This is particularly true if there are circumstances that impact how people behave (such as conflict or significant levels of humanitarian assistance) that would not be present in the ideal system.

3.2 KEY OUTCOMES

At the core of every System Pathways map is one or more **Key Outcomes**, designated by red boxes. These elements represent an objective or desired outcome for the system. Key Outcomes are the first elements added to system maps and are likely the easiest to identify.

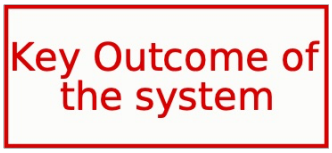


Figure 10: A Key Outcome element.

Key Outcomes are a distinguishing feature of our methodology, and they enable practitioners to easily translate their results chain onto their system map, ensuring that all the elements on their map will eventually enable the achievement of their overarching development objectives. On a larger system map, there will likely be more than one Key Outcome, each representing a different high-level system objective.

Key Outcomes can be identified based on the following:

- Overall project goals (For example, a project design document will often specify Key Outcomes.)
- Existing literature and secondary sources that review key system outcomes explored in the past or identify those outcomes targeted for future investment
- Stakeholder and expert input regarding major system needs and priorities
- System components on "critical paths" in the system, in the sense they **enable** many other components or many other things enable them
- Potential outcomes of resources invested by development actors, government, private sector, or others (For example, if a training is facilitated, consider the desired outcomes of that training.)

Example 3.1: Key Outcomes The Key Outcome of the "Farmer Practices" subsystem is "Farmer has adequate income." For our project in Uganda, facilitating smallholder farmer income was identified by several stakeholders as the *most* important system outcome. Refer to the list above of ways to identify key system outcomes.

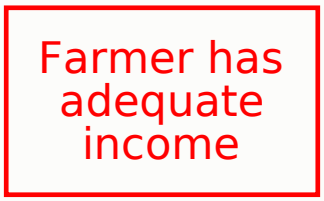


Figure 11: The Key Outcome of the "Farmer Practices" subsystem.

3.3 CONNECTIONS

The next system map component is the connection. On a system map, a connection (arrow) between two elements means that the first element **enables** the second. The direction of the arrowhead is important. It is grounded at the element that serves as the enabler and points to the element that it enables. There is a subtle difference between **enabling** and causing. A connection simply means that an element facilitates another element or makes it more likely to exist, not that it necessarily triggers the second element.

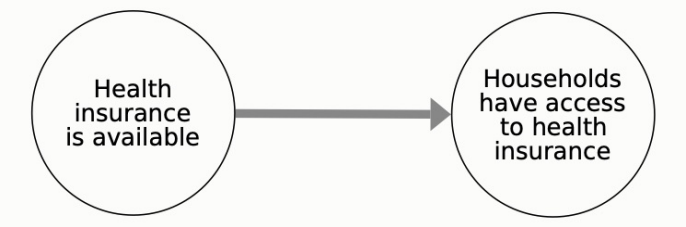


Figure 12: Two map elements with an enabling relationship as shown by the connection (arrow) between them. In order for a household to access health insurance, health insurance needs to be available.

Example 3.2: Connections This example shows two map elements from the "Farmer Practices" subsystem with an enabling relationship as indicated by the connection between them. One enabling factor for a farmer to have a good yield is to purchase and use inputs such as seeds or fertilizer, preferably good quality inputs. Purchasing and using quality inputs **enables** the element that it points to ("Good yield for Farmer"), as it helps to make it possible for the farmer to have a good yield.

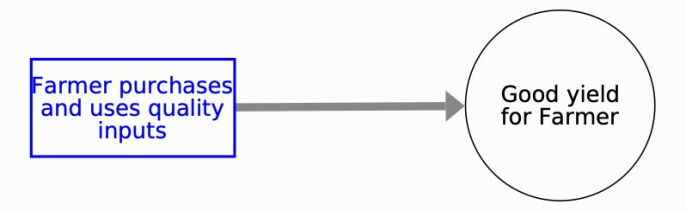


Figure 13: An example of a connection between elements.

3.4 BEHAVIORS, RELATIONSHIPS, AND CONDITIONS

Each System Pathways map is made up of a core set of elements: **Key Outcomes**, **Behaviors**, **Conditions**, **Relationships**, and **Interventions**. Each of these element types has a distinct convention using shapes and/or colors and represents a different concept. In this section, we will discuss Behaviors, Conditions, and Relationships.

Behaviors:

A Behavior element details an **action** carried out by an individual or entity. Each Behavior element follows the same syntax: **X actor engages in Y behavior**. Behavior elements are generally independent of each other – an actor can choose whether or not to engage in a behavior independent of the actions of other actors in the system. A Behavior element uses active verbs, and often represents actions that are repeated over time - that is, a particular actor in the system tends to regularly engage in this behavior.

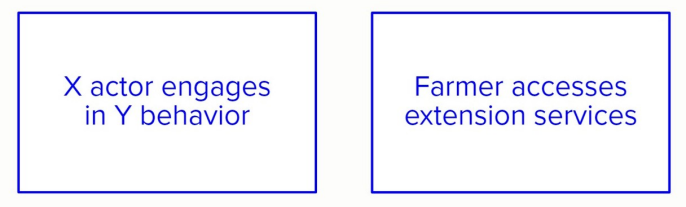


Figure 14: A Behavior element.

Conditions:

A Condition element details **fixed** qualities or attributes of the system environment that influence activities or changes in the system. Conceptually, Conditions are the

circumstances that must exist for a given Behavior, Relationship, or other Condition to successfully take place. They may also represent the presence of incentives which influence actors.

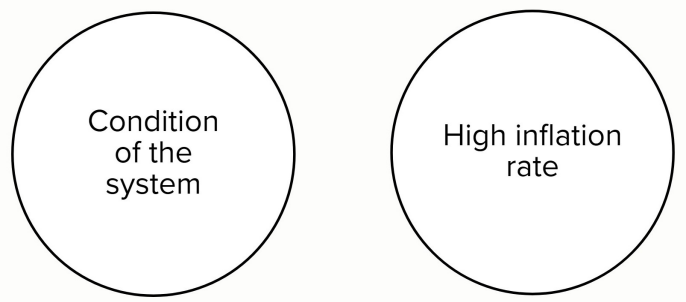


Figure 15: A Condition element.

Relationships:

A Relationship element indicates a personal or transactional connection between two actors in the system. A Relationship can represent interactions of varying strength, such as a longstanding business relationship or a tentative working relationship between two organizations.

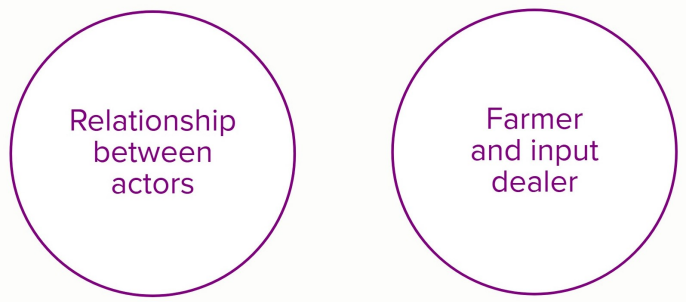


Figure 16: A Relationship element.

Relationships are important components of a system. They often **enable** other elements, such as by creating an environment of trust that makes it easier for an actor to engage in a particular behavior. A relationship could also represent the regular exchange of information or repeat interactions/transactions between parties, which could also enable other elements of the system.

Example 3.3: Behaviors, Relationships, and Conditions Remember that the Key Outcome in the "Farmer Practices" subsystem is "Farmer has adequate income." Through our research and study, we identified several elements that directly **enable** farmers to earn an adequate income. These can be seen in Figure 17.

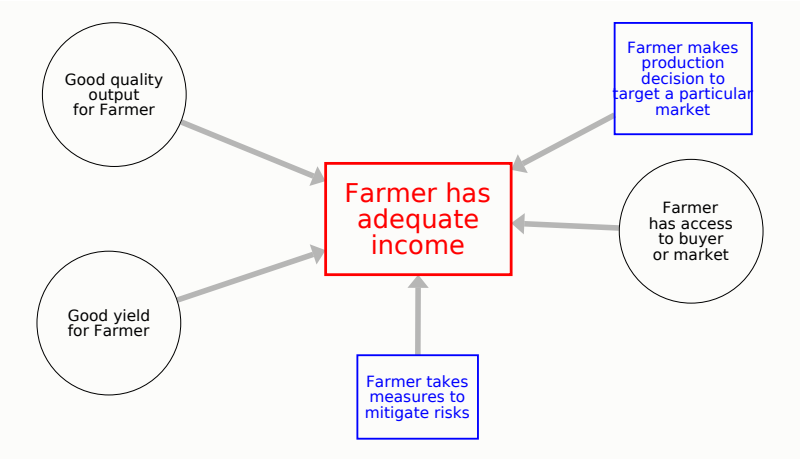


Figure 17: All of the elements that directly **enable** the Key Outcome "Farmer has adequate income"

Farmer income is often based on selling cash crops. Two ways to increase income are for the farmer to sell better quality at a higher price, and to increase their quantity of crops. We write these as Conditions: "Good quality output for Farmer" (e.g. cash crop quality) and "Good yield for Farmer" (e.g. harvested crop size per land cultivated). They are Conditions because there are no actions taking place; the system just needs to be in a state in which these conditions are met. Now let's zoom in on these two enabling elements and look at their secondary and tertiary enabling elements in Figure 18.

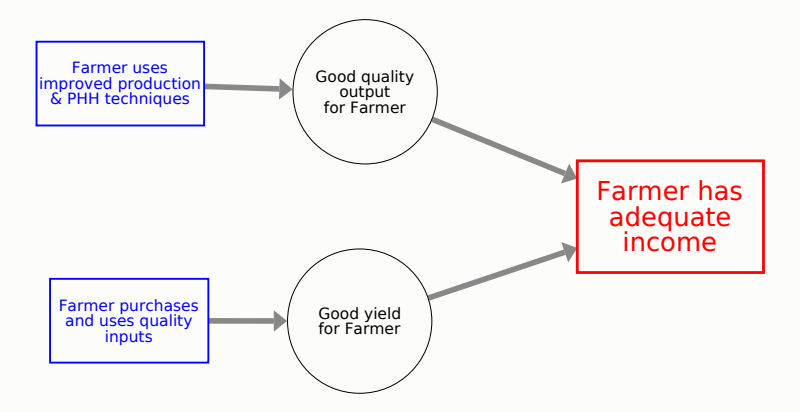


Figure 18: Focusing on the Conditions "Good yield for Farmer" and "Good quality output for Farmer."

We can trace backwards from either of these Conditions - for now we will look more closely at "Good yield for Farmer." Using our knowledge of the system, we identified the elements that **enable** farmers to achieve good yield from their harvests and added them to the map. Figure 19 shows all of the elements that are in some way connected to the Condition "Good yield for Farmer."

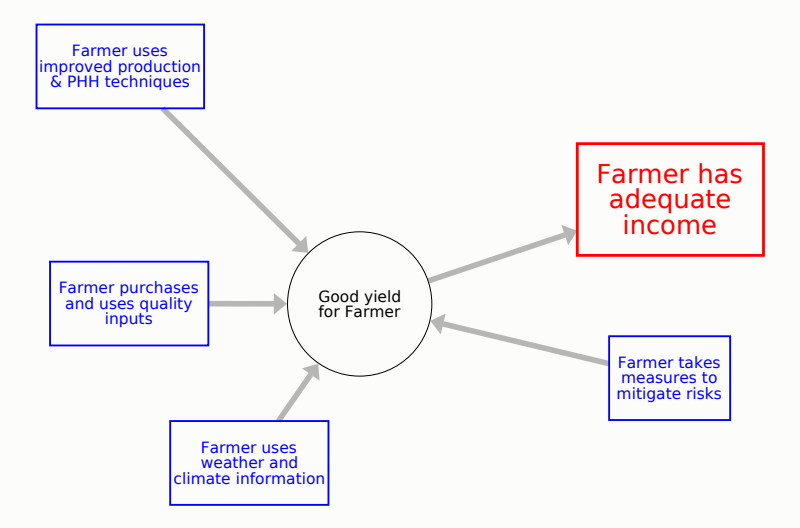


Figure 19: Identifying the elements that directly enable the Condition "Good yield for Farmer."

3.5 INTERVENTIONS

Interventions:

An Intervention is a project or initiative being implemented by an actor in the development community that is designed to influence the system, represented by a green box.

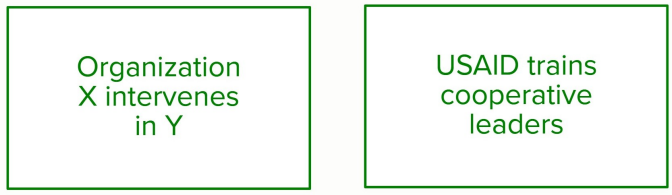


Figure 20: An Intervention element.

Including Interventions on system maps help practitioners to improve their understanding of all the work being done across the sector. This can better illuminate opportunities for collaboration or areas in which no work is being done.

Example 3.4: Interventions In Uganda, USAID has pursued several interventions related to farmers obtaining good quality seeds and increasing their yield. One such intervention is the education and training of farmers on improved farming techniques. These trainings would not exist in the system if not for the intervention of the development organization, thus we add them as Interventions. Figure 21 shows an example of an Intervention element **enabling** "Farmer uses improved production & PHH (post-harvest handling) techniques."

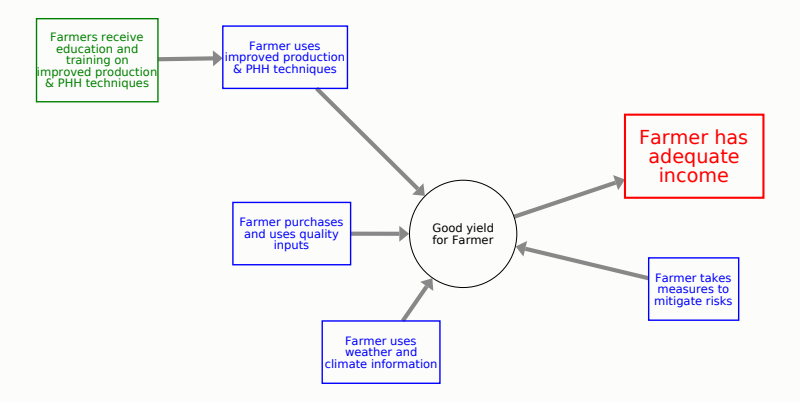


Figure 21: An example of an intervention in a system.

3.6 PATHWAYS

A **Pathway** is a chain of enabling elements that often ends at, and collectively **enables**, a Key Outcome. Using Pathways to organize system maps is one of the most important components of our methodology. The purpose of a Pathway is to illustrate one flow through which an Key Outcome is impacted. They represent "branches" of interrelated elements within the larger system (similar to development tools like logical frameworks and results chains).

Our mapping approach does not inherently prioritize one Pathway over another; all Pathways are viewed on a single map. This technique helps to enable development practitioners to easily see the whole system and make informed decisions about which Pathways are more promising for intervention. This method of identifying leverage points for intervention is discussed further in Section 6.3.

Example 3.5: Pathways The example we have used throughout this Section has looked at the Key Outcome of the "Farmer Practices" subsystem: "Farmer has adequate income." Let's continue zooming in to one of the Conditions that enable farmers to have adequate income ("Good yield for Farmers") and finish building our Pathway.

The first step in identifying a Pathway is always to ask **"What enables this?"**. As we saw in Figure 19, there are several things that **enable** a farmer to achieve a good yield. For this Pathway, let's focus on the various inputs farmers use to improve their yields. A

good label for the Pathway might be the "Agricultural Inputs Pathway." The parameters for adding or removing elements from the Pathway can now be bounded by the relative strength of an element's connection to agricultural inputs.

Of the elements that enable farmer to achieve a good yield, there are two Behaviors that are specific to agricultural inputs: "Farmer purchases and uses quality inputs" and "Farmer uses improved production and PHH techniques." Both of these elements directly **enable** a farmer obtaining a good yield and so they both have connections pointing directly to "Good yield for Farmer."

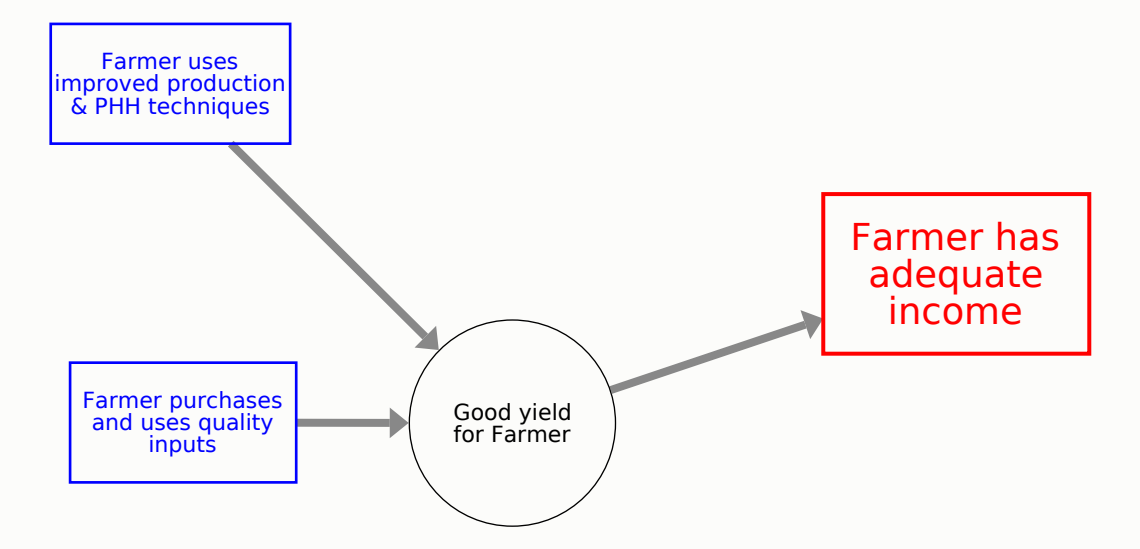


Figure 22: Two key enablers of "Good yield for Farmer."

For each of these Behaviors, we again ask ourselves **"What enables this?"**. Based on our knowledge of the agricultural system in Uganda, we added the other key enabling elements to both Behaviors, seen in Figure 23.

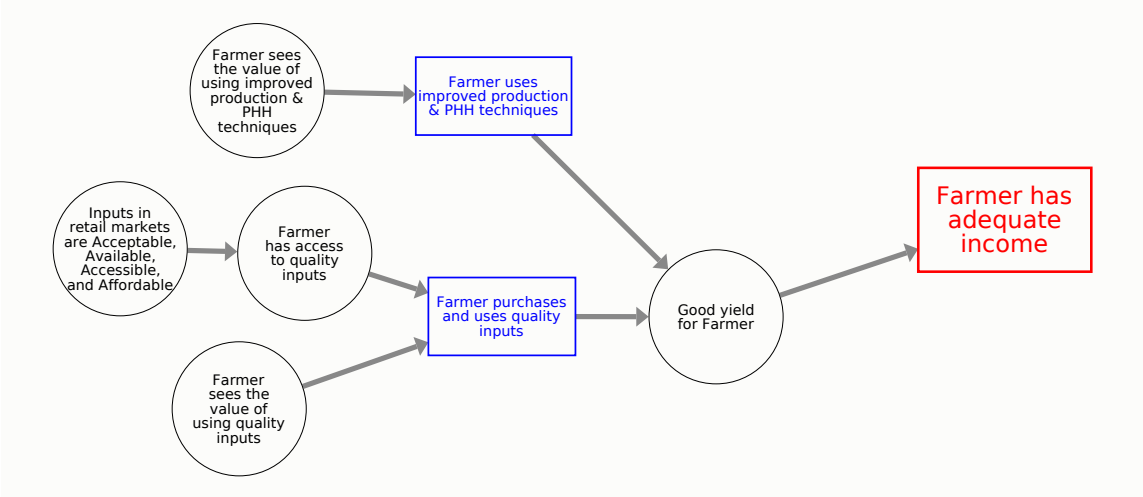


Figure 23: Expanding the Agricultural Inputs Pathway.

At this point, we make a judgement as to whether or not the Pathway is complete. See Section 4.2 for guidance on identifying when a Pathway is "complete." For this example, we have expanded it to include sufficient detail and can decide that it is in fact complete.

3.7 LOOPS

Pathways are a linear, branched organizing framework for a set of elements, but complex systems rarely change in linear fashion. Reactions to change often affect earlier elements in a linear Pathway. Connecting to earlier elements in a pathway creates a Loop. Loops continue to enable change over time through iteration of the cycle. These iterating loops describe feedback that is often critical to understanding the system's dynamic behavior.

It is natural for humans to perceive changes in the system and react in an attempt to further the change or correct it. Thus, feedback loops may be reinforcing, in which change begets further change in the same direction, or balancing, in which change in one direction is balanced by change in another. Iteration of reinforcing loops can amplify interventions, building into more significant and/or widespread change. Iteration of balancing loops can dampen efforts, constraining the change intended. Thus, discovering Loops and monitoring their effects can be important in developing and testing theories

of change. See Section 6.2.4 to learn more about finding Loops in an effort to develop deeper understanding of system dynamics.

3.8 SUBSYSTEMS

Subsystems are smaller clusters of elements that represent a specific conceptual or thematic subset of the larger system. Each subsystem represents a discrete concept that is guided by the concept's Key Outcomes. Dividing a system map into subsystems makes the map more manageable and organized and is an exceptionally useful tool when working with large and complex systems. Smaller or higher-level maps will likely not need to be broken down into subsystems.

Example 3.6: Subsystems Throughout this Section we have explored the "Farmer Practices" subsystem which is part of the larger system map that we developed for Uganda's agricultural market system. In Figure 24, you can see the full "Farmer Practices" subsystem. In Figure 25, you can see the 11 subsystems that make up the agricultural market system map.

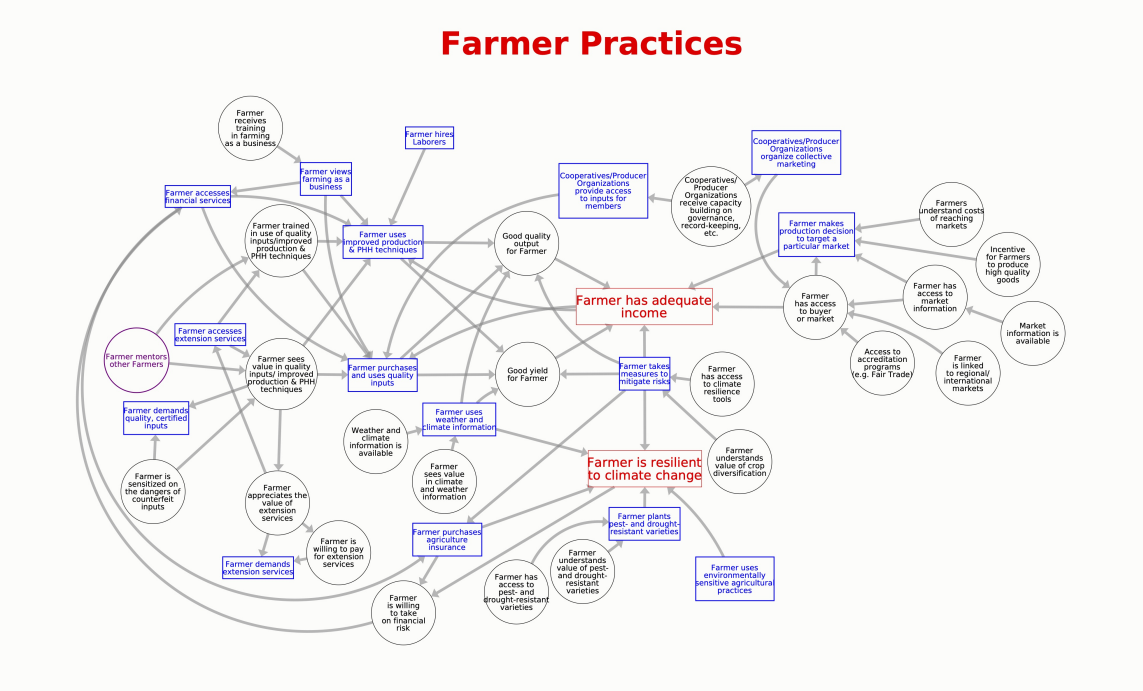


Figure 24: The “Farmer Practices” subsystem.

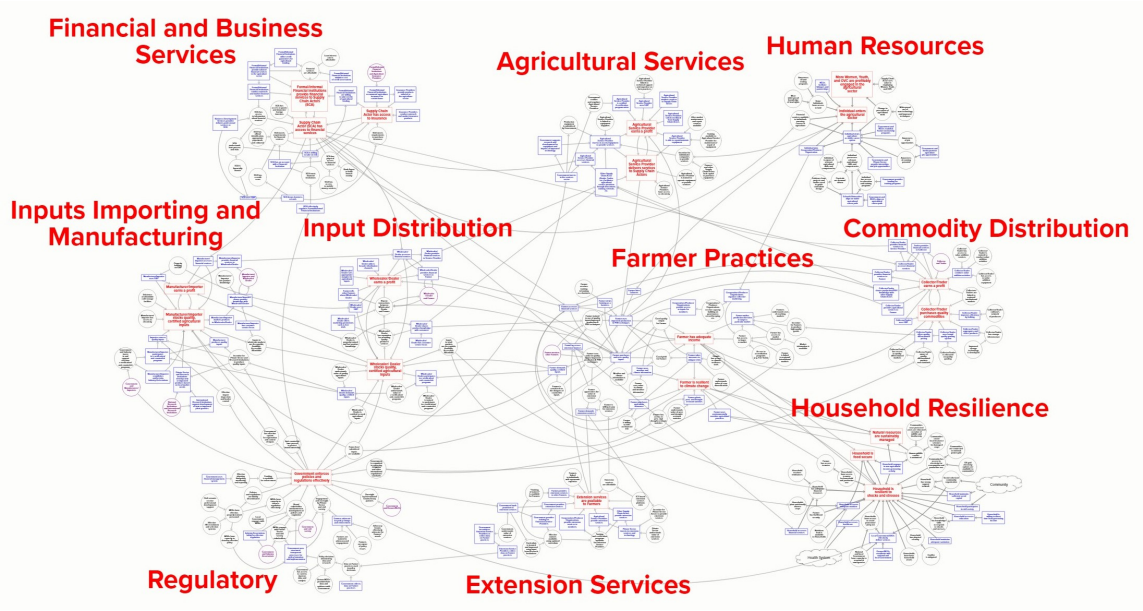


Figure 25: The full Uganda agricultural market system map with subsystems labeled.

The four subsystems in the center row of Figure 25 represent Uganda's agricultural value chain, and the subsystems above and below it detail the system components that impact the value chain. This is one example of how you might organize your system map into subsystems.

3.9 INCORPORATING COMPLEXITY ON THE SYSTEM MAP

Going Deep 3.2: Other Types of Elements Depending on the scope of the system you are mapping, you may find that you need to include more specific permutations of Behaviors, Conditions, Relationships, or Interventions to better represent the system. This section provides some examples of these types of elements and their conventions.

Mindsets:

Mindset elements are a type of Condition that is used to represent an opinion, point of view, or perception held by a system actor which will influence their behavior. They are represented by orange circles. This element type is particularly valuable when it is important to represent not only the behavior but also the mindset of the actor engaging in the behavior (often the target of development interventions). Common Mindset elements will begin with "Actor sees the value of...", or "Actor understands..."

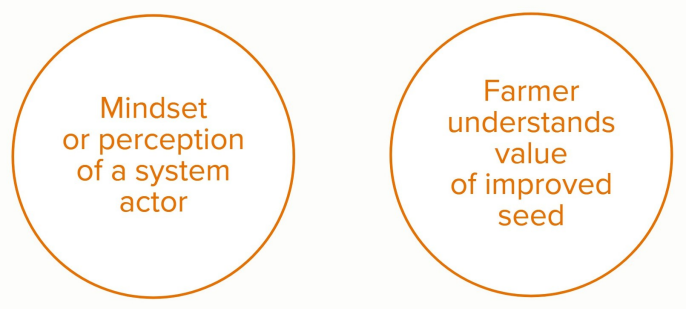


Figure 26: A Mindset element.

Government Behaviors:

For some systems it will be useful to visually differentiate the behaviors conducted by a government entity. In these cases, we use the Government Behavior element type, represented by a teal box. These elements represent any actions that the government

engages in the ideal state. Again, system map elements will always be worded to represent how the system is *supposed* to work, not necessarily the current reality. If a government entity is currently providing a subsidy, but in the ideal state they would not, the map should **not** have a Government Behavior reading "Government provides subsidies" as this would not represent the ideal state. Rather, "Government provides subsidies" should be included as an Intervention.

Figure 27: A Government Behavior element.

Including a Government Behavior element is just one example of how to highlight the role an actor plays in the system. Not every actor should be given its own Behavior type. These types of elements should only be used if it is important for visual purposes that a particular actor's behavior is highlighted.

We recommend creating and consulting a Role Map for the system, discussed later in this section.

Clouds:

Cloud elements are used as placeholders for another system that interacts with the system being mapped. This could be another complex system that you are choosing not to map because it is not part of your focus area. These external systems may be important to represent, but attempting to include specific elements from the system may lead you "down the rabbit hole." Cloud elements enable practitioners to quickly and easily represent other systems of interest. For example, when mapping household resilience, a logical Condition might be that the household has access to healthcare. Instead of trying to identify the various elements that enable a household to access healthcare, which would be out of the scope of your map, you can include a Cloud element entitled "Health System."

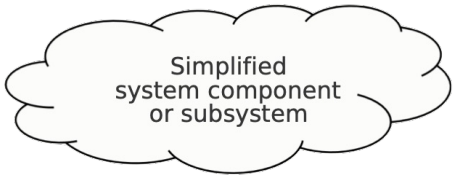


Figure 28: A Cloud element.

Shocks and Shock Effects:

Shock elements represent some shock or disturbance to a system, and are represented by a solid red box. These shocks are often external to the system itself, but will have widespread system impacts, which will likely evolve over time. For example, during COVID-19, Shock elements could include: "Non-essential businesses closed" or "Government imposes transportation restrictions."

When a shock occurs, its repercussions may be felt across the system map. In these cases, Shock Effect elements are used to represent the new elements that have become part of the system due to the Shock. If the Shock is "Government imposes transportation restrictions," then one Shock Effect element might be "Cost of transportation increases." The government imposing transportation restrictions is the cause (enabler) of transportation costs increasing, a system element that was not previously a part of the system. Shock Effect elements are a way of representing changes to the system as a result of the shock, and may be Conditions, Behaviors, or Relationships. They are represented by red circles with light red fill.

Figure 29: A Shock element (left) and a Shock Effect element (right).

See examples of Shocks and Shock Effect elements in Section 6.5.

Going Deep 3.3: Roles System maps aim to identify, understand, and analyze the dynamics among the various actors participating in the system. Therefore, one of the

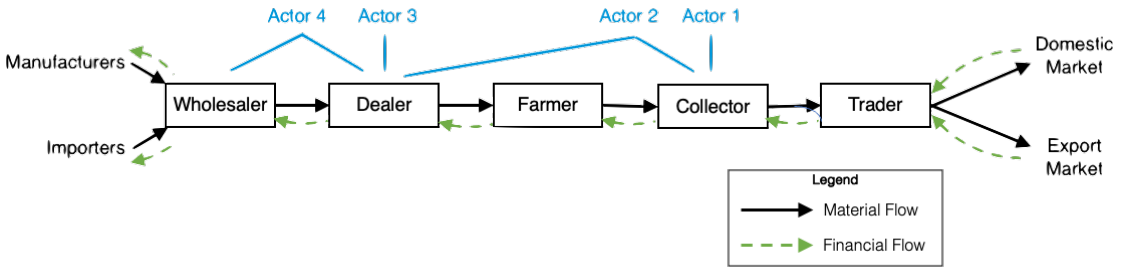
foundations of any system map is a clear definition of who the actors are and how they engage in the system.

In developing the Uganda agricultural market system map it was not always simple to label an actor since many actors play more than one role in the market. For example, the role of "village agent" was traditionally linked with the activity of purchasing harvested crops to aggregate supply for larger traders. However, village agent actors have increasingly taken on additional roles such as selling agricultural inputs to increase farmer productivity. Thus, these agents were engaging in both agricultural input distribution and harvested commodity distribution. In such situations, stakeholders may use the same title to refer to actors engaging in the market in distinct ways or create a new situational title to distinguish creative actors from traditional labels. Such approaches can create confusion, add complexity, and fail to represent the system effectively.

By focusing on roles instead of actors, the system map can use a common language for the potentially complex interactions and activities of actors in a market system. Actors can associated with each role they play to appropriately characterize their market system engagement. This also has a side benefit of better characterizing the various "business models" that market actors create by combining different roles.

A **Role Map** can be a helpful visual framework to define market system engagement for various actors and communicate the nature of the role. Many map elements, especially behaviors and relationships, require a clear definition of the actor's activities and interactions. Role Maps can provide an clear and common reference to associate the right actor(s) for each system map element.

For the Uganda agricultural market system map, it was helpful to define a Role Map based on the transnational relationships across the supply chain (a.k.a. value chain). The material flow from left to right positions roles in a distribution system spanning agricultural inputs to farmers and harvested crops to food markets. The financial flow from right to left positions roles in a monetary system based on the value extracted from their activity enabling material flows.



The graphic highlights two aspects regarding how the Role Map provides clarity while characterizing different business models. First, the Role Map can identify actors that play roles in the supply chain for distinct commodities. As discussed above, village agents can engage in the supply chain of both agricultural inputs and harvested crops. In the figure, Actor 1 only plays the role of Collector, buying harvested crops from Farmers and selling to Traders; this was often the default role for an actor labeled as a "village agent." Actor 2 is also an agent in the village but engages not only as a Collector of harvested crops but also as a Dealer of agricultural inputs. The label Dealer-Collector indicates a different business model than the traditional "village agent" business model based on the Collector role alone. Market facilitation for Actor 2 may need to be distinct given their engagement in the supply chains for different commodities.

Second, the Role Map can help clarify broader roles within the supply chain for a single commodity. In the figure, Actor 3 only plays a Dealer role, buying agricultural inputs from Wholesalers and selling to Farmers. Actor 4 is not only a Dealer for agricultural inputs but also serves as a Wholesaler selling to other Dealers, buying directly from Manufacturers and/or Importers. The label Wholesaler-Dealer indicates a broader role in the agricultural input supply chain and market facilitation for Actor 4 may enable positive cascading effects to other Dealers given their additional role as a Wholesaler.

4 CREATE: BUILD A BASIC SYSTEM MAP

Objectives: Begin applying the System Pathways mapping methodology to your sector or context by creating a map. Even a simple high-level visual of the system will help you to identify knowledge gaps, opportunities, and challenges. It provides a foundation to discuss the dynamics of the system and key interactions.

Prerequisites: How to read and understand a System Pathways map (review Section 2 and Section 3).

Products: A simple System Pathways map that you can use in various ways.

Key takeaways:

- **Identify Key Outcomes** for the system you are mapping.
- Ask the question **"What enables this?"** to identify new elements to add to the map.
- Continue adding elements to build **enabling pathways**.
- Bring together stakeholders to **gather feedback** on changes to make to the map.

4.1 GETTING STARTED

When creating a system map for the system in which you work, we suggest laying out a large sheet of paper (or dedicating a large whiteboard) and several colored pens/markers: blue, black, red, purple, and green. You can also use the online software platform, Kumu, that was used to create the maps in this toolkit. See Appendix B for an introduction to using the Kumu platform. This activity can be done alone or in a group. Not only is this the first step in developing your system map, it is also an opportunity to incorporate other perspectives as you brainstorm and/or refine elements of the map.

Keep in mind throughout this exercise that:

- The map should reflect
    - The status you desire or expect to see in the system, including Key Outcomes
    - The Pathways that enable (or constrain) these Outcomes

- The map will not be
    - Complete - the map expands thinking but does not capture all thoughts
    - Perfect - the map is a tool and not a definitive description
    - Static - the map evolves as the system changes

4.2 CREATE A PATHWAY

A good first step in building a map is to create a single Pathway. With one Pathway as a starting point, it will be easy to expand to include other elements, and any additional Pathways and loops in that expansion. The steps below will walk you through how to create a Pathway using a new example Pathway shown in Figure 30.

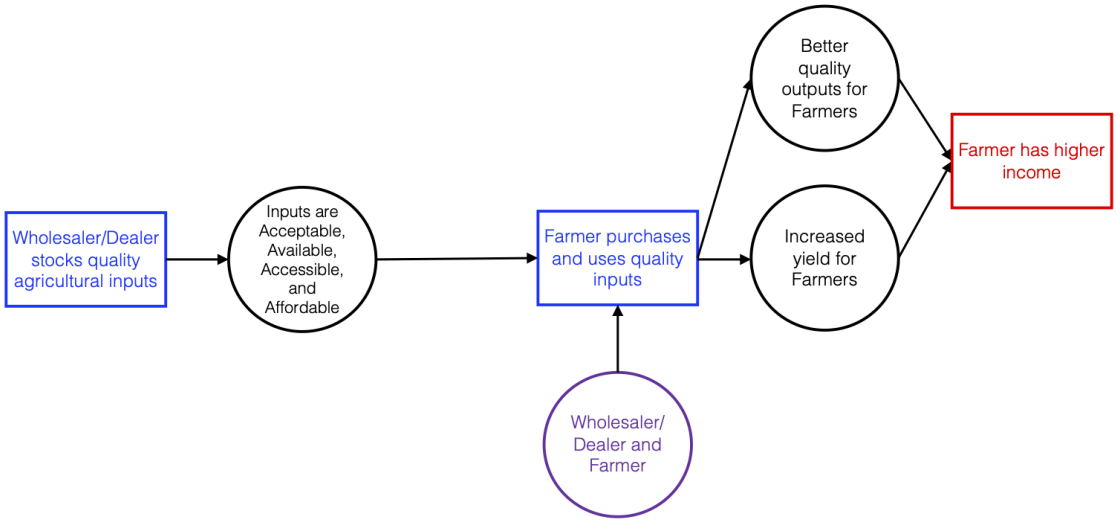


Figure 30: A Pathway example.

1. **Identify a Key Outcome**. The next step is to identify a Key Outcome that is of importance for you. For example, you may be part of a project with a fundamental end goal. Key Outcomes are often very broad statements that are not tied to a specific activity/intervention (e.g., "Households have access to electricity" rather than "Households use solar panels"). If you have a results chain/framework, your Key Outcome will likely be your Development Objective. A project may have more

than one Key Outcome. If there are several, we suggest compiling a list and then choosing one to start.

As a reminder, **Key Outcomes** can be identified based on the following:

- Overall project goals (For example, a project design document will often specify holistic outcomes or objectives.)
- Existing literature and secondary sources that review key system outcomes explored in the past or identify those outcomes targeted for future investment
- Stakeholder and expert input regarding major system needs and priorities
- System components on "critical paths" in the system, in the sense they **enable** many other components or many other things **enable** them
- Potential outcomes of resources invested by development actors, government, private sector, or others (For example, if a training is facilitated, consider the desired outcomes of that training.)

Choose the Key Outcome that you want to expand upon first. In the next sections we will trace its enabling elements to understand what directly and indirectly **enables** this Key Outcome within the system. When you have selected a Key Outcome, use the red marker to write it on one side of your paper/whiteboard and enclose it in a red box.

Example 4.1: Identify a Key Outcome For this example, we start with a very broad key Outcome of "Farmer has adequate income." For our project in Uganda, facilitating smallholder farmer income was identified by several stakeholders as the most important outcome. Note that the threshold for defining adequate depends on the context and objectives for the group creating the map.

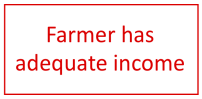


Figure 31: The Key Outcome to start building our map.

2. **Identify enabling elements.** This step begins with the question "What directly enables this outcome?" The answer can be a combination of elements. Does it require:

- A behavior change?
- The existence of a relationship?
- The presence of a condition?

See Section 3 to learn about the different types of elements and how they interact with the map and the Key Outcome.

Remember that "enabling" is distinct from "causing." The presence of an enabling element facilitates the second element to be present. The presence of an enabling element will not necessarily cause another element to be present. The ability to assess causality may come later when system measures are implemented. For now, we are simply trying to understand the elements that are involved.

Every element that you add to your system map will enable *something*, so do not worry about which element you choose to start with. Once you have added your first element, the map-building process will flow and become more manageable and familiar.

For this step, it is fine to add several elements to the map. Elements will often have several enablers. However, try to think critically to ensure every element you consider is thematically relevant. Myriad options can arise from trying to describe complex social, cultural, and economic structures in a map and it can quickly get messy. Use common sense to evaluate if an element is too vague or too disconnected to contribute to useful understanding of this pathway. The level of detail of a map is up to those who create it and how they intend to use it. For example, a map used to initiate discussion with stakeholders can be less detailed than one that is being used to identify opportunities for new interventions. Ultimately, a map is an abstracted reflection of reality and cannot encompass every component or every pathway.

Also keep in mind that some of the elements you identify may not be present in reality since the map represents the desired state. For example, an enabling relationship may involve parties who not currently connected. It is still important to document that potential relationship to highlight its enabling role.

Begin to brainstorm some conditions, behaviors, and relationships that enable your key outcome and add them to your map. Draw each enabling element in the appropriate color (blue for behaviors, black for conditions, and purple for relationships). Draw a connection (arrow) in black between the elements as you add them to signify their enabling relationship. Once you have drawn a couple

elements that directly enable your key outcome, try to trace back another layer to identify secondary or tertiary enabling elements. Each type of element can enable any other type. There are no limits on what types of elements can interact. Draw a connection between any elements that have an enabling relationship.

Note: It may be hard to draw a clear line between conditions and behavior changes. We generally treat as a behavior change any variable where an action by the actor demonstrates that it has occurred (e.g., we can observe a farmer purchasing agricultural inputs). We treat as a condition any variable where the change is largely internal – such as understanding something or trusting something. However, there are several elements that are hard to classify as one or the other, such as trust or willingness to take on risk.

Example 4.2: Identify enabling elements Remember that our key outcome for this exercise is "Farmer has adequate income." What enables this to happen? Farmer income is often based on selling cash crops. Two ways to increase income are for the farmer to sell better quality, at a higher price, and more quantity of crops. We will phrase these as conditions: "Good quality output for Farmers" (e.g. cash crop quality) and "Good yield for Farmer" (e.g. harvested crop size per land cultivated). Of course, the farmer also needs a market that will buy quality outputs in the volume required. This is another condition: "Farmer has access to buyer or market."

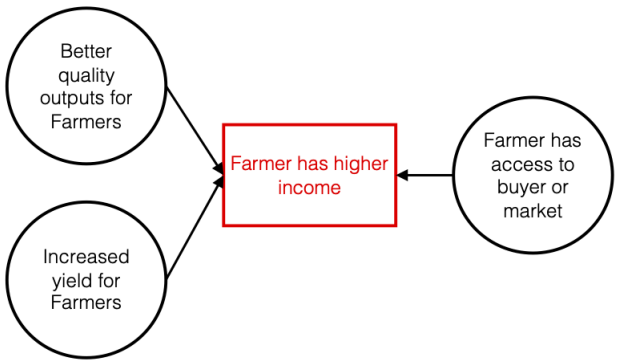


Figure 32: Some elements that directly enable this key outcome.

3. **Build out the pathway.** From the set of elements you just added to the map, select one to consider further. For this new element, again ask the question "What directly enables this element?" Does it require:

    - A behavior change?
    - The existence of a relationship?
    - The presence of a condition?

    Keep in mind the guidelines shared in Step 2 as you continue to add enabling elements to the pathway.

Example 4.3: Build out the pathway Step 3 instructs us to select on of the enabling elements we identified in Example 2. We decide to focus on enabling the "Increased yield for Farmers" condition. This can require Farmers to make decisions such as using quality agricultural inputs (e.g. seeds) and using good production and post harvest handling (PHH) techniques. These are behaviors, which we will describe as "Farmer purchases and uses quality inputs" and "Farmer uses improved production and PHH techniques." It turns out that these conditions can also improve crop quality, so we also draw enabling connections from these behaviors to the condition of "Good quality outputs for Farmer."

Step 4 consists of repeating Step 3 to build out the pathway. We select the behavior "Farmer purchases and uses quality inputs" to continue. Several conditions enable this behavior, starting with "Farmer sees value in quality inputs." A key enabler for the purchase is having agricultural inputs of acceptable quality in markets that the farmer can access; and they should be in stock and reasonably priced. We combine these aspects of the retail offer in one condition: "Inputs are Acceptable, Available, Accessible, and Affordable." Another enabling condition is that the "Farmer has financing", either in cash or credit, to make the purchase. Finally, we identify that a relationship between the seller (Wholesaler or Dealer) and the Farmer further enables this purchase.

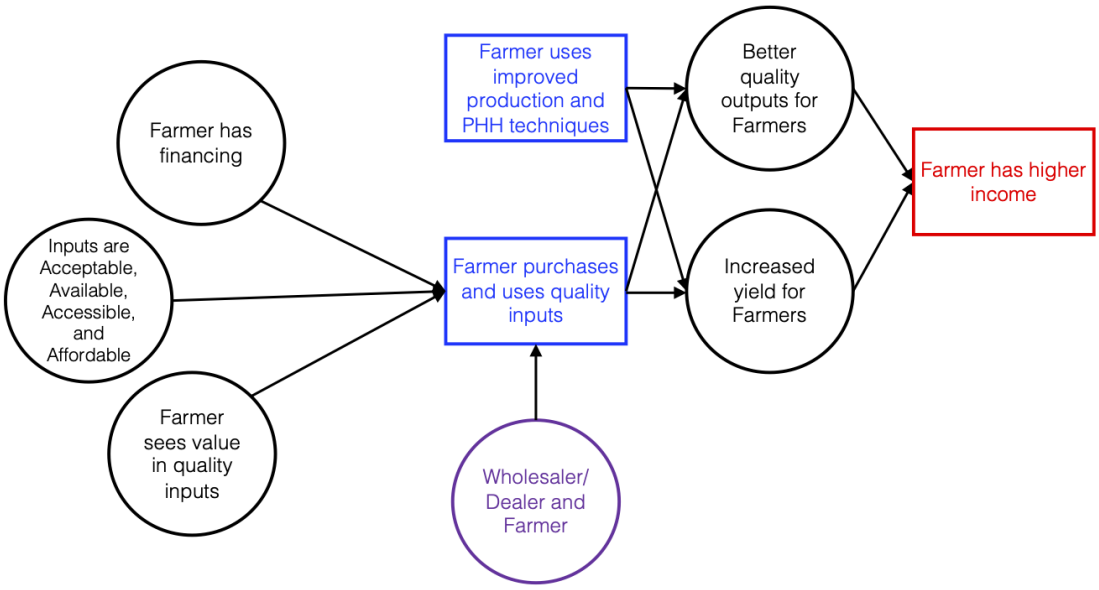


Figure 33: Elements that enable "Increased yield for Farmers." Note that they also enable another condition that we already identified: "Better quality outputs for Farmers." We continue building the pathway with enablers of the behavior "Farmer purchases and uses quality inputs."

4. **Complete the pathway.** Repeat step 3 for each element to continue building out the pathway until you reach consensus that the pathway has reached its end. It can be challenging to decide when to stop this step and complete your pathway, since you often can think of further enablers. The key is determining if further enablers are important for your purpose. It is more obvious when you reach an intervention that you are proposing or implementing. Otherwise, you may want to consider if you or your audience can still see a strong connection between new elements and the key outcome. Stop adding to the pathway when you reach the point where enabling elements are too distantly connected to where you started or where the element is beyond your scope of consideration. See Example 4 for an example discussion of how to determine when a pathway is at the end.

   Note that as the pathway grows it need not remain linear. An element may be enabled by an earlier element on the pathway, effectively forming a loop. Loops represent pathways that continue to change through reinforcement and iteration of the cycle. Reinforcing cycles may be particularly important in achieving systemic change, since small changes can iteratively build into larger and more widespread changes over time.

Example 4.4: Complete the pathway. Completing Step 4 requires judgment to determine when to stop building the pathway. We will highlight a couple common scenarios for completing a pathway. First is reaching an intervention. A behavior that enables functioning input markets (such as a market that meets the four A's (products are Acceptable, Available, Accessible, Affordable)) is that an agricultural Wholesaler or Dealer stocks quality agricultural inputs. For this example, our organization is implementing an intervention with agricultural Dealers on this stocking behavior. As Step 5 suggests, we can add this intervention to the pathway. An intervention is a natural stopping point for this pathway.

Step 6 offers the option to revisit an existing element and continue a parallel branch. Considering the condition "Farmer sees value in quality inputs" in this example, assume our organization is not working with extension services that could enable that condition. Reaching a condition that is beyond your scope of consideration is a second scenario for completing a pathway, even though you might need to revisit this stopping point as you seek broader system insights.

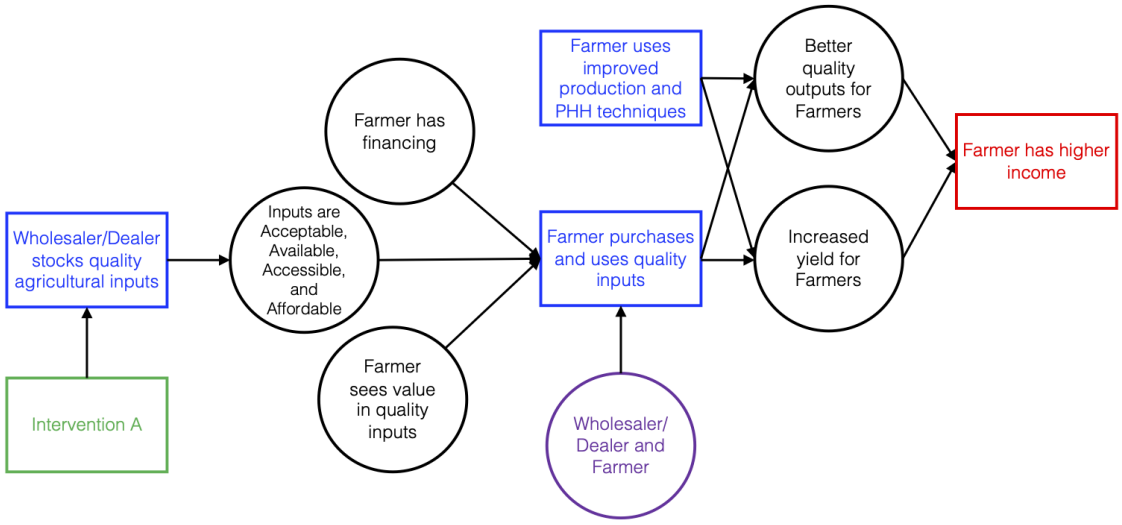


Figure 34: Our example includes two common scenarios for completing a pathway: reaching an intervention (Intervention A) and reaching a condition beyond your scope of consideration (Farmer sees value in quality inputs).

5. If you are aware of **interventions** that directly impact elements on your chain, add those in green. It is fine if a pathway does not contain an intervention.

6. After completing a pathway, you can revisit an existing element with several enablers and build out parallel branches. Repeat step 4 to complete this new branch pathway. While your first initial pathway will likely resemble a stick, the combination of branching pathways may look more like a tree. This is common, and natural, and encouraged!.

You have just completed your first pathway! This is a crucial step in conceptualizing how system elements are connected and eventually enable key outcomes, and is the first step in developing your systems map.

4.3 BUILD OUT THE MAP

Creating a Pathway in Section 4.2 is a valuable first step in learning how to critically answer the key question **"What enables this?"** and to build skills in working with others to identify connections. Once you have identified and built out your first Pathway, you can begin building out the rest of the map using the steps outlined. As you/your team work with markers and paper, things may quickly get confusing. Keep in mind that at this point the goal is to start generating ideas and insights and get used to identifying elements and their interconnections. Creating a more formal map in the software discussed in System Pathways Toolkit Annex will result in a cleaner version for ongoing use.

- **Find another Pathway.** For any given Key Outcome, there will be more than one Pathway that enables it. It is good to reconsider the **enablers** of a Key Outcome and develop alternate Pathways until you run out of ideas.
    1. Revisit Step 2 of Section 4.2 to identify the **enabling** elements of a Key Outcome.
    2. If there is an enabling element with no obvious Pathway to build, then revisit Steps 3-6 of Section 4.2 to complete the Pathway for this element.
- **Choose a different Key Outcome.**
    1. Revisit Step 1 of Section 4.2 to identify Key Outcomes.
    2. If there is a Key Outcome with no enabling elements or Pathways, then continue revisit Steps 2-6 of Section 4.2 to identify its enabling elements and their associated Pathways around one of these other Key Outcomes. As you work through this process, keep in mind the elements that you

already have on your map. Some of these existing elements may also enable your new Key Outcome (or any other new enabling elements that you add). Sometimes, instead of adding brand new elements to the map, you may be able to simply add new connections from existing elements.

- **Find interconnections between Pathways.**
  1. Review the Pathways that you already have on your map.
  2. Look for ways that the elements along different Pathways may interact.
     - Should there be a connection linking an element from one Pathway to another?
     - In order for one element to **enable** another, is there some missing intermediary element? Add that to the map and draw the appropriate connections.
     - Are there elements that are **enabled** by your Key Outcomes? Draw connections coming out from your Key Outcome and into these elements.
  3. Note that in making connections between Pathways you may create loops. This is not only fine, but encouraged. As Section 3.7 describes, feedback loops often reveal the deepest understanding of the system.
- **Add detail and clarity.**
  1. Closely review the elements on your map and the connections between them. Have you missed any details that may help others understand the system?
  2. Step back and reflect on your element labels. Are there any elements that are too broad or vague? This may be a Behavior with no clear actor (e.g. "People use banks") or a Condition that is overly general (e.g. "Financial services are available"). You may only need to make small changes in language to make the element more clear. But you should also consider splitting a vague element into two or more specific elements.
  3. Refine the elements on your map until there is consensus that they are specific and clear.

Example 4.5: Refining Vague Elements Let's say we have added a Behavior to our map: "People use banks." When we review our elements, we realize how general this is.

What specific type of people are using banks? Farmers? Input dealers? Traders? Other agribusinesses? Also, there are many different ways to use a bank. Does this mean taking out a loan? Opening a bank account?

We should choose specific concepts and refine our element: "Farmers open bank accounts." If we decide that we want multiple system actors to undertake the action, consider replacing something general like "people" with "value chain actors." This adds specificity that we aren't talking about the entire population, just actors along the agricultural supply chain that we are interested in.

Similarly, try to have each element represent one concept. "People use banks" not only does not specify the actor, but also encompasses several behaviors, such as making deposits or taking out loans. "Farmers open bank accounts" specifies a single action.

It often helps to be as precise as possible when defining a Behavior or a Condition, particularly when it comes time to create indicators to measure a system map. The more precise the concept, the easier it is to understand, and ultimately to measure.

4.4 GATHER FEEDBACK AND ITERATE

One of the most valuable uses for system maps is as a starting point to align with stakeholders. Individuals with different roles in the system may identify additional elements or connections or open up a discussion about how they think the system works differently from what has been mapped. Starting this conversation over a concrete visual can more clearly bring out these different beliefs.

The stakeholders you may consider getting feedback from include:

- Government agencies
- Private companies
- NGOs
- Donors
- Other end users

A workshop is a useful format in which to convene these stakeholders to review a system map. Appendix A includes a template for stakeholder engagement, both for building and reviewing a system map, with options that are flexible according to the size

of the stakeholder group and time and resource constraints. Appendix A also includes sample workshop slides, which are designed to be modular to fit your requirements.

The map should be updated once consensus is reached on a more accurate depiction of the system. Throughout the feedback discussions, keep in mind that no map is a perfect reflection of reality. It is possible that consensus about how the system works can't be reached, but uncovering the differences in perspectives is valuable to understanding how to better work with these stakeholders.

5 COMPLETE: ORGANIZE A COMPLEX SYSTEM MAP

Objectives: Deepen your knowledge about the organizing structures of a system map and apply the principles to the simple map from Section 4.

Prerequisites: Understand the purpose of a system map (review Section 1 and how to read one (review Section 2). It will be helpful to have started to create your own system map (review Section 4).

Products: A further organized and developed system map.

Key takeaways:

- **Subsystems** group related components and Pathways to organize a system map by common themes/ideas.
- A system contains different **subsystems**, but they are all inherently linked.

5.1 OVERVIEW

Previous sections have discussed how to read and to create a map. This Section provides a deeper look at the organizing concepts of system mapping. Once you have created a few Pathways, you can begin to connect and organize them. We zoom out to look at subsystems, before zooming out again to take in the system as a whole.

5.2 SUBSYSTEMS

For organization and ease of reading, a System Pathways map can be divided up into multiple **subsystems**. Subsystems are natural groupings of map elements that align with a common theme. Subsystems should be created by identifying broad, distinct concepts within the main system and finding elements closely tied to those concepts. Spatially distinguishing the subsystems makes the map easier to digest.

Every map is different, and the best way to organize subsystems will be different. A few ways to get started are:

- **Think about the inherent structure of the system:** Does a natural structure emerge? In the Ugandan agriculture market, there are various different actors – farmers, input dealers, financial services, etc. It makes sense to give each actor a subsystem to reflect this natural structure.
- **Look at past work:** Is there a typical way the concepts on the map are arranged? For household resilience, human capabilities play a key role. In the literature these are frequently grouped into categories such as bodily health, education, or social capital. The most relevant of these categories can become a subsystem.
- **Identify broad concepts you want the map to capture:** In what way can the map be greater than the sum of its parts? For household resilience, livelihoods also play a key role. An important concept to explain is that households are constantly making decisions about how to best generate income, and how to invest the income they generate – this is the livelihoods cycle. Thus, some subsystems of the map can be dedicated to different ways of generating income (e.g. farming) and investing income (e.g. education).

These methods will produce countless different ways to organize your map into subsystems. Choosing the best arrangement is a difficult and subjective task. Some points of guidance are:

- **The more important it is, the more space it should take up:** When people first look at the map, they will naturally spend about the same amount of time looking at the different components. Thus, the amount of space something takes up should be equivalent to the amount of time you want people to spend thinking about and looking at it.
- **Keep similar things together:** The map should be as readable as possible, so if two subsystems are similar (e.g. Agriculture and Pastoralism are both livelihoods) they should be placed close together.
- **Show sequences:** Again, to make the map as readable as possible, you should try to capture natural sequences. For example, in the market systems map, "Inputs Importing and Manufacturing" is followed by "Input Distribution", which is followed by "Farmer Practices", which is followed by "Commodity Distribution." This reflects the physical flow of material in the market system, so is a more intuitive way to arrange the map.

As an example, let's look at the wider subsystem in which our example Pathway lies. The "Financial & Business Services" subsystem of Ugandan agricultural system is shown in Figure 35.

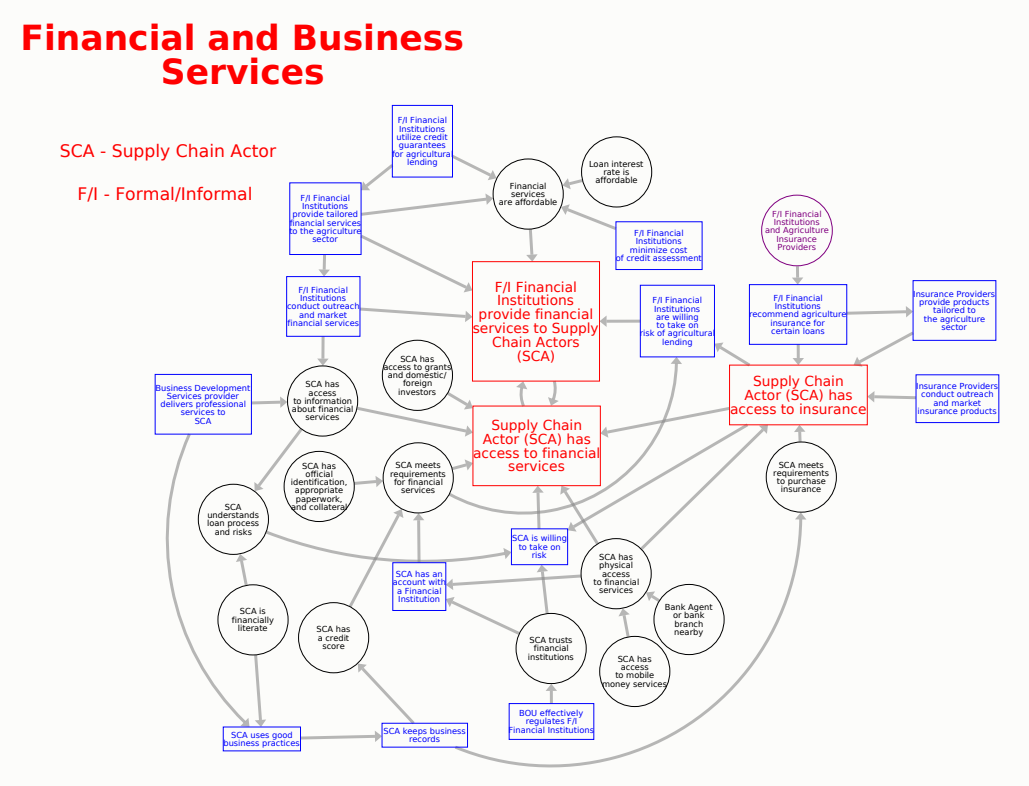


Figure 35: The "Financial & Business Services" subsystem, a part of the wider Ugandan agricultural market system.

We can parse through some of the elements within the subsystem to build our intuition on the theme (without necessarily tracing connections and pathways). The **Key Outcomes** within a subsystem will be the most illustrative. The three Key Outcomes in this subsystem are:

- "Supply Chain Actor (SCA) has access to financial services."
- "Formal/Informal (F/I) Financial Institutions provide financial services to Supply Chain Actors (SCAs)."
- "Supply Chain Actor (SCA) has access to insurance."

All three of these are related to financing. We can then look at the other components in the subsystem to continue to deepen our understanding of how they are related. Skimming through the subsystem, we see components with labels like:

- SCA has a credit score.
- Financial institutions minimize credit assessment costs.
- Financial services are affordable.
- Bank agent or bank branch nearby.

All are in some way related to the financial sector. It may be that not every single element in a subsystem explicitly reflects the theme. Since the idea behind system mapping is that elements not directly connected to a Key Outcome still have impact through a Pathway, there may be some elements that seem tangentially related to the subsystem theme.

System maps are used to visualize inherently complex contexts. Therefore, it can be challenging to limit scope and decide when enough has been included. To account for this ambiguity, a system map can employ a Cloud element. Find the "Household Resilience" subsystem in Figure 36. You'll notice the two Clouds labeled "Health System" and "Community." These are included to acknowledge the important roles that both of these play within the context of agricultural markets. However, detailing out these subsystems goes beyond the scope of this particular system map. The Cloud is used as a soft boundary. It includes the fact that health concerns impact households' resilience without getting more specific.

As you decide on appropriate boundaries for your own system map, add in Clouds for elements that fall outside of the scope of your context. These can also be used as a placeholder to be filled in later.

While subsystems can make complex maps more manageable, it is important to remember that they are only an organizing construct. They are not independent of each other. Connections between elements in different subsystems may not be depicted in order to create white space for clearer groupings of similar map elements. However, important pathways for systemic change can span subsystems even if the connections between the subsystems are not always present. For example, the condition "Farmer has financing" in Figure 34 in the previous section could be enabled by the condition "Supply Chain Actor (SCA) has access to financial services" in Figure 35. Thus, there is a longer pathway that connects the Farmer Practices subsystem with the Financial and Business Services subsystem. While subsystems help you visualize complexity, understanding of complete pathways is still fundamental for systemic change.

5.3 THE ENTIRE SYSTEM

Of course, the subsystems do not operate in isolation and are inherently interconnected. We can zoom out to see the subsystem in the context of the entire system map. In Figure 36, subsystems are labeled with red text. We briefly look at the other subsystems to get a sense for the other building blocks of the system and how the one we are looking at is relatively positioned. We see separate subsystems for "Agricultural Services," "Input Distribution," "Farmer Practices," and "Commodity Distribution," among others. Quickly observing the various subsystems builds a stronger understanding of the scope of the entire system.

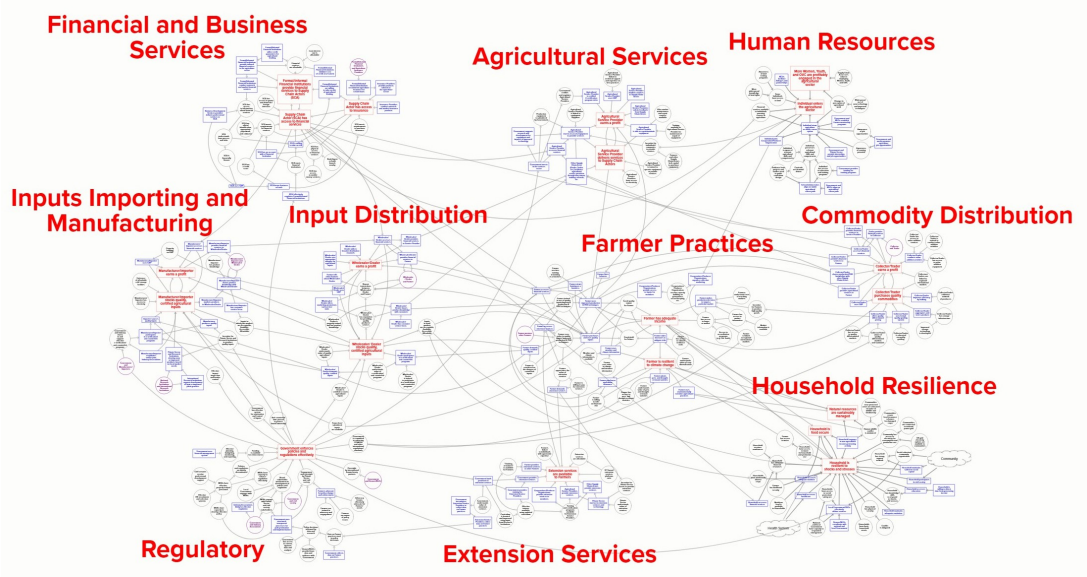


Figure 36: The entire agricultural market system map.

Notice that connections reach from elements of one subsystem into another. There are no hard boundaries for one subsystem versus another. The construct of a subsystem is useful for focusing on a particular area within a system. Certain elements could reasonably be considered in more than one subsystem when focusing in this way.

Once we have a sense for the other subsystems within a system and how they are positioned relative to each other, we can look for connections between them which show how the subsystems interact. The "Financial & Business Services" subsystem has connections that reach into the "Regulatory," "Household Resilience," "Farmer Practices," and "Human Resources" subsystems.

There are many connections which closely connect the "Farmer Practices" subsystem with the "Households Resilience" subsystem, highlighting how closely those themes overlap in the real system. Within farming households, the decisions made about cultivation are influenced by the household's relative resilience. In turn, the decisions a household makes about farming practices will impact its level of resilience.

Return back to the map that you have built in Section 4. Brainstorm how it could be organized into subsystems. Consider broad themes and concepts within your system. It is helpful to have subsystems that have similar scope. For example, a "Farmer Practices" subsystem is more general while an "Herbicide Procurement" subsystem is quite specific. Having these two themes within the same system seems incongruous and like there may be other pieces which could be grouped into the "Herbicide Procurement" subsystem to turn it into a more general one, such as "Inputs Distribution."

As best you can, add your subsystem labels to the map. The paper version of the map may be challenging to organize spatially into subsystems, but keep in mind that it can be organized in the future using software (see System Pathways Toolkit Annex).

Going Deep 5.1: Organizing Uganda's Agricultural Market System For a detailed example of the thought process behind organizing a system map into subsystems, we invite you to review the release notes for v2.0 of the map of the Ugandan agricultural market system. Section 3.2 provides an explanation of the theme of every subsystem. Within each subsystem, it discusses some of the important connections and elaborates on the language of some elements. As you think about which themes are most appropriate for your own map, reading through these release notes can strengthen your understanding of useful focus and scope of subsystems.

The latest release notes can be accessed here

6 INTERPRET: UNCOVER INSIGHTS USING SYSTEM MAPS

Objectives: Gain a broader understanding of how to utilize a system map in practice.

Prerequisites: Create a system map.

Products: A system map with prioritized leverage points, and an understanding of how to use the system map for other applications.

Key takeaways:

1. System maps can be used to better understand how change occurs in your system.
2. System maps can be used to identify leverage points for change, opportunities for future intervention in the system.
3. System maps can also be used for communication, collaboration, learning, adaptation, and understanding shocks to the system.

6.1 OVERVIEW

This Section describes how system maps can be analyzed and used to uncover insights about the system. The Section will review several key ways that system maps can be used:

1. **Understand Your System**: Once you have created a system map, you can see how it links to existing theories of change and identify key paths to change and loops within the system. You can also identify barriers to change and gaps in your knowledge about the system.
2. **Identify Leverage Points**: System maps can be used to find leverage points in the system where new interventions could improve outcomes.
3. **Communicate**: System maps can be used as a communication tool and to promote a common understanding of the system.
4. **Collaborate, Learn, and Adapt**: Use the system map to identify opportunities

for collaborating, learning about the system, and using system maps to identify ways to adapt an intervention.

5. **Assess the Impact of Shocks**: System maps can be used to understand how a shock propagates through a system, the impact of the shock, and how resilient the system is to shocks.

It is important to note that all of the analysis described in this section will be more robust if data has been added to the system map, and indicators have been created to measure the status of the elements. For example, having data facilitates identifying key pathways, testing dynamic hypotheses, and finding barriers to change, and further allows for monitoring of system change and identifying data gaps. We encourage you to consult the System Pathways Measurement Toolkit for a primer on measuring system maps.

6.2 UNDERSTAND YOUR SYSTEM

6.2.1 LINK TO EXISTING THEORIES OF CHANGE

Once your system map is complete, you can use it to "see the bigger picture": how your system functions and the dynamics within your system.

First, you should be able to link your system map to existing theories of change about the system. The Pathways in the system are designed to correspond to linear results chains or logframes. You should be able to visualize where your results chain or logframe is located in the system, and trace the path from the Intervention to the Key Outcome on the system map. If your results chain or logframe does not correspond to an existing system Pathway, we encourage you to go back to Section 4 and reorganize your map and/or create a new Pathway. This will allow you to see how your results chains or logframes fit into the broader system, and begin to identify other Pathways and elements in the system that will impact the outcome of your intervention.

6.2.2 IDENTIFY KEY PATHWAYS TO CHANGE

Next, based on your understanding of the system, you should be able to identify key Pathways to change: which Pathways in the system are most instrumental in producing change in the outcome of interest? Which are more central? Perhaps one Pathway is

strictly necessary for there to be change in the Key Outcome, and without it the system cannot change; perhaps the Pathways are interchangeable, but one or more of them is more likely to produce a larger change. What constitutes a Key Pathway will differ from system to system, but what they have in common is that without them, change in the Key Outcome becomes impossible, unlikely, or more difficult. Identifying Key Pathways is an essential component of finding leverage points, which is discussed in the next section.

Example 6.1: Finding Key Pathways For example, in the "Financial & Business Services" subsystem, there are several Pathways that determine access to financial services, each of which is necessary, but not sufficient, for the Supply Chain Actor to access a loan. There is one that could be considered the most central, or the most important: physical access to financial services (highlighted in green in Figure 37). If the Supply Chain Actor does not have physical access to financial services, it does not matter whether the other Pathways are functioning properly - without physical access there can be no true access to financial services. As such, this would constitute a Key Pathway. Another important Pathway that enables access to financial services is the Supply Chain Actor meeting the requirements for financial services (highlighted in orange). Both of these Key Pathways are highlighted in Figure 37.

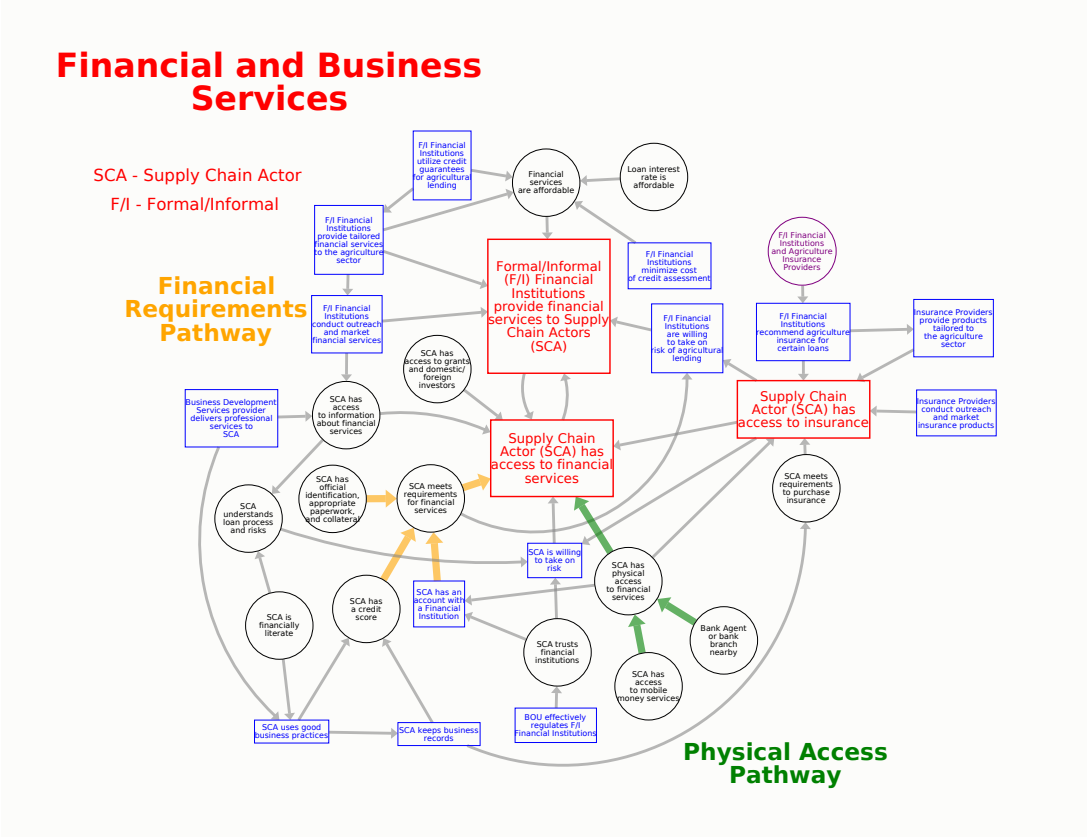


Figure 37: Two pathways highlighted on the system map of the "Financial & Business Services" subsystem within Uganda's agricultural market system.

6.2.3 FIND BARRIERS TO CHANGE

You may find that there are elements in the system that in their current state are keeping the system from functioning properly. The map represents the ideal state, but given your knowledge of the system, you may know of certain elements or Pathways that are not functioning according to the ideal.

To find barriers, look for elements whose status you envision as "red" - the behavior is not widespread, the relationship is poor, the condition is not met, etc. These are potential barriers to change in your system. Then look at where these potential barriers are located in the system. How central are they? How close to a Key Outcome? Are they on an important Pathway that is essential for driving change in the system? You

may know, for example, that an element on a key change Pathway is not functioning according to the ideal, or that its status is low ("yellow" or "red"), and as such the change along this Key Pathway is stalled, which could also stall change in your Key Outcome. These are all potential barriers to change, depending on how much of an impact this poorly-functioning, non-ideal element is having on the rest of the system.

This is an example of an exercise that is made easier when the system has been measured, as outlined in the System Pathways Measurement Toolkit. Once the status of system elements has been measured, barriers can be identified by looking for elements with a "red" status, and determining whether they are on an important Pathway or otherwise blocking change in the system.

Example 6.2: Finding Barriers to Change For example, in the "Financial & Business Services" subsystem, we could envision several potential barriers to change. If we know that Supply Chain Actors (SCAs) are reluctant to take on the risk of a loan, for example, we expect the status of the Condition "SCA is willing to take on risk" to be "red", and the Key Outcome "Supply Chain Actor (SCA) has access to financial services" to be impacted. Some elements may not be central enough to act as barriers. If, for example, we know that few Supply Chain Actors use Good Business Practices (at bottom left), we might imagine the status of the Behavior "SCA uses good business practices" will be "red", as shown in Figure 38. This element may not serve as a barrier, though, as it is not very central to the system - it will depend on how important the elements it enables are, and whether those elements can still function even if "SCA uses good business practices" is "red." The Behaviors "SCA keeps business records" and "SCA has a credit score" are enabled by the Behavior "SCA uses good business practices" in this map, but it is possible that the Supply Chain Actor can have a credit score independently of whether they use Good Business Practices - in other words, the proper functioning of "SCA uses good business practices" would likely not be essential, and would not be stalling change in the system.

As mentioned above, these assessments are easier to make when there is concrete data behind the elements - when you know the status of an element is "red" based on data, rather than based on intuition or general knowledge of how the system functions.

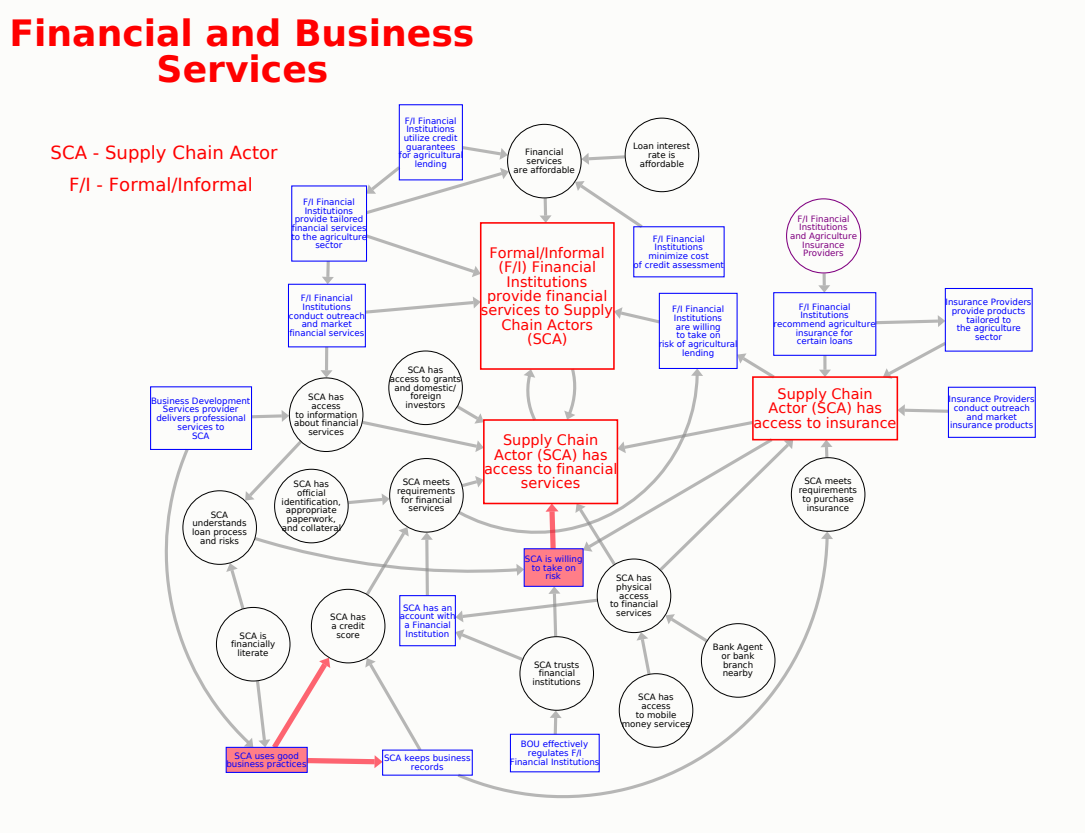


Figure 38: Two example barriers to change on the "Financial & Business Services" subsystem within the system map of Uganda's agricultural market system.

6.2.4 UNDERSTAND DYNAMICS AND LOOPS

You may want to understand the dynamic behavior in the system in order to develop or test theories of changes. While change can occur through incremental evolution, the catalysts for more dynamic change are often feedback loops, which were introduced in Section 3.7. Loops are cycles in the system that can be reinforcing (where change begets change in one direction) or balancing (where one change counters another change). Iteration of reinforcing loops can amplify interventions, building into more significant and/or widespread change. Iteration of balancing loops can dampen efforts, constraining the change intended.

We will not dive into the theory of system dynamics in this document, though interested

readers can learn more by exploring our research that applies this theory, which is referenced in the "Going Deep" section below. But rest assured that feedback is an important aspect of complex systems and you should expect to find loops in your system. We include an example to illustrate how you can identify loops by adding connections to a system map. The combination of multiple interacting causal pathways and feedback loops enables deeper inference regarding the drivers of system behavior.

Example 6.3: Finding Loops For example, we could very easily create loops in the "Financial & Business Services" subsystem by adding a few connections. If we assume that Supply Chain Actors (SCAs) who access financial services are given some kind of credit score, or at least that their information is stored by the financial institution, this enables them to meet the requirements for financial services in the future. If we add this connection, we can see that there is now a loop (shown in yellow in Figure 39) - meeting requirements for financial services **enables** access to financial services, which in turn **enables** an SCA to meet requirements for financial services in the future via a credit score. This connection has created another loop as well, shown in blue: meeting the requirements for financial services **enables** financial institutions to take on the risk of lending, which in turn **enables** the top Key Outcome ("Formal/Informal (F/I) Financial Institutions provide financial services to Supply Chain Actors (SCAs)"). This then enables the bottom Key Outcome, access to financial services, which enables meeting the requirements for financial services. These would be considered reinforcing loops - they create change in the same direction, all leading to greater access to financial services.

Another connection could be added to create a smaller loop around information access. If we assume that a Supply Chain Actor who accesses financial services is now better positioned to access information about them (such as having a contact at a financial institution), there would be a connection from the Key Outcome "Supply Chain Actor has access to financial services" to the Condition "SCA has access to information about financial services." This creates a small loop, shown in purple, with just two elements. This is also a reinforcing loop, as it works in the same direction as the broader system is changing, which is towards greater access to financial services.

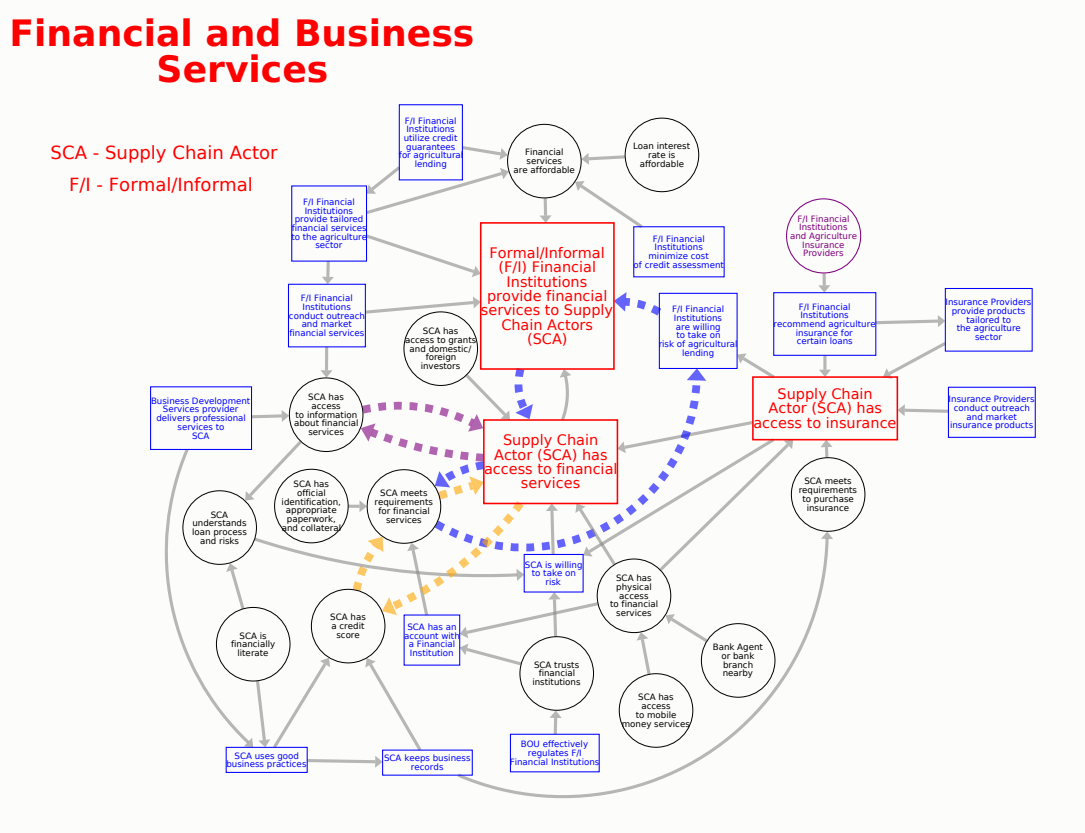


Figure 39: Several example loops shown on the system map of the "Financial & Business Services" subsystem within Uganda's agricultural market system.

Going Deep 6.1: Understanding Dynamics in the System For more detail on understanding dynamics by identifying and interpreting loops in a system map, we invite you to read the academic paper associated with this toolkit, "A Systems Framework for International Development: The Data-Layered Causal Loop Diagram" in the journal *Production and Operations Management*. The article is open-access and is available at https://onlinelibrary.wiley.com/doi/abs/10.1111/poms.13492.

6.3 LEVERAGE POINTS

This section describes how to determine which parts of the system to leverage in order to influence desired outcomes using a system map. We will walk through the five steps to identify leverage points by focusing on a shared example.

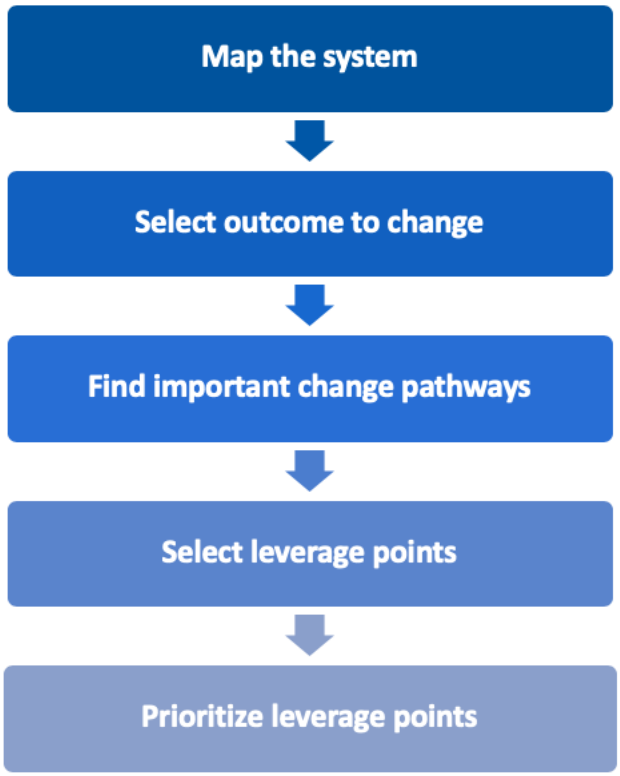


Figure 40: 5 step process to identify leverage points

What is a leverage point?

A leverage point is an opportunity to intervene in a system to change Behaviors, Relationships, or Conditions that will drive changes to a Key Outcome. An Intervention is the work done to change a map element at a leverage point. The leverage point it is acting on could be any of the system elements. Existing Interventions on the map are based around a leverage point that was previously identified. These Interventions are working to drive change to an outcome through a particular Pathway.

Example 6.4: An Example Leverage Point Figure 41 shows an example of a leverage point. The Condition "Farmer has credit score" is a leverage point and is highlighted in the figure with a star. By acting on that map element, change in the system can influence Key Outcomes. In this case, changes to farmers' credit scores will influence the Key Outcome "Farmers take out loans to improve farming practices."

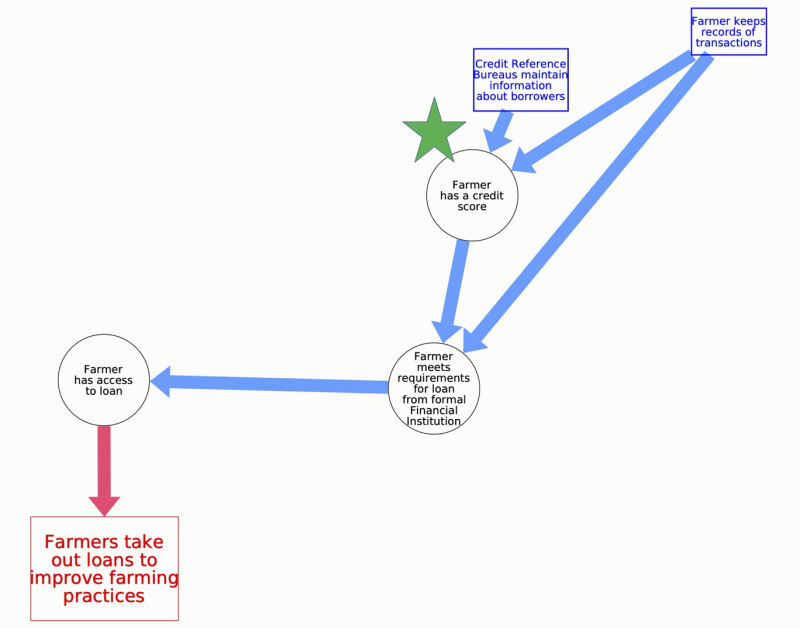


Figure 41: Example leverage point

6.3.1 MAP THE SYSTEM:

Identify Key Outcomes and the Pathways that **enable them** on your system map. Following the System Pathways mapping methodology, Key Outcomes are labeled using bold red text (see 4.2 for a discussion on how to create pathways). In Figure 42, you can see the key Pathways highlighted with three Key Outcomes identified.

6.3.2 SELECT THE OUTCOME TO CHANGE:

Pick a specific outcome that you want to change. Remember that outcomes are the desired change(s) toward which the development project is working. **Key Outcomes** are the outcomes on which your efforts will focus. Not all outcomes need to be designated

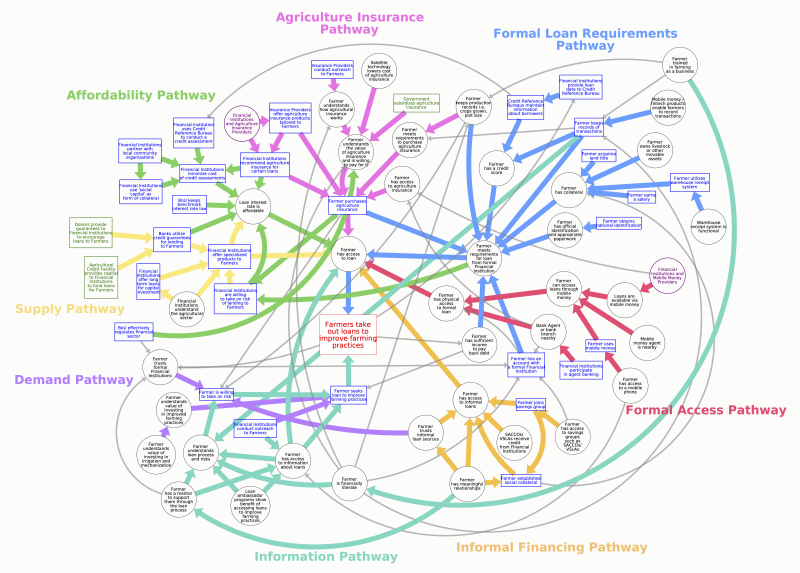


Figure 42: Map the system

as **Key Outcomes**. In the example, we are going to concentrate on the Key Outcome "Farmers take out loans to improve farming practices."

How do you select which outcomes to prioritize? Many development projects have already designated 2-3 outcomes of interest, and all of these can be selected for an Intervention. On the other hand, larger projects may have a large number of desired outcomes, some of which are short-term (e.g., Farmers take out loans to improve farming practices) and some of which are long-term (e.g., Increase farmer incomes). When there are a large number of outcomes, you may want to select a subset of these outcomes. The **"key" outcomes** should include the most important long-term outcomes, and the intermediate outcomes that enable the selected long-term outcomes.

When identifying these important outcomes, the following inputs can be used:

- Overall program goals (for example, a program may specify the most important outcomes)
- Stakeholder and expert input
- Resources invested by development actors, government, private sector, or others: consider potential outcomes of these resource investments (for example, if training is facilitated, consider outcomes of training)

Figure 43: Select the outcome to influence

- System components on "critical paths" in the map, in the sense they enable many other components or many other things enable them
- Comprehensiveness, in that the set of key outcomes should span the parts of the system in which changes may be expected
- Existing data, literature, and other secondary sources to identify key outcomes examined in the past, or those linked to the interventions or resource investment

6.3.3 FIND IMPORTANT CHANGE PATHWAYS:

Next, we will identify Key Pathways that **enable** the outcome of interest. Pathways are described in Section 3.6. Pathways are a series of linked elements that **enable** a Key Outcome. To identify the Pathways related to your Key Outcomes, consider:

- Which Pathways are already functioning well and which are further from their ideal state?
- Which Pathways are essential to driving change in the outcome?
- Which Pathways are barriers to change on any of the Pathways?

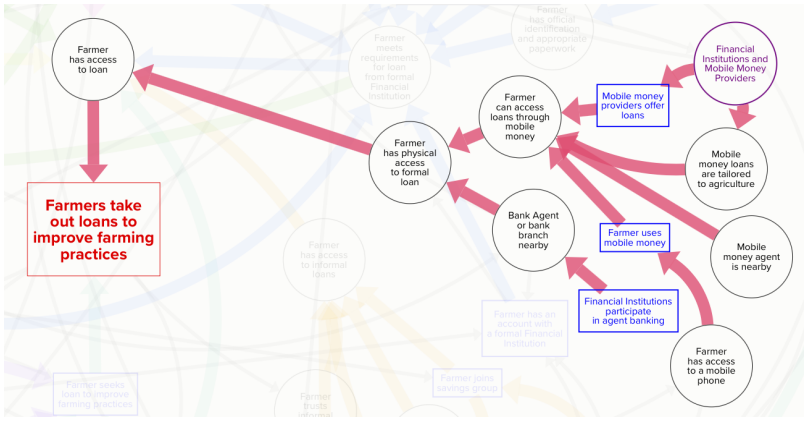


Figure 44: Key Pathways: Formal Access Pathway

As you identify key Pathways, there may be several that influence the outcome you selected. Figure 44 and Figure 45 are both examples of Pathways that enable the Key Outcome "Farmers take out loans" we are interested in. Ask yourself, are some Pathways more important than others? There may be Pathways acting as barriers and/or counteracting the progress made on other Pathways. These may be candidates for key Pathways.

See Section 6 Interpret the Results of the **System Pathways Measurement Toolkit** to learn how measuring your system map can help you assess system Pathways.

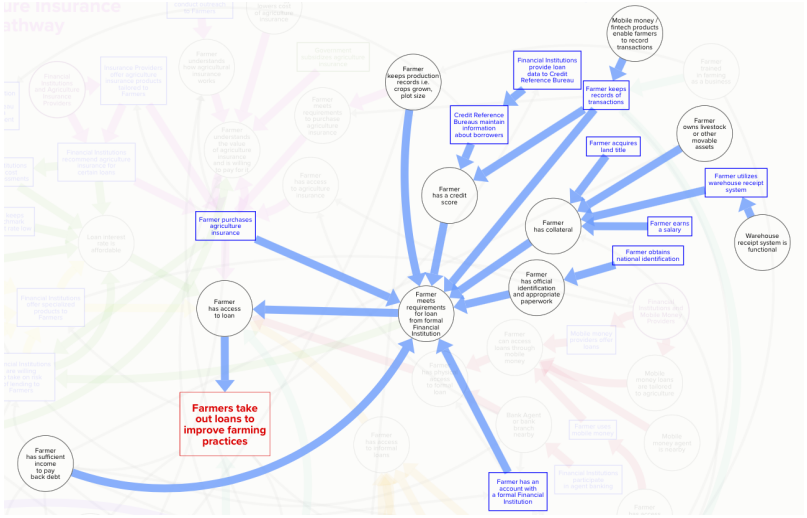


Figure 45: Key Pathways: Formal Loan Requirement Pathway

6.3.4 SELECT LEVERAGE POINTS:

To select your leverage points, first recall that a leverage point is an opportunity to intervene in a system in order to change Behaviors, Relationships, or Conditions that will drive changes to a Key Outcome. When deciding where to intervene in a system, there are several points to consider:

Gaps: Are there major gaps in the current portfolio that need to be addressed?

- **Feasibility**: Is change currently feasible? Are there resource/capacity/political constraints?
- **Evidence**: Have similar interventions been successful in the past? Is data or other evidence available?
- **Capabilities**: Where is it appropriate for your organization to intervene? Does this match your organization's strengths and abilities?
- **Scale**: If considering a market facilitation intervention, are spillover/multiplier effects possible at this leverage point?
- **Scope**: At what level would you intervene? National, district-level, local?
- **Complimentary**: Are other interventions working on the same Pathway? Are there benefits to "piling on"?
- **Consequences**: Are there potential positive or negative externalities? Unintended consequences?

Example 6.5: Selecting Leverage Points Figure 46 shows three selected leverage points. The Condition "Farmer keeps records of transactions" is a leverage point and is highlighted in Figure 46 with a star. An Intervention could be built to act on that map element by building capacity at financial institutions to teach recording keeping. A second Condition, "Farmer utilizes warehouse receipt system" was identified. An example Intervention related to this Condition would be piloting a warehouse receipt system in a district. An existing Intervention was highlighted on the Condition "Farmer has official identification and appropriate paperwork." A choice could be made to invest further in this Intervention or prioritize new funding. Last, a leverage point was identified at the Condition "Farmer has an account with a formal Financial Institution." A corresponding Intervention would be to support financial institutions to conduct outreach.

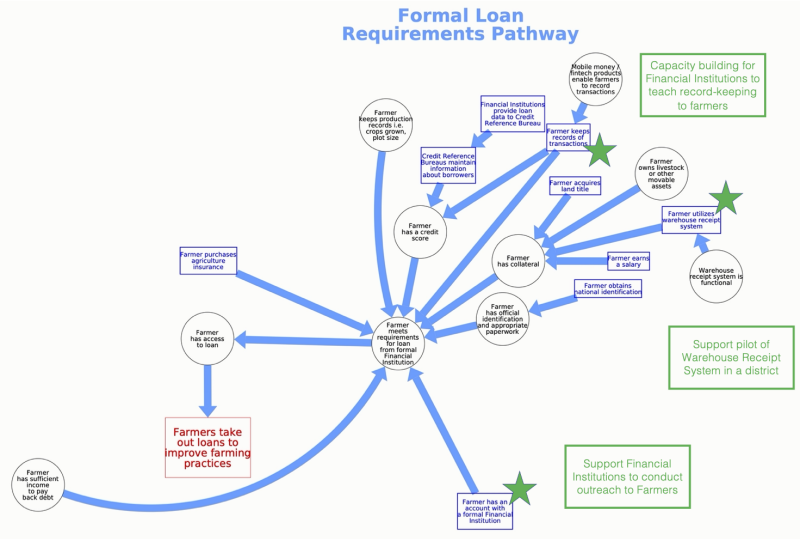


Figure 46: Leverage Point Identification

6.3.5 PRIORITIZE LEVERAGE POINTS:

After having identified potential leverage points, there is often a need to prioritize them. In some cases, you cannot do everything due to budgetary constraints. In other cases, you might want to sequence the places you intervene for the most impact or political reasons.

- **Capabilities**: Does your organization already have the tools, capabilities, or relationships to intervene at this point?
- **Coverage**: Are other organizations already working on this Pathway? Would certain interventions be complementary/additive?
- **Timing**: Is the timing or sequencing of interventions important? Short-term vs. long-term priorities?
- **Impact**: Is it important to consider the impact per dollar/return on investment?
- **Confidence**: Do we have evidence that change is possible? What are the explicit/implicit assumptions we are making? Do we have data or evidence to back up our prioritization?

Example 6.6: Prioritizing Leverage Points Figure 47 shows how potential leverage points on the Formal Loan Requirements Pathway can be prioritized. Taking into account the capabilities, coverage, timing, impact, and your confidence level the leverage points can be sequenced in priority order. Note: not all identified leverage points have to be prioritized. For example, the third leverage point in Figure 47 could be selected for later development and set aside.

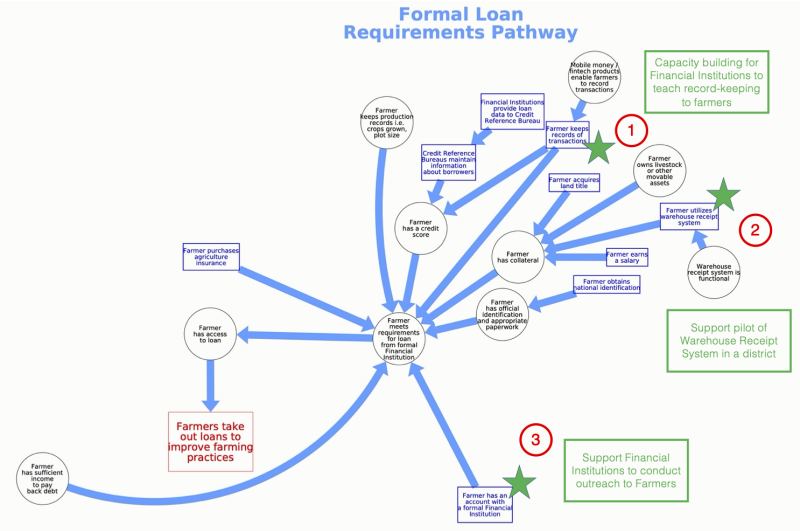


Figure 47: Prioritize Leverage Points

Going Deep 6.2: Deeper on leverage points After you have brainstormed leverage points where your organization could intervene (by looking at Key Outcomes and the Pathways that **enable** them and identifying potential leverage points (Behavior, Relationship, or Condition), ask yourself if you should be using the existing leverage points (where an Intervention already exists) or if there are new ones where there is currently a gap in the system map.

For your current leverage points, evaluate if these are the right places to be working:

- What is the evidence base for this leverage point (data/experience/intuition)?
- Why is this a good leverage point for investment?
- Is there data or evidence to support the choice and prioritization of leverage points?

When you identified key Pathways, were there any Pathways without current Interventions? If so, then you can investigate why that is the case and if investment makes sense in this area.

- What elements on this Pathway and how are they performing (See the System Pathways Measurement Toolkit
- Why are no organizations working on this Pathway? Are there political considerations not included in your system map?

6.4 COLLABORATE, LEARN, AND ADAPT

6.4.1 COLLABORATE

System maps can be incredibly valuable tools for facilitating collaboration between stakeholders in a system. First, the very act of creating a map promotes a collective understanding of the system, ensuring that stakeholders understand each others' mindset and perspective, as well as each others' dynamic hypotheses about system change. The map itself serves as a communication tool to promote collective understanding, both within your organization and with external stakeholders. The map helps you communicate your understanding of how the system functions through a visualization of the system. The map then provides a framework for discussing differing perspectives on the system, making changes to the map as needed, and coming to agreement about the way the system functions. This leads to a system map that reflects the collective knowledge of all stakeholders, and a common understanding of the system across stakeholders.

Once the map has been agreed upon as an accurate representation of the system, it can then be used to facilitate dialogues about the system and the different theories of system change held by the various stakeholders in the system. If Interventions have been added to the map, it can further be used to communicate to other stakeholders where you are intervening in the system, and to visualize where various stakeholders are intervening in the system as well.

To fully use a system map for collaboration, it is essential to add Interventions to the map - both your own and those of the stakeholders you hope to collaborate with, either within or outside of your organization. Once the map is created, and Interventions have been added, you can use the map to visualize how your interventions influence different parts of the system, and identify ways to coordinate and connect stakeholders

working in the same system. In particular, we recommend using the map to look for opportunities for collaboration and complementarity. We define collaboration as deliberate coordination and knowledge sharing on a particular goal or intervention within the same part of the system, while complementary interventions are ones that influence different parts of the system but work towards the same goal or outcome.

With the visual aid of a map representing the system, these opportunities can be identified based on the location of Interventions on the map. Collaboration opportunities can be identified by scanning through the map and looking for sets of Interventions that are near each other. They may be working to influence the same element or elements that are very close to each other. These are typically elements on the same Pathway, which as previously discussed is usually a group of thematically similar elements representing a particular causal chain or chain of influence.

The system map can also be used to identify opportunities for complementarity. It is often necessary for several parts of the system to evolve or change at the same time in order to see a change in the desired outcome. Complementary interventions indirectly support each other by influencing different parts of the system that come together to produce a desired outcome. Complementary interventions are slightly more difficult to identify, as we are not merely looking for elements in close proximity on the map, as we did above. Instead, we start with a particular Intervention or Pathway and then trace backwards and forwards along the connections to see which other Pathways and Interventions are interlinked and are working towards the same Key Outcome. A good rule of thumb is to look for Interventions that make it more likely that some Intervention will succeed in driving change in the system, such as by putting in place essential enabling Conditions or Behavior changes on adjacent Pathways or elsewhere in the system that are needed to enable the change desired by the first Intervention.

Example 6.7: Finding opportunities for collaboration and complementarity Figure 48 provides an example from a map representing the value chain for iron rich beans in particular districts in Uganda. Several activities were working on this value chain in these districts, and their Interventions were added to this map. Remember - Interventions are represented by green boxes.

This map excerpt shows examples of both collaboration opportunities and potential complementarities. The collaboration opportunities are circled in green. As you can see in Figure 48, they all belong to the same Pathway, which is **enabling** the Behavior "Farmer group sells beans to trader." One set of Interventions is **enabling** the Condition "Trader is established in Abim and Kotido", while the other **enables** the Condition

"Farmer group is connected to trader." We could assume, for example, that the activity working to help establish traders in the district could work with the activity trying to connect farmers to traders, by providing an introduction to the traders.

Next look to the elements circled in grey for potential complementarities. These Interventions should be complementary to the Interventions circled in green, as all of these Interventions ultimately **enable** "Farmer group sells beans to trader." In the case of the Interventions circled in grey, they **enable** "Bulking center functions effectively", which in turn **enables** "Farmer group aggregates quality beans", and then "Farmer group sells beans to trader." These Interventions are focused on aggregation and storage through bulking centers. They are not directly related to the Interventions circled in green, but represent a piece of the system that **enables** the same element. In this case, the interventions are complementary, because successful aggregation of beans is essential for farmer groups to sell to traders. In other words, the Interventions in green are more likely to produce the desired changes in "Farmer group sells beans to trader" if the Interventions circled in grey are successful at driving change on the adjacent Pathway.

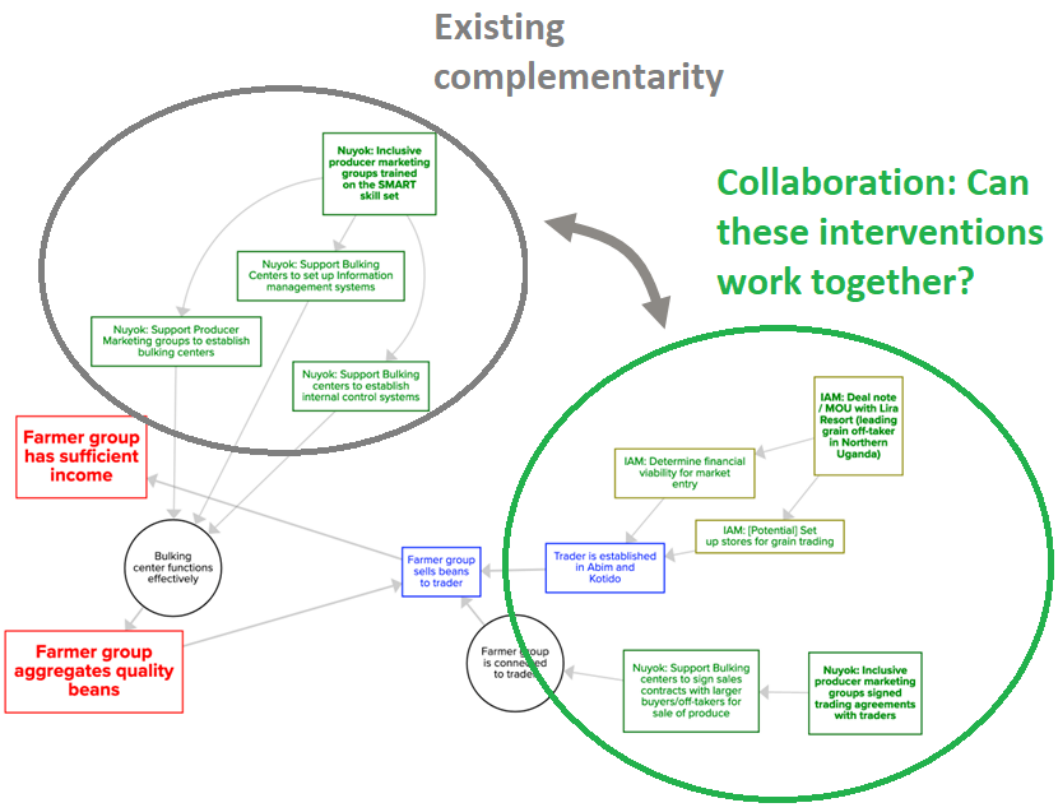


Figure 48: An example of opportunities for collaboration and complementarity from a system map of the iron-rich beans value chain in select districts in Uganda.

6.4.2 LEARN

As you have likely found by building your own system map, the very process of creating a system map uncovers new learnings about the system, as it encourages practitioners to discuss, debate, and document how they think the system functions. Not only does this process foster collaboration among stakeholders, as they come to a common understanding of the system, it also promotes learning about the system. Inevitably, stakeholders come away from building or reading a system map with some new insight into the system and how it functions. In this way, the map itself is a learning tool, both as it is being built, and afterwards as it is being shared with stakeholders.

Often the process of creating a system map also uncovers areas of the system that need

to be better understood, contributing to the learning agenda for the system. Perhaps in the process of creating the system map, you realized there were certain elements or areas that you were not sure about, or certain Pathways that you could not finish. These can be added to your organization's learning agenda. If data is being added to the system map, this process may also uncover important gaps in the available data and information. Perhaps most importantly, the maps **enable** you to prioritize which knowledge or data gaps should be addressed first, based on how essential they are to understanding system change. You should prioritize filling knowledge gaps that are on key Pathways, or relating to elements that are more central to the map, as discussed in Example 8 below.

Finally, if you are adding data to your map, as outlined in the System Pathways Measurement Toolkit, you will likely identify data gaps through the process of looking for data and creating indicators, and can prioritize filling these data gaps in a similar way - which are more essential to understanding how the system functions and how it changes over time. Measuring system elements adds another dimension of learning, as once data is added to a system map, it can be used to track change in the system over time, and assess whether the anticipated changes are occurring. Again, we encourage you to consult the System Pathways Measurement Toolkit to learn more about creating indicators for your system map.

Example 6.8: Find knowledge gaps We return to the map representing the value chain for iron rich beans in particular districts in Uganda for a hypothetical example. One of the Key Outcomes in this system is "Farmer has sufficient income", and this is directly **enabled** by "Farmer sells beans to community." The interventions working in this district were promoting beans sales through two channels: to traders (directly or through farmer groups) and to the local community. An important Condition in this case is "Community beans demand is sufficient", circled in purple. If there is low demand for beans in the local community, this sales channel will not function as anticipated, and farmer income will not change as expected. As such, it is important not to take this Condition for granted, but to understand what **enables** it - perhaps creating a Pathway that works backwards from the Condition to fill in the elements that **enable** it. If you were collecting data about this system to create indicators, this would also be an important element to be able to measure, and if data was missing, it would be an important gap.

Contrast "Community beans demand is sufficient" with the element to its left, "Household has adequate nutrition." This is an outcome of both increased income and local

purchasing of beans. It was not deemed a Key Outcome of the system, and on the larger map is a contributing factor to household resilience. This would be an example of an information gap that is less essential - it is not central to understanding change in the Key Outcome, and is rather a byproduct of change in the Key Outcome. This is not to say that understanding household nutrition is not important, and if resources are available, it should be understood and measured. But in this example, "Community beans demand is sufficient" is far more important to understanding whether the system is functioning as expected and whether the Key Outcome will change as a result of the Interventions. This is an example of how the map can be used to prioritize which knowledge gaps should be filled first.

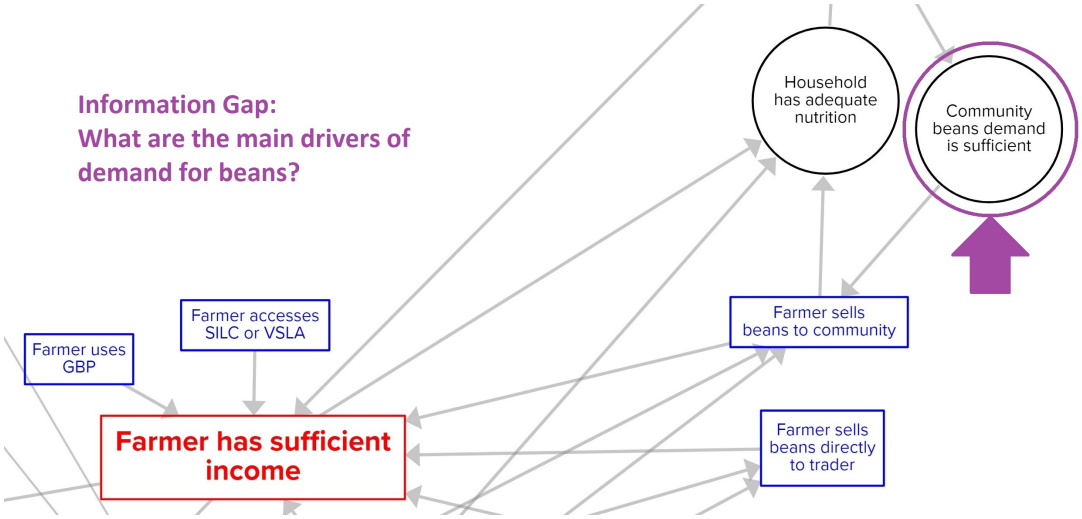


Figure 49: An example of a knowledge gap from a map of the iron-rich beans value chain in select districts in Uganda.

Going Deep 6.3: Using Maps to Organize Information If you are using the Kumu software platform to create your maps, there is one more way the map can be used as a learning tool: it can be used to organize information about the system. In Kumu, each element can have a profile with various types of metadata. This can be used as a bibliography, to document sources that were consulted when building the map. It can also be used as a kind of catalog, to store links or other information related to that element. See Appendix B for more details about how to access and add metadata to your elements.

If you have a lot of information about the system, such as reports, links, or other documents, one way to organize the information is by element. When the element is selected, the associated information will be displayed in the side panel. As seen in Figure 50, there is more information about this particular element ("Livestock have sufficient mobility") in "Pastoralism in Uganda: Theory, Practice, and Policy."

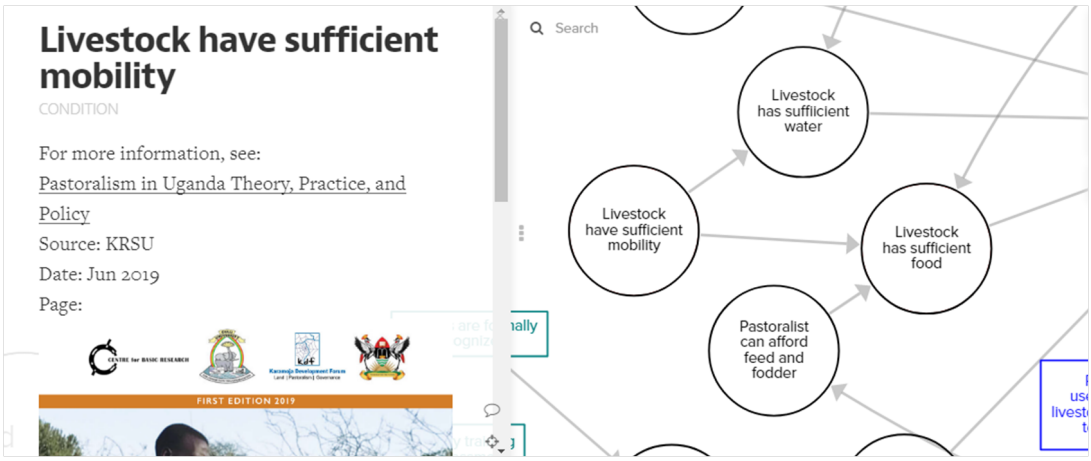


Figure 50: An example of using a map to catalog documents, from a map of pastoralist livelihoods in the Karamoja region of Uganda.

To learn more about Kumu profiles, please consult https://docs.kumu.io/guides/profiles.html.

6.4.3 ADAPT

Finally, system maps are invaluable tools to support adaptation in complex environments. They are particularly useful when it comes to adapting a particular activity or an intervention. First, when it is clear that a pivot or adaptation is necessary, it is useful to have a common mental framing of the situation, which a system map provides. This is a benefit of building a map collaboratively, which we strongly recommend: the various stakeholders' dynamic hypotheses about how the system changes can all be considered and included. It is useful to write them down, compare, confirm or deny, and come to a common understanding of how the system operates. This allows you to benefit from each others' perspectives. For more about engaging stakeholders, please consult Section 4.4.

The system map you construct will reflect your dynamic hypothesis about system change: each element you create and each connection you add represents your understanding of how the system operates, and by extension the pathways to potential change in the system. As the status of system elements changes over time, so too does the overall status of the system change, according to your dynamic hypothesis.

Often times an adaptation is needed when it becomes clear that the system is not changing as expected. In this situation, the system map can be used to test your dynamic hypothesis, and to try to understand why the system is not changing as expected. One way to do this is to identify the barriers to change, as discussed in Section 6.2.3. This is easier when you have directly measured the status of your elements over time, but as discussed it is also possible to use your understanding of the system to assign a status to the elements. If there are elements that are red or yellow (not yet to their ideal state, or not yet widespread), suggesting that change is stalled, these are prime candidates for barriers to change, and may signal locations in the system where an adaptation is needed. If you have identified a barrier on a key change pathway, it may be necessary to work around it - such as by finding another pathway to change that will impact the key outcome that you care about. It may not be possible to avoid the barrier, but at least the map can be used to diagnose where change is stalled in the system.

If you find barriers to change that are unexplained, it may be necessary to update your dynamic hypothesis and change the map. Say, for example, all of the elements along a pathway are "green", or functioning well, and one element at the end is unexpectedly "red" - unexpected in the sense that you would expect to see change in this element if all of the elements proceeding it are "green." This suggests that your map is missing elements, or perhaps even an entire pathway, that would explain the status of the element that is "red." This means that your dynamic hypothesis has to change - your understanding of what causes change in the system needs to adapt to accommodate this new information and the new elements that need to be added. Once the map has been changed to explain the status of the "red" element, you may find that a clear opportunity for adaptation emerges, such as an alternate pathway or an opportunity to intervene along the existing pathway.

Similarly, you can use loops to test your dynamic hypothesis. If you have identified loops in your map, such as discussed in Section 6.2.4, you have a hypothesis about how change is occurring through these loops - with the change either balancing or reinforcing, depending on the direction. You may find that your loop has stalled - that you are seeing change in some elements but not others, and not as you would have expected. This is another way to identify a potential barrier, and to look for

opportunities to adapt - perhaps there are other pathways feeding into the loop that you could intervene on, for example.

Finally, if you have identified leverage points, as discussed in Section 6.3, you may have found opportunities for new interventions, or particular pathways where additional interventions are needed to produce change. These can also be opportunities to adapt - if a particular intervention is not working, one of the leverage points you identified could be a prime candidate for a pivot to a different intervention. We encourage you to use the exercise of identifying leverage points as an opportunity for collaboration as well. You can discuss the leverage points you have found with other stakeholders, see where they are intervening in the system, and identify areas where you can collaborate or work in complementary ways.

As before, it is easier to identify opportunities for adaptation when the map is measured, as it is easier to find barriers, identify stalled loops, and find leverage points. Again, we encourage you to consult the System Pathways Measurement Toolkit to learn more.

Example 6.9: Adapt We return once more to the map representing the value chain for iron rich beans in particular districts in Uganda for a hypothetical example. Suppose that we have determined that "Farmer group sells beans to trader", shaded in red, is a barrier. We have either measured this element and realized that it has not changed over time, or we know from experience or intuition that this piece of the system is not functioning well. In this example, "Farmer group sells beans to trader" enables one of the Key Outcomes, "Farmer group has sufficient income." If this is a key pathway (essential to driving change in the key outcome) then "Farmer group sells beans to trader" is an important barrier to address, and an opportunity for adaptation.

First, we look to the elements that enable "Farmer group sells beans to trader": the presence of a trader in the district ("Trader is established in Abim and Kotido"), a linkage between the farmer group and a trader ("Farmer group is connected to trader"), and the availability of a crop to sell ("Farmer group aggregates quality beans"). If one or more of these elements are red, these are candidate leverage points, and opportunities for adaptation. Say, for example, that the existing interventions had all focused on ensuring that the farmer group is able to collect produce from its members and engage in collective marketing ("Farmer group aggregates quality beans"). We assume this element is green as a result. However, it could be the case that "Farmer group is connected to trader" is red - the farmer group is not connected to a trader, which means it is unable to sell. This would explain why "Farmer group sells beans to trader"

is red, and is an opportunity for a new intervention or a pivot, to address this element ("Farmer group is connected to trader") that itself is also acting as a barrier.

If all three of the enabling elements were "green", or functioning normally, then we would need to update our dynamic hypothesis as to what enables "Farmer group sells beans to trader" - something is missing from our map that would explain why the farmer group is unable to sell (perhaps road quality or transportation are issues, for example, and would be "red" if included on the map). We would then be able to adapt our approach based on this updated system map.

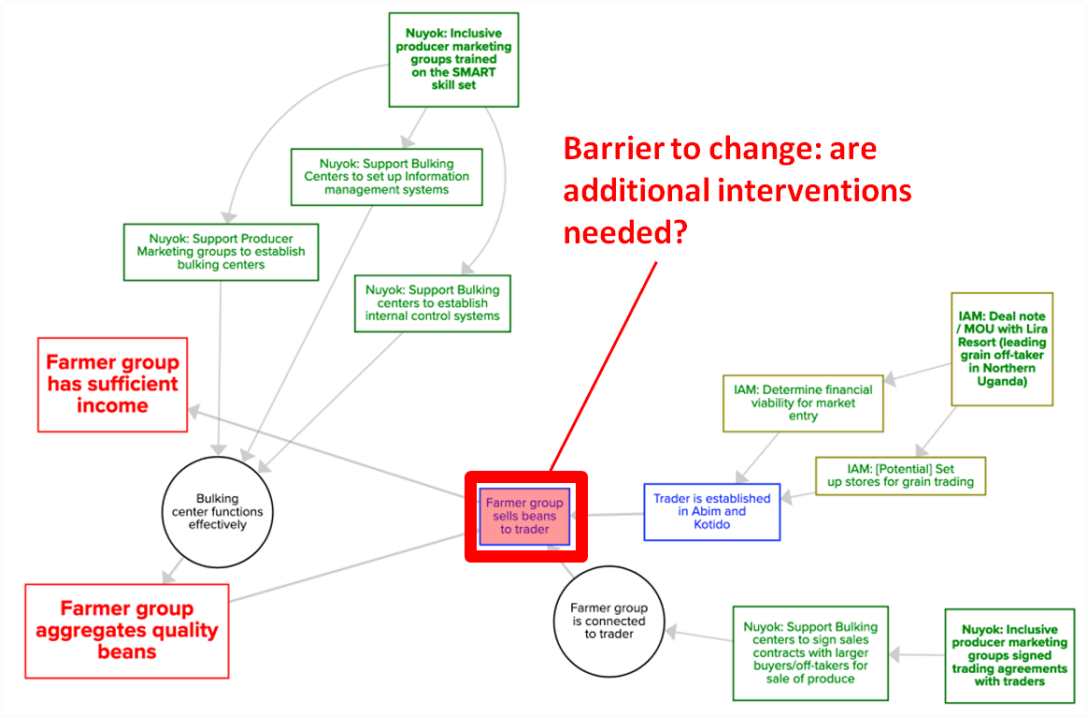


Figure 51: An example of a barrier to change from a system map of the iron-rich beans value chain in select districts in Uganda.

6.5 ASSESS THE IMPACT OF SHOCKS

System maps can be used to analyze how an external shock affects the system (see Conducting a Rapid System Assessment for a detailed discussion). An external shock

is a significant and sudden change that affects many parts of the environment the system operates in. A shock can have many distinct effects on the environment, many of which will directly impact the system.

A shock can be represented on a system map as a series of new elements — Shocks and Shock Effects. A Shock element is the highest level representation of the shock, for which the specific implications for the system may not be immediately apparent. A Shock element will then enable one or more Shock Effects, which represent the specific ways that the Shock impacts the system. The Shock Effects then connect to existing elements on the map, showing exactly what this shock effect is expected to impact. A Shock Effect can also connect to other Shock Effects to capture the complex action of some Shocks. The effect on the rest of the system can then be inferred by assigning element statuses throughout the system. For more information on how to do this, see the System Pathways Measurement Toolkit.

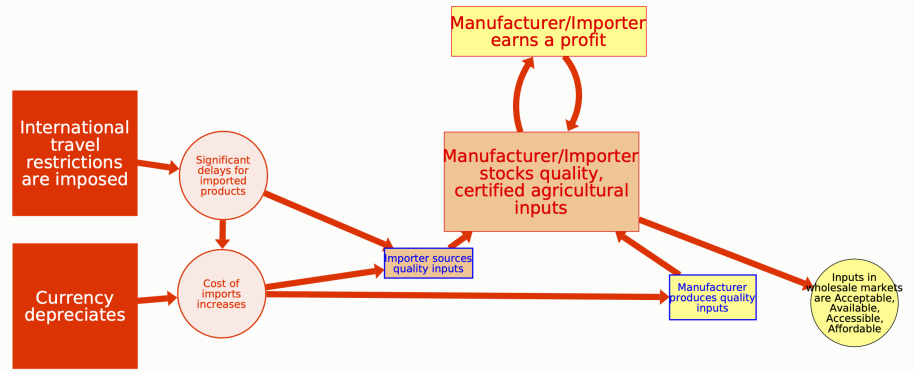


Figure 52: COVID-19 Shock on agricultural inputs

A good example of how a shock can be analyzed using a system map is with the various shocks caused by the COVID-19 pandemic. The COVID-19 pandemic and resulting government responses are sufficiently complex and wide-reaching that they were broken up into multiple specific Shocks to the system. One such Shock is "International travel restrictions are imposed", shown in Figure 52. A Shock Effect resulting from this Shock is "Significant delays occur at border", which is a more specific effect that can be readily connected to the system. This effect impacts the Behavior "Importer sources quality inputs." This effect also connects to another Shock Effect, "Cost of imports increases", which subsequently **enables** "Manufacturer produces quality inputs." In this example, the elements have also been assigned statuses based on the degree to which they were impacted by the Shock.

To see the COVID-19 system map example in more detail, see the MSM Activity's four COVID-19 rapid system assessment update reports, which assess the impact of COVID-19 on Uganda's agriculture market system using the Uganda Agriculture Market System Map.

- COVID-19 Update Report No. 1 (June 2020): https://dspace.mit.edu/handle/1721.1/127279
- COVID-19 Update Report No. 2 (June 2020): https://dspace.mit.edu/handle/1721.1/127280
- COVID-19 Update Report No. 3 (July 2020): https://dspace.mit.edu/handle/1721.1/127281
- COVID-19 Update Report No. 4 (Executive Summary) (Sept 2020): https://dspace.mit.edu/handle/1721.1/127826
- COVID-19 Update Report No. 4 (Sept 2020): https://dspace.mit.edu/handle/1721.1/127825

7 LEARN MORE

This toolkit provides an introduction to the System Pathways Framework and a step-by-step guide to creating a system map. The System Pathways Framework was developed by the USAID/Uganda Feed the Future Market System Monitoring (MSM) Activity. System maps (and systems thinking in general) are an invaluable tool for development practitioners. If you are interested in applying systems thinking to your work, or learning more about the Ugandan agricultural market system, please reach out to our team at msm.uganda@mit.edu . You can also visit our website to access our previous work.