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# Value Chain-Induced Constraints Limiting Scale of Conservation Agriculture in South Africa

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## Abstract

The potential of scaling conservation agriculture (CA), for long-term food security, remains under-investigated within the context of agricultural food value chains in South Africa. To scale the use of CA an understanding of the current agricultural value chains, their functioning, regulatory framework and constraints, is essential and this raises a key question: What are the main shortfalls and deterrents in agricultural value chains and why might CA be faced with challenges to feed into these existing structures, through which it could, the hopes are, create a more inclusive and sustainable farming system for long-term food security? The empirical data from an ethnographic qualitative participant research showed that interviewed value chain participants (VCP) are limited in acting on account of their economic constraints. None of them had products that supported CA, while financial institutions argued that such products would not be necessary, as any risk mitigating farming system would, in any event, result in financial benefits to the farmer.

**Keywords:** agricultural value chains, sustainable agriculture, agricultural economics, agricultural finance, farm ecology & policy

## 1. Introduction

Biodiversity is the planet's greatest asset [1]. Anthropocene-induced species loss is estimated at up to 10,000 times the rate of natural extinction, in which Hui et al. [1] argue agriculture, next to overfishing, industrialisation and urbanisation, plays a considerable role. Humans rely heavily on ecosystem services, which include cleaning air and water, stabilising weather, maintaining soil fertility, dissipating waste, controlling pests, pollinating crops, generating power and discovering new antibodies, and providing food, timber, cloth, medicine, minerals and industrial materials such as coal, oil, gas, rubber, plastics, and chemicals [1]. Humans have never contributed to such flows, but have always made use of them, today at a rate, where such ecosystem services are less likely to be available indefinitely.

Planetary boundaries, a concept developed by Rockström et al. [2], which identifies safe operating spaces within earth systems, such as climate stability, fresh water, land system change, ocean acidification, phosphate and nitrogen biochemical flows and biosphere integrity, are integral parts of the ecosystem services and represent our planet's limits in supplying such services within the principles of our

planet's carrying capacity. To sustain humanity, we need to manage its biosphere within that carrying capacity, to maintain such services, and avoid regime shifts, mass extinction or repeating boom-bust patterns of earlier civilisations which were unable to manage their natural resources and regional carrying capacities [1].

## **1.1 Problem statement**

Of Rockström's et al. [2] and Steffen's et al. [3] eight planetary boundaries, agriculture is by far the biggest contributor to defined limits of five of the boundaries; fresh water use, climate change, change in nitrogen and phosphate bio-chemical flows, land-use change as well as biodiversity loss. Agriculture also contributes up to 30% of CO<sub>2</sub> emissions to climate change [4, 5] and is, due to feedback loops from nitrogen and phosphate bio-chemical flows and deforestation, also a great contributor to biodiversity loss [2, 3].

Nelson et al. [6] suggest that due to climate change, global agricultural output is likely to decline between 10 and 15% in the next 60–70 years and even up to 50% in drier regions of Africa. Compared to the rest of the continent, arguably, much of South African (SA) agricultural land is located within such dry regions. With predicted changes, SA might need to consider whether its conventional farming (CvF) systems are appropriate going forward, while on the other hand evidence shows that alternatives, more sustainable farming systems such as CA, are comparably more climate resilient [7–9]. Arguments that farmers should adapt to such production systems in order to mitigate an output reducing impact due to climate change are weighing in more and more.

Low tillage, a form of CA regularly practiced in KwaZulu-Natal (~60%) and the Western Cape (>70%), indicates that in two provinces good headway has been made in favour of CA; yet finds little to no adoption in other provinces [10]. CA is based on three principles, no-till, crop rotation, and cover crops (residue retention) to increase both soil organic matter, aggregate stability and water holding capacity, while reducing soil bulk density, erosion, carbon emission and exposure to drought and ultimately increased yield [11]. With rain-fed crops in dry climates, CA can significantly increase productivity [12]. Pittelkow et al. [12] also argue that this indicates that CA will play an important role in mitigating the impacts of climate change. Therefore, CA is one of many farming practices farmers can adopt to farm with less environmental impact, while preparing for climate change.

Midgley et al. [13] argue that while South Africa's National Development Plan has identified agriculture as a primary economic objective, although not explicit, it is biased towards large scale, commercial and CvF practices, such as tillage and monoculture. South Africa's Integrated Growth and Development Plan [14], as well as the Agricultural Policy Action Plan [15], on the other hand, promote equitable growth and sustainable use of resources.

Food security is defined as having access to food of nutritional value at all times [16]. In this article we argued that CvF in a world of climate change poses a risk to food security, while a focus on more sustainable farming practices such as CA uses less water, requires less nitrogen and phosphate, sequesters CO<sub>2</sub> and diversifies the ecosystems of farmland, with the ability to decrease soil erosion, increase soil life and fertility and other ecosystem services to the benefits of a farmer's long-term profitability [11, 13, 17, 18]. Its uptake, however, remains low in SA. We argue that CA has an important role to play in a transition and show why, from evidence of our research, CA does not find support from SA food value chains.

This leads to questions such as: why CA adoption rate remains low; what role agricultural VCPs can play to promote CA; and what institutions, policies, and VCPs are responsible for hindrances to adoption? What limitations do VCPs themselves

experience in potentially supporting CA, and how do feedback loops in existing business models of VCP block a transition to CA?

## **1.2 Research approach and design**

Our study was undertaken as an ethnographic based research exploring business cultures and morals using qualitative semi-structured interviews. The questions for the research participants (VCPs) were not directed at any commodity in particular; however, because we also questioned silo owners and millers of maize, answers of some VCP often hinged around maize, also a main crop type in South Africa [19]. The choice of businesses interviewed was based on their involvement in the food value chain and their general size and importance they played and impact they had in their respective industries. Because of the sensitivity of the topic the interviewer needed to let go of any presumptions and assumed a less critical and more supportive attitude to attain more unbiased responses from the participant.

The interviews were then transcribed to attain primary qualitative data. For the coding and categorising, we used grounded theory as an inductive systematic methodology typically used in social sciences to analyse qualitative data and give it conceptual structure through categorisation of general themes emerging from the data [20–23].

Preceding the analysis and results of the research data, we reviewed literature to assess existing knowledge around the challenges facing existing economic and ecological farming systems and relate it back to CA.

## **2. Literature review**

Conventional agricultural systems, particularly practiced in the developed world, produce vast amounts of food, yet they come at a significant cost to the environment. While the situation is complex, the details are often not acknowledged; in the following we outline high level important aspects that challenge the long term economic, social, and ecological sustainability of CvF and then show what alternatives exist that could replace CvF practices.

### **2.1 Problems of conventional agricultural systems**

Covering 1/3rd of the planet's surface [24] agriculture has resulted in disturbed ecosystems [25–27], land degradation [28], loss of biodiversity [29–31], leaching fertiliser, nitrification of groundwater, eutrophication of above groundwater ecosystems, coastal dead zones [26, 32], small organism mortality [33, 34], and biological resistance build-up against agrochemicals [35–37]. Modern industrialised agriculture and overgrazing are blamed for destroying a third of the planet's topsoil within 40 years, adding 10 million hectares every year to the toll of soil erosion [38] which is 100 times faster than naturally occurs [39].

We deploy 2½ million tons of pesticides and fungicides annually and nevertheless lose 40% of crops globally to pests, diseases and weeds [40], while its use is also responsible for over 40,000 human deaths and 3–5 million cases of pesticide poisoning every year [41]. At no time in history has agriculture had such a high impact on the environment than in the last 100 years [25, 42–44].

### **2.2 Resource hungry agriculture's impact on planetary boundaries**

Agriculture globally occupies 13 times more land than any other Anthropocene land use [24] and is arguably the biggest contributor to biodiversity loss and



altogether the greatest human impact on our “planetary boundaries” [2]. Seventy per-cent of all freshwater globally is used for agriculture [41], while in SA it is estimated to be 63% [45] with no surplus for future development [46]. Agriculture is energy-hungry, emitting up to 25% of global CO<sub>2</sub> [5, 47–49], while the USA uses 17% of all its energy to get food through the value chains onto its tables [50]: that is 1000–1500% more energy than what the food itself contains in the form of energy [48, 49].

Food-related health issues, like diabetes in industrialised countries [25], keep growing, as the nutritional value of fruits and vegetables dwindle [51–53] and are less present in conventional farmed produce than in organic produce [54]. Nutritional losses continue to occur during processing and storage, typical for industrialised food systems [55–57].

“The roots of this crisis lie in the preceding decades of excess...” says the global financier George Soros and “...for 25 years the West has been consuming more than we have been producing...living beyond our means” Australian Prime Minister in the Sydney Morning Herald July 25th 2009 [58]. Consumption and growth cannot continue ad infinitum on a finite planet [59]. However, our entire economic model is based on growth funded by debt [60, 61], and as unlikely as economic growth can continue indefinitely, growing debt by civil society, businesses, and government, will also find its limits. A bubble is likely to burst once planetary boundaries and ecosystem services [62, 63], needed to fuel the growth, reach their limits.

### **2.3 Benefits of agroecology, organic farming and conservation agriculture**

CA practiced with LEI, in combination with cover crops, has the ability to harvest atmospheric nutrients, build soil organic matter, increase soil life, loosen soil, increase water holding capacity and aggregate stability, reduce soil compaction, reduce erosion, recharge the water reservoir, improve water quality, reduce nutrient leaching, and increase pest, disease, drought resilience, and CO<sub>2</sub> sequestration [64–71]. A favourable argument in using cover crops as part of CA is the financial viability with increased crop yields and decrease input costs [65, 72, 73].

The yield gap between CvF and organic farming (as another sustainable production system with many parallels to CA), especially with proper diversification practices, is 8–9% smaller than originally estimated [74]. Using 1 ton less synthetic nitrogen fertiliser in organic farming saves the equivalent of 5.2–7.6 tons of carbon emissions [75]. Organic fertiliser in Ethiopia have increased yield by 2–3 times, outperforming inorganic fertilisers [76]. In the US, organic farming achieves comparable yields, but are 28–34% better during droughts [7–9].

Conventional tillage increases soil-based CO<sub>2</sub> respiration and has almost 14 times the carbon emission than no-till [77]; additionally exacerbated by warming global temperatures [78, 79], adding up to 50Pg of soil carbon emissions for the Anthropocene, due to tillage [80]. Organic agriculture uses 2–7 times less energy than conventional agriculture [81, 82] and sequesters 5–15% of greenhouse gas emissions [83, 84]. Tropical agro-forestry systems can sequester between 4 and 6 ton/ha of carbon annually [85–87]. Coghlan [88] even argues that trees planted by local farmers in the Sahel can push back the desert.

A study in Europe has shown that organic farms support more birds, butterflies, beetles, bats and wild flowers than conventional farms, while biodynamic farms have higher levels of soil fertility than organic farms and considerably higher than conventional farms [89, 90].

While we see clear benefits to more sustainable farming practices, such as CA, penetration in South Africa remains low and highly variable between provinces [11], the question remains, why are we not seeing CA products in retail shelves more regularly, or why, when CA poses less risk, do financial institutions not promote CA?

### 3. Value chain research findings

The findings of this research are concluded from data collected through interviews with some of the largest agricultural VCPs in South Africa, trying to assess if there are blockages inhibiting CA produce from penetrating the market on a broader scale, and if there is potential scalability of CA produce through these value chains. The following narrative details the results of our interviews.

#### 3.1 Banks

The benefits for banks to promote CA to farmers is to end up being less exposed to risk themselves; a capital exposure risk due to drought, potentially exacerbated by climate change. We interviewed four of the largest banks in South Africa, all of whom have been supplying credit to commercial farmers for decades. We asked them whether they had CA tailored products with reduced premiums for farmers because of less perceived risk. Almost all interviewed banks responded in one way or another, saying that they fundamentally did not get involved with production-based decisions around farm practices, such as CA. Three banks argued that these were decisions farmers needed to make for themselves, and as one bank put it, banks would otherwise be in conflict with lender's liability principles.

All of the four banks argued that good production practices for a farmer automatically showed up in production output benefits and a better balance sheet, which in turn would result in a lower risk profile for a farm and in turn, result in a cheaper credit with better premiums. The argument that this might take years for farmers to achieve was generally responded to that that was the nature of farming. One bank confirmed their view that a production method changeover, specifically to CA, would more likely result in an initial increase in cost and reduction in yield, before any yield increases could be observed and benefits would reflect on the balance sheet for farmers to attain better premiums.

Subsequently none of the banks supplied a product that would give farmer credits with reduced premiums should a farmer convert to CA. Only one of the interviewed banks was aware of research that evidenced that CA was a less risky production method, especially in times of drought. Two of the banks stated they would not plan for a specific product for farmers that would entice them to do CA if research were to evidence CA was actually a less risky production method. In contrast the other two banks indicated that they would think about making CA part of the funding application decision or create a product that would have less 'hurdles' during credit approval process, if research showed CA did reduce risk.

All four banks, however, agreed that if CA mitigated risk, it would in any event ultimately reflect on the financial track record and performance over time and subsequently reduce their risk profile, in turn again reducing the premiums these farmers would have to pay. However, a credit offer always remains a decision based on analysing every farm's risk profile, individually.

#### 3.2 Insurers

Insurers are first and foremost exposed to hail and then to drought. Insurers' willingness to take on climate risk on behalf of the farmers makes them also susceptible to the farming practices of the farmer, particularly where new machinery and farming principles such as CA have the ability to reduce drought risk and risk of exposure for insurances. The benefits for insurers to promote CA to farmers is not only about reducing risk of capital exposure to drought, but also other climate change risks and the impact of pests and diseases. With a lower risk premiums

insurers charge could be less, which would add economic benefit to the farmers and speed up adoption of CA and a transition to more sustainable farming practices.

We interviewed three of the largest insurers, who together cover around 80–90% of the market in South Africa. None of them had a product tailored to accommodate farmers that farmed with CA practices, or a product that supported the adoption of CA, and none of them indicated that they were thinking of having such a product in future.

When confronted with the questions whether they knew about research that evidenced that CA resulted in more climate resilience and less water stress the insurers argued, similar to banks, that their business model with the way the calculations were done for pricing policy premiums, would automatically benefit those farmers who chose good farming practices that gave consistent yield and had the ability to decrease risk of crop loss at the same time. For example, a farmer that could consistently show stable historic yields, even during draught or 'environmental shocks' would automatically get a cost benefit on the premium of the policy, than a farmer that had bumper yields in good years, but suffered great losses during droughts.

One insurer said, the principle of insurance hinges around good practice, no matter if you use CvF practices or CA practices. Good practice reflects in the historic records, which they would use to price the premium. However, to attain such benefit the track record and historic proof needed to be in place and that would take a few years before reflecting as a better guarantee against crop loss or as a better price on the policy, or both. Farmers who made use of a lot of fertiliser, yet did not look after their soils, this insurer said, might well be likely to show more yield than CA farmers in bumper years, but were also much more likely to suffer greater losses during challenging years. Another insurer said that a well-developed underwriting process would pick up such fluctuation risks and subsequently price more expensively.

When asked whether they as insurer would think about developing products to entice the farmer to take the route of CA and get a better premium without needing to wait many years to benefit, all three interviewed insurers were not thinking of developing such products, nor seemed in favour of it. It would not work with their underwriting principles one insurer argued. One of the few risk mitigating tools they had, this interviewee said, was to work with some form of proof of historical data; you could unfortunately not insure just on a promise that something might happen.

All three of the interviewed insurers knew, or had read something about CA being able to reduce risk by being more climate resilient and building soil structure that would enhance the ability of soil to retain more water. However, to one of the insurers drought was less of a risk than crop loss due to hail and for hail CA had no solution. The interviewee said that they were less exposed to drought, as only after germination would their insurance kick in, and because germination would mitigate a large portion of risk the exposure to drought was less risky than hail. For example, if a farmer has not planted because of low rainfall, or the seed has not emerged because of low rainfall, there will not even be a policy in place to claim against, because the policy is only triggered after the seed has emerged. Because their exposure to drought was so low, getting farmers to farm CA would only have a very small effect on their business in any event, not validating the effort to develop a product targeted at supporting CA.

Another insurer challenged the notion that farmers actually understood the relationship between CA, soil organic matter, the ability to store more soil moisture and what that meant for their crops being more climate resilient. To this insurer, the one farmer he knew only wanted to do CA because of the no-till aspect, which saved fuel and was less capital intensive. This farmer was less thinking about CA benefits on future yields being at less risk due to climate change but was more interested in reducing costs.



### 3.3 Traders and processors with silos and milling

The interviewed traders and food processors package maize and maize starch products into end consumables that they sell to supermarkets. Consumers' choice in front of retail shelves influences their brand and supporting a procurement of CA produce could attach a sense of sustainability to their brand and grow an awareness amongst their consumers that their brand is ecologically just and fair to the planet's recourse base. The question is if this is a valid and sufficient argument for the traders to get farmers to supply them more CA farmed produce. We interviewed two large traders and food processors in South Africa that were also owned silos and milling operations of maize. Due to their large product profile, their answers considered a wide range of products.

The term CA generally confused both traders as they were not sure how it related to organic and GMO-free farming practices. In contrast to banks that have dedicated agricultural business units with knowledgeable staff, the traders usually purchased produce from other traders and cooperatives, without needing to understand production methods. After explaining CA in a bit more in detail, the interviewee's answers were more cantered around general sustainability including responses around organic and GMO-free produce. The general topic though was still in line with CA principles.

Because the two interviewed traders were buying from other traders, silo owners, and co-operatives, they had no control over what was in the silos from which they attained their maize, or what portion of the maize in a silo was from CA practices. One trader said they would not keep GMO maize separate, even if they had access to it, as they used about 300,000 tons of maize a month and keeping anything separate in their storage, in such type of bulk environments, would not make sense, specifically for South Africa where 70% of maize is farmed as GMO maize. This trader mostly bought from silo owners, other traders and co-ops, and other than during harvest, in order to fill their own silos, they would not buy directly from farmers.

The same trader said that if he had a farmer that farmed using CA, or was GMO-free, it would be just too small for him to go and collect a 100 tons, which is three truck loads, while they are looking for at least, between 3000 and 5000 tons to fill a silo. This trader claimed that such small quantities would not be viable within their system, where they would have to thoroughly clean an entire mill or alternately install a whole new mill for R120m. This miller did not foresee any change happening in the near future for them, and the second trader said he could not honestly comment on whether there was a trend amongst farmers to go GMO-free or CA, as they were too detached from farmers to comment.

Both traders also perceived that there was no demand for CA, GMO-free or organic, and subsequently there was no strategy within their companies to attain certain products or create product ranges that were either GMO-free, organic or farmed with CA practices. One trader confirmed that there was merely demand for GMO-free maize from an insignificant part of the population, a mostly health conscious upper-class society, who at the same time, he criticised, did not understand GMO. There was also no pressure on them from the market side supplied more GMO-free or CA produce. One trader said that they were processing huge volumes and that the odd packet of organic maize, organic flour, non-gluten flour, or GMO-free sold in Woolworths were of such small quantities that they were sourced from completely different channels and producers, rigged to supply such a niche market, which was not theirs to serve.

Both traders agreed that for them as big millers, it was not feasible to separately mill and brand for a potential small volume of GMO-free, CA, or organic demand.



While one trader believed that this situation would not change for them in the near future, the second trader said that they would switch over to GMO-free, once the majority of farmers did so as well and reliable volumes and batches could be processed in that way. However, in contrast to GMO-free, CA was not at all on the radar for them, as the market did not understand what it meant, and the demand was not there.

Around the question of how government could get involved with creating a supportive framework for CA, both responded very similarly in that open market principles of supply and demand should prevail and government should not interfere with legislation or policy. One of the traders said that they did not want a duty on maize, as it existed with wheat, especially where the duty funds disappear and are not invested back into agriculture. This interview participant said that if ever government were to think about a maize duty on such a large staple, it should be used to flow back to agriculture to change the farmers' minds to do CA. One trader responded that government should be careful not to 'play' around with the basic food needs of a nation, and should let free market forces of supply and demand regulate the food supply.

### **3.4 Supermarkets**

Similar to traders, were supermarkets to support CA through preferential procurement could likely attach a sense of sustainability to their brand and grow also an awareness amongst their consumers for being ecologically just and fair to the planet's recourse base. The question arises whether this is a valid and sufficient argument for retailers, who compared to traders have a direct engagement with end consumers, to encourage farmers to use CA.

We interviewed three major retailers in South Africa, all of whom had some form of sustainably farmed produce on their shelves already. The interview was conducted with senior employees of these organisations who were responsible for, or involved with, the purchasing of farm produce. During the interview, the respondents tended to focus their answers more around sustainably farmed products than specifically CA produce. The retailers, as became clear, have not been confronted with CA produce specifically, but usually with a host of differently and sustainably farmed produce, ranging from organic to low carbon etc.

The retailers did not have dedicated shelves that sold CA produce, as most of them had for organic products; they would either be on the same shelf and branded differently or altogether placed somewhere else. None of the retailers had CA farmed maize in their portfolio, and when asked whether they would buy CA produce if it were readily available, two of the three retailers would probably purchase CA products if there were a demand for CA produce. One retailer said it would be pointless to buy it, if the consumer did not understand what it was. To that retailer, the average consumers was more likely to understand, or have heard about GMO-free or organic produce, but not CA produce.

All three retailers agreed that there was very little understanding from the consumer side about CA, and that it was unlikely to change in future. The retailers said that a lot more education would need to take place for the average consumers to understand CA, or even organic farming, and until then, the demand is low and is likely to stay low.

However, one retailer said that it saw CA practices amongst farmers increasing, independent from market demand. They could see it, for example, through produce like sweet corn, with very successful farmers doing no-till sweet corn. To them, the increase in CA seemed likely, and it would be driven from the farmer side, as the benefits of CA were for the farmer and less for the consumer, at least at this stage.

If asked whether they would focus specific product ranges on organic, or sustainably farmed produce, the answers varied between the retailers. Although not specifically focussing on product ranges, one retailer had bad experiences of organic produce and subsequently had more grocery line products like olive oil and biscuits that were organic than fresh produce, which they had tested unsuccessfully a few years earlier. This was related to an inconsistency in supply and price premiums of 25–30% for organic produce which consumers were not prepared to pay. The second retailer said that they also did not have any specific focus on organic or sustainably farmed product ranges, but that they had a wide range of produce and groceries, with a slightly stronger hold on organic fruit and vegetables.

The third retailer had a very high turnover with one specific fruit and because it was as a high-volume product it was fairly easy to maintain the flow of this organic certified product. Through their programme, they said they would try to get as much sustainable produce as they could, and although it was not easy, the whole idea of the programme was to start making farmers think more about how they were farming.

For most retailers, the consumers understood organic farming, but not CA and responded with an unwillingness to start branding another sustainable production method and to educate the consumers. One retailer suggested a softer approach to building a stronger base for sustainability was a better way, than to go out and brand a host of sustainable production methods, it would confuse the consumers.

This retailer also argued that the consumer is often very indifferent to whether produce is farmed in a sustainable manner or not. This retailer argued that their own internal research showed that they could, for example, have tomatoes come from a producer that farmed according to their sustainability programme and another that did not and selling the tomatoes at the same price did not make the consumer chose the sustainably-farmed produce more. The retailer reiterated that it is mostly a benefit to the farmer to farm more sustainably, as many of their suppliers farmed their produce less expensively than those who did not farm sustainably.

## 4. Discussion

### 4.1 Summary of data

From both the grounded theory used to analyse the qualitative interview data and the qualitative data collected we have generated **Table 1**. There are four major themes that we could identify using coding principles of grounded theory and **Table 1** shows for each of those themes how each of the VCPs is positioned against a theme.

While some retailers supported organic products, none of the VCP had any form of products which supported CA and with exception to one bank, next to none of the VCP were thinking of or prepared to develop products related to CA. This notion also closely relates to the last column on the right, where all retailers and traders indicated that if they were to choose to support either organic or CA, they would support organic because it is an established brand. In other words, no one was prepared to engage in establishing another brand around CA.

Both retailers and traders also indicated that it is very unlikely that any of their clients would demand CA farmed produce as they were also very unlikely to understand what CA was about in first place. Across the board of all interviewed VCPs there was very little support for CA or to drive a change to more CA farming practices.

	Do you have a CA product?		Do you plan for a future CA product?		Do consumers demand CA?		What are you inclined to support?	
	Yes	No	Yes	No	Yes	No	CA	Organic
Banks (4)	0.0%	100.0%	25.0%	75.0%	n.a.	n.a.	n.a.	n.a.
Insurers (3)	0.0%	100.0%	0.0%	100.0%	n.a.	n.a.	n.a.	n.a.
Traders (2)	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%
Retailers (3)	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%
Total	0.0%	100.0%	6.3%	93.8%	0.0%	100.0%	0.0%	100.0%

**Table 1.**  
*Summary of responses around CA (sample sizes in brackets).*

4.2 Policy discussion

Generally, there was a broad confusion amongst all respondents around what CA meant, and how that related to organics and GMO. Even a retailer that was well versed in the procurement of foods from more sustainable farming practices was not sure what was meant with CA. Many interviewees believed a lot of consumer education efforts would need to happen before they could drive CA from a market-ing perspective.

While the retailers did have sustainable products like organic, branding a second sustainability label did not make sense and therefore they also did not put pressure on traders and millers to supply them with CA products. The opinion amongst the retailers and traders was that maize was purchased from other traders, cooperatives and silo owners, where there was no control over the separation of CA maize and non-CA maize. The traders agreed that it would be cumbersome and expensive to try to keep CA maize separate, and it would only ever work if most farmers were to switch over to CA farming.

The feeling from one trader was that generally, government should not get involved in regulating the market, as it did with the duty on wheat. If, however, any duty was to be imposed, the funds from such a duty could be used to fund agricul-ture and be used to possibly support CA through extension for example. On the discussion of GMO-free products, the traders would not change their operations or invest heavily for a small consumer group perceived to have ‘upper-class angst’. The retailers also showed an unwillingness to start branding another sustainable method next to organic produce, which by now only a few consumers understood.

The feeling amongst the banks was that they do not get involved with what is fundamentally a farm production level decision which was to be made by the farmer himself. In any event, lender’s liability principles would not allow them to dictate any form of farming operations when giving a credit. Banks argued that if CA mitigated risk, it would automatically show on a farmer’s balance sheet, and subse-quently affect the risk profile and credibility of the farmer to his benefit; although most respondents agreed that it would take years for a farmer to see such benefits reflecting on his credit profile. While one bank was sure to create a product that in future would assist farmers converting to CA, two more hinted that there was the possibility of a future product that assisted farmers going CA and supported them through a potential initial cash-dip, if CA research proved to be less risky and more productive for farming in the South African context. Policy could therefore support more research into CA benefits for individual regions of South Africa.

All the interviewed insurers seemed to know about research that evidenced that CA resulted in more climate resilience and less water stress. Similar to banks the

insurers argued that by the nature of their business model and the way in which the underwriting process works, calculating policy premiums, farmers would automatically benefit if they chose better farming practices that resulted in more consistent yields with decreased risk of crop loss. None of the insurers were also supporting the notion of developing a future product that supported CA. Because mitigating risk is the insurer's business, they would not insure a new system based on a promise that it might mitigate drought in years to come. For one insurer drought risk was a small exposure and therefore drought risk mitigation was for them less high on the agenda.

Because, as argued above, there is an attractive financial argument in favour of CA, farmers are likely inclined to take up CA as a farming practice for their own future financial benefits. With less 'draught risky' farming practices this in turn would position these more favourably in front of financial institutions such as banks and insurers. Yet such a transition would be driven by the farmer and not VCP or policy, in contrast, because almost all VCP showed little interest in developing CA targeting products, a policy driving CA support through the VCPs would likely yield little impact.

Based on our findings a key implication is that government policy concerning CA should endeavour to provide an enabling environment for the future uptake of CA. We suggest that a slow process of change is the route that policy should take, with key aspects focussing on policy enabling training and capacity development of farmers, through field extension and agricultural schools, to adopt CA. Because CA is also a cheaper production system and needs less external inputs, focus should be on smallholder farmers who mostly struggle with access to external inputs.

Over time, a policy that favourably supports CA would grow the farming user base; and in doing so end-consumers would automatically get access on a broader base to more sustainably farmed products without any system change in the value chain, in which the value chain participants have clearly indicated not to drive CA as a system.

## 5. Conclusion

We have argued that CvF practices have high external input costs and a substantial impact on natural ecosystems, ecosystem services, soil erosion, and CO<sub>2</sub> emissions. These are results of a conventional industrial agricultural complex that also dominates the modern South African agricultural food value chain. We have argued that more sustainable farming practices such as CA are more climate resilient and supply more nutritional value, both of which favourably impact long term food security.

We have raised the question whether South Africa's current food system has the ability to sustain long-term food security and if changes in the existing food value chain complex would be able to drive a transition into a more sustainable and food secure alternative such as CA.

From the research data we can conclude that none of the respondents had a product that supported CA and the general inclination of most interviewed was not particularly in favour to support CA through new product development in their respective institutions. Mostly it was argued that it would either interfere with their specific business-client integrity, or it would not fit into their specific business model or alternatively be too difficult to sell to the end consumer, who understood organic but not CA. The traders argued that with the large volumes and silos they worked in, keeping CA produce separate would be very costly.

For the respondents from the financial institutions CA had the potential to mitigate risk, however in the eyes of most of the respondents there was yet not



enough evidence to prove solid risk mitigation. Therefore, they argued, it would be better for them to rely on the existing business model and underwriting process, which would feedback a preferential pricing to a farmer automatically, were he able to use a production system that reduced risk. Subsequently the development of new products to drive the support of CA would not be required. Of the 12 respondents only one indicated that it would develop a product in future that would specifically support the adoption of CA on farmer side. Most retailers and traders indicated that if they were to drive anything sustainable they would support organic which was already an established 'sustainability' brand and needed far less effort to communicate to end consumers.

We can conclude that South Africa's VCPs are neither a support network today, nor will they be one tomorrow; therefore they are not a potential channel to drive a transition. However, while the VCPs were generally supportive of sustainable production methods (such as CA), from an operational perspective and from within their existing business models, VCPs are unlikely become initiators of a sustainable transition driven by CA supportive products. For policy purposes we may deduct that efforts for a transition and required training of farmers would need to focus on education rather than enforcing policy on value chains and their existing business models.

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