Evaluating Farm and Food Systems in the US[1]

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Part way through Ken's chapter you may wonder what an elegant critique of mid-20th century agricultural economics has to do with systems and evaluation. Quite a lot as it turns out. For a start it highlights the importance of history in the systems field – something often downplayed in many systems-based approaches. Vital clues to our mental models are to be found in the past. Ken then picks up on Gerald Midgley's idea that greater insights can be gained from a situation by using multiple methodologies. In this case, he draws on methods from four methodologies already described in this volume; system dynamics, soft systems, complex adaptive systems and critical systems. The use of critical systems may not be immediately obvious, but consider this – isn't using "wise elders" an application Critical Systems Heuristic's use of critical expertise to question the dominant consensus ?

Summary

Evaluation of food and agricultural system activity in the US is complicated by systemic economic relationships that extract considerable wealth from rural communities. These external pressures severely limit the options available to community-based food systems initiatives, and may confuse evaluation efforts. Analysis of regional farm and food economies, informed by the insights of "wise practitioners," illuminates the nature of these extractive relationships, setting the stage for more precise systems evaluation. In this paper, economic data will be applied to three systemic evaluation methods, drawn from Systems Dynamics, Soft Systems Methodology, and Complex Adaptive Systems. How well does each of these methods account for available data? How might each be used? How might evaluators use these tools to engage in systems analysis, or to devise or assess progress toward specific theories of change? How can insights from wise practitioners be tested and incorporated?

Evaluating farm and food systems in the US

Local food and farm systems

A dynamic, diverse movement in the US now attempts to build community-based food systems (CBFS) in thousands of urban and rural locations (Meter 2003). As one example, a cluster of 50 growers and producers have formed the Southeast Minnesota Food Network. Here, farmstead butter and cheese makers, large-scale orchards, food distributors, coop retailers, and specialty meat producers

1 This paper draws upon insights graciously provided in reviews of early drafts by Bob Williams, Bill Harris, Lee Mizell, Glenda Eoyang, Tom Berkas, David Scheie, and JoAnne Berkenkamp. Additional insights were offered by Martin Reynolds, Richard Bawden, Gerald Midgley, and other authors in this volume, during a meeting in October, 2005.

collaborate with small community-supported agriculture (CSA) produce farms (in which consumers buy food "shares" in advance), linking businesses into a coordinated effort.[2]

That such activity takes place within an advanced farm economy with such high apparent productivity is remarkable. That its proponents view themselves as creating new food systems requires evaluators to apply systemic evaluation techniques.

Local activities are complex in themselves, yet they are deeply impacted by complex, global relationships (such as global commodity markets and capital flows) that are difficult to understand. No matter how one might wish to simply draw a boundary around local action and limit one's work to that setting, this often proves impossible.

Similarly, selecting appropriate evaluation tools can be a daunting task. Evaluators may play a variety of roles in any given assessment, including framing, revising, or measuring progress toward a theory of change. They may be called upon to interview participants, or to summarize survey responses or other quantitative data. Evaluators may be the strongest voice upholding a long-term or systemic vision. Systems methods described here may all have utility for any of these tasks.

This evaluator's professional experience has shown that systemic evaluation efforts are often hampered by (a) the difficulties of modeling systemic activity concisely; (b) a lack of understanding of economic constraints; and (c) overlooking the insights of important stakeholders. Thus, this paper begins with an overview of economic lessons that have emerged while evaluating food-systems activity. Then it will show how diverse evaluation methods may be applied, especially in modeling, by incorporating economic analysis that offers simplifying insights, views from multiple perspectives, and testimony from wise practitioners.

For this paper, CBFS are defined as *systems of exchange that strive to bring food producers and food consumers into affinity with each other*, for the purposes of fostering health, promoting nutrition, building stronger community ties, keeping farm families on the land, and building wealth broadly among community members (Meter 2003 p8).

This contrasts with the prevailing US agricultural economy, which focuses on production of *commodities* that are more typically raw materials for further processing than actual foods to be eaten directly by humans. Less than half of one percent of all U.S. farm commodities is sold directly to consumers. [3]

Both community-based and commodity-based food systems have interacted on the North American continent since Europeans first settled here. Shifting economic and policy winds have altered their relative strengths. Comments by several "wise practitioners" led to key indicators that measure this everchanging balance.

2 Further information about the network can be found at http://www.localfoodnetwork.org/

3 US farmers produced $201 billion of commodities in 2002, of which $812 million (0.4%) was sold directly to consumers (USDA/NASS Agricultural Census 2002).

What does a healthy farm economy look like?

In the late 1970s, working as a journalist to cover the impending depression in the farm economy, I asked a group of Minnesota farm neighbors how they could tell when the farm economy was healthy. Without using the term, and long before I worked as an evaluator, I had asked the farmers to suggest an indicator.

The men replied without hesitation, thinking back to the days, twenty-five years earlier, when they had started farms in this community. They told me that when their farm economy was strong, their rural community had its own supply of credit, sufficient to cover the costs of farm production (Meter 1990).

In those days, any farmer worth his salt could – and was expected to – earn the money to make a down payment on land by simply starting to farm. Food these farmers raised was largely consumed locally, through commercial channels that were relatively farm-friendly. Farmers received a greater share of the retail price of food. One man in this circle raised eggs for a year, bringing in enough profit to make a down payment on land the next. Another invested savings he held from a previous farm. Others might ask a parent, or other relative. Only as a last resort would a farmer visit the local banker for a loan. "Back then, it was like a sin to borrow money," the farmers added with one voice. To them, paying interest – even to a local bank – meant taking money out of the farm community (Meter 1983 p3).

A quick look at farm credit data confirmed their tale. Aggregate farm debt was $6 billion in 1950, during the time they were describing. By 1985, farm debt had soared to $222 billion (Meter 1990 p8–9),[4] – and it had become clear farmers would not be able to pay it back. Tracking the unsustainable debt loads their neighbors carried, these farmers told me there would be a farm crisis soon. Their prediction was entirely correct.

Testing these sources

I trusted the stories told by this group of wise practitioners, not only because federal data bases confirmed their stories, but also because their stories passed severe internal tests. Accustomed to meeting together in the context of a local environmental action group, this cluster of farmers had raised children, shared farm chores, and weathered crises together. Any story was subject to close scrutiny from others in the group. Incorrect notions met a quick challenge. Running diverse farm operations and holding differing skills and needs, these farmers brought varied views to each conversation. [5]

Moreover, the farmers' testimony was persuasive because these men were both immersed in information about the impending crisis, and detached from it. None of this group had applied for the large loans that typified farm lending at

4 Data drawn from USDA Economic Research Service, Farm Income Statement and Balance Sheet. Recent data from this series is available at http://ers.usda.gov/Data/FarmIncome/finfidmu.htm. Current value of this debt (in 2005 dollars) is $403 billion.

5 Of course, it is also possible for consensus to obliterate the truth, or to marginalize important but unpopular views. In this case, the consensus seemed to this viewer to accompany a sense of openness to new evidence, rather than a closed interpretation, but of course this is a subjective determination.

the time – and which, the farmers correctly surmised, could not be repaid. Most of the farmers in the group I spoke with had, moreover, served on the local county committee for a federal loan program. Scrutinizing their neighbors' farm business plans, they knew the fundamental economics intimately. They had seen their neighbors succumb to lenders' pressure to take on more debt than they wanted, and they knew how their neighbors felt about that.

As it turned out, the farmers' comments led me to decades of research and writing. Their practical experience attuned them to indicators that economists from USDA and other federal agencies had overlooked.[6] Moreover, by following their intuitions and by refining their analysis through informal discussion,[7] they had surpassed the ability of federal agencies to understand the impending crisis. They also had more freedom than official experts to report their conclusions, facing few of the political pressures that are routinely placed on academic researchers and agency staff.

Now, after extensive follow-up research over 25 years, it is clear to me that the indicator they chose – the strength of responsive local credit sources – is indeed a profound measure of the health of farm communities. While actually compiling such data is extremely impractical due to privacy concerns, widely reported surrogate data provide compelling evidence that confirms the farmers' views.

Consulting the data

What USDA's Economic Research Service does report is the amount of farm debt held by "individuals and other" lenders. This is available for each year since 1910. While not identical to "local" credit, it overlaps powerfully.[8] Individual lenders were the primary source of farm debt from 1910 until 1972, with the exception of the New Deal years, as can be seen in chart 1. In the early 20th Century, when three of every four dollars of farm debt was held by individuals, most loans would have been held by relatives or neighbors, simply because rural economies were more localized.

Now, nearly a century later, with greater capital mobility and widely dispersed families, it is harder to equate the two. Yet it is still true that all individual lenders are "local" in a meaningful way – each loans money to farmers for reasons that are not strictly commercial. Each is part of the farmer's community, rather than strictly an entry on the balance sheet. Individual lenders offer credit which is responsive to farmers in a different way – perhaps more strict or perhaps more lenient – than for commercial or public lenders.

6 I discussed these findings with a retired senior ERS economist at a national conference in 1995. His comment: "Wow. We never even thought of anything like that."

7 See also Flood 1999 p68-69.

8 It must also be stressed that the term "community-based" (or perhaps better, "responsive") credit may be more useful to apply here than "local." Certainly a sharecropper who was forced to borrow from his landlord in order to raise a crop would not herald "local" credit as an ultimate goal, since this would perpetuate his dependency. For these white farm owners of Minnesota, without direct experience of such exploitive practices, and who could assume some overlap among "community," "responsive," and "local," this distinction had not yet been addressed.

This is not the place to demonstrate the above story in greater detail, but one chart showing farm credit sources is shown below. For our purposes it is enough to state a few select facts. Two eras in US farm history are generally recognized as the peak times for agriculture: the "golden era" of 1910–1914, and the post-WWII expansion which lasted until the mid-1950s. During each era, individual lending peaked. As mentioned, 75% of all farm debt was held by individuals during the earlier golden era. Later, in the postwar period, fewer than half of farm loans were extended by individuals – yet this represented a recovery in individual lending, after 1933, when New Deal policies restored to rural communities their capacity to lend. In both eras, foreign markets were strong, and urban populations were expanding. Credit was not sufficient by itself to cause this prosperity, yet prosperity was based upon the responsiveness of local credit sources to farmers who wished to reach expanding markets.

However, during two severe agricultural crises, individual lending plummeted. Lack of credit was a significant cause of the 1920s farm depression, a global crisis which, many experts have concluded, was the precipitating factor for the Great Depression.[9] Few Americans realize this was a global agricultural depression (Rothermund 1996). Ultimately, under the New Deal, the federal loans that were extended to farmers worked to restore local savings and thus, community capacity to extend credit.

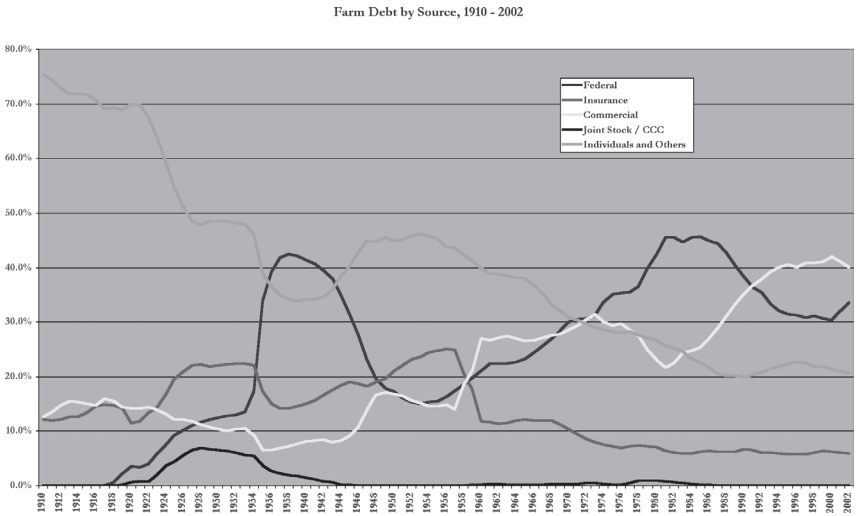

Chart 1

CBFS are mainstream **CBFS decline** **Old CBFS fade**

Farmers choose local or export **exports dominate** **New CBFS emerge**

9 See Galbraith (1954); Timoshenko (1933); Friedman and Schwartz (1963); Temin (1976); Perkins, (1969); van der Wee, (1972); Martinus; and Latham (1981).

Similarly, the 1985 farm debt crisis – which the Minnesota farmers I interviewed were predicting – was instigated by the "grain for oil" trade in 1973, in which farmers were asked by the federal government to export large quantities of grain to compensate for rising oil costs during the OPEC oil embargo. Farmers complied, and federal lenders pressured farmers to take on larger and larger loans to expand production. This created a short-term windfall for many farmers, but also encouraged many to take on debts they could not repay. Moreover, the new technology these farmers adopted, enabled by federal loans, was too expensive for local lenders to support.

A few years after the peak of the crisis, individual farm credit had fallen to 20%, its lowest level of the century. Individuals had become the third most important source of farm debt. Unfortunately in this more recent crisis, federal intervention *weakened* rural credit sources, in favor of commercial and federal lenders. Thus, these loans worked, over the long haul, to undermine the very foundation of the rural economy. Farmers began to make more and more of their interest payments to distant lenders who were both unresponsive, and unlikely to reinvest in farm communities.

The Extractive Economy

In fact, from 1913 to 2005, US farmers paid $595 billion more in interest payments than they received from federal farm subsidies.[10] This means that farmers have subsidized the mainstream economy. Moreover, as credit markets became increasingly global, farm interest payments increasingly failed to recycle back to farm communities. Potential investment capital was drawn away from the rural communities in which farmers produce commodities. The potential for rural regions to build wealth of their own has been weakened.

Thus, farmers operate within an economic context that is increasingly very efficient in extracting wealth from rural communities, and very inefficient in building wealth in those locales where primary commodities are produced.

This data suggests that CBFS stand as a self-organized counterpoint to the prevailing extractive economic structures. From the point of view of citizens in communities, the global economy exhibits considerable disorder. Yet this "disorder" is actually the outcome of a lack of power amidst highly structured global relationships, dominated by international firms that hold considerable influence over global markets, concentrated investment capital, high levels of technology, with significant barriers to entry. These conspire to create immense power for those who command these systems. At the same time, they enforce tremendous disinvestment and deep powerlessness for those who do not.

10 Calculated by the author using constant 2005 dollars from USDA Economic Research Service, Farm Income Statement and Balance Sheet data. Recent data from this series is available at http://ers.usda.gov/Data/FarmIncome/finfidmu.htm.

So what?
Evaluation and the use of systems methods

Knowing the farm economy is extractive – that more wealth is removed from, rather than retained inside, producer communities – is critical to effective evaluation of community-based food system activity. Many of the difficulties encountered by community foods initiatives derive from this extractive character. Next, we turn to how evaluators may make use of this understanding.

Three Modeling Methods

Each of the three modeling tools will now be outlined briefly. Each may be applied in building logic models for CBFS initiatives. Practical considerations for using each will be assessed.

Causal-loop diagrams (CLD)

The most visible proponent of causal-loop techniques is Peter Senge, who popularized this System Dynamics approach in his best-seller, *The Fifth Discipline* (Senge 1990). Senge focuses on building a consensus among diverse stakeholders so they can agree how best to implement a strategic plan (Flood 1999). Senge further identifies "system archetypes," representing classic processes in which delays or feedback make the outcomes of a given action difficult to foresee. If people recognize these archetypes in their local food systems work, it may bring greater unity to their understanding of the systems issues they face.

Soft Systems Methodology (SSM)

"Soft" systems methods were developed by Peter Checkland and others to address issues that arise without clear, tangible definition or boundaries. Often in such cases, straightforward numeric analysis is difficult. Multiple perspectives are likely to be valid. SSM explicitly distinguishes "real world" phenomena from the systems model itself. Collaborators work together to model a systems condition they face, and then compare that model (or often multiple models) with actual events.[11]

Complex Adaptive Systems (CAS)

A number of Complex Adaptive Systems approaches focus on the complex and changing nature of systems, recognizing that as people within a system take action, the system itself changes. One qualitative version of CAS suggests that those who launch a systems change initiative perform an analysis of CDE: Container, Differences that make a Difference, and Exchanges.[12] CDE attempts to

11 Much of the information covering SSM is drawn from Williams 2002 and 2005. See also Boon Hou Tay's and Kate Attenborough's chapters.

12 Material covering CAS is drawn from Eoyang & Berkas (1998) as well as Eoyang (2004). Also Williams (2002) and Williams (2005); Lichtenstein (2000). Note that the Evolutionary Agroecology and Biocomplexity Initiative at Iowa State University defines agriculture as a complex adaptive system. See also EABC Statement of Terms. Australian researchers identified emergence as a key property of food systems, eg Crawford, Nettle, Armstrong and Paine (2002). Although not specifically analyzed by Sørensen and Vidal (2002), CAS approaches appear to address their concern that SSM and other soft approaches require expert facilitation. See also Glenda Eoyang's chapter.

assist those working within complex systems to define that changing context, and to assess the efficacy of their efforts given the changes that occur.

Each approach has its particular strengths and weaknesses. These will be characterized according to the following qualities (see summary chart on page xx):

- Easily understandable
- Expresses feedback and other systemic qualities
- Heuristic value (leads to future learning)
- Expresses separation between "reality" and "model"
- Lends itself well to lay use
- Builds agreement among diverse stakeholders
- Designed to build consensus among participants
- Expresses change over time
- Embraces multiple perspectives
- Expresses power dynamics at work within the initiative itself
- Designed for use in a highly bounded, stable or specific organizational context
- Expresses stocks (accumulation) and flows (movement) of resources
- Lends naturally to measurement of key dynamics

Now, we turn our attention to each of these respective modeling methods.

Causal-loop diagrams as a tool

Many groups use causal-loop diagrams as a tool for strategic planning. These diagrams are a significant advance over more linear models often used in theories of change, since they account for the ways in which systems will "push back" against (resist), or reinforce, efforts to change the system.

Focused on work within organizations, Senge argues in *The Fifth Discipline* for making explicit the feedback loops that tend to either amplify or offset any activity that may be initiated, distilling these understandings into archetypal diagrams.

Many practitioners caution that it is most fruitful to use causal-loop diagrams to model a *change initiative*, rather than the *system itself* (Eoyang 2005), simply because this creates a more concise image of the proposed change and potential resistance to it. Using causal-loop diagrams to model entire systems can lead to large, unwieldy charts.

One of Senge's archetypes, "Limits to Growth," could be applied to CBFS movement, showing how efforts to increase the scope of CBFS activity may be frustrated by systemic pressures (Senge 1990 p379). The diagram below is one such way of modeling this scenario.

The downward curving arrow on the top right represents potential donations or investment by foundations or businesspeople. Investors may seek rapid financial return, or may invest for more patient, long-term benefit.

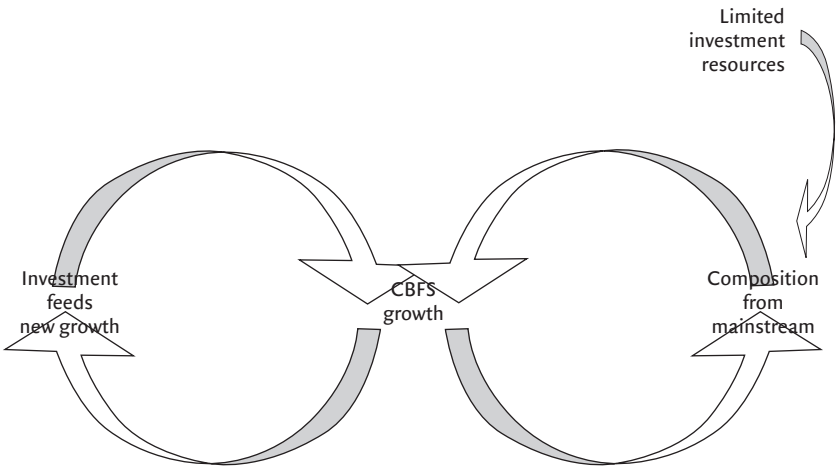

Figure 1: Causal-loop diagram of limits to growth archetype
Note: in this causal-loop diagram, "R" signifies feedback that reinforces the action being initiated, while "B" signifies feedback that opposes or "balances" this action.
Investment, of course, could also be channeled directly to the CBFS itself, which could be represented by an arrow pointing to "CBFS growth" at the center of the diagram.

Such a diagram may serve to unify the vision of participants in a CBFS initiative. Used in an iterative process, in which succeeding diagrams refine earlier ones, even a simplistic CLD may have heuristic value, by identifying critical stages where unintended impacts may occur. This strengthens formulations of a theory of change, and recognition that systemic feedback is likely to be encountered.

One limitation is that Senge's work focuses on change efforts within organizations. In such relatively closed settings, simplifying diagrams may be quite appropriate. However, the real-world complexity of community initiatives may not be well represented (Flood 1999 p71). Causal-loops defined at one scale may have no legitimacy at larger or smaller scales.[13]

Moreover, power and resource flows change over time. Pushback may lead to new configurations of power. Archetypes may shift over time. Analysts have noted that causal-loop diagrams cannot easily account for these changes over time (Williams 2005b). Moreover, changes in resource stocks and flows cannot accurately be modeled by causal-loops, limiting their utility for long-term efforts (Richardson 1986).

13 This issue plagues any modeling exercise. Yet CLDs suffer the most of the three reviewed here, since boundaries are not explicitly defined. Both CATWOE and CDE exercises force a modeling exercise to define specific boundaries and then reflect on whether they are adequate to the issue at hand.

The very simplicity of the causal-loop diagram may also force the focus of a food systems effort into too narrow a viewpoint. It may well be that those who, for instance, focus on the growth of CBFS in the US, would overlook the fact that foreign producers, say coffee producers in Costa Rica or soybean growers in Brazil, are affected by decisions made in US consumer markets, and vice versa. In this case, what is viewed by "growth" by local practitioners may be seen as "push-back" by, say, Chilean grape growers. If these distant stakeholders are not at the table, their interests may be overlooked.

Further, Flood argues that consensus-building itself may be inappropriate, since various stakeholders may hold inherently different interests (Flood 1999 p71). Enforcing a consensus may overlook or obscure the power dynamics within the effort itself. Consensus may be artificially imposed by the most powerful or vocal voices at the table, which will skew the modeling process (Flood 1999 p70).

Although causal-loop diagrams are *systemic* in illustrating feedback effects, they may not be adequate to modeling a *system* over time. This approach may be most useful for people in early stages of systems understanding, who do not yet realize that the system will resist efforts to change it, or with groups that have not had occasion to make their own assumptions about feedback loops explicit. It may not resonate as well among those who have already experienced systems push-back in their own lives.

Nor do causal-loop diagrams appear to lend themselves well to more quantitative assessment, being primarily qualitative images of action and feedback. If one were to model the US farm economy at various points in time, and correlate this to the chart of farm credit diagram above, distinct causal-loops could be applied to different eras of farm production and diverse policy regimes. The data would stand independently of which causal-loop image might be selected for any given era. Still, in Figure 1 (see page 145), knowing the extractive nature of the mainstream commodity economy adds a new level of understanding to the balancing force that limits the growth of CBFS. Thus it suggests caution for those evaluators who might recommend integrating community systems more closely into the mainstream.

One "Soft Systems" approach: CATWOE analysis

The issue of multiple perspectives that plagued Senge's approach to framing consensus is addressed directly by Soft Systems Methodologies, which place strong emphasis on the importance of multiple viewpoints, and upon making explicit the difference between the "reality" we experience, and the models we create as we work in varied contexts. CATWOE is one such method.

Acknowledging that our models of systems are always simplifications, and seldom conform exactly to "real-world" contexts, SSM works diligently to develop models that help explain that reality. Yet we are always limited by our own models. Thus we often test our own *understandings* of systems, more than the systems themselves. Since most people interpret the systems in which they dwell through

their own first-hand experience, comparing these experiences is key (McKinney 2002).

To many practitioners, the first Soft Systems step is to define the "problem situation" at hand. Right away, I would suggest that use of the word "problem" be avoided.[14] This can immediately cast a shadow of negativity or powerlessness over the discussion at hand. In my professional experience, it is more effective to use the word "issue" rather than "problem," since this leaves the doors open for more comprehensive, and less negative analysis. "Problems" may indeed be opportunities.

I am told that Checkland came to realize this in his later work (Williams 2005b). Flood offers a deeper analysis, stating that many so-called "problem situations" are ongoing, rather than discrete. Modeling them as a moment in time, or as a single problem to be resolved, will not suffice. Rather he suggests a focus on "interacting issues and dilemmas to be managed on a continuous basis" (Flood (1999). This approach lends itself quite well to situations where power interests may persistently conflict, and to contexts in which a recurrent dilemma will not be solved, but must be addressed.

Preceding a "CATWOE" analysis, many practitioners begin by asking participants to draw "rich picture" diagrams – unstructured images that participants create to illustrate key system dynamics they experience in their contexts. Core forces or "interacting issues" are identified from these diagrams, or from subsequent discussion. From this rich picture, one or more singular perspectives (*holons*) are selected. For each specific perspective, a proposed transformation, or cluster of key elements (using the "CATWOE" acronym [15]) is defined:

C: the Customers who benefit from this system;
A: the Actors who transform system inputs into outputs;
T: the Transformations that are made;
W: Worldview, the relevant viewpoints and assumptions made by various stakeholders;
O: the "Owner" to whom the system is answerable; and
E: the Environment that influences but does not control the system.
(Williams 2005 p6).

Each unique set of CATWOE elements leads to its own "root definition" (or purpose) of the food system under analysis. [16] Multiple CATWOE constructs could be created by focusing one at a time on the viewpoints and interests of each of the diverse stakeholders present.

14 See also Flood (1999) p6, 71 and Chapter 10.
15 Some practitioners argue that a more insightful approach uses a "BATWOVE" analysis; in which "consumers" are separated into "beneficiaries" and "victims." Furthermore "beneficiaries" and "victims" can be ideas as well as people. Others suggest that it is most useful to begin with T (transformations), W (world view) and O (owner) as initial steps in such analysis.
16 For more on root definitions, see Leonard & Beer (1994).

For example, two separate CATWOE constructs might be defined for a given community foods effort, depending upon the point of view to be taken:

ROOT DEFINITION 1 *(Perspective: increase efficiency of food production)*
Customers: Food consumers who buy directly from farms through buying clubs, farmers markets, coops, or community-supported agriculture (CSA) arrangements.
Actors: Food producers who seek to meet this consumer demand.
Transformations: Potential investments to increase the efficiency, scope, or size of these food-producing firms.
Worldview: For this example, we will assume that food producers value commercial efficiency highly. (Of course a variety of other potential worldviews are also possible, including those which place greater value on community connections, on organic food, or those of farmers who wish to place a limit on their workday, etc.)
Owner: The landowner or the owner of any given food business being considered.
Environment: A vibrant local discussion of getting healthy local foods to the region's residents.

The "root definition" (or purpose) of the food system described above would be to increase the efficiency of food production in a given community.

ROOT DEFINITION 2 *(Perspective: build local infrastructure)*
Customers: Civic leaders who wish to assure a steady supply of food for local residents.
Actors: Small groups of citizens already engaged in diverse healthy foods activity.
Transformations: Potential infrastructure investments (ie communications, finance, and facilities) that connect these disparate efforts into a more effective, more highly linked system.
Worldview: An assumption that the stronger the prevailing community connections, the greater will be food security.
Owner: Residents of the region.
Environment: Policy discussions toward local food security.

The purpose defined in this second example would be to increase the region's food security by connecting various food-related initiatives into a more self-conscious system.

In a classic soft systems methodology the next step will be to develop a visual model based on each CATWOE and according to a specific set of systems principles (Williams 2005). However, there are many variations. For instance, CATWOE configurations may inspire revised "rich picture" diagrams, or lead to revised CATWOE definitions (new root definitions), each new step potentially adding new levels of understanding. In such an iterative process, participants may

generate new systems insights by working together – even when self-interests are not identical.

Diverse viewpoints would, for example, shape interpretation of data such as that found on Chart 1 (page 6). The decline of local credit sources would likely be seen as a negative development by local lenders, or by those who care about building community capacity. To a commercial lender, of course, this same trend may be considered desirable.

As can be seen from these two simple examples, the same local food system can appear quite different from diverse viewpoints. How the prevailing local food system is understood, how it is portrayed in diagrams, and how it is modeled in creating a theory of change will depend on the selection of CATWOE elements. Evaluators might well work with local participants to show how these differing "root definitions" emerge out of different constructs, and in turn lead to different evaluative assessments of "worth." By examining the diverse challenges that emerge when the differing views of varied stakeholders are adopted, hopefully a more integrated understanding of the complexity of the local systems would result.

Either of these "root definitions" would be enhanced by an awareness that powerful economic structures extract wealth from any given rural locale. Evaluation under root definition one, for example, would be made more complete by realizing the forces that act against the growth of any individual farm or processor that may wish to respond to local food demand. Under the second root definition, investments in *networks*, rather than in specific *firms*, are favored. Either insight might shift the focus of evaluation.

This method does seem to add important depth, when compared to causal-loop diagrams. CATWOE creates a structure that can be embraced by beginners. This approach also has strong heuristic value. Change over time can be accommodated here by tracking transformations that may alter the system. Less clearly-bounded situations can be modeled iteratively using successive CATWOE definitions.

Many evaluators have seen SSM as an effective tool to use with groups of collaborators in learning and making meaning together (Williams 2005 p2). Leonard and Beer (1994) argue that SSM is best used when there is uncertainty about the issues to be confronted, at a point when a group individuals might lay down their organizational perspectives to define new approaches. SSM may not be appropriate, they argue, when an issue is already clear. They suggest that SSM may lend credibility to efforts to interpret hard data, since interpretation of such data is subjective. The clarification of diverse viewpoints may lend rationality to this interpretation, especially when the viewpoints of those who have been marginalized emerge. (Leonard and Beer 1994 pp 37, 32, 34).

CDE analysis – one Complex Adaptive Systems approach:

Diverse Complex Adaptive Systems (CAS) approaches, both quantitative and qualitative, focus on the complex and changing nature of systems. CAS approaches

acknowledge that as people within a system take action, the system itself changes, resulting in combinations of structured and less-structured elements. Some recognize that activity in a CAS may be random. Or groups of individual agents may self-organize to create greater stability. Some computer models track how groups of individual actors, following simple rules appropriate to their contexts, may create complex patterns of behavior across the system. Evaluation often draws upon these insights.

Flood considers spontaneous self-organization to be a special form of *emergence*. (Flood 1999 p2) This refers to unexpected patterns of complexity that result from simpler processes, but could not be predicted from the rules followed in the less complex process. Evaluators also look for "*attractors*:" patterns, clusters of energy or resource flows that tend to create stability among disorder, and that may provide the backbone for lasting systems change.[17]

Many consider analysis of time-sequence data – measurements taken at regular intervals, using similar techniques, that show historic trends or patterns – as the most useful way to illuminate changing resource flows or emerging attractors (Eoyang and Berkas 1998 p14).

In this paper, one specific qualitative approach will be used: CDE (Eoyang and Berkas 1998 & Eoyang 2004). This method raises three core questions:

> C: what is the Container in which we work – what boundaries do we place around our context?
>
> D: what are the "Differences that make a difference"? What issues or dilemmas do we find posed within the system at hand, or what measures can we identify, that tell us whether systems change is proceeding in the proper direction?
>
> E: What are the Exchanges that occur within and across system boundaries? How might these exchanges be altered or shaped to promote desired changes?

For our discussion, looking at the big picture, the Container is the US farm and food economy, as viewed in its global context. "Differences that make a difference" might include the competing views of diverse participants in the farm and food economy, or the differing social connections formed by people who work to build community affinity, rather than purely commercial relations. The strength of local credit sources, as discussed above, would be one such measure of the Exchanges that occur. Obviously, many alternate CDEs could also be defined at different scales.

In CDE, the different realms of order and disorder, structure and randomness, self-organization versus imposed, are all embraced. Simply by assuming a high degree of disorder, CDE poses processes that are not dependent upon the boundaries of a specific firm or department. There is a very immediate sense of *change over time* built into the approach, and a humble sense of the limits of human capacity to intervene amidst the complexity and inertia of prevailing systems.

17 Definition of emergence adapted from Flood, 2. Definition of attractors adapted from Eoyang.

CDE lends itself quite well for evaluations involving those internal to a process, less susceptible to manipulation from external parties. The need for multiple perspectives seems to emerge easily from its complex understanding of randomness and structure. The open-ended nature of CDE creates strong heuristic value.

The caution to be made here is that, having defined an inner tension, diverse stakeholders may find they don't hold common interests, and do not agree. This may not be a path to greater unity, yet even making differing views explicit can strengthen future collaboration, if the evaluator is able to present a positive approach.

CDE may be less useful in highly structured situations. Furthermore, although it appears to be a powerful tool for those within a complex environment to use to understand the complexities they experience, that very immersion may make it difficult for participants to achieve the detachment of "real world" and "model" that SSM strives toward.

Consulting "wise practitioners"

No matter which modeling method is pursued, consulting with "wise practitioners" is often useful. These are source people, well-immersed in the context to be evaluated, who have gained special insight, or who are especially articulate in taking a broader view of the issues at hand. One way to think about them is that they are the people who have their feet planted firmly in the mud of the situation, but also keep their eyes open, reading the winds. They draw, therefore, from at least two perspectives at once. They know intimately the issues that are faced on the ground, and yet they can speak about this insight from a position that is broader than their personal self-interest.

One of the key challenges, of course, is to know how to select the appropriate wise practitioners. Often the most visible or popular voice is not the most informed, or the most informative.

Many experts recommend that a group of specialists from a variety of disciplines be brought in (Flood 1998 p68), so that the blind spots inherent to any specialty will be less persuasive. This can be a highly effective and stimulating process. Yet Flood, referencing D T Suzuki, offers a strong caution here, pointing out that if to specialize is to break reality down to its component parts, this may be like breaking a mirror into pieces and reassembling it. Once put back together, an image may appear in the mirror, but it will be a broken image – not as whole as if the mirror had not been broken in the first place. (Flood 1998 p14)

There is strong alternative path, less easy to define or standardize, that can also be effective if participants are chosen carefully. This is to select one or more people who are themselves generalists – people who never occupied, or who have already stepped outside the confines of, any given specialization.

A special case of this is in a community setting. Rooted community residents tend to be generalists, since they have experienced the systemic pressures that apply to their lives intimately, and over time. If a group of such immersed residents

has worked well together, gaining mutual trust and respect, they are exceptionally well positioned to provide systemic insights. These are people who, to adapt Flood's words, have learned inside feedback structures. (Flood 1998 pp68-69) They have also engaged in thoughtful reflection about their own mental frameworks (Flood 1998 p68). They are able to "see the world through the eyes of another."[18] They know how systems push back, and are less likely to rely on linear models than specialists would.

Such sources may have a visceral, rather than a modeled, insight into systems dynamics. People in poor or marginalized communities, for example, often have a far richer understanding of the powerful than do the powerful themselves – since they have been forced to deal with the consequences of decisions made by the powerful. The reverse understanding is rare.

For an outsider who interviews such an immersed practitioner is the need to gain enough mutual respect with the interviewee that one will be trusted with the best stories, rather than the official tales that are often told well-meaning outsiders. It is also essential to have enough first-hand experience in the context itself, or enough allies who do, that wise insights can be separated from dishonest or self-serving statements.

Conclusion

The complexity of systems thinking creates a distance for many lay people. Yet these same lay people may have strong intuitive understandings of the systems in which they work. Especially in the process of constructing, evaluating or revising theories of change, the modeling methods outlined here hold great utility by providing a common language to the discussion.

Each of the three modeling methods discussed in this paper hold utility for different constituencies and varying situations. Each should be considered valuable tools for the evaluator's toolbox. It may be fruitful to blend their use in many settings, guided by the cautions raised in the evaluation literature as outlined here.

In each case, incorporating the testimony of wise practitioners as well as insights from quantitative data, helped to deepen use of the evaluation tool. While closed-loop diagrams may be too qualitative to be well-suited to the incorporation of data, new insights were gained by consulting well-chosen data sets. CATWOE definitions were informed by data that illuminated the experiences of various stakeholders who experience extractive relationships in different ways. CDE analysis relies heavily, as does much of CAS evaluation, on time-series data. In each case, quantitative analysis was strengthened by incorporating the insights of wise practitioners.

18 Flood, 63, citing the work of C. West Churchman.

The following table summarizes the qualities of the methods reviewed:

Characteristic	Causal-loop Diagrams (Systems Dynamics)	CATWOE (Soft Systems Methodology)	CDE (Complex Adaptive Systems)
Easily understandable	Yes	Yes	Yes, but CAS difficult
Expresses feedback and other systemic qualities	Yes	Yes	Yes
Heuristic value (leads to future learning) (Forrester 1985)1	Yes	Yes	Yes
Expresses separation between "reality" and "model"	Yes	Yes	Yes
Lends itself well to lay use	Yes	Yes	Perhaps
Builds agreement among diverse stakeholders	Yes	Yes	Yes
Designed to build consensus among participants	Yes	No	No
Expresses change over time	No	Perhaps	Yes
Embraces multiple perspectives	No	Yes	Yes
Expresses power dynamics at work within the initiative itself	No	Perhaps	Likely
Designed for use in a highly bounded, stable or organizational context	Yes	Perhaps	Seldom
Expresses stocks (accumulation) and flows (movement) of resources	No	Perhaps	Yes
Lends naturally to measurement of key dynamics	No	Perhaps	Yes

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