
Change management in vegetable farming: the case of farmers in Delta State, Nigeria

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Abstract At the advent of climate change, changes in policy and the introduction of climate change adaptation strategies resulted to speedy changes in the vegetable sub-sector. Organic fertilizer joint farming operations, vegetable crops diversification and irrigation were introduced simultaneously or within a short duration. Hence, the capability to efficiently manage technical and organizational change become crucial to vegetable farmers. To unveil how farmers growing vegetables changed management, four groups of farmers were paid to visit and intervene. These farmers made investments in organic fertilizers, irrigation and vegetable diversification. Three of the groups were joint farming, while one of these three operated in cooperative farming operation basis. Ten agricultural extension agents were also interviewed. Change was articulated in this article through the employment of a framework of change. The in-depth presentation and cases of the four groups of farms and a conceptual model for change management on vegetable farms, as adapted are captured. The results indicated that contemporary innovations and farming systems introduced to comparable farms which produced highly varying outcomes. Sustained gradual changes, previous change experience, intrinsic motivation, interaction with agricultural extension agents and diligent planning of farming operations positively influenced farming performance during and after change. A principal revelation that change needs to be appreciated as a managerial challenge and not just an issue of adoption of new innovation.

Keywords: Change management, Climate change, Vegetable farming, Organic fertilizers, Organic farming, Vegetable farmers

Introduction

One of the very important challenges in contemporary time is climate change (Puupponen *et al.*, 2015). It is a constraint of global scale as a result of its effect on the environment, human economic activities and the outcomes (Oosterveer and Sonnenfeld, 2012). Pearlbery (2013) stated that climate change has direct influence linkages with societal functions which encompass agriculture and farming as a result of the policy in climate is forced to design new objectives for methods of production and consumption of food. Within this

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scenario of agricultural system, some new policy and technologies are meant to reduce vulnerability to climate change conditions. Agriculture and food production are influenced in various ways by recent development (Renwick and Wreford, 2011). However, the success of these climate change policy implementation depends on the general social change level of farmers in accordance with the climate policy goal and climate change mitigation and adaptation strategies.

One of the technologies advocated for farmers to adopt is soil fertilization technology such as animal droppings (Farmyard manure) and biochar soil amendment, that are known to have advantages of soil fertility and carbon sink effect (Lehmann *et al.*, 2006). Compost was also recommended to farmers. Another introduced strategy was diversification in terms of vegetables. Vegetable farming is not characterized as heavily capitalized all food industries. However, it is very much regulated in Nigeria. At the inception of this country, the new climate change policy has prompted sustainable soil fertility management, propelled the use of traditional agricultural technologies because it is observed that the traditional agricultural system proves to be of higher sustainability and environmental friendly than conventional strategies (Altieri, 2004). The traditional soil fertility innovations advocated for their use included biochar, farmyard manure, and compost (Ofuoku and Albert, 2014). Farmers are expected to change from chemical fertilizers to organic fertilizers (manures).

Drip irrigation is reported by Ofuoku (2009) and Ofuoku *et al.* (2011) that is another technology recommended to farmers. Before this development, farmers planted vegetables used rainfed agriculture. The farmers are expected to grow vegetables throughout the year using drip irrigation. This implies on and off-season productions in the midst of climate change effect. Vegetable farming is currently encountered period of speedy changes. These changes affected vegetable crop production, particularly soil fertilization and framed by climate and agricultural policies and innovations. This implied organic fertilizers, drip irrigation and farm expansion are advocated in Delta State, Nigeria. It involved changing from chemical fertilizers to organic fertilizers, and rainfed agriculture to irrigation in farms. Vegetable farming is not subsidized in Delta State. However, farmers received the improved seeds. The number of registered vegetable farmers in Delta State increased from 525 in the year 2000 to 583 in 2010 (Delta Agricultural and Rural Development Agency (DARDA), 2012). Vegetables such as leafy vegetables, water melon, cucumber, and tomatoes are mainly grown by vegetable farmers in the state. Ofuoku and Albert (2014) observed that a large number of farmers in Delta State had changed their production strategies from inorganic fertilizers to organic fertilizers. The

objective of study was to closely unfold the change processes on various vegetable farms in Delta State, Nigeria.

Materials and methods

Qualitative data were used for this study. The detailed data on farms were collected from 321 farmers. While trying to identify the research problem, six agricultural extension agents, from the three agricultural zones of the state; who regularly interact and play advisory roles to the farmers during change processes involving organic fertilizer utilization, irrigation and diversification were interviewed using semi-structured interview schedule. Some information were derived from interviews with extension agents who are experienced in numerous processes of change, while others are derived through the analyses of identified case materials. They were asked about the processes of change, what the attributes of successful transition are, and a process with challenges, and about the interval of the transition phase. Transition to diversification was also included. The interviews with agricultural extension agents confirmed that a large variation in how farmers manage the change processes exist, both in the period after change and in the length of the period of transition. Many farmers had problems in the transition period, particularly those that combined technological and diversification change. Taking cue from these interviews and earlier existing knowledge, a thematic interview guide was designed and directed at farmers who passed through a huge transition, which included diversification irrigation and organic fertilizer application from 2010 to 2018. Structured sample of farms with varying experiences in the period of change that involved investment in irrigation and vegetable crops diversification were made. Visits were paid to these farms in 2017 and 2018. Out of the four cases, three others that were also visited included the diversified vegetable farms, irrigated and organically fertilized farms. In the process additional information were accessed. All the farms can be regarded as family farms. The next generation, the son of the farming household head in each case was also interviewed. The interviews were created and comparison was made of them. All the farmers had bigger than average farm size. There existed cases of varying factors, such as age of farmer, the number of people engaged in operations per day, the use of family members, and hired labour. In two of the four cases, the farmers succeeded with change in consonance with own standards in the study area, two failed to accomplish their goals.

The four cases stand for variation based on important variables for achievement of successful change rooted on the interviews with farmers and extension agents who play advisory role. The farmers' subjective yard stick were used to assess how well they had managed the change process and the

level of satisfaction they had with respect to performances in the post-change phase, while they confirmed the performance through recorded data on output, and pest and disease control. All the extension agents who were interviewed stated that vegetable output is crucial or significant for economic consequence after huge investments. The most senior and most experienced extension agent stated as follows: 'Vegetable yields are much more crucial after organic fertilizer application, irrigation and diversification with vegetable crops than when the farm size was 0.5ha when farm income is not based on subsidies'. Vegetable yield per ha was used as the yard stick for performance during change and post-change. The farms were likewise distinct with respect to quantity of organic fertilizers, irrigation and vegetable seeds they were required to procure due to challenges they had with the transition, and the quantity of seeds that germinated. The percentage emergence of seeds is an important factor in vegetable farming. These figures were also used as the indicators of performance in the period of change. The quantity of vegetable yield per week, the number of seeds that failed to germinate and the quantity of vegetable seeds procured were collected from the records of the plots.

Emanating from interviews with agricultural extension agents and vegetable farmers, four illustrative and typical cases of farmers of different age groups, varying levels of motivation, different change experiences and the manner in which the change process is managed were considered. While discussing the cases, explanatory factors that explain the reasons behind few challenges in some cases of changes in technology were discussed, while in other cases the change period were prolonged and farmers experienced significant drops in yield. The four cases indicated that management of change in technology experienced constraints, and that previous change experience, motivation, family resources, use of agricultural extension agents and diligent planning can make the transitional period easy.

Brief narratives of the four cases are presented as follows:-typical citations from the interviews are included. Comparisons of the four cases are based on important variables. Derivations of some, these were made from the literaturesome were derived from interviews with extension agents who are experienced in numerous processes of change, while others are derived through the analyses of identified case material.

Case 1(n=115): Young vegetable farmers with previous technology change experience. In this case farmers in their early thirties who inherited or took over farm management for the period of 10 years past were involved. They took over their family farms after working regularly and in an active manner on their family farms in their earlier youth years. Prior to take over of their family farms and creating their personal investments, they actively participated in

adoption of organic fertilizers, irrigation and diversification of vegetable crops. These were young tertiary institution graduates who are highly intrinsically motivated to establish their respective vegetable farms. After taking over the farms they sought for ways to expand their farm size for diversified vegetable production, and in the process, bought more pieces of land. As a result of rural-urban migration, neighbouring vegetable farmers quit vegetable farming or died, in some case of the neighbouring farmers, as their children were not interested in farming, they had the opportunity to purchase more pieces(s) of land to increase their farm sizes and decided to diversify vegetable cultivation. After putting into consideration their investments and the way forward on how to utilize the existing farm implements, they decided to restrict themselves to the existing facilities in the farm bought. The cultivation period was more demanding than the period before diversification, since the farm size had increased. This was especially so when farm operations required their adequate participation and they also had to coordinate the day-to-day farming operations. They respectively had of advantage having their aged parents close to their respective farms as great source of aid in this phase. In the midst of some problems initially, the challenge of becoming conversant with the new method, they were able to maintain increased vegetable outputs in the phase of transition to organic fertilizer usage, irrigation and diversification. Becoming conversant with the new system of management was a problem, even as relatively young persons who were used to vegetable farm systems of management. However, during the interview they gave a feedback, indicating immediate reduction in vegetables yield when they reduced, the quantity of organic fertilizer per crop as more crops were grown. Before diversification, they planned for farm size expansion and irrigation. The expected results can be expected in careful investments control which concerned economically satisfactory, and their future vision to succeed in building a very large farm with various vegetable types in the space of 5 years and achieve the double of their output.

Case 2 (n=76): Farmers in their Fifties with changes after 20 years of vegetable farming. On these vegetable farms the farming couple decided to invest in the use of organic fertilizers after 20 years of farming in their respective farms that were inherited from their parents or their husbands. Their earlier diversion of resources to off-farm activities (trading for husband and food processing for wife) disrupted their plan to diversify vegetable production. Investment in organic fertilizers and diversified vegetables production became an important condition to continue to stay in vegetable production business. In the case of this set of farmers, they had no plan to diversify into new plots of land as they felt they could diversify on their

existing farm land. However, they found this not possible because of pests and disease build-up. This made them to respectively plan whole new facilities and huge investments (irrigation) while in search of the means to diversify and expand production, the farm family rented plots of land that were far away from their farms. The rented farm lands were 0.5-2.5ha. The plan was to rotate vegetable types on owned and rented farm lands. The strategy was to hire farm labour on pro rate basis. Without consultation with agricultural extension agents, they started cultivation within a short period of planning. The hired labourers were not adequately supervised and this led to some lag in planting and application of organic manure which were not applied according to specifications. This led to performance of crops that was below expectation in the rented farm plots. There were huge problems with organic fertilizer application. This is because; the hired labourers were better knowledgeable in inorganic fertilizers application than in organic fertilizers application. This arrangement did not encourage the farmers as the return on investment was not encouraging.

Case 3 (n=62): Young farmers in partnership farming with experienced farmers. The farmers interviewed had high level motivation in vegetable farming. Their ambition was to take over and develop the respective vegetable farms; they operated the farms that were at the lead in joint operation of four vegetable farms. In 2010, they acquired more farm lands and in the respective cases, the 3rd partners came on board. Prior to this time, there is a history of continuous change that qualifies to be termed a long one. The young farmers' parents, who owned the farms had either retired or passed on, thus they took over then farms. These principal farmers are graduates of agriculture from various tertiary, institutions, while their partners were not. The principal farmers took charge of planning and cultivation and sowings, while one of the other two partners assisted them in their respective cases. They had earlier worked in various private agriculture related organizations. In the bid to cut costs they gradually acquired more plots for diversification of vegetable crops between 2010 and 2014. The transition to the use of only organic fertilizers was done gradually because of the stock of inorganic fertilizers they had in stock. One thing that is note worthy is that they are accustomed to handling of change, so they had no challenge that weighed down on them as these challenges were immediately surmounted. By this, they were able to meet up with people's demand. They took advantage of previous experience they had with continuous change. Transition to irrigantion farming was also gradual because of the cost involved. The three partners were very familiar with themselves prior to the partnership. Thus during the process of planning, they opened up their minds to each other. The three of them jointly participated in drawing of budget and

control of cost. The only disadvantage they had was that they had poor competence level in economy of farm; as a result, they consulted agricultural extension agents (Subject matter specialists) who aided them in setting up yearly budget. The extension agents also helped them to monitor the budget. As a result of this, the principal and his partners became confident and realized that one is motivated better when goals are set and achieved. At last they found that they performed well than what they expected from the budgets.

Case 4 (n=62): Farmers in their fifties engaged in joint farming as means of diversification. The respondents were in their 50s, and had managed their vegetable farms with their parents dating back from early 1990s. They had hired farm labourers. Earlier on in the year 2005, they had the plan of diversifying because they were not meeting the market demand for other vegetables not grown, so they needed to expand and utilize organic manure instead of chemical manure and also carryout irrigation. In 2008, they were invited to a meeting which was arranged by the Delta State Agricultural Development Programme. In the meeting, cooperative farming arose during the discussions on the way for ward. However, they ended up agreeing up on pairing to expand their farm sizes to give room for diversification. Prior to the farming season in 2008, they met with an agricultural extension agent who helped them to settle an agreement, which stipulated that rotational operations will be done. In that rotation agreement, everybody working on the farm of the other two partners would carry out operations in the farm of one of the partners in a particular week and in the next one, they move to the other partners' farm to carry out that same operation. The planning, did not take long even when they did not know each other well before the new arrangement. However, they had acquired more land before the arrangement.

They started in that year's farming season and all the operations were carried out on rotational basis successfully. During this period, they regularly exchanged visits to their farms to exchange ideas on any noticed challenge. On an interview with the principal farmer he was asked whether he would have gone solo in the diversification, he responded thus: 'I would have done expansion for diversification solely, but with my current experience it is still alright'.

Results

Comparison of the four cases

The four cases are compared in this section. It is started by presenting some results from vegetable farming before, during and after change. Figure 1 shows the average vegetable yield per hectare on the four groups of case

farms. The four group farmers vary so much on their levels of performance during and after change. The cases 1 and 3 had a higher vegetable output than the two other case vegetable farms especially in the change year and the first and second year after change (Figure 1). Case 1 increased vegetable output in the year of change and increased output progressively in the first and second year of change. In case 2 vegetable output dropped significantly in the year of change and first year after change and increased output in the second year after change. Case 3 witnessed significant enhanced vegetable output progressively in the years of change and after change. However, the outputs were much less than in case 1. The case 4 farmers had drop in output in the year of change and significant increase in yield in the first and second year after change. Case 2 and Case 4 farmers had encountered the problem with sourcing of organic fertilizers and water supply to dispense through the irrigation facilities; hence they performed at a rate of 41% and 35% respectively in the year of change.

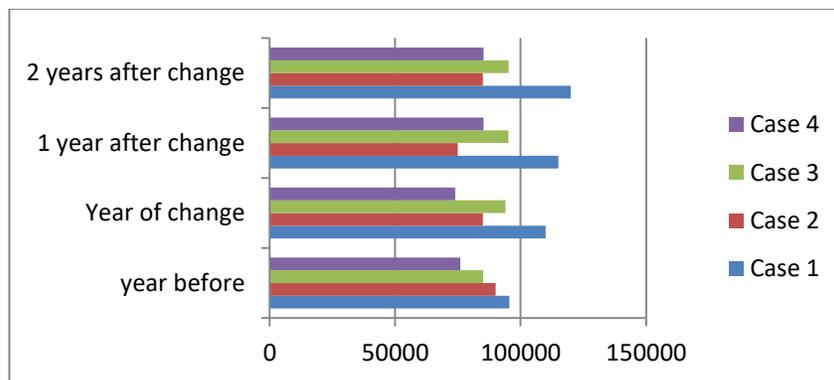


Figure 1. Mean vegetable yield per hectare in the year before change, during change and after the first two years of post-change era for the four group case farms

Farmers in Case 2 witnessed a further drop in output in the first year after change because most of them could not surmount the afore mentioned challenges until during the second year after change. Overall most farmers in Case 1 and Case 3 had significant superior production economy during the period of change than case 2 and Case 4. The progression in yield during the first and second year of change is at variance with the findings of Hansen and Juvell (2014).

Comparing cases of change management

The cases 2 and 4 found the most transformational changes that did not possess the needed changing experience as much as the farmers in cases 1 and 3

(Table 1). The strained capacity found they experienced a consequence of the enormous transformation. The strained capacity coupled with poor level of change experience prompted the vulnerability of the change process to unexpected occurrences and challenges. In terms of change, case 4 experienced a sudden change. Many changes occurred at the same time, from solo to collaborative farming with new partners, from chemical fertilizers to organic fertilizers; from single farm to big farm; and from rainfed agriculture to irrigated farming. It is worthy of note that the farmers in case 4 never knew each other prior to the period and were at varying, stages of life. They had limited experience with change also.

Table 1. Comparism of cases of change management

Variables	Cases 1	Cases 2	Cases 3	Cases 4
Type of Change	Gradual farm Expansion, technology alteration	Transformational farm land expansion, new innovation and new organization	Gradual farm expansion, technology alteration	Transformational farm expansion new technology new organization
Change experience	Building investment in land acquisition for expansion, and change of irrigation system	Diversified to trading	Farm expansion and change of irrigation system cooperated	Restricted experience of change
Capacity	Strained, but adequate	Strained, long transition	Strained but adequate.	Straineds long period of transition
Change management (Phases of transition)	Increased outputs and production	Challenges with innovation. Output drop strained partnership relationship	Solved expected problems as they emerge	Challenges with innovations output drops, but recovered.
Motivation	Intrinsic	Extrinsic	Intrinsic	Extrinsic
Use of extension agents	Prior to change	Restricted	Deliberate prior to change and post change	Restricted
Joint operation planning	Restricted	Restricted	Careful	Restricted planning
Performance (Postchange)	Better than envisaged	Financial Challenge, did not experience envisaged results	Achieved objectives earlier than envisaged	Did not achieve envisaged results

The farmers in Cases 1 and 3 had previous experience with change process. As a result of their previous experience, they were prepared mentally, for possible challenges of transition, and the ways of handling them.

As far as they are concerned, continuous change was part of their life. They already acquired a high level of capacity to change. Since Case 2 and 4 did not have change experience, they would have not had poor performance if they had accessed the services of agricultural extension agents. Hansen & Jervell (2014) emphasized on the importance of an extension or agricultural advisor on the necessity to consult extension agents during and after change.

Cases 1 and 3 farmers used extension advisory services while planning and executing changes. The farmers in Case 1 also consulted extension advisors where they had restricted level of competence. Contrastingly, the farmers in Case 2 and 4 did not have interaction with extension agents adequately before the change, during the change and after the change.

The farmers in Cases 1 and 3 were intrinsically motivated to improve the vegetable farming business. The changes were the consequences of proactive search for opportunities. Many exhibited high magnitude of intrinsic motivation to continually improve their farms.

Comparatively, the change in Case 2 was more extrinsically motivated than Cases 1 and 3. The farm families diverted some funds to trading. The farmers in Case 4 had the motivation for change, but were constrained by sources of production resources. They became motivated when they met the extension agent who arranged meeting between them and their cooperative operation partners. One of the extension agents emphasized on the critical nature of intrinsic motivation when he was talking about the most significant variable for success: 'The vegetable farmers require high level of commitment.' They need to invest much time to do the work and do it well. Seeing what other farmers have been able to achieve is not enough. They are very much observable during meetings. There are those who do not pay attention. These ones, in order to succeed have to embrace what is entailed in the process prior to the start before they should start'.

Case 3 vegetable farmers invested much time to discuss and plan their operations. They discussed openly and were able to develop trust in themselves, had a high level comprehension of change, were able to create consonance with respect to what they expected. They were able to create a similar understanding of the future goals and redevelop their previous manners of working, their day to day routines and practices by thorough plan procedure, frequent commutation and sharing of ideas at the stretch of the transition phase. The

principal farmer was likewise high satisfied with the way the joint operation played out. Case 1 farmers did not invest plenty of time to plan their joint operation since it practically just entails expansion of farm land, changing the type of soil fertilizer, use of drip irrigation and vegetable crops diversification. Case 2 and 4 farmers invested very small times to plan and discuss. This explains the reason their expectation could not be met. In case 4, the farmers did not have a good and familiar understanding of themselves prior to engagement in the cooperative operation arrangement. In case 2 most of the farmers said they were conversant with and their partners prior to the partnership arrangement. But as the transition unfolded, they found that they had differing practices and routines. At this time, they had not been able to develop a consonant comprehension of their future goals and adjust or amend their manner of carrying out their work, their practices and routines.

Previous experience of the farmers with change raises the capacity of the farmers to change, thereby improving the management of change (Hansen and Jervell, 2014). Intrinsic motivation creates improvement in change management and the performance of the farm during and after change. Deliberate interaction with extension agents and carefully planned joint operations make positive contribution towards management of change, translating into contribution to performance in farming during change and post change periods (Farinde *et al.*, 2013).

While analyzing the cases, it was discovered that age as a factor had a likelihood of influencing transformational change. This implies that young farmers more easily handle transformational change than older farmers as found in cases 1 and 3. As found in case 2, after several number of years of vegetable farming, soil fertility management changed, and irrigation become mechanized instead of being done manually and had outcomes that were successes. In a case like this pressure from external sources pushing farmers to change may both inhibit already established routines and reduce motivation. Cases 1 and 3 had young farmers and in case 1, the principal farmers either took charge or were frequently supported by their parents and had supplementary competence from their partners as it was in Case 3. The relative success of the younger farmers is attributable more to motivation and social capital than to age. Farmers in all the cases indicated that there were decreased incidents of pests and diseases and consequently enhanced output during and after transition to use of organic fertilizer, irrigation and diversification.

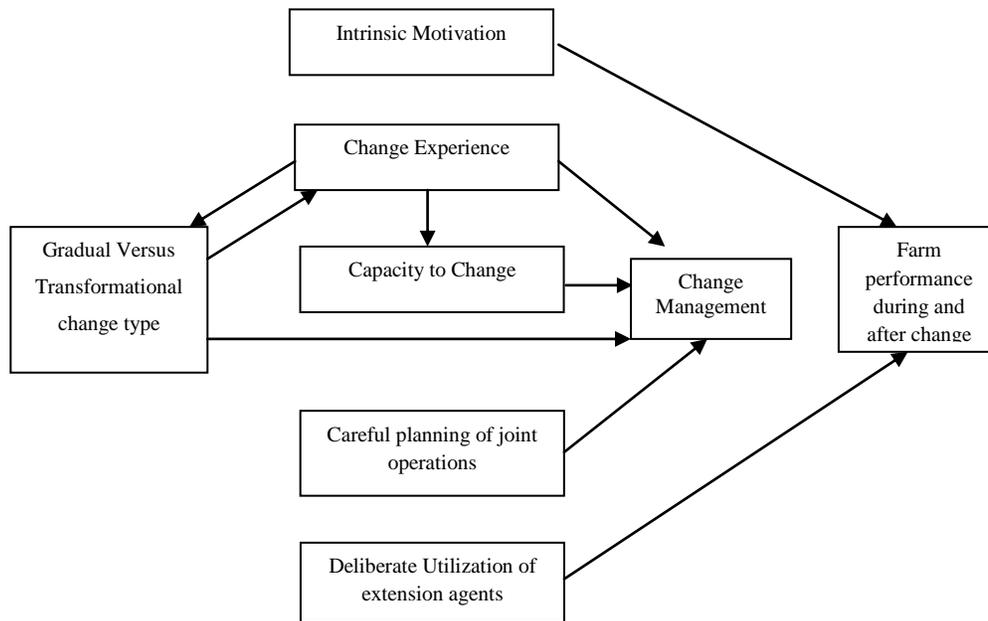


Figure 2. Conceptual model of change based on the hypotheses. Adapted from Hansen and Jervell (2014)

Discussion

Since the introduction of technologies for adaptation to climate change, many studies have been conducted on adaptation to climate change. These include studies on acceptance of climate change and adoption of climate change adaptation strategies (Arimi, 2014; Ahmed, 2016). These studies did not address the measures of adaptation to climate change from the perspective of change management. This study is one of the first of such studies to articulate the introduction of organic fertilizer, irrigation, and crop diversification from the perspective of management of such change. This study indicates that vegetable crops farmers embark on enormous changes such as the combining crop diversification technological which includes organic fertilizer, and irrigation and organization in confirmation of the observations of Ofuoku and Agbamu (2012). The transition phase may be prompted by environmental constraints in many cases and this may take some years. In this case study the complex nature of change management and the way previous change experience influences the period of transition are brought to light. Previous change experiences enhance transitions on three theoretically distinctive bases. The first is that changes that are earlier imply that new changes turn out to be

more gradual or slower. Secondly, earlier change offers experience that develops acquaintance with processes of change, more pragmatic prospects or realistic expected outcomes and higher capacity to handle challenges that are involved, likewise through mobilization of more resources such as members of the family and extension agents. Thirdly, earlier change experience in a small-holder situation may mean that the farmer condones uncertainties and is practically in search of enabling situations for improvement.

The vegetable farmers in Cases 1 and 3 embarked on what may be regarded as investments that are not profitable in the 2000s, purchasing more lands for a relatively few vegetable stands. However, these investments that were viewed as being unprofitable may have created gains for them on the basis of or in the perspectives of enhancing management abilities and capability for change. In times past, they had obtained priceless change experience and abilities that gave them the enablement to manage new changes and transitions. As challenges emerge, their earlier experience offers them the self-confidence they require to surmount them. While adopting organic fertilizers, they did not contend with the constraints of cost, application and storage simultaneously. To them the process of change is very less demanding. The findings are in consonance with Hansen and Jervell (2014), Eisenhardt and Brown (1999), Brown and Eisenhardt (1997) who argue that change requires regular and rhythmic implementation by what, they termed as time pacing. Linsu (1998) suggests that this develops a regular, rhythmic and proactive strategy to change that is capable of increasing the potential for change by promoting an urgency sense, thus, it raises the degree of the effort made in the perspectives of information seeking and learning and enhances the capacity to absorb. However, simultaneously, it gives a sense of control to people because change turns out to be something that can be predicted, efficient, and focused (Hansen and Jarvell, 2014).

There are a lot of challenges in changes that entail simultaneous diversification, improvement, technology and organization. This confirms the observation of Hansen and Jarvell (2014) that changes that embrace expansion, growth, technology and organization at the same time pose challenges. Embarking on cooperative farming and farm operations cooperation are basic changes in organization. This is so because it makes organization to be more complex and raises the chances for emergence of conflicts during decision-making and in daily work. Be that as it may, the findings of this study indicate that a new change of that nature in management of farm is implemented successfully when those involved are able to invest in terms of much time to plan. These findings are a confirmation of those of Hansen and Jervell (2014);

Schei *et al.* (2012). Partnership with a farmer that is passive forms one other way of reducing the complex nature of joint operations as also suggested by Hansen and Jervell (2014).

The findings also confirmed the significance of intrinsic motivation in change management. These findings are congruent with those of Zimmermann and Campillo (2003). Farmers that passed through transformational changes required a high dose of inner interest and a raised magnitude of motivation to achieve success. Though not enough to achieve the enormous changes explained in this study, encouragement from the Ministry of Agriculture and extension agents is likewise of help to them. Inner interest and intrinsic motivation are required to be able sustainably to surmount all the difficult tasks that need to be done in transformational changes. This factor needs to be considered by policy makers in the course of changing regulations and setting up investment schemes to promote large investments.

The implications of this study for vegetable farmers, or other small agribusinesses experiencing large changes is that the same type of innovations is capable of yielding highly varying outcomes when introduced to similar farms. Vegetable farmers should not be oblivious of the fact that managing change as they maintain daily production will inhibit their capability. Thus, they need to make preparation for a likely deficit in performance. Earlier experience, the capacity to manage change and adequate capacity is critical to coping with the involved in transition; enough time to align with growth, which in most cases takes many years is needed by vegetable farmers. This is especially so when required management capacities are not possessed prior to the investments.

There are some limitations in this study. The limitation is rooted in the retrospective interviews and the respondents being humans are suspected to have had selective memory while describing and explaining earlier behaviours, in the process of looking back to the previous years. As recommendations for further study, future studies can possibly make attempts to trend with change processes as they are unveiled with time. Future researches may also confirm this model of change through the application of quantitative data analysis and quantitative analysis in other agricultural, enterprises. This study confirms that the objective evaluations of performance that are based on numerous indicators of productivity over the period of years are a confirmation of the results obtained from the interviews dwelling on the constraints involved in management of change.

The factors having positive influence on vegetable farmers' performance during and after change include previous experience with change, contact and consultation with agricultural extension agents, continuous gradual changes, diligent planning of joint farming operations and intrinsic motivation. Vegetable farmers who had experience from sustained change procedure build up managerial acumen and the capacity to change that is most likely going to be crucial for meeting future changes with marked success. Transformational changes, like those faced by vegetable farmers based on introduction of irrigation, crop diversification or changes in soil fertility innovation need to be appreciated as managerial challenge, and not just a factor of scale of production or adoption of contemporary innovation.

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