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Introduction to special issue: smallholder value chains as complex adaptive systems

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Abstract

Purpose – The purpose of this paper is to introduce a new conceptual framework for smallholder value chains based on complex adaptive systems.

Design/methodology/approach – The authors review the application of the framework to three case studies and explore their implications. The authors reflect on the value of a framework based on complex adaptive systems compared to alternative frameworks.

Findings – The authors argue that the dynamics of smallholder value chains have received insufficient attention.

Research limitations/implications – By focusing on these dynamics and on the capacity for adaptation among value chain actors the framework provides a new perspective on smallholder value chains.

Originality/value – Complex adaptive systems provide a useful framework for analyzing value chain dynamics.

Keywords Agriculture, Development, Value chains

Paper type Research paper

Civilizations are highly complex systems [...] Such systems can appear to operate quite stably for some time, apparently in equilibrium, in reality constantly adapting. But there comes a moment when they “go critical”. A slight perturbation can set off a “phase transition” to a crisis – a single grain of sand causes an apparently stable sandcastle to fall in on itself [...] A small input to such a system can produce huge, unanticipated changes [...] Causal relationships are often non-linear, which means that traditional methods of generalizing from observations are of little use [...] certain complex systems are wholly non-deterministic, meaning that it is next to impossible to make predictions about their future behavior based on past data [...] civilizations of all shapes and sizes exhibit many of the characteristics of complex systems in the natural world – including the tendency to move quite suddenly from stability to instability. (Niall Ferguson, *Civilization*, pp. 299-302).

Anyone familiar with smallholder value chains in developing countries can immediately recognize the force of this analogy. As with civilizations, smallholder value chains share several characteristics of complex adaptive systems, including sensitivity to initial conditions (“a single grain of sand”), shocks that are generated from inside the system and sudden changes from equilibrium to crisis, creating uncertainty in the minds of value chain actors and the need for constant adaptation, which makes the performance of these value chains difficult or even impossible to predict.

Uncertainty in smallholder value chains relates to diverse, often interrelated areas: insecure agricultural production due to altering pest and disease pressure, climate change and variability, and fluctuating availability of labor; market dynamics, with shifts in supply and demand patterns which, in turn, are linked to demographic change; technological innovation,



which influences inputs, production, storage, processing, packaging, and distribution; policy change, including modifications of the regulatory framework (e.g. food safety standards) and voluntary standards systems driving the behavior of value chain actors; and institutional change, with repercussions on the support environment (e.g. delivery of technical, business and financial services). Embracing the idea of value chains as complex adaptive systems has powerful implications for how development agencies and the private sector work to support smallholder participation in value chains, for how they design interventions, and for the tools and methods used to assess and monitor progress. Although thinking about complex systems has had a significant influence on economics (Anderson *et al.*, 1988; Arthur, 2015), however, its influence on thinking about smallholder value chains has been limited.

Yet recent years have seen significant changes in the dynamics of smallholder value chains. Globalization has seen the emergence of Northern-based lead buyers that can influence the terms on which actors in developing countries participate in international markets (e.g. Dolan and Humphrey, 2004; Gibbon and Ponte, 2005). This has been accompanied by changes to the business environment in which smallholders and small businesses in developing countries operate, such as the expansion of contract farming (Jaffee and Morton, 1995; Minot and Sawyer 2016), the growth of supermarkets in developing countries (Reardon *et al.*, 2008), and the growth of private standards for facilitating international trade in agriculture (Potts *et al.*, 2014). For many smallholders and businesses in developing countries, changes in the structure of markets at home and abroad have offered the potential for larger returns from market engagement, but also the need for increased investments (e.g. in infrastructure, capacity building, business organization), greater capacity to manage risk and uncertainty. Development agencies have supported smallholders and businesses to build their capacity for participation in value chains, with the expectation that engagement will contribute to poverty reduction and broader development goals (Humphrey, 2005; Seville *et al.*, 2011; Haggblade *et al.*, 2012a).

Despite this, many value chain initiatives are designed with limited understanding of market dynamics, actual and potential threats in the business and regulatory environment and, most importantly, without a backup plan when underlying assumptions prove to be wrong. This “best guess” approach to the value chain development (VCD) does not serve the long-term interests of smallholders, businesses, and other stakeholders interested in effective and efficient development programming. Meaningful guidance for the design, implementation and assessment of VCD initiatives requires a better understanding of how complexity plays out in the context of smallholder value chains and the related implications for the resource-poor and vulnerable stakeholders in the upstream segments of these chains, their business partners further downstream the chains, as well as policy makers and service providers supporting these chains.

This special issue of *JADEE* seeks to address this need by demonstrating the relevance of complex adaptive systems thinking for understanding the dynamics of value chains in developing countries and the implications for smallholders, their business partners and other stakeholders that engage in these chains. We begin the special issue by presenting a conceptual framework for the analysis of smallholder value chains as complex adaptive systems. This is followed by three case studies where we apply this framework to value chains where smallholders and downstream buyers and processors confronted major shocks and/or uncertainties in the system. The case studies analyze the value chains and their actors, the nature of the shocks or uncertainties faced, the adaptive capacity of chain actors, and the implications for the design of future VCD initiatives that recognize the limited capacities of smallholders and other resource-poor value chain actors.

This introduction has two objectives. First, we review the application of the conceptual framework and some general lessons that emerge from the three case studies. Second,

we reflect on the value of a conceptual framework based on complex adaptive systems for the analysis of smallholder value chains, with specific reference to three alternative conceptual frameworks widely used by researchers and practitioners.

Applying the framework

The conceptual framework presented in this Special Issue is based on a review of relevant literature on complex adaptive systems, and particularly its application to economics. The framework identifies seven “common properties” of such systems: time, sensitivity to initial conditions, uncertainty, interacting agents, endogenous shocks, sudden change and adaptation. These are combined into a simple visual representation that also shows the connections between the various parts of the framework. We show how these common properties can be used to generate a set of research questions and illustrate through case studies how they can be used to analyze the trajectory of smallholder value chains (Orr *et al.*, 2018).

This conceptual framework can be used in two ways. One is to guide the diagnosis of specific value chains. The framework can be used to explore the dynamics of the chain and explain its performance over time. In this case, researchers may base their analysis on the common properties that they believe are most relevant for that particular value chain. The second way to use the conceptual framework is as a comparative device that can promote generalization and cumulative learning about smallholder value chains. In this case, researchers will wish to apply the complete framework to a representative set of smallholder value chains in order to assess the usefulness of the framework for identifying general lessons about the dynamics of smallholder value chains.

In this special issue, we have used the conceptual framework as a diagnostic device. In each case, we applied the conceptual framework selectively, choosing the properties that were most relevant for each individual case study. We avoided a prescriptive format or imposing an agreed structure, leaving the authors to tell the story as they saw fit. In other words, we have used the conceptual framework as a point of reference rather than force the case studies into a single, uniform mold. While this demonstrates the value of the framework as a tool for analyzing the dynamics of smallholder value chains in very different contexts, it rules out using it to make systematic comparisons. Other researchers may wish to use the conceptual framework differently, as a comparative device to develop generalizations, applying all seven common properties to a larger, carefully selected set of case studies in order to make generalizations across different contexts. However, this is beyond the scope of our study. Rather, the three case studies presented here should be seen as pilot studies, or a preliminary field testing of the framework. Since our diagnostic approach with a small number of case studies has given important insights, it seems likely that a more comprehensive application of all seven properties to facilitate comparisons across settings can deliver worthwhile generalizations about the dynamics of smallholder value chains.

The three case studies in this special issue – sorghum beer in Kenya, taro in Nicaragua, and high quality cassava flour (HQCF) in Nigeria – were purposely selected because they represented cases where smallholders and other chain actors operated in a demanding business environment, where non-governmental agencies (NGOs), government agencies and other actors had intervened in different ways in support of smallholder participation in the chain, and where the chain experienced one or more major shocks or uncertainties. The cases were not selected to highlight specific properties of the conceptual framework or to be “representative” of certain commodities or the range of smallholder value chains. They reflect the relatively close connection of international agricultural research centers with rural development processes and the context in which these take place.

The first case study analyzes the effects of an endogenous shock – an excise tax – on the value chain for sorghum beer in Kenya. This sudden change sharply reduced demand for

sorghum beer, with knock-on effects on sorghum production. Two years later, the excise tax was reversed, thanks largely to advocacy by a farmers' organization, which had the capacity to challenge government policy. The second case study analyses the impact of uncertainty on the value chain for HQCF in Nigeria. The authors identify four major sources of uncertainty – frequent changes in policy, shifts in the demand and availability of HQCF, the availability and price of cassava roots, and energy costs – which have hindered the development of the value chain. Business actors in the value chain have responded to uncertainty in different ways but the authors argue that, by “reserving the right to play,” the milling industry has paralyzed the growth of the chain. Finally, the third case study analyzes the effect of an endogenous shock – the failure to meet quality standards – on the smallholder value chain for taro in Nicaragua. Here an ambitious attempt to break into the US market collided with market realities that inexperienced farmer cooperatives were not equipped to deal with, and where failure to adapt spelt the death of this particular supply chain. Adaptation in this case required long-term investment in building capacity which was not forthcoming because it was less attractive to international NGOs seeking quick wins and tangible “results.”

Table I summarizes the case studies in relation to the seven common properties of complex adaptive systems identified in the conceptual framework. All three case studies

Value chain Location	Sorghum beer Kenya	High quality cassava flour Nigeria	Taro Nicaragua
<i>Common properties of complex adaptive systems</i>			
1. Time	1980-2016	1980-2016	2005-2016
<i>Key forces driving change</i>			
2. Sensitivity to initial conditions	Government agrees zero excise duty on sorghum beer	Government stipulates inclusion of HQCF in bread flour	Dependence on US market Stringent quality requirements for exports
3. Endogenous shocks	Government imposes excise duty		US buyers switch to alternative suppliers
4. Sudden change	2013 Budget following election		Exports to US collapse
5. Uncertainty	Conflict between development and fiscal objectives Brewers stop buying sorghum	Government changes HQCF inclusion rates Low demand for HQCF from wheat millers Competing demand for cassava roots Energy supply and price	Cooperatives lack capacity for quality control Cooperatives lack close relationship with US buyers
<i>Responses</i>			
6. Interacting agents	Smallholder organization lobbies government	Wheat millers successfully resist inclusion of HQCF	Cooperatives fail to reach agreement with US buyers
7. Adaptation	Brewers develop substitute for sorghum beer Government reduces excise duty	Smallholders supply alternative cassava value chains HQCF processors seek alternative buyers	US buyers switch to other suppliers Smallholders switch to other crops
<i>Outcomes</i>			
	Supply chain for sorghum beer recovers	Supply chain for HQCF stagnates, while chains for alternative cassava products prosper	Supply chain for taro exports fails, limited domestic market

Table I.
Comparing applications of the framework across three case studies

analyze dynamics over time. The period covered extends from 11 years in the case of taro to 36 years for sorghum beer and HQCF. All three case studies were sensitive to initial conditions. In the case of sorghum beer and HQCF, the initial impetus came from a government policy decision, while in the case of taro it came from reliance on a single export market. In the case of taro, this proved fatal. Two of the value chains experienced endogenous shocks that were related to these initial conditions. These endogenous shocks were also sudden: overnight in the case of the budget decision to impose excise duty on sorghum beer, while the collapse in the export of taro took just four years. In combination, sensitivity to initial conditions, endogenous shocks, and sudden change created uncertainty, which was a common feature of all three value chains. In the case of sorghum beer, uncertainty arose from conflicting policy goals, with government prioritizing fiscal over development objectives. For taro, uncertainty lay in the lack of a close relationship between cooperatives and US buyers, which led to rejected shipments. In the case of HQCF, uncertainty had multiple sources, on both the supply and demand sides, which combined to frustrate the development of the value chain.

Two common properties – interacting agents and adaptation – capture the responses to this uncertainty. Decisions by one actor can spark a chain-reaction among other players. This “cascade” of decisions is illustrated by the snapshot of the value chain for “khat” in Kenya (Orr *et al.*, 2018). For taro, the reluctance by international NGOs to strengthen the capacity of cooperatives had consequences for other actors, restricting membership for growers and also the breakdown of commercial relationships with US buyers. In the case of sorghum beer, the coalition of agents that created this value chain broke down when government lost trust in the brewery. It took concerted action by a well-organized smallholder lobby and a reputed think tank to overcome this breach. In the case of HQCF, the resistance of the milling industry to substitute cassava for wheat flour, in defiance of government policy, effectively prevented the growth of the value chain.

Adaptation is perhaps the single most important feature of complex adaptive systems. All three case studies contain extended discussions of adaptation, partly because this determines whether certain supply channels or even the value chain itself survive, but also because the capacity for adaptation seems to be missing from many smallholder value chains. In the case of taro, the failure of cooperatives to adapt to the stringent quality standards of international trade, when combined with the ability of US buyers to simply switch suppliers, was the determining factor in the collapse of the value chain. Similarly, brewers in Kenya were able to adapt to the loss of their market for sorghum beer by swiftly introducing a new product. Smallholders in Nigeria and Nicaragua were also flexible, switching to other crops or supplying rival value chains. Options for sorghum growers in Kenya were more limited. However, a strong farmer organization had the capacity for adaptation that was needed to rescue the value chain from a potentially lethal policy change.

The seven common properties provide entry points for the analysis of smallholder value chains. The properties themselves can be explored more fully using a different set of analytical tools. The concept of adaptation, for example, is central to the framework, but this concept can be understood in different ways. The literature on business management is a fertile source of ideas.

The case study on HQCF in Nigeria employs a typology of adaptive strategies – shaping, adapting, and reserving the right to play – to analyze how business actors in the value chain responded to uncertainty. Similarly, the property of interacting agents and the need to understand decision-making by value chain actors may draw on political science. The concepts of the neo-patrimonial state and ethnicity can help explain the government of Kenya’s turn-about on sorghum beer. This is not an isolated instance. In Ghana, the ethnic rivalry between President Nkrumah’s Akan tribe and Ashanti cocoa growers in the 1950s

resulted in punitive taxation that destroyed the value chain. Recovery came only in the 1980s when power passed to a different ethnic group (Easterly, 2013). These examples suggest the need to go beyond the seven common properties themselves and develop sub-frameworks for deeper analysis. The conceptual framework is only a starting point which opens the door to a creative process of analysis that may employ a range of concepts from other disciplines to explore how these seven properties operate in specific contexts. The framework should expand rather than constrict our vision and invite us to cross disciplinary boundaries.

The case study method avoids first principles but assumes that we can derive generalizable principles from them. It is inappropriate to derive general principles from the small number of case studies presented here. However, one common feature of these three value chains is their un-predictability. In two cases (sorghum beer and taro), development was interrupted or terminated by sudden shocks, while in the case of HQCF, the expected development simply failed to materialize.

Managing an unpredictable future is major pre-occupation in the world of business. Management theory in the 1960s assumed a stable business environment that could be controlled by centralized planning (Ansoff, 1987). The energy crises of the 1970s shattered this assumption. What was the point of long-range planning if market conditions could change so fundamentally and so quickly? Today, management theory lays much more emphasis on the external forces determining business success. Markets, prices, and competition create a “turbulent” environment that leaves little scope for formal planning (Ansoff, 1990; Mintzberg, 1994). Frequently, strategies are not “deliberate” but “emerge” from the pattern of events in ways that cannot be predicted in advance (Mintzberg and Waters, 1998). The key to business success lies in finding ways to deal with “turbulence.” Instead of road maps with fixed routes, firms need compasses that provide them with strategic direction but leave room for flexibility (Whittington, 1993). Management texts in the 1980s stressed the importance of organizational flexibility in staying close to customers and anticipating market trends (Peters and Waterman, 1982). In the same way, the development of smallholder value chains requires the capacity to operate in turbulent environments and to respond quickly to changes in market conditions.

Uncertainty in the business environment makes VCD an inherently tricky proposition. Of course, there are examples of successful smallholder value chains. The value chain for teff in Ethiopia is a prime example – although success was apparently achieved without direct support from government and donors, except for plant breeding (Minten *et al.*, 2013a, b). In Bolivia, the Brazil nut value chain is a prominent example for sustained benefits of smallholders and other resource-poor value chain actors over many decades (Stoian, 2004; Guariguata *et al.*, 2017). Nevertheless, in the competitive world of rural development and agricultural research where there is a premium on success stories, it is salutary to be reminded of failure. “Success stories” are rarely revisited to assess their performance over time. The value chain for *camu camu*, once heralded as a commercial success for smallholders in the Peruvian Amazon, has subsequently suffered a sharp decline in export demand coupled with limited demand at home, suggesting “partial success” at best (Blare and Donovan, 2016). Where interventions in value chains have failed, there is a tendency to blame development agencies for not following “best practice” – the management equivalent of “pilot error.” This technocratic view of failure with its faith in procedures overlooks the complexity of smallholder value chains where uncertainty and sudden, internal shocks are constant threats. Value chain actors may have only a partial understanding of these threats or they may be outside their control. In a system with so many unknowns, success is never final – but by the same token, neither is failure.

From the perspective of complex adaptive systems, failure reflects the inability to adapt. The case studies demonstrate the importance of adaptation for the sustainable development

of smallholder value chains. Clearly, the high rate of failure in the business world shows that adaptation is not automatic. What makes adaptation difficult and success so elusive? Here evolutionary biology offers an important insight. Successful evolution is not the result of getting one factor right but about “avoiding many separate possible causes of failure” (Diamond, 1998). In short, a successful smallholder value chain is one that avoids a combination of potentially fatal threats. Some of these threats are known and can be avoided in advance. But others are unknown. In a complex adaptive system, all the possible causes of failure cannot be predicted. It is this capacity of complex systems to generate the unexpected – what Helga Nowotny (2016) calls “the cunning of uncertainty” – that really tests the capacity for adaptation. Avoiding many separate possible causes of failure requires the ability to adapt to the unexpected. Where this capacity is lacking, external support to create this capacity may be essential for the value chain to survive. Organizations supporting VCD, be they governmental or non-governmental, can support smallholders by doing a sound risk assessment prior to interventions, establish an effective system for monitoring, evaluation and learning for adaptation along the way, and having a “Plan B” for situations of major change where adaptation is not an option. In such cases, smallholders and other resource-poor value chain actors can benefit from an alternative strategy that compensates for income shortfalls resulting from a major change in the original value chain.

Implications of this framework

Seek complexity and order it. (Clifford Geertz, 1968).

Frameworks attempt to reveal the hidden order in complexity. Reflecting on these three case studies raises wider questions. Does a framework based on complex adaptive systems say anything new? What (if anything) does it add to existing frameworks and ways of seeing smallholder value chains?

The novelty of a framework based on complex adaptive systems is that it focuses squarely on value chain dynamics. Experience suggests that smallholder value chains not only operate in a rapidly changing business environment but often lack the management capacity to successfully adapt to changing conditions. A framework based on complex adaptive systems offers a way to conceptualize these dynamics, to identify which dynamics have the greatest potential impact on the performance of the chain and to highlight the need for strategies and tools that can assist adaptation.

Alternative conceptual frameworks for VCD pay limited attention to these questions. The three most widely known frameworks are the guides to VCD developed by development agencies, the framework based on global value chains (GVC) and that based on new institutional economics (NIE). Below, we summarize the main differences between these frameworks and one based on complex adaptive systems.

Many development agencies have developed guides to VCD (Donovan *et al.*, 2015). These share many common features: value chain mapping, identifying opportunities for upgrading, and calculating value addition and profitability for each business actor in the chain. But they are short on advice about what might go wrong. A recent review of 11 guides to VCD concluded: “The guides are designed to be implemented largely independently of the specific context in which the chain is situated, despite the major implications context has for the design of interventions and overall success of the chain” (Donovan *et al.*, 2015). Consequently, they may fail to identify killer assumptions (“sensitivity to initial conditions”), the potential effects of unexpected events (“endogenous shocks” and “sudden changes”), their cumulative impact on the value chain (“uncertainty”), the quality of the relationship between key actors (“interacting agents”) and the capacity required among actors in the value chain for successful adaptation to these threats. As a result, smallholder value chains may be caught unawares by changes in market conditions

and be ill-prepared to adapt to these changes quickly and effectively. In short, the standard guides to VCD offer limited help on how to anticipate and handle change.

The GVC framework has been widely adopted by development agencies (Werner *et al.*, 2014) and applied to case studies of agricultural value chains (e.g. Daviron and Gibbon, 2002), elaborated by Gibbon and Ponte (2005). This framework was developed to explain the role of multi-national buyers in determining the conditions in which producers and businesses in developing countries participated in international trade. It responded to the changing architecture of world trade following the collapse of commodity trade agreements and market liberalization in developing countries. Table II shows the relevance of this framework for our four case studies.

The focus of the GVC framework has been on traditional export crops (cocoa, coffee) or on new high-value crops (e.g. horticulture, ornamental plants) that are traded on world markets. However, sorghum beer and HQCF are traded in national markets. They are not buyer driven, in the sense of being controlled by lead firms that specialize in retail or branding rather than manufacturing. Indeed, buyers face stiff competition when sourcing raw materials of these staple food crops. They are not subject to stringent quality standards (beyond fair average quality) that reinforce control by buyers. Indeed, formal grades and standards for these crops may not exist or are not enforced. In cases like these, the seeds of success or failure in the value chain must be sought not in the vagaries of the world market or the dominance of lead firms, but in the specifics of the crop and the local situation (eg. Cramer, 1999). On the other hand, the commercialization of staple food crops does give greater control over product diversity to buyers, who can specify the crop varieties with the market traits that they require, or pay premiums for quality. The collapse of international commodity agreements resulted in new forms of vertical coordination as business actors combined different functions in the value chain. For example, processors became exporters or buyers set up exclusive contracts with local exporters. This has not happened with our case studies, except for HQCF where we see the emergence of vertical integration as millers invest in large-scale mechanized production.

By contrast, the GVC framework is clearly relevant for crops that enter international trade. Applying this framework focuses our attention on the buyer-driven nature of these value chains. In the case of taro, importers switched to lower-cost countries and the need to meet quality conventions for the US market exposed weaknesses in adaptation among cooperatives. The GVC framework offers important insights, though without adequately describing the stepwise adaptations by smallholders and other actors in the upstream segments of the value chain to the new market conditions. In the case of taro, although traded internationally, buyers' reach did not extend beyond arranging for the delivery of the product and setting basic quality standards. The larger challenge for the value chain actors in Nicaragua was meeting US regulations for fresh vegetable inputs. A framework based on complex adaptive systems highlights the need to build capacity for adaptation among business actors, and for better planning and coordination among stakeholders to

Smallholder value chain	Sorghum beer	High quality cassava flour	Taro
<i>Attributes of GVCs^a</i>			
Global market	No	No	Yes
Buyer driven-ness	No	No	Yes
New quality conventions	No	No	No
Changing control over product diversity	Yes	Yes	No
New forms of vertical coordination	No	Yes	No

Note: ^aDaviron and Gibbon (2002)

Table II.
Relevance of the
global value chain
(GVC) framework

respond to unanticipated changes in the business environment. These are important lessons for international NGOs, governments and donors seeking to develop smallholder value chains.

Another strength of a framework based on complex adaptive systems is its relevance for specific supply channels within smallholder value chains. Within a single value chain there may be four different business models (Haggblade *et al.*, 2012b). While the GVC framework is relevant for type 3 (contract farming) and type 4 (integrated agri-business), our case studies fall into type 1 (individual smallholders in spot markets) and type 2 (organized smallholders in spot markets). Value chains where smallholders sell in spot markets face a distinctive set of problems. Generally, demand is not the critical issue determining the development of the chain. This is true particularly for staple food crops like cassava and sorghum in Africa, where markets for these crops are growing rapidly thanks to population growth, urbanization and an expanding middle class. Likewise, demand may not be the critical constraint for smallholder crops selling in international markets, as the example of taro shows. Instead, the critical problems lie on the supply side, including year-to-year fluctuations in production and competing uses between sales and home consumption which affect the continuity of supply, or in the absence of coordination between business actors, government, and NGOs, and the lack of capacity among some business actors to adapt quickly to changing market conditions. This creates an uncertain business environment in which a number of things can go wrong. When we add limited capacity for adaptation, then clearly the development of these value chains will not be plain sailing.

Finally, the conceptual framework based on NIE views VCD as determined by institutions (“rules of the game”) that encourage investment by reducing systemic risks and transaction costs (Dorward *et al.*, 1998; Dorward and Kydd, 2004). This framework has proved useful in identifying potential sources of weakness or “market failures” in national as well as global markets. However, the primary focus of the NIE framework is on structure. Viewing smallholder value chains as complex adaptive systems adds an extra dimension, because it turns the spotlight on adaptation. This directs our attention to the interaction between value chain actors and the room for maneuver that they have in responding to turbulence in the chain. In other words, the primary focus is on agents. Naturally, this focus on agency has its dangers, and has to be balanced with recognition that the structure in which value chain actors operate imposes limits on their powers of adaptation. The framework of adaptive complex systems can help us to determine the boundary between agency and structure, and suggest where those possible limits to adaptation operate and where they can be overcome.

All interpretative frameworks run the risk that, by imposing order on complexity, they conceal as much as they reveal. The specific and the unclassifiable are sacrificed on the altar of theory. This is also true of complex adaptive systems, where there is an inherent paradox in seeking order in complexity or “chaos” which may by definition defy order. In the GVC framework, case studies of individual value chains become “historical specificities” relegated to the “empirical background” (Daviron and Gibbon, 2002). While this is the approach of the social sciences but it raises the question: What are we missing? Are there elements in these case studies, or in other case studies, that do not fit the framework of complex adaptive systems? Just as the GVC framework admits the existence of “exceptions” (Daviron and Gibbon, 2002) so there must be negative instances for the framework proposed here. One example is where the value chain is controlled by a single ruler. President Marcos of the Philippines, the world’s largest producer of coconuts, used his power to fleece the smallholder value chains for copra and coconut oil (Boyce, 1992). Understanding his behavior and the fate of this value chain does not require a conceptual framework based on complex adaptive systems. We need more case studies that will challenge the framework and test its assumptions.

In conclusion, we do not claim that a framework based on complex adaptive systems is essential to understand the dynamics of smallholder value chains. Asked to examine the origins and effects of the excise duty on sorghum beer in Kenya, an analysis that took a standard value chain approach would address many of the same questions, such as the conflicting agendas of different value chain actors, their interactions, the effect of this shock on the value chain, and the implications for the future of the chain. This reflects the power of the value chain approach. In particular, if we define a value chain as a strategic network through which “exchange develops, adapts, and grows” (DFID, 2008) then the results of the analysis may be similar. The concept of a value chain is itself based on systems thinking, where components are inter-connected. In short, we do not claim that a perspective based on complex adaptive systems poses new questions that are required to understand the dynamics of smallholder value chains or gives unique insights into these dynamics.

What we do claim, however, is that many of the questions required to understand these dynamics can be found in complex adaptive systems. The framework turns the spotlight on the twin problems of dynamics and adaptation. All value chains experience sudden shocks, are created by interacting agents, and change over time. Where they differ is in their capacity for successful adaptation. In our view, this framework can deepen our understanding smallholder value chains in two ways:

- (1) *Ex post*, by directing our attention to the capacity for adaptation in the value chain. Viewing smallholder value chains through the lens of adaptation can sharpen our analysis in several ways: identifying the key factors required for successful adaptation, highlighting the critical role of a specific actor in the process of adaptation, or explaining why adaptation took a particular form.
- (2) *Ex ante*, by directing our attention to the critical factors that could determine the sustainability of smallholder supply channels within the value chain. Often these factors are specific to the local context which is neglected by many VCD guides. This highlights the need to identify these threats in the diagnostic phase of VCD, and to build the capacity of value chain actors to adapt to these threats as part of VCD.

Adaptation itself has become increasingly central to the world in which smallholder value chains now find themselves. On the one hand, globalization has intensified competition in world commodity markets, while urbanization and the growth of Africa’s middle class have created new domestic markets. At the same time, privatization and market liberalization have given responsibility for governance to the value chain actors themselves. Global warming may also increase the frequency of natural shocks, making markets and prices more volatile. All this has increased the need to adapt swiftly and effectively to changes in market conditions. If this Special Issue helps to spark fresh thinking about the issue of adaptation in smallholder value chains, its purpose will have been well served.

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