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Triple-win strategy? Why isn't everyone doing it? A participant-driven research method to reveal barriers to crop rotation in Ukraine

Abstract

The agri-food sector must adapt to changes in climate variability, while also helping to mitigate climate change. Measures termed 'triple-win' mitigate and adapt to climate change, while also improving soil health, thereby increasing yields. These measures might appear to be the easiest to implement, but in practice barriers prevent full realisation. This study aims to move beyond previous research efforts that identify and categorise barriers by i) revealing hidden barriers, ii) understanding the interactions between barriers and iii) exploring ways to address barriers. A case study focusing on crop rotation as a triple-win strategy in Ukraine demonstrates how a participant-driven iterative research approach can achieve these objectives. During semi-structured interviews with farmers and stakeholders, crop rotation emerged as an area of considerable dissensus with stakeholders commonly citing the greedy behaviour of producers as the problem. Further discussion indicated that the political economy of Ukraine caused financial constraints for producers and Q methodology allowed for additional clarity on the opposing views of crop rotation. Three factors emerged: producer insecurity, national insecurity and business insecurity. These three perspectives reveal contrasting priorities with producer insecurity and business insecurity concerned with the conditions under which producers must operate, while national insecurity has a focus on improving agricultural production to benefit the nation. Consensus statements across all factors could provide first steps to addressing barriers and an opportunity to open discussions amongst stakeholders. Finally, barriers arising from political processes demonstrate that climate policy needs to be integrated with other sector specific policy decisions.

Keywords: agriculture; climate change; adaptation; mitigation; stakeholder engagement; sustainability

1. Introduction

In 2015, global atmospheric carbon dioxide levels surpassed 400 ppm underscoring the urgency for mitigating and adapting to climate change. Measures deemed to be 'triple-win' should be the easiest and quickest measures to implement due to benefits provided independent of climate change, yet this does not consistently happen (Moran et al. 2013). The agri-food sector provides an ideal case study to explore why, since globally the sector must increase production, mitigate climate change through reduced emissions or enhanced carbon sinks, and adapt to climate change (Wolfenson 2013). Moreover, options that can potentially meet all three of these challenges exist in this sector and include: diversification of crop rotation, restoration of organic soils and improved management of agricultural lands (Glantz et al. 2009; Smith and Olesen 2010). The failure to consistently implement these options potentially indicates the presence of barriers. Barriers can be defined as obstacles that can be overcome through use of resources, policies, effort, management and a change in perceptions and attitudes (Metz et al. 2007; Moser and Ekstrom 2010).

Considerable research has identified barriers to mitigation, adaptation and pro-environmental behaviour. Smith et al. (2007) found that barriers to climate change mitigation in agriculture related to uncertainty, cost and technical feasibility. Adaptation barriers have been categorised as technological, financial, social, cultural, cognitive and behavioural (Adger et al. 2007). A lack of communication (Raymond and Robinson 2013), political commitment (Semenza et al. 2008) and trust in government (Macnaghten and Jacobs 1997), as well as an incomplete understanding of the problem or a misperception of risk (Gifford 2011; Lata and Nunn 2012) provide for further categorisation of barriers.

While barriers have been identified and categorised, this study fills some notable gaps in the literature. In a review of adaptation barrier research, Biesbroek et al. (2013) found that studies did not explain how and why barriers arose or how to overcome them. Furthermore, the interdependencies between barriers and the processes that allow barriers to persist have not been explored (Eisenack et al. 2014; Jones and Boyd 2011). Through a

case study of sunflower and crop rotation in Ukraine, this study's aim is to understand how political, economic and social context, climate and differing perceptions interact to function as barriers.

Ukraine provides a compelling country for this type of study due to the many opportunities and challenges related to adaptation, mitigation and improved agricultural production. As the second largest country in Europe with 69% arable land, some of the most fertile soils in the world and a central location to access many world markets, Ukraine's agri-food sector has many geographical advantages (Fileccia et al. 2014). However, climate projections indicate increasing droughts and greater extremes in precipitation events for Ukraine (Dronin and Kirilenko 2012; Fischer et al. 2014). Meanwhile agricultural production in Ukraine has not been climatically robust. Ukraine's agricultural output decreases substantially during droughts and climate fluctuations have caused crop losses of up to 75% in recent years (Adamenko and Prokopenko 2011; Karacsonyi 2010). Moreover, Ukrainian agriculture faces challenges independent of climate change; such as, worsening soil erosion and declining soil fertility (Fileccia et al. 2014). See Online Resource 1 for a more detailed background of the case study.

This research approach differs from previous barrier research. Biesbroek et al. (2013, 2014) describe a lack of clarity for the term barrier in the literature, specifically a lack of consistency as to what is being prevented. In this case, barriers are anything that undermines or prevents the implementation of crop rotation. However, unlike most other research, interviewees were not explicitly questioned about barriers to crop rotation. Instead, this research uses an iterative, participant-driven research method incorporating semi-structured interviews, ethnographic data collection and Q method.

2. Methodology and Case Study Description

This research employed a participant-driven method to reveal the less apparent barriers and interaction of barriers to crop rotation by first allowing participants to indicate that crop rotation was a topic of concern. Next, application of Q methodology sought an explanation for the disagreement surrounding the topic. The starting point is the creation of the *concourse*: a set of statements on the topic gathered from interviews, literature or a combination of sources (Van Exel and de Graaf, 2005). Participants sort the statements into piles according to the level of agreement/disagreement. In each pile only a limited amount of statements can be stored, so that the final Q-sort reflects a coherent discourse on a given topic. It should be noted that the Q-methodology aims to unveil all the possible shades on a given topic without the urgency to represent the generality of the population (Brown, 1980). Moreover, participants in a Q-method study (termed the P-sample) need to be chosen carefully among well-informed individuals about the topic of interest (Brown, 1980).

This approach follows the precepts of Fourth Generation Evaluation as described by Guba and Lincoln (1989). Stakeholders identify areas of concern during semi-structured interviews, claims from stakeholders are introduced to other stakeholders via the Q sort, clarification is sought from participants and finally if consensus cannot be achieved the process provides clarity on future steps to be taken. Q method fits well with fourth generation evaluation, since it gives a voice to the many different perspectives of an issue (Rogers 1995; Van Exel and de Graaf 2005). Conflicting understandings can be a barrier independent of any other issues (Parry et al. 2007) and by systematically identifying discourses, Q methodology provides clarity to differing perspectives. In addition, Q method can create a more neutral environment proving to be particularly valuable when applied to complex and controversial issues (Addams and Proops, 2000). Refer to Online Resource 2 for a schematic of the authors' view of how this study's methodology corresponds specifically to barrier research.

As previously mentioned, crop rotation and the cultivation of sunflower emerged as an area of considerable disagreement during the initial interview process. Crop rotation provides many benefits including: soil fertility improvements, erosion decline, pest reduction, reduction of agricultural chemicals and climate change adaptation (Bio Intelligence Service 2010). Crop rotation technically qualifies as a triple-win strategy by improving yields, increasing soil carbon (mitigation), and increasing soil moisture holding capacity (adaptation) (Bullock 1992; Lal 2004). In Ukraine crop rotation is an accepted practice, so path dependence and lock-in barriers as highlighted by Maréchal (2007) are not a potential barrier.

Yet, many farmers reportedly do not follow the official recommended crop-rotation calling for sunflower to be planted at most once every seven years in the same field (Lindeman 2004). The area sown with sunflower began increasing in the late 1990s due to increased profitability from reliable export markets (EBRD and FAO 2008; Lindeman 2004). Ukraine became the top global exporter of sunflower in 2012 (McFerron 2014; Ministry of Foreign Affairs of Ukraine 2012). In addition to profitability, the deep rooting system of sunflower provides another advantage by allowing it to grow well under dry conditions. However, sunflower removes higher amounts of water and nutrients relative to other crops and continuous cropping increases soil fungal diseases (National Sunflower Association 2003; Robinson 1966).

Soil quality and erosion can have a variety of measurements and definitions depending on the stakeholder's perspective: from a loss of productivity to a decrease in key indicators of soil health (Robbins 2011). In this methodology, diverse stakeholders with a variety of perspectives set the agenda by providing definitions of the problem, potential explanations and revealing the complexity of solutions.

2.1. Interview Process

Purposive sampling was used to gather a wide-range of perspectives. Interviewees consisted of national agricultural, development and environmental experts in Kyiv (n=18), regional experts¹, large agriholdings and smallholder farmers. See Online Resource 3 for a detailed description of participants. Regional experts and farmers came from three different regions of Ukraine: the Forest-Steppe region of western Ukraine (L'viv and Ternopil oblasts), the mixed forests of the Polissia region in northern Ukraine (Chernihiv oblast) and the Steppe region of southern Ukraine (Kherson oblast). This provided coverage of the three major agro-ecological zones of Ukraine. However, most of the regional focus and farmer discussion happened in the Kherson oblast (regional experts n=13, farmers in region n=15). While the Steppe zone already has a semi-arid climate, projections indicate an increase in the intensity and frequency of droughts for the zone, making it the most climatically vulnerable region in Ukraine (Adamenko and Prokopenko 2011; Dronin and Kirilenko 2012). In this region, field observations, key informant discussions, regional expert opinion and farmer's views could be compared. Statements from interviews in Ukraine's west (n=4) and north (n=4) were included in the discourse for the Q sort.

Snowball sampling was used in Kherson, where a key informant assisted in reaching experts and farmers managing farms of various sizes and ownership structures. Interviews were conducted in the spring and summer of 2012. Typically interviews were conducted in Ukrainian with simultaneous translation; however, some of the national interviews were conducted in English. Interviews were recorded after verbal permission was granted by interviewees. Interviews typically took from 30 minutes to 1 hour, but lasted up to 4 hours when farm or facility tours were included in discussions.

Interviewees varied in expertise, so open-ended questions administered in a semi-structured format ensured that research remained flexible and participant driven. National and regional experts were questioned about adaptation, mitigation, and the most pressing social and environmental issues for the country and region respectively. Farmers were asked about farming in Ukraine, adapting to climate variability, efficiency measures and soil improvements as shown in Online Resource 4.

The constant comparison process of grounded theory revealed crop rotation as an area of considerable dissensus (McGhee et al. 2007). As part of this constant comparison process, memos were written to note themes using a contact summary template shortly after each interview (see Miles and Huberman, 1994). Each line of the transcript was given gerunds or in-vivo codes using Max QDA software (see Charmaz, 2006). Preliminary results from coding of interviews were used to explore potential perspectives and possible explanations prior to developing the Q sort discourse.

¹ Regional experts included leaders of agricultural support groups and representatives of government agricultural agencies operating at the oblast and raion levels (provinces and districts).

2.2. Q Methodology

In Q methodology, sample size does not equate to the number of participants doing the sort, but rather the number of statements used (Eden et al., 2005). Following the grounded approach of the methodology, the concourse was built exclusively from statements taken from the interview transcripts. Statements consisted of direct quotes from interviews, since direct statements from participants provide the best material for study (Brown, 1980)². Statements covered the full range of views expressed by respondents pertaining to crop rotation, sunflower (oilseed crops), soil health and land tenancy.

The Q sort was administered to participants online using Q-sortware (Pruneddu and Zentner 2011) from mid-2014 through to 2015. As typical of similar studies, a small group of purposely chosen respondents provided for a diversity of perspectives (Cairns and Stirling 2014). Eight out of ten of the Q sort participants were a subset of the original interviewees. Since farmers and large agri-holdings participants from earlier interviews were difficult to reach, two new participants were recruited to complete the Q-sort. One of the newly recruited participants was a farmer and the other participant was an economist working closely with large agri-holdings; thus covering the range of stakeholders desired for the study.

Participants sorted statements into a quasi normal distribution by placing a fixed number of statements (indicated in parentheses) into boxes labeled strongly agree (3), agree (4), partially agree (4), undecided/neutral (5), partially disagree (4), disagree (4), strongly disagree (3) as shown in Online Resource 5. Since the individual must carefully consider each decision in relation to the other sentences, a forced distribution helps to reduce issues often associated with completion of self-reports; such as providing answers perceived to please the researcher and choosing extreme and middle values among the range of options (Block 1978; Fluckinger 2014).

Data analysis was performed using the 'qmethod' library (Zabala 2014) within R v32.2. Factor analysis measures the relationships among many statements across respondents (Brown 1980). As a result, the analysis reveals the range of viewpoints shared by specific groups of participants rather than individual narratives (Watts and Stenner 2005). A preliminary evaluation of the statement correlation matrix suggested the presence of three factors. Therefore factor analysis was performed forcing the extraction of three factors and Varimax rotation maximised the variance explained while keeping the factors independent.

In order to aid in factor interpretation, a follow-up email was sent to respondents inquiring about their reasoning behind statements placed in the strongly agree and strongly disagree columns. In addition, the respondent who had the highest loading (correlation) for each factor was sent a description of the factors to elicit feedback or corroborate the final interpretation.

3. Results

Abandonment of crop rotation and subsequent soil depletion was the natural resource problem mentioned most by interviewees. However, a lack of consensus emerged as to who was responsible for the problem, if crop rotation was a problem, why crop rotation was not being followed and finally what needed to be done to solve the problem. Technical crops such as sunflower and rape were viewed as a problem due to increased cultivation. Sunflower was also provided as an example of already observed climate change due to the crop being cultivated farther north than it had in the past.

The statements used in the concourse for the Q sort indicate the major subject areas emerging from interviews and field observation. Results from interviews and statements used in the Q sort concourse have been organised according to the categories: problem definition, responsibility, explanation and possible solutions. Each statement corresponds with one or more types of barriers as shown in Online Resource 6.

² Two statements in the "responsibility" category were changed to a more positive and less blaming tone.

3.1. Interview Findings

Problem Definition: Is the problem crop rotation, expansion of sunflower or deteriorating soil?

According to interviewees the problem could be defined as a deterioration in soil health, an increase in technical crops and/or the abandonment of crop rotation. The scope of disagreement amongst stakeholders about crop rotation specifically is evident in the following two quotes.

“It is a lie that farmers don’t follow rotation and don’t care....It is stupid for someone in Kyiv to dictate what is done.” (Roman, Kherson Farmer)

“They grow sunflower until land is not good and then stop renting land.” (Peter, National Agricultural Expert)

While most interviewees valued and approved of crop rotation, some respondents saw the current recommendations as too strict and believed that alternatives to maintaining high quality soil existed. Sunflower was viewed to cause two distinct problems: the continuous cultivation deteriorated the soil and the abandonment of other crops threatened food security. The quality of Ukrainian soil was described as a treasure and important to national security. While some respondents expressed an opinion that soils were better cared for during Soviet times, others would vehemently disagree.

The Q sort statements for this category include:

- Expansion of technical crops (oilseed) threaten food security.
- The increase in technical crops causes soil problems in Ukraine.
- Crop rotation is not a necessity; alternatives exist to maintain high quality soil.
- Soils were cared for better during Soviet times.
- The quality of Ukrainian soils is deteriorating.
- Ukrainian soils are a matter of national security.

Responsibility: Who is not following crop rotation?

Typically, farmers held the view that producers followed crop rotation. Only one interviewee from an international agri-holding declared that bribes could be paid to officials in lieu of adhering to the recommended crop rotation. Interviewees often claimed that large agri-holdings were blamed for growing mostly technical crops for profits and destroying the land. Although a few respondents claimed large companies use the best and most current technologies and practices, so they were not the problem. Meanwhile, small-holders often specialise in fewer crops. According to an agriculture support worker in Kherson, some villages define what they grow and only grow one crop. In their experience, smallholders were not following crop rotation.

The Q sort statements for this category include:

- Large agri-holdings use the best technologies available.
- Large agri-holdings follow crop rotation.
- Small-holder producers follow crop rotation.

Explanations: What factors contribute to the recommended crop rotation being abandoned?

Due to the profitability of sunflower, many interviewees but not farmers often attribute the failure of farmers to follow crop rotation to greed. However, other issues emerged from field observations and further discussion with interviewees.

According to scientists at a soil testing facility in Kherson farmers abandon crop rotation to plant the most profitable crops (sunflower and rape) and/or soil problems arise due to farmers experiencing financial constraints. Furthermore, farmers only contacted the facility when they observed a problem with the soil and did not work at preventative measures due to a lack of finances. The lack of financial assistance available to farmers is apparent in the following quote.

“Farmers do not have enough resources to support the soils and do the right practices.” (Igor, Kherson Farmer)

Due to the land sale moratorium farmers do not truly own the land, so land cannot be used as collateral to secure low interest loans adding to financial strain. The land sale moratorium was also believed to cause short-term planning and unsustainable practices. One interviewee stated that an agri-holding did not follow crop rotation because of the potential for agricultural land to be taken by those in political power. The agri-holding’s managers were not confident that they could take a long-term view of business and the land and decided to make the most profit in the short-term. This explanation has more to do with insecurity of land tenancy rights, contrasting with the seemingly more prevailing belief that large agri-holdings managers think that the land can be abandoned once the soil has been exhausted and profits gained.

The 2011/2012 season in Kherson demonstrated how climate change and financial constraints can interact to form a barrier to crop rotation. A law had just been passed limiting the amount of area of grown sunflower to 10%. From personal observation, the area under sunflower cultivation in the region appeared close to 80 per cent. When queried about the dominance of sunflower in the region, a village leader explained that the law was new and that this year sunflower was planted because of crop failures. Many farmers experienced multiple crop failures due to climate variability. One farmer stated that winter wheat was destroyed by frost, spring wheat was destroyed by heat, and the grapes and gardens did not do well due to seasonal variability. An agricultural support worker in the region identified planting sunflowers late as an adaptation strategy, but they also acknowledged that it might not work. While planting a deep-rooted plant, such as sunflower, provides a short-term strategy, it could prove to be maladaptive in the long-term because of the large volume of water extracted from the soil. Interviewees explained that farmers could opt to grow a different crop, but after losing several crops they preferred to minimise risk by cultivating the most profitable crop. In the following quote, a farmer explains crops in the region, the difficulty experienced in the 2011/2012 season and the attempts made to follow recommendations for growing crops.

“*The main crops we grow are sunflower and rape. We grow sorghum and oat for rotation but it does not make a lot of money. We try to stick to all the rules and technologies and fertilizers. This year we planted some seeds according to the rules, but the rest we planted a bit later and it got enough rain, so it helps not to sow all of them at the same time.*” (Orest, Kherson Farmer)

According to many respondents, government policies have created a difficult business environment. In response to seasons with poor harvests of wheat and barley the Ukrainian government has often set export quotas. However, the government’s interference in markets leads to uncertainty making it difficult for farmers to plan accordingly (Brummer et al. 2009). One farmer stated that he did not wish to grow wheat due to the instability in pricing. When export quotas lead to a decrease in the price paid for wheat, it becomes even less profitable compared to sunflower and rape.

Finally, smallholders often have a tradition of growing only one or a few crops, so tradition acts as a barrier preventing them from following crop rotation.

The Q sort statements for this category include:

- When producers do not follow crop rotation it is because of greed.
- Government gets in the way of business.
- Small-holders receive no support from the state.
- When smallholders fail to follow crop rotation it is because they have a tradition of growing only a few crops (or a single crop).
- Producers abandon crop rotation during difficult years.
- If producers owned the land they would take better care of it.
- Insecure land tenancy agreements lead to short term planning and ultimately shortened crop rotations.
- Producers believe that those in power can take land away from them at any moment.
- Export quotas discourage producers from growing some crops.
- Sunflower can be grown in more regions of Ukraine because of changing climate.
- Producers who do not follow crop rotation can pay unofficial payments to avoid fines.
- Rules and laws for crop rotation are too strict.

Solution: What changes should be made to ensure producers follow crop rotation?

Occasionally respondents in Kyiv voiced frustration about lack of accountability compared to Soviet times. One respondent said that in the old days someone who did not follow crop rotation would be sent to Siberia. Some respondents want laws to be enforced feeling that the government needs to ensure that the country produces enough food. However, others argue that rules cannot be enforced due to corruption. Most agree that the land sale moratorium needs to end, but how and when to end the moratorium continues to be debated. Lifting the land sale moratorium will help producers with acquiring more affordable loans and potentially increase land tenancy security, but many interviewees worry that the current business and political climate is not yet right and those with political connections could potentially benefit the most³.

Foreign investment is also a debated topic. Some respondents expressed concern about foreign interests gaining control of land and deteriorating the soil. At the same time, many argue that foreign investment brings needed expertise and knowledge to Ukraine that would encourage sustainable practices.

The Q sort statements for this category include:

- Foreign investment should be encouraged.
- Lifting the land sale-moratorium will help producers.
- Producers will have greater security when they truly own the land.
- Foreign investment needs to be monitored.
- People with political ties will benefit the most from lifting the land sale moratorium.
- The government needs to implement policy to ensure that enough food is produced in the country.

3.2. Q – Sort Analysis

The factor analysis explained 53% of the total variance, the first and the second factor each explained 19% of the variance and the third factor explained 15%. Reliability of each factor was acceptable (>0.8), with 0.94 for Factor 1, 0.92 for Factor 2, and 0.89 for Factor 3. The three factors were highly independent. Factor 1 and 2 had no correlation at all ($r=-0.01$), Factor 2 and 3 ($r=0.18$) and a very weak correlation between Factor 1 and 3 ($r=0.21$).

Table 1 shows the z-scores for each of the statements along each factor. The ‘qmethod’ package also evaluated the absolute difference between z-scores in each factor for every statement. A significant difference between z-

³ The Yanukovich government was in power at the time of interviews, thus responses often reflect the views of a government that has since been overthrown. Nonetheless, the Q sort was completed after the new government was in place and conversations with interviewees indicated that much progress still needed to be made.

scores ($p < 0.05$) indicated disagreement between factors. If the difference between z-scores was not significant, the three factors were determined to hold a similar opinion and the statement was labeled as “Consensus”. Of all the 27 statements, only 8 were consensus statements indicating that the three factors gave voice to different views on crop rotation. Refer to Online Resource 7 for a visual representation.

According to the consensus statements across all factors, agreement appears possible for statements in each of the categories. The quality of Ukrainian soils is deteriorating (problem definition), small-holders do not follow crop rotation (responsibility), producers abandon crop rotation during difficult years (explanation) and foreign investment should be encouraged (solution).

The three factors have been described as Producer insecurity, National insecurity and Business insecurity. Respondents in the producer insecurity factor tends to ‘side with farmers’. For instance, the statement that farmers abandon crop rotation due to greed falls into disagree for this factor, while this statement falls in the neutral category for the other two factors. Those belonging to the national insecurity factor tend to be most concerned with what is best for the nation and less with individual producers. The business insecurity factor reveals the view that the political economy of Ukraine causes problems by creating a difficult business climate.

Factor 1: Producer Insecurity

Respondents who loaded on to this factor included: two farmers, a farm extension service worker and a person working in agricultural business support. In general participants loading on to this factor felt that conditions needed to be improved for producers through institutional changes and better support systems. Respondents in this factor were more likely to hold the view that large agri-holdings follow crop rotation and feel strongly that smallholders do not receive support from state. Two statements pertaining to security of land tenancy and corruption appeared in the agree side of the distribution for this factor: i) producers believe that the land can be taken away from them by those with power and ii) people with political ties will benefit the most from lifting the land sale moratorium. While they have the view that the current state is not secure, they also see potential difficulties with establishing a land market.

This factor demonstrates the view that soils were better cared for during Soviet times. This could be due to greater support from the state during Soviet times or accountability. However, those in this factor also viewed government to get in the way of business indicating that current policy was not helpful. They also supported foreign investment⁴.

Factor 2: National Insecurity

Respondents who loaded on to this factor include: two researchers at national research centres and a national organic certifier. The factor 2 perspective disagrees considerably with the views revealed by factor 1 as demonstrated by the z-scores in table 1 (see statements 3,10 and 27). Those loading onto this factor have a concern for the conditions of the nation as evident in agreement with statements: soils are a matter of national security and government needs to implement policy to ensure enough food is grown in the country. They agree that insecure land tenancy agreements lead to short-term planning and shortened crop rotation; however, this does not necessarily relate to producer insecurity. Rather when producers rent land they do not need to think in the long-term, so they do what is best in the short-term.

Factor 3: Business Insecurity

Respondents who loaded on to this factor included: an agricultural economist and the leader of a national non-profit agricultural organisation. Factor 3 indicates a perspective that the business climate in Ukraine needs to be improved. Those in this factor hold the view that land ownership needs to be addressed as evident in their agreement with the following statements: i) producers would have greater security if they owned the land and ii) producers would take better care of the land if they truly owned it. In addition, respondents loading onto this

⁴ Many of the interviewees working in agricultural support stated that all assistance to farmers had come from international groups and none had come from the Ukrainian government.

factor potentially disagree that those with political connections will benefit the most from removing the land sale moratorium. However, the negative z-scores for the statements related to lifting the land-sale moratorium might also indicate difficulty with judging statements that predict the future. Like those in Factor 2, respondents loading to this factor disagree that large agri-holdings follow crop rotation, but they hold the view that crop rotation is not always necessary, as other technologies exist. In addition, those loading to this factor believe that large agri-holdings use the best technologies available. Respondents belonging to factor 1 and factor 3 both agree with the statement that government gets in the way of business. However, this factor has the most favourable view of large agri-holdings and does not place lack of smallholder support in agree. For these reasons, this factor has been labelled business insecurity and provides a voice that differs from producer insecurity.

4. Discussion and Conclusions

This study demonstrated the complexity of climate change barriers by using an iterative, participant-driven approach. Open conversations in initial interviews highlighted the various disagreements relating to crop rotation. The diverse perceptions about crop rotation and agriculture coming from the interviews were included in the Q sort to facilitate clarification of different perspectives and allowed for connections to be made between issues.

While during interviews greed was a reason provided for producers not following crop rotation, it was often followed up by the financial constraints farmers face. In addition, when presented with other potential explanations in the Q sort, greed did not rank as an explanation for abandonment of crop rotation. Moreover, the statement “farmers abandon crop rotation during difficult years” appeared as a consensus statement across all factors; consistent with observations and interviews during the 2011/2012 farming season in the Kherson oblast. The difficult years and corresponding financial difficulties will only worsen with climate change and thus continue to be a barrier for crop rotation if not addressed. These results relate to factors and not individual stakeholders, so it cannot be said that everyone has exactly the same view. However, only one stakeholder placed greed in the agreement side of the sort.

Statements pertaining to land ownership also appeared in the agree side for each of the factors indicating that this could be an area of some agreement and could potentially be a barrier that can be addressed. Disagreement appears to exist in the detail for which land ownership matters the most, and therefore how it functions as a barrier. Factor 1 reveals the view that producers feel that land can be taken away from them at any moment, but also demonstrates concern over who benefits from lifting the land sale moratorium. Factor 2 captures the view that short-term agreements lead to short sighted planning and shortened crop rotations. Factor 3 reflects that when farmers own the land they have higher security and they would also take better care of the land. Moreover, the inability to own land constrains farmers financially due to the lack of collateral available for low interest loans; thus interacting with problems that arise during ‘difficult years’ and forming a financial barrier.

Biesbroek et al. (2014) argued that investigating the mechanisms behind barriers can point to more detailed and appropriate solutions. For instance, when inadequate financial resources are identified as a barrier (see, Adger et al. 2007; Smith et al. 2007), the proposed solution might be limited to increasing or improving the use of resources. In this case study, financial constraints are the most apparent barrier preventing producers from following crop rotation, but several issues interact and augment the financial constraints of producers in Ukraine. As demonstrated, removal of the land sale moratorium could secure land tenancy rights, lead to longer term planning and allow producers to access low interest loans. A well-developed plan to remove the land sale moratorium provides a more precise policy to address financial issues than just increasing financing available to producers and/or enforcement of crop rotation.

Given the background of each respondent, the factor that respondents load onto does not come as a surprise. Producers and those working to support local producers had greater concern for producer security, while those working at the national scale had concern for the nation’s food production and resources. Risbey et al. (1999) maintain that adaptation is a multi-scale process requiring a recognition of complexity and scale during

investigations. Indeed, the differing perceptions of stakeholders revealed during factor analysis reflect the scale at which each stakeholder operates. Moreover, while the disagreements at first seems unsurmountable consensus actually does exist beneath the surface.

This work focused on crop rotation partly because, as a well-accepted strategy, it should easily be implemented in Ukraine. In reality, it is a source of considerable disagreement. Again, scale determines whether crop-rotation can be termed a triple-win measure. At the global and national scale, crop-rotation improves soil health and increases soil carbon content thereby adapting and mitigating climate change, and improving production in the long-term. While technically a triple-win measure, within the context of the political economy of Ukraine, crop rotation does not appear to be a winning measure for farmers. The agreement that farmers abandon crop rotation during difficult years indicates that the loss of short-term profits are too large a financial burden for many farmers. Increasing the diversification of crop rotation and conservation tillage face not only the same challenging context, but additional barriers as the techniques require equipment and specialist knowledge (Fileccia et al. 2014). If complex strategies are to be implemented successfully, hidden barriers must first be understood and addressed for the simpler measures.

Guba and Lincoln (1989) maintain that fourth-generation evaluation never stops it only pauses. In this case study, this method has an additional strength in that it can be used to shift blame away from greed and could open up discussions amongst stakeholders. Areas of consensus can be a place to start further discussion amongst stakeholders. Furthermore, all factors agree that Ukrainian soils are deteriorating; demonstrating some agreement about the problem. This is particularly important for the next steps needed to implement solutions. Foreign assistance also appears to be favoured by participants. Therefore, this method provides ideas for helping to address barriers.

This work has demonstrated how the political economy can hinder farmers and thus serve as a barrier to climate change measures. Farmers in Ukraine need to adjust to changes in an uncertain business climate in conjunction with climatic changes. The politics behind these processes needs to be understood and climate policy needs to be integrated with other policies to ensure that the most vulnerable in a country do not pay the biggest price.