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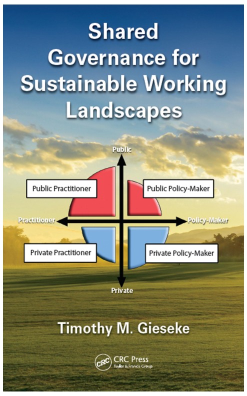

Shared Governance for Sustainable Working Landscapes

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Devising a wicked solution

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section two

Devising a wicked solution

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chapter six

Devising a wicked solution

The first step in devising a wicked solution is recognizing the problem as a wicked one (Commonwealth of Australia, 2007). This sounds obvious, but many complex problems are viewed as complicated, solvable problems; and attempts are made to address wicked problems by recasting them as tame ones. By treating a wicked problem as a tame problem, energy and resources are misdirected, resulting in solutions that are not only ineffective, but also can actually create more difficulty (Nelson and Stolterman, 2003).

Rittel and Webber (1973) state that finding the solution is intimately tied to the problem, to the extent that finding the problem is the same as finding the solution; the problem cannot be defined until the solution can be found. And the information needed to understand the solution and the problem depends on one's idea for solving it.

Since wicked problems are part of the society that generates them, any resolution brings with it a call for changes in that society. These changes include different forms of governance, new methods of research, and decision making based on that research (Brown, 2010). Instituting these changes requires the application of transdisciplinary science. This process requires experts from multiple disciplines, together with policy makers, stakeholders, and representatives of various public entities, to produce practice-oriented knowledge for addressing complex societal problems (Buizer et al., 2011)

6.1 A transdisciplinary approach

There is an ever-increasing call from society and the scientific community for transdisciplinary approaches to tackle fundamental societal challenges, especially those related to sustainability (Lang, 2012). Interest in transdisciplinary research has burgeoned in the last 10 years (Gray, 2008). Transdisciplinary research differs from interdisciplinary research (which focuses on integration across disciplines) as its goal is to transcend disciplines by focusing on real-world complex problems through collaboration between academic and nonacademic stakeholders (Patterson et al., 2015). A transdisciplinary approach is essentially a participatory, interdisciplinary process whose success is founded by building joint visions of the issue of concern, finding a common language, and discussing the trade-offs that result from particular choices, and above all through collaborative learning (Jager, 2008).

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Lang (2012) defines transdisciplinarity as a reflexive, integrative, method-driven scientific principle aiming at the solution by using knowledge from various scientific and societal bodies. This definition highlights that transdisciplinary research requires (1) a focus on addressing real-world problems and a (2) collaboration with different disciplines and actors from outside academia, and looks (3) to create knowledge that is solution-oriented, socially robust, and transferable to both scientific and societal practice (Lang, 2012; Patterson et al., 2015). Transdisciplinary research is necessary because understanding, analyzing, and contributing to transformations toward sustainability cuts across academic disciplines, policy domains, and societal sectors (Patterson et al., 2015).

6.1.1 Acquiring system knowledge

Transforming an agriculture production system requires fundamental knowledge concerning natural and social factors and processes, and their connections. In their report, *Research on Sustainability and Global Change—Visions in Science Policy*, Swiss researchers (Conference of the Swiss Scientific Academies, 1997) state that three types of knowledge are required:

1. Systems knowledge of structures and processes, and variability (the observed system as it *is*)
2. Target knowledge of the desired system (the system as it *ought to be*)
3. Transformational knowledge on how to make the transition from the current to the target situation

Transdisciplinary research is much more than interdisciplinary data gathering; research in this sense is also rooted in imagination and intuition (Jackson, 2008). A transdisciplinary approach explores the research questions at their intersections to allow stakeholders to invent new science together to reframe their conceptual frameworks. Such reframing requires the suspension of current assumptions in which the previously unthinkable can become reality (Gray, 2008). To resolve a wicked problem, one requires a new mental model that has not been imagined before (Brown, 2010).

6.2 Imagination as a wicked solution strategy

Imagination is essential for the construction of mental models or representations of reality that people use to understand complex phenomena (Jackson, 2008). Imagination is associated with creativity, insight, vision, and originality and is also related to memory, perception, and invention. All of these are necessary in addressing the uncertainty associated with wicked problems (Brown, 2010). Coming to terms with wicked problems

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not only requires knowledge and intelligence, but imagination as well (Fulton, 2011).

Using examples in the formalized sciences, Brown (2010) states how the imaginations of Linnaeus, Aristotle, and Darwin all contributed to the understanding of life forms. These leaps of creativity were essential for them and others to imagine the complexities of biological processes and are essential in solving transdisciplinary, wicked problems. One of the greatest critical thinkers of modern times, Albert Einstein, stated imagination is more important than knowledge. Referred to as *thought experiments*, Einstein imagined himself chasing a light beam, which was credited to his eventual comprehension of the theory of relativity (Norton, 2015). These thought experiments are necessary for new concepts as knowledge is limited to all we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand.

Brown (2010) states that despite these common experiences, scientists are accustomed to thinking imagination is the enemy of scientific research and discounts it as the source and creative spark for scientific inquiry. In seeking solutions for wicked problems, researchers and decision makers are brought together, each with radically different understandings of the issue. To make linkages between them, they must use their imagination to place themselves in others' shoes to identify problems and solutions.

CogNexus Institute founder Jeff Conklin sees imagination as the key to addressing research *fragmentation*. Fragmentation refers to the individual perspectives, understandings, and intentions of the stakeholders, all of whom are convinced that their version of the problem is correct. The inability to imagine the situation of other stakeholders is a significant challenge to resolving wicked problems (Conklin, 2006).

6.3 Identifying wicked solution sources

If imagination can spark a solution idea for a wicked problem, it can only provide a plausible starting point and from there one must experiment, learn, and adapt. Transdisciplinary collaboration, by definition, carries an effort beyond traditional disciplinary study and into the real world. Without this strategy, many efforts get struck with *analysis paralysis*, a condition that prevents any further action until all is known about the task at hand (Govindarajan and Gupta, 2001). At this point, execution is more important when innovation is at the heart of a strategy, since innovation involves treading into uncertain waters and pursuing entirely new models. The greater the uncertainty of a problem and the solution, the lesser will be the value of a well-thought-out strategy.

Six case studies developing new models for addressing agricultural landscape sustainability were chosen to provide transdisciplinary insights and a source for a wicked solution. None of the case studies were

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initiated with the stated goal of using a transdisciplinary approach to solve the wicked problem of sustaining landscapes. The stakeholders that initiated each of the projects did so to address a specific need relative to their organizational values and objectives.

The six projects chosen for the agricultural landscape sustainability case studies share a unique connection geographically, politically, and chronologically. Geographically, all occurred within the borders of the state of MInnesota in the United States. Politically, they each had a broad spectrum of stakeholders and collectively involved diverse stakeholders such as agriculture producers, local, state, and federal agencies, nonprofit organizations, and industry representation. In total, stakeholders included dozens of public, private, and nongovernmental entities and hundreds of practitioners. Chronologically, the projects occurred from 2001 to the present day with minimal overlap and gaps in their delivery.

6.4 *Six pilot project case studies*

Individually, the six case studies sought new ways to account for and value natural capital, to address the varied sustainability concerns of stakeholders, and to develop new intersector relationships to meet their objectives. In some cases, they reassessed their traditional ways of working and solving problems. This reassessment of protocol is often necessary as wicked problems are often unsolvable with existing governance structures, skill bases, and organizational capacity (Commonwealth of Australia, 2007).

Each project had different motivations and intentions for addressing agricultural landscape sustainability. The research paradox of using these case studies is that while they have a rather limited geographical scope, somewhat contrary to the broad vision one often desires in transdisciplinary research, their relatively close proximity in time and space allowed knowledge transfer to occur with relative ease. This proximity and the chronological nature of the projects (2001–present) aided in compiling and devising a wicked solution, as the six cases, in aggregate, resembled a longer-term transdisciplinary approach with adaptive management characteristics.

The six case studies are listed in chronological order; organization and project name are included:

1. 2001–2009; Minnesota Milk Producers Association (MMPA): Environmental Quality Assurance Program (EQA)
2. 2006–2008; Minnesota Project: Conservation Planning for Agronomic Service Centers
3. 2007–2008; Minnesota Pollution Control Agency: A Conservation Bridge for Agriculture Professionals

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4. 2010–2011; Minnesota Department of Agriculture: Livestock Environmental Quality Assurance Program
5. 2012–present; Minnesota Department of Agriculture: Ag Water Quality Certainty Program
6. 2013–2014; Chisago Soil and Water Conservation District (SWCD): Sunrise Watershed AgEQA Project

Each case study approached this common issue of agriculture sustainability using unique strategies developed from multiple stakeholder perspectives and governance styles. To analyze the case studies for transdisciplinary insights, five questions from Brown's (2010) open transdisciplinary inquiry perspective were used:

1. Focus: What is the problem being addressed?
2. Context: What are the views of the stakeholders?
3. Sources of evidence: What are the stakeholders' knowledge bases?
4. Synthesis framework: How was evidence and knowledge compiled and analyzed?
5. Collective learning: What were the findings (partial, uncertain, and open-ended)?

The purpose of this inquiry is to view the case studies with a transdisciplinary lens and to use the new knowledge to create a rich picture of the agriculture landscape system as it *ought to be* (Williams and Van 't Hof, 2014). A rich picture describing the system as it *ought to be* contains the target knowledge consisting of the new configuration of stakeholders, components, value flows, and outputs assumed to be the new basis for agriculture sustainability.

6.4.1 MMPA's EQA

The MMPA initiated an environmental quality assurance program (MMEQA) in 2001 with a focus on developing greater statewide consistency in conservation technical support for dairy farmers and to certify farms when they met state and industry-developed environmental quality regulations (LCCMR, 2001).

The context of the project included the range of agricultural production and sustainability perspectives from the agriculture, conservation, government, and environmental sectors. This was the knowledge base and evidence used to create the on-farm environmental assessment. As the lead stakeholder, the MMPA had final approval of the resource assessment template, training program, and assurance process. More than 300 dairy farms were assessed by MMPA-trained technicians using a practice-based assessment consisting of five categories: water quality, odor

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and air quality, soil quality and nutrient management, habitat quality and diversity, and community image.

The findings were that the assessment process was a good learning tool for dairy farmers, but the data collected was cumbersome (not scalable) and did not serve the accounting and assurance purposes of any of the other stakeholders. The MMPA program did create a broader technical base for dairy farmers through the training program. A conclusion was that there is a growing interest for some type of agriculture sustainability assurance process, but it needed to be more comprehensive, inclusive, and streamlined.

6.4.2 *Minnesota Project's conservation innovation*

The Minnesota Project, a nonprofit organization, received a 2006 United States Department of Agriculture (USDA) Conservation Innovation Grant (MP-CIG) to implement a project (*Conservation Planning with Agribusiness Centers*) to train agronomic professionals to become Natural Resources Conservation Service (NRCS)–certified conservation planners. The focus of the project was to increase private sector technical assistance capacity in response to the passage of the Conservation Security Program (CSP): an outcome-based incentive program of the 2004 USDA Farm Bill. This project had a similar objective to the MMEQA of increasing technical assistance for agriculture producers, but for different stakeholders.

The context of the MP-CIG varied from the MMEQA, as several of the primary stakeholders (state government agencies, agribusinesses, and conservation organizations) questioned the need or demand of the training program. Politically, the government conservationists viewed the role of conservation planning to reside with government agencies, not private sector agronomists. They also recognized the private sector was profit-centered and did not envision farmers paying for a service that was provided free from the USDA and partners. Several agriculture groups thought this may expand conservation requirements for farmers. In contrast to their concerns, some private sector agronomists viewed this as a progressive approach to address emerging environmental needs or as a new business opportunity.

Despite these perceived obstacles, 28 agronomists attended the 9-day course over a 9-month period. The trainings were presented by professionals in government, agriculture, academia, and business. They consisted of classroom and field exercises on the importance and management of agriculture landscape resources.

The findings of the effort included the realization that only a small percentage of agronomic professionals would be able to become efficient conservation planners, but the majority was capable of becoming efficient assessors of on-farm natural resources. Due to their existing

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role, agronomists had trusting relationships with the farmers, knowledge of the landscape, and insights into the production system of the farm operation. Since the majority of the information needed to conduct resource assessments is collected by agronomists, a natural resource assessment became a cost-effective endeavor for the agronomist, in contrast to being a very costly endeavor for government conservation staff that often have to develop a relationship with farmers from the beginning.

From a process perspective, it was found that an on-farm assessment based on land management indices was a more efficient method than the practice-based accounting of the MMEQA. It was also an effective method to educate agronomists and farmers on government program objectives and create a convenient "dashboard" to provide public and private resource professionals a means to quickly identify on-farm conservation concerns.

This case study identified the index-based resource assessment as a pivotal component in integrating production resource and natural resource management at the farm level. The indices were developed within the scientific communities of government and academia and applied within the technical community of agronomy for the benefits of agriculture practitioners and government conservation planners. The index-based platform provided support for a transdisciplinary approach to agriculture landscape sustainability. It provided the platform for academic and nonacademic participants to engage in sustainability outcomes (NRCS CIG, 2005).

6.4.3 Minnesota Pollution Control Agency's conservation bridge

The 2007 project, *A Conservation Bridge for Agriculture Professionals* (CBAP), was developed to address the perceived need for more private sector conservation advisors and to identify costs. With the emergence of corporate sustainability efforts, carbon and water quality trading schemes, pending water quality regulations, and expanding government conservation incentives, it was proposed that agriculture producers need direct access to a larger field of natural resource professionals.

The focus of the project was to identify the costs and benefits of agriculture professionals conducting index-based on-farm resource assessments. The project objectives were to employ the trained conservation professionals from the MP-CIG project and use a similar index-based assessment template. The context and stakeholder views were narrower in scope compared to the MP-CIG, but the stakeholder types were similar. Agriculture advisors were paid US$400 per assessment to account for the soil, water, and habitat resources of the farm operation.

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A survey on the ease and ability of completing these natural-resource assessments for the 30 farm resource assessments was conducted by the agronomists and their farmer clients.

The farmers surveyed stated the following:

- Understood the concept of using management indices to rate their farm operation
- Liked the concept of measuring the management of their farm operation for themselves and others, but several were concerned about who would get the information, how it would be used, and other privacy issues
- Generally agreed with the "measurement" results
- Could see value in using this process as developing a related conservation plan document
- Felt that this type of resource-assessment process could be integrated with their production plans

The resource assessors surveyed stated the following:

- Understood the concept of using management indices to rate farm operations
- Liked the concept and felt it could be very beneficial for many of the resource issues farmers are facing at the local to national level
- Generally agreed with the results but felt that some of the indices need to be further refined
- Thought the process would be helpful for them to develop conservation plans and felt they would be more proficient after doing several of these
- Felt that this process could be incorporated into a farmer's production plans

This case study reinforced the findings from the MP-CIG project that an index-based resource assessment was a cost-effective means to generate new resource management knowledge and to integrate the objectives of farmers, agronomists, and government agents. It also aided the agriculture community in understanding the objectives of government conservation programs (MPCA EA, 2010).

6.4.4 Minnesota Department of Agriculture's EQA

In 2009, the Minnesota Legislature passed Chapter 172, Article 2, Section 2 to fund the Livestock Environmental Quality Assurance Program (LEQA) for the purpose of providing resource management analysis, assistance to create an implementation plan, and assurance the plan was completed.

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The focus was to create the means for livestock farmers to assure their farm operations met the state's water quality objectives relative to watershed total maximum daily load (TMDL) plans. TMDLs are watershed goals stating how much of a particular pollutant is permitted to be in a waterbody. Similar to the MMEQA, the program development involved a broad base of agriculture, conservation, and environmental stakeholder perspectives. It also provided training for public and private agriculture and conservation professionals to conduct on-farm assessments and assurance. In contrast to the MMEQA, the narrative assessment was converted, in part, to an index-based assessment. This conversion was based on the findings of the previous case studies.

The findings of this project included the creation of *landscape intelligence*, the result of using index scores associated with a parcel of land, creating an *assessment unit* that could be aggregated at multiple scales. The potential of landscape intelligence was revealed when a regional cheese processor and an electric utility inquired about the use of the LEQA model and its indices to account for sustainability objectives. Each was seeking a method to account for sustainability of their products of cheese and electricity. In discussion, it was discovered that each entity could express their own sustainability criteria independently yet use similar indices. In theory, it would allow multiple entities to procure sustainability data in a more cost-effective means than if each entity adopted noncompatible assessment processes.

The synergies of this process extended beyond just the financial costs of data collection and analysis, but also included a means for others to participate in the processes of landscape sustainability with relative ease. This cooperative process was recognized as a shared governance model with the August 2011 report entitled, *Using a Shared Governance Model to Certify Minnesota's Clean Water Legacy Farms* (Gieseke, 2011).

6.4.5 EPA–USDA–MN Ag Water Quality Certification Program

In January 2012, the Environmental Protection Agency, USDA, and Minnesota's Governor signed an agreement to develop the Minnesota Agricultural Water Quality Certification Program (AWQCP). The focus of the project was to develop a regulatory assurance process and a 10-year contract option for agriculture producers to ensure water quality sustainability.

The context and knowledge base of the stakeholders consisted of a state–federal partnership that included the USDA, EPA, Minnesota Department of Agriculture (MDAg), Minnesota Pollution Control Agency (MPCA), Minnesota Board of Water and Soil Resources, and Minnesota Department of Natural Resources. The Minnesota Legislature passed a 2014 statute further defining the purpose and goals (MN Leg, 2014).

Program input was provided by agriculture, conservation, environmental, government, and industry representatives to pilot the project in

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four watersheds. State and local governments collect and manage the database and make adjustments to the index parameters, calculations, and other components as necessary. Local conservation district staffs run calculations for the water quality index (WQI) using soil data, topography, cropping system, fertility, and pest management.

The preliminary findings were that similarly to the LEQA, the WQI scores associated with a management unit (field) can be compiled and organized in various methods to create landscape intelligence. GNP Company, a chicken processor, is participating in the program and is using the landscape intelligence as a means to account for sustainability outcomes for their brand (Redlin et al., 2015).

6.4.6 Chisago SWCD's AgEQA™

The Sunrise Watershed Project (AgEQA) was jointly initiated by the Chisago SWCD and the MPCA with a focus on increasing conservation technical support capacity for producers in the watershed and on creating a method to account for water quality improvements in the Sunrise Watershed.

The context of the program development included input from the Chisago SWCD, local agronomists, NRCS staff, the MPCA, and Ag Resource Strategies, LLC, a private business. An AgEQA portfolio was created using indices related to water, soil, plants, nutrients, and wildlife within the farm management units of farmscape, farmstead, livestock facilities, and fields. The indices were scaled from 0 to 100 with 100 being the best management for a particular resource.

The portfolio, consisting of natural resource index values, was viewed as a representation of the farm's ecological assets. The value of the assets could be improved by adjusting landscape management strategies. The index-based portfolio could be used as a common platform for the farmer, agronomist, conservation agent, and the MPCA to discuss and value these ecological assets.

This local project was presented by Kimble (2014), UN Foundation Vice President, at a Global Land Tool Network meeting at The Hague in June 2014. She noted, "What the experts in Europe and elsewhere had not focused on is the multiple layers of regulatory policy in the U.S.—and few understood the distinction between EPA's objectives and those of USDA. [The way this project] approached the information makes it possible start a land evaluation at a more rudimentary level and build up. This approach would work well in Brazil where there are some differential policies between states like Minas Gerais and the federal government. It was a good complement to an Australian presentation on dairy farm management—which highlighted some similar challenges."

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This unique scenario, where a relatively small and local project was introduced to an audience with a global perspective, revealed the commonality of issues faced among agriculture sustainability stakeholders and practitioners.

6.5 A [compiled] transdisciplinary approach

The close geographical, political, and temporal relationships among these six case studies provided the context of a transdisciplinary approach. Each was focused on addressing real-world problems and collaborating with different sectors, disciplines, and actors from outside academia. Because these six projects occurred chronologically over a decade, new knowledge from one project could be readily incorporated into the next project. It created an adaptive management atmosphere that was solution-oriented and allowed for the social acceptance of new ideas over time.

6.5.1 Retelling the transdisciplinary story

Compiling the six projects and retelling them as an aggregated decade-long effort provides insights and generates transformational knowledge. Transformational knowledge enables practitioners to evaluate different problem-solving strategies; to achieve the competence to foster, implement, and monitor progress; and to adapt and change behavioral attitudes (Hadorn et al., 2006). Transformational knowledge is the basis for the decisions on how to transform the system as it *is* to as it *ought to be*.

This transdisciplinary story began with a milk producer representative seeking new ways to increase technical assistance to help dairy farmers meet environmental goals and account for natural resource management. The MMEQA on-farm assessment was beneficial in helping producers understand their environmental issues, but the narrative format was a bit too challenging to aggregate information or to convince other entities to formally recognize the certification.

The MP-CIG proposal was also in response to the lack of conservation technical assistance for producers but from the perspective of a new federal conservation program. The assessment process incorporated environmental indices, rather than a narrative assessment format to streamline data collection and management. It was concluded that conservation planning was too challenging to incorporate into the agronomist workload, but it was recognized that a stand-alone index-based resource assessment process would be an efficient method to integrate the expertise of agriculture professionals into the conservation delivery system.

With this new knowledge, the CBAP project analyzed the costs and willingness of agronomic professionals to conduct on-farm index-based assessments. Both were deemed favorable as long as the agronomist was

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currently working with the producer. The LEQA program adopted the index-based assessment process on a field basis and created landscape intelligence. This data could be customized to address sustainability objectives for a variety of stakeholders such as state government, a cheese processing plant, and an electric utility. This common platform revealed a shared governance model that allowed engagement by disparate stakeholders with common, but not identical goals.

The AWQCP applied the index-based process specifically to meet state water quality objectives. Similarly to the LEQA, but in a more formal manner, corporate sustainability stakeholders recognized it as a usable valuation platform to account for their sustainability claims as it related to water quality.

The Sunrise AgEQA project compiled multiple indices to address the broad spectrum of natural resources and calibrated the indices on a 0–100 scale to act as a farm portfolio dashboard. This portfolio approach was recognized at the international level as a potential common platform to address agriculture sustainability at the local and global scale.

6.5.2 *Transformational knowledge*

Transformational knowledge is the knowledge required to understand how to transition a system from as it *is*—the system knowledge—to as it *ought to be*—the target knowledge. It refers to the knowhow, the tacit knowledge that can be derived from target and system knowledge. System knowledge refers to the current state of a system, its underlying drivers, and its ability to change. Target knowledge determines the design of a plausible system that may meet the desired outcomes.

To achieve sustainability outcomes, future environmental and sustainability research needs to place significantly greater emphasis on target and transformation knowledge as well as system knowledge in the human and social sciences (CASS, 1997). Imagining and retelling the six case studies as one transdisciplinary story revealed several key evolutionary points. The story began as an effort to address the lack of technical assistance and to create a means to account for agriculture sustainability. The story ended with three key findings: (1) an index-based training module to increase the technical assistance available from the private sector, (2) a dashboard accounting system and portfolio, and (3) scalable landscape intelligence in the form of index values that could be exchanged between stakeholders.

The key transformational knowledge points include the following:

- The trusting and financial relationships agriculture professionals have with agriculture producers are vital to acquiring landscape and management data.

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- The aptitude of agriculture professionals is aligned with assessing natural resources.
- The production data sets collected by these professionals are applicable to calculating multiple sustainability indices.
- The additional costs associated with generating index-based natural resource assessments were minimal as long as the agriculture professional was engaged in the production aspect of the farm.
- Index-based accounting by geo-referenced points created scalable landscape intelligence.
- Index-based accounting enabled efficient data transfers to multiple sustainability stakeholders.
- A *shared governance* model is an efficient means to acquire data and share the values.
- Index-based portfolios act as a common platform for stakeholders to interdependently value natural capital and its outputs.
- The concept of an index-based assessment and valuation platform resonated as a potential solution to various agriculture systems in multiple countries.
- With these insights, a rich picture consisting of this target knowledge is created to show how the agriculture landscape system *ought to be*.

6.6 *The system as it ought to be*

To seek a resolution of a wicked problem, a rich picture of what the system *ought to be* is drawn as a companion to the system as it *is* (Williams and Van 't Hof, 2014). The rich picture in Figure 6.1 is based on the same components and stakeholders shown in Figure 2.3. The system as it *ought to be* is designed to capture the insights of the transdisciplinary story. Agriculture agronomists and other production professionals are engaged with both commodity and ecosystem service production and data management. The index values are connected spatially and temporally to the landscape to create scalable landscape intelligence and can be incorporated into sustainability asset portfolios at multiple scales.

Beyond just simply listing assets, these portfolios create new values. This causes new opportunities to emerge as participants are able to link assets across organizational and political boundaries (Morrison, 2013). With access to sustainability portfolios, utilities, government agencies, corporations, and nongovernmental organizations (NGOs) may procure the sustainability data they need to substantiate their sustainability claims. This process begins to align ecosystem service values in a similar manner to the way traditional commodity production values are aligned, where market, government, and NGO activities are complementary and

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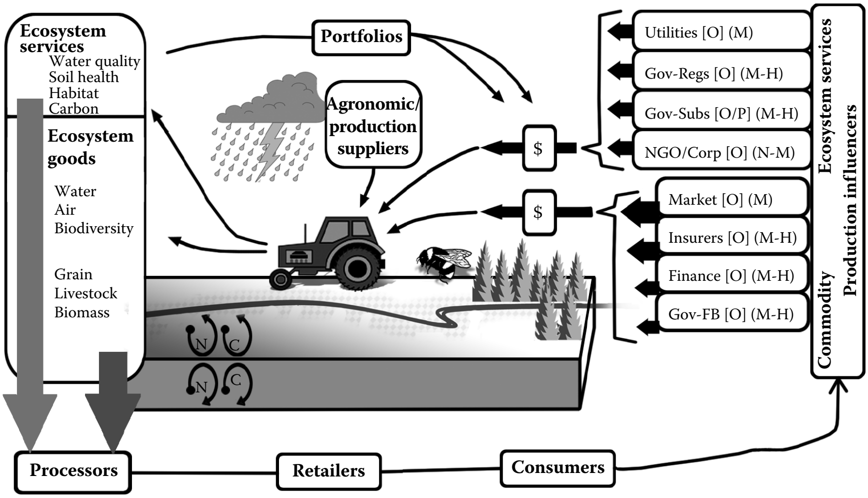

Figure 6.1 A rich picture of the system as it ought to be is based on the same boundaries and components of the system as it *is* in Figure 2.3. For this transformation to occur, the ecosystem services production influencers adopt an outcome-based accounting system to create an alignment of values similar to the commodity pathway. A common governance style is not mandatory, but a shift toward market governance may occur by adopting outcome-based accounting systems. A ecosystem service portfolio allows these less tangible assets to be exchanged.

additive. This begins to address the wicked problem of low and diffuse values and high and multiple transaction costs associated with exchanges for ecosystem services.

6.7 Identifying the wicked problem and solution partners

Seeking solutions to wicked problems often brings one into unchartered territory. After two decades of business research projects, Camillus (2008) stated that it is impossible to find solutions to wicked problems. Rittel and Webber (1973) state beginning down the wrong path may not only lead to failure, but cause additional problems. Camillus (2008) suggests that the simplest techniques are often the best, and [practitioners] with their tacit knowledge and commitment, are crucial in developing strategies to cope with or resolve wicked problems. Communication networks must cater to the flow, processing, and management of data, since information is necessary for all decision makers to participate.

Rittel and Webber (1973) suggests that one must use intuition to begin the process of resolving wicked problems and indicated that finding the problem is the same as finding the solution, of which both depend on the information gathered based on one's idea for solving it.

Using Rittel and Webber's suggestion of intuition and duality thinking, a conclusion is that the wicked problem of agriculture sustainability is the low and diffuse values and the high and multiple transaction costs associated with an ecosystem services *market*. Within this logic, the wicked solution is to *combine* the low and diffuse values associated with ecosystem services and *reduce and share* the high and multiple transaction costs. The solution is envisioned in Figure 6.2 as the inverse of the problem.

The three sources of the wicked agricultural landscape sustainability problem are identified as (1) varied scope and scale of natural capital outputs, (2) disparate stakeholder values, and (3) conflicting governance styles. These sources manifest into low/diffuse values and high/multiple transaction costs. Within this context, the three principle resolutions proposed are to (1) integrate natural capital data, (2) align sustainability actions, and (3) enable a shared governance platform.

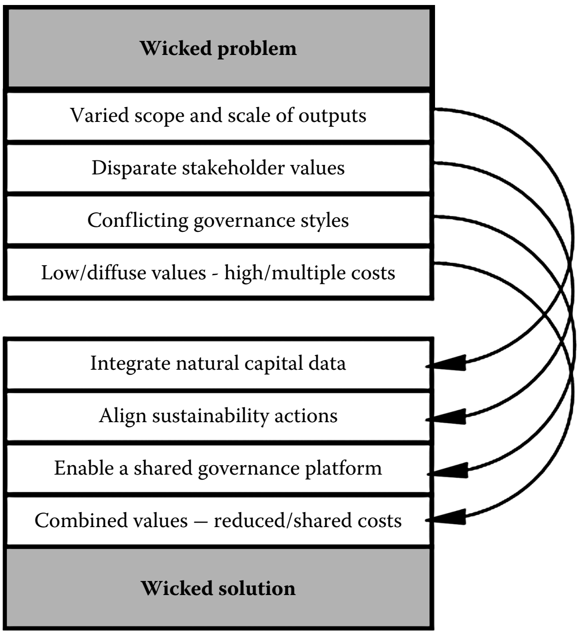

Figure 6.2 The components of the wicked problem and the wicked solution are shown to have a reciprocal relationship. The three principles of the wicked problem of agriculture sustainability lead to low and diffuse values for ecosystem services and high and multiple transaction costs. This is resolved with three wicked solution principles that result in combined values and reduced and shared transaction costs.

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6.8 Wicked solution sources

Resolving the wicked problem of agriculture sustainability requires solutions from several governance sources. The source of technical, scientific, political, and wicked problems was described in Figure 2.1 with each issue emerging due to a combination of consensus and/or disagreement on values and knowledge. In review, when there is consensus on values and knowledge, the problems are technical; when there is consensus on values and disagreement on knowledge, the problems are scientific; when there is consensus on knowledge and disagreement on values, the problems are political; and when there is disagreement on values and knowledge, it is a wicked problem (Meuleman, 2013).

Nickerson and Zenger (2004) concluded that particular governance styles are more apt to solve specific types of problems. In their research of business firms and governance styles, they identified three governance styles: authoritative hierarchy, market, and consensus hierarchy. These three governance styles of business firms parallel the hierarchy, market, and network governance styles, respectively. To create a complementary solution matrix, Nickerson and Zenger's (2004) research on governance styles and problem solving was overlaid with Meuleman's (2013) typology of problems. Combining these problem and solution source concepts creates the associations shown in Figure 6.3. Hierarchical governance, relying on order, aligns with solving technical problems. Market-based governance, relying on innovation, aligns with

Values / Knowledge	Consensus	Disagreement
Consensus	**Hierarchy** (technical)	**Network** (political)
Disagreement	**Market** (scientific)	**Shared** (wicked)

Figure 6.3 The typology and source of problems and solutions are based on combinations of consensus and disagreement of values and knowledge. Based on the types and sources of problems shown in Figure 2.1, governance styles that are best adapted to address certain types of problems are paired with those problems. Hierarchy governance is suited for technical problems, market government for scientific problems, network governance for political problems, and shared governance for wicked problems. (Adapted from Meuleman, L., *Transgovernance: Advancing Sustainability Governance*, Springer, Heidelberg, Germany, 2013).

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solving scientific problems. Network governance, relying on horizontal communication, input, and trust, aligns with solving political problems.

To complete the solution matrix, a shared governance concept is associated with resolving wicked problems. Since a shared governance model does not disregard other governance styles, the information gathering and problem-solving benefits of each governance style may be realized.

Shared governance benefits can be captured with an interactive platform.

Patterson et al. (2015) see supportive platforms and networks as particularly beneficial for developing thinking and capacity for transformations toward sustainability. Operating at different scales and with different sets of participants, platforms, and networks can offer different strengths, yet contribute in several common ways. This may lead to building *communities of practice* where participants are involved in sustained engagement and dialogue around particular issues of mutual interest.

6.8.1 Shared governance platform

The role of a shared governance platform is a similar role that firms play in traditional markets.

Williamson et al. (1991) explain a firm exists because it reduces the transaction costs that emerge during production and exchange, and can create efficiencies that external entities or individuals cannot. Due to the complexity of agriculture landscape sustainability, no one firm or entity can capture all the knowledge needed, and a solution demands more coordination than a typical firm. A shared governance platform is proposed as the means to capture the multiple and often less tangible values from the agricultural landscape and enable people to interact.

6.8.2 Enabling communities of practice

The purpose of a community of practice is to provide a way for practitioners to share and acquire information and provide support to each other to achieve their objectives. The intention of the shared governance platform is to create these connections, but also to provide the technological architecture to calculate and account for ecosystem services and enable transactions.

To do so, the shared governance platform uses land management indices that are able to *package* an extensive amount of data into singular units. It houses a cache of indices that together will function as a *landscape language*. The new language provides the form and content to create a useful method to communicate sustainability values across sectors and disciplines. A new language is vital to transcend the issues of the system as it *is*.

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A more fluent communication of outputs, outcomes, and values would enable stakeholders from any sector to coordinate activities in a mutually beneficial manner. This allows *governance actors* to interact to achieve outcomes rather than depending on organizations with conflicting governance styles to communicate through multiple organizational layers. *Governance actors*, discussed in Chapter 8, are the individual representatives from the public policy maker, private policy maker, public practitioner, and private practitioner sectors. Aligning the sustainability activities among governance actors enables the shared governance objective of creating partnerships, equity, accountability, and ownership at the point of services (Porter-O'Grady, 2001).

The next three chapters examine how an index-based landscape language (Chapter 7), an alignment of sustainability activities (Chapter 8), and a shared governance platform (Chapter 9) contribute toward enabling a *wicked solution* to transform the agriculture system as it *is* to the system as it *ought to be*.