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RESEARCH ARTICLE:

Action Implementation and Performance Assessment with Continuous Improvement and Innovation Process in Sharptooth Catfish (*Clarias gariepinus*) Small Businesses in South Africa

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Abstract

Continuous Improvement and Innovation (CI&I) is a business management strategy that concentrates thinking and action on the things that makes the real difference. Performance assessment is the most significant step in CI&I, as it analyses and reports on outcomes – it reveals which goals have been achieved and which are still to be achieved. Emerging aquaculture farmers are not searching for handouts; they want to compete on a commercial scale. Aquaculture can only attract investors if it becomes profitable and viable. As part of the research reported here, role-players in sharptooth catfish businesses attended focus group discussions, and were equipped to implement actions and assess their own performance. The performance assessment process was followed to monitor the action that had been taken and to report results. Mechanisms such as action monitoring and support; observation; the formulation of questions and ideas; identifying opportunities; performance assessment; and achievement stacker were applied to assess the achieved outcomes. The study led to the identification of markets and potential customers; signed orders; access to processing plants; the printing of business material (e.g., stickers); training; and the completion of new ponds. Questionnaires were sent out and completed. An experiment with earthworms and tilapia fry used as catfish feed was completed successfully. In conclusion, the outcomes of this study have revealed a need for further research that would assist small businesses in the catfish industry in growing and becoming profitable.

Keywords*: continuous improvement and innovation (CI&I); performance monitoring and evaluation; implementation; aquaculture; farm and business management; sustainability*

Introduction

Continuous Improvement and Innovation (CI&I) is a business management strategy that concentrates thinking and action on the things that makes the real difference (Griffith and Mullen, 2016). Businesses must perform better than their opponents at any given time if they wish to remain relevant and competitive (Clark *et al.,* 2001). Action implementation is one of the eight steps in the cycle of CI&I. The purpose of action implementation is to focus effort on actions that would assist businesses in achieving their goals and ensuring effective and efficient implementation. Teams are implementing actions designed in step 4 of CI&I to receive regular support from colleagues and maintain focus and momentum. This step requires regular feedback sessions to keep people focused on achieving their goals and targets, and where necessary to refine the initial action implementation plan (Timms and Clark, 2014). Performance assessment is the most significant step in CI&I because it analyses and reports on outcomes – it reveals which goals have been achieved and which are still to be achieved (Alford *et al.,* 2008b). It also highlights achievements and gives feedback that can contribute to further improvements and innovations

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(Gray *et al.,* 2015). For performance to be successful, it must be based on outcomes rather than activities, as activities run the risks of continuing forever and being immeasurable (Smith, 1999). As Kerssens-Van Drongelen and Cook (1997) say, "you get what you measure." Businesses are forced to maximise on technology and resources, particularly human resources, to be globally competitive (Tovey *et al.,* 2010). This is especially true for businesses that rely on ineffective extension support that leads to poor returns (Griffith *et al.,* 2008) and businesses with five-year plans that are never implemented (James, 2016a).

Performance assessment allows actions to be ranked according to their level of significance and enable businesses to detect changes and disparities that have occurred (Sala *et al.,* 2011; Kumar *et al*., 2012; 2018). Active performance assessment is compulsory if a business wishes to implement a reporting framework capable of critiquing achievements while identifying opportunities for improvement, goal adaptation and creating fresh knowledge (Marlow, 2005). Consistent and repeated performance assessments are required to safeguard the success of improvement and innovation projects (Gray *et al.,* 2015). According to Kaplan and Norton (2015), the impact of non-financial measures (e.g., customer satisfaction, employee attitude, and human, strategic and organisational performance) is just as beneficial as the impact of financial performance measures "Navigating today's enterprises through complex competitive environments is at least as complicated as flying an airplane" (Kaplan and Norton, 1996). Marlow (2005) emphasises the importance of ensuring that key performance indicators (KPIs) and critical success factors (CSFs) are interrelated. Designed key actions (KAs) must be prioritised and linked to KPIs to influence CSFs and the attainment of outcomes (Davies and Kochhar 2000; Alford *et al.,* 2008a). According to Alford *et al.* (2008a), KPIs can only benefit organisations if they focus on what is important and yet are easy to communicate.

In addition, they should be used to detect and support models and techniques that realise success and to detect whether actions are impactful or not. KPIs must also provide strong evidence of achievements and influence to prove to funders that the model is effective (Clark *et al.,* 2001). Vanclay (2004) reports that capitalizing on profit is no longer the major motive of many farmers, and economic benefits are not enough to bring about the much-needed transformation. Laboratory Report (2014) report that the development and support of small, medium, and micro-enterprises (SMMEs) can lead to the creation of wealth via aquaculture. Emerging aquaculture farmers have made it clear that they are not looking for handouts; they want to compete with commercial farmers in terms of production and sustenance (Van Vuuren 2012). However, James (2016a) describes the aquaculture sector in South Africa as a "troubled industry with poor performance and few success stories". Aquaculture will attract investors if it becomes profitable and viable (Van Vuuren 2012). In the wake of an 80% drop in the South African pilchard harvest, a market acceptance survey found that sharptooth catfish (*Clarias gariepinus*) could replace pilchard in South Africans' diet (Matthews 2016). However, according to Writer (2018), 70% of new small businesses in South Africa fail within two years. It is therefore important to implement business frameworks that are sustainable, innovative, and empowering, and that have proven to be successful in business sectors other than agriculture (Gray 2013).

Catfish businesses in South Africa were recruited to apply the eight steps of CI&I to determine how best to achieve improvements and innovations (see Figure 1). Then, as recommended by Parnell *et al.* (2008), the eight steps of CI&I were followed to monitor the actions that had been taken and to report on results. The process guided and empowered partners to select; accomplish; evaluate; rank; sustain; and give feedback on improvements and innovations (Clark *et al.,* 2008). This countercultural practice that empowers people to implement and report was necessary owing to lengthy waiting periods before conclusions could be reached about results at the end of the financial year (Parnell *et al.,* 2008). The report on the study consists of three parts, namely *Part I: Decision of participants*; *Part II: Focus, situation analysis, impact analysis and action design*; and the current paper, *Part III: Performance assessment.* Parnell *et al.* (2008) report that, CI&I assist in determining which areas in businesses require change. It also assists in monitoring

and reporting on the impact that those areas have, especially their impact on productivity and profitability before changes are introduced. CI&I tools were applied to identify where improvement and innovation were required, and catfish partners took action to bring about the necessary change in their businesses.

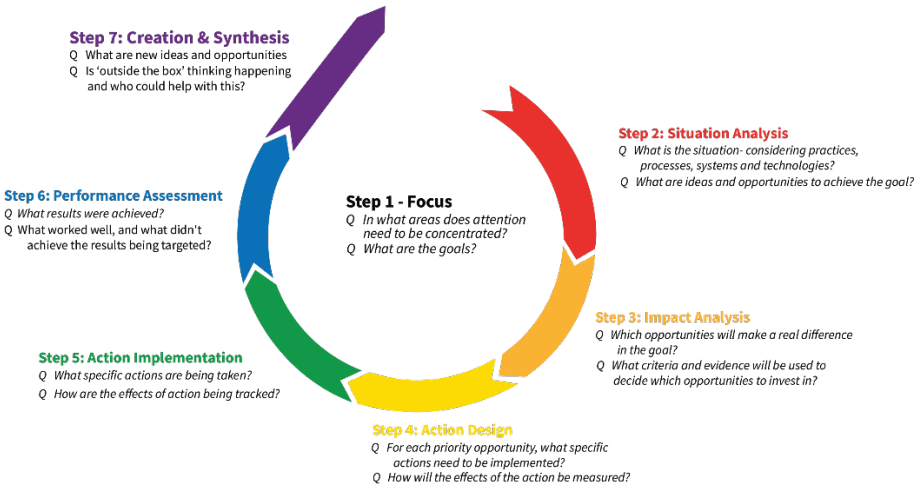

Figure 1: Eight steps of continuous improvement and innovation (CI&I) applied in sharptooth catfish businesses (Timms and Clark 2014)

Systematic complex methods that are used to design, implement, and monitor projects have only recently been introduced in the agriculture section. One of these methods involves the use of the CI&I framework (see Figure 1). It is expected that problems will arise when CI&I is implemented, and those problems will require proactive management (Parnell *et al.,* 2008). Agricultural managers (farmers) should report on projects every 90 days to improve their chances of achieving success and enhancing the rate of improvement and innovation (Alford *et al.,* 2008b). They should assess their progress and monitor changes that take place over time (Parnell 2008). Businesses deal with a unique situation that require unique interventions to improve their profitability and viability (Clark *et al.,* 2008). Researchers, individuals with a stake in the research and communities should collaborate to ensure success (Gray *et al.,* 2015). Parnell *et al*. (2008) state that a linear innovation model following a top-down approach assumes that scientists, researchers, and scientific professionals are solely responsible for innovation.

According to Madzivhandila *et al*. (2008), a top-down approach is organised internally and delivered to the people, and its outcomes are normally short-lived. CI&I has introduced a counterculture that assists, motivates, and empowers everyone in an organisation with the knowledge and skills required to innovate (Francis 1992). Real-world success would be bolstered if business managers voluntarily made the decision to be proactive and accountable to CI&I implementation (Gray *et al.,* 2015). Organisations or businesses that apply CI&I must determine whether their partners value the process and want to continue applying it (Alford *et al.,* 2008b). This paper reports on the actions that were taken after the 30-day CI&I activity timeline and reporting rule had been followed. The research questions guiding the study were: What specific actions were taken? How were the effects of actions tracked? Additional research questions were aimed at performance assessment: What were the results? What worked well? Which goals were not achieved?

Materials and Methods

The study was conducted in the Limpopo, Mpumalanga, Northwest, and Free State provinces of South Africa. Raw data were collected during focus group discussions and interviews with small-scale catfish farmers and businesses based in these provinces. An action implementing tool was applied to assess which results have been achieved in relation to the goal. Focus group

discussions were held and partners gave feedback according to their allocated tasks derived from the action design step. To improve on the implemented action, the reports were openly shared and scrutinised by other participants. In addition, this step also involved monitoring of the established key performance indicators (KPIs) (Timms and Clark, 2014). There are three fundamental constituents in this step namely: monitoring of results; reporting and support to "maintain momentum and motivation (Clark *et al.,* 2012)." People have to create their own strategies for implementation to achieve their own goals (Griffith and Mullen, 2016). According to Timms and Clark (2014), the purpose for action implementation was to "focus effort on the actions that will help to achieve the goal; ensure actions were carried out effectively and efficiently; ensure regular support and check differences between actions implemented and those that were designed to achieve the goal".

The tools used to take action include: Action checks; action monitoring and support tools; charts; critical success factors (CSFs) or key performance indicators (KPIs) or key actions (KAs); design and re-design; observations, questions, ideas and opportunities (OQIO) to support action taking; recording frameworks; regular and frequent thinking, feeling and action in cycles every 30, 90, 180 and 360 days; reporting for support; short-, medium- and long-term goals; and SMARTT goals (Timms and Clark, 2014). This study applied an action monitoring and support tool (Table 1) and an OQIO tool (Table 2), and partners prepared short reports and presented them to other team members. Members recorded OQIO from the presentation to offer support to the presenter. The presenter took the feedback into consideration and synthesised high-impact opportunities that improved and innovated action implementation. Timms and Clark (2014) emphasise the importance of action implementation, which is simply to check how far the action has progressed, providing people with an opportunity to communicate their achievements and obtain support if necessary. In addition, if action had not been taken the last 30 days, this step would be able to establish the reasons behind to improve progress (Timms and Clark, 2014). The tools were also assessed on a scale from 1- to 10 (1 = low; 10 = high).

Table 1: Description of achievement stacker tool

Mechanism	Achievement stacker
Type	Tool
Purpose	To motivate by recognising and acknowledging achievements people have made
Level	Practice, process, and system
Implementation	1. Equip people with cards and marker pens. 2. As they are listening to each of their colleagues share their reports about the actions they have taken and the improvements they have achieved, the list the achievements they think the person has achieved, one per card. 3. After each report, or at a designated time, the achievements are affixed to a large wall space 4. The achievements can be grouped in several different ways: • Similar types of achievements can be grouped together • Achievements can be grouped depending on the individual, work unit or project to which they relate. • Achievements can be grouped depending on the timeframe in which they were achieved 5. The completed Achievement Stacker should be recorded. This can be done quickly with a camera, but the data can also prove very useful in other formats 6. Remember, while recording the achievements is one think, recognising, acknowledging, and celebrating the achievements is important for the motivation and momentum need to sustain improvement and innovation.
Source	Gray (2013)

Table 2: Description of observations, questions, ideas, and opportunities tool

Mechanism	Observations, Questions, Ideas, Opportunities (OQIO) and collaborative OQIO

Type	Tool
Purpose	To give and receive support, observation, questions, ideas and opportunities can be synthesised into opportunities to improve innovation.
Source	Gray (2013)
Implementation	OQIO with individuals 1. Write down the focus. 2. Answer the question 'what observations can I make about the focus, the action taken and the results achieved and not achieved. Record the observations in the appropriate column in the framework. 3. Answer the question 'what questions can I formulate about the focus, the action taken, and the results achieved and not achieved? Record the questions in the appropriate column in the framework. 4. Answer the question 'what ideas can I generate about the focus, the action taken, the results achieved and not achieved? Record the ideas in the appropriate column in the framework. 5. Look at the observations, questions and ideas and create and synthesise opportunities for improvement and innovation in the context of the focus. 6. The assumption is that the OQIO is being used purposefully to develop opportunities for improvement, so two key questions should be considered as the last step in using the tool: How will I action the opportunities? Who needs to be involved in implementing them? Collaborative OQIO 1. Set up the venue for the activity by: • Writing down the focus so that it is visible to all participants • Establishing one 'station' or multiple 'station' for each of 'observations', 'questions', 'ideas' and 'opportunities'. • A 'station' consists of butchers' paper stuck on a wall or easel with colour marker pens available and the item written at the top of the sheet. • Each 'station' needs to be far enough away from every other 'station' to make sure that people can focus on the 'station' they are visiting without distractions. • However, all the 'stations' need to be in the general vicinity of one another to create an atmosphere of energy and connectedness. 2. Divide the group into pairs (or threes at most) and equip each individual with coloured marker pen. 3. Ask the pairs to stand at a 'station' marked either 'observations', 'questions' or 'ideas' (not 'opportunities' at this time). Give the pairs 2-5 minute to think of and record 'observations' if they are in front of an 'observations' sheet, or 'questions' or 'Ideas' as appropriate. After 2-5 minutes ask the pairs to move to a different 'station; and add their "observations' or 'questions' or 'ideas' to a list started by a previous pair. Reading what is already recorded will stimulate participants thinking and prevent unnecessary duplications. Participants can add comments to those contributions already on the list but may not detract from the intent of what is already written. 4. Once the pairs have recorded their 'observations' and 'questions' and 'Ideas' ask them to visit (in pairs) all the 'stations' to read and d think about all the contributions recorded by the group. Ask pairs to then move to 'stations' labelled 'opportunities' and ask them to synthesise (and record) opportunities for improvement and innovation. 5. Enable participants to reflect on the pool of opportunities developed and add more opportunities stimulated by this reflection.

Performance assessment involves tracking the results of the action implemented according to the CSFs and KPIs. This step assisted teams in assessing whether their goals have been achieved or not according to the focus (Clark *et al.,* 2012). It becomes easier to detect which methods worked well if KPIs are established during action design and monitored during action implementation (Clark *et al.,* 2012). The tools applied in performance assessment were an achievement stacker

(Table 3) and results assessment (Table 4). Teams prepared a report and gave a presentation on their results and explained what worked well and what did not work to achieve the goals. Listeners noted which results the presenter had achieved, and the type of support required for further implementation. Timms and Clark (2014) emphasise that celebrating people's achievements is critical to motivate them to sustain success. Similar types of achievements were grouped together, and final achievements were recorded. The tools were assessed for value on a scale 1- to 10 (1 = low; 10 = high).

Table 3: Description of action monitoring tool

Mechanism	Action Monitoring and Support
Type	Tool
Purpose	To maintain the momentum for action and keep it focused on achieving the results targeted in action design.
Level	Practice, process ad system
Implementation	Each member prepares a brief report using action monitoring and support. As the report is presented each member record what was achieved and the type support they believe the reporter deserves.
Source	Timms and Clark (2014)

Table 4: Description of results assessment

Mechanism	Results Assessment
Type	Tool
Purpose	People can determine and make conclusions about the level of achievement of their goal. They would also be able to assess the effectiveness and efficiency of how the results were achieved.
Level	Practice, process and system
Implementation	A brief report should be prepared of the results achieved according to the CSFs and KPIs. Reporters should also think about the type of support they require to keep achieving the goals. Listeners would also give input of what was achieved or not achieved.
Source	Timms and Clark (2014)

Results and Discussions

CI&I in aquaculture is new and there is not enough literature on this topic to compare the results of the current study to other researcher's results. The identified drivers that catfish businesses in this study could modify to attain improved profits were as follows:

Water access: According to the results obtained in this study, quotations for drilling water borehole were obtained and the total costs would be R24 810, 00 for a water pump machine, control box, pipes, and electric equipment (Table 5). Some projects reported that water drilling service providers had been contacted but failed to visit the business sites or provide quotations. Water licences were not obtained from the Department of Water Affairs (DWA) owing to a lack of funds, but commercial projects had already obtained water licences. The support required included financial assistance from government, but partners expressed a lack of confidence in the system. Prioritising the acquisition of water licences was necessary, as start-ups farmers in aquaculture need a water-use permit from the DWA before their operations can commence (James, 2015). Laboratory Report (2014) attempted to eliminate this need to apply for water- use licences by businesses as it takes four to eight months to obtain such licences, which hamper production. However, little has been achieved by this initiative (James, 2016b).

***Market access*:** As part of this study, market questionnaires were distributed in various communities. Projects that did not use questionnaires reported that their communities were already aware of their businesses and there was no need to establish new markets. According to

other partners, questionnaires created awareness and determined the type of market opportunities available in their local communities. Meetings were scheduled with radio station managers and funds were required to book advertising slots. In addition, social media advertisements were made and, business materials (e.g., cards and stickers) were printed. Billboards could not be erected because the government did not keep its promise to finance such billboards. Market liaison linking the producers of fish products to consumers is on-going. Letters of intent from feeding schemes could not be obtained. The study showed that wholesalers and retailers preferred to purchase 50 g to 70 g of catfish. Van Vuuren (2012) emphasises that rural farmers are encouraged to produce enough fish to sell in their ventures. Operation Phakisa also identified the development and promotion of local off-take agreements with major retailers as an opportunity to grow aquaculture in South Africa (Laboratory Report, 2014).

Cost effective-feed supply: Here partners explored various types of feed to grow catfish at an affordable price. They reported that earthworms were in abundance locally and some shared their knowledge of farming with earthworms in their local areas and the farming processes involved. Cow dung, pig waste and chicken waste were available to be used as fish food by local farmers. Some of the projects reported that they were not formally registered. Feed is a thorny issue in aquaculture as it accounts for up to 70% of the total cost of production (Matthews, 2016). For Aquaculture to succeed, research should be locally relevant, resulting in a globally competitive industry in areas such as specific diets, food safety and markets (Laboratory Report, 2014). For instance, rural farmers in Egypt receive funding and subsidies for feed mills to reduce the input costs of start-ups (James, 2016b).

Harvesting equipment: Partners were able to obtain quotations from hardware stores and they required support to travel to shops that sold harvesting equipment in bulk. Water quality equipment was bought by government, but was never delivered to projects, since the service provider forgot the equipment in a vehicle and decided to leave it with an extension officer. The extension officer failed to deliver it to the project.

***Construct ponds*:** Ponds were constructed, but old pond walls were not mended because the partners had other commitments, such as poultry farming. Probing revealed that ponds were situated at a distance from partners' homes and the fish were often stolen. A solution was to obtain fish licences or permits from the Department of Agriculture to gain access assistance from the local authority and thus prevent theft. Partners told the researcher that, the apartheid government used to arrest people found holding fish without a permit and, when arrests were made; the matter took three months to resolve without arbitration. There was a high need for properly planned and constructed ponds to maximise aquaculture productivity since ponds were the main production systems used for fish farming in rural areas (AgriSETA, 2020). Furthermore, the costs of revamping fishponds and depreciation had to be included during budgeting to ensure that ponds could be refurbished when necessary (Engle and Stone, 2007). In countries like Myanmar, agriculture departments went the extra mile to equip fish farmers with pond construction skills and to disseminate best practices to increase aquaculture production (World Fish Center, 2020).

Aquaculture skills: Some partners successfully secured and attended training at the local University. Others had already been trained according to agriculture managers and were refused further training. Partners stated that they had been trained very long-ago during farm visits but had no hands-on practical training. It came as no surprise that training was needed – even in the beef industry farm visits were used to share information and inform farmers about technological developments (Griffith *et al.,* 2008). Partners in this study failed to indicate whether they had been trained during the action design, impact, and influence phases of CI&I. The researcher observed that all partners of the cooperative were present during the focus, situation analysis, impact, and action design sessions and this caused partners to hold back. However, the few partners that attended the performance assessment sessions could therefore talk more freely about the matter of training and the problems they experienced. Timms and Clark (2014)

emphasise the importance of doing different things if one wants to achieve different results. Again, sourcing external expertise is crucial to increase knowledge and enhance decision-making (Griffith *et al.,* 2008). Francis (1992) emphasises that hands-on technical training must be conducted in segments over time rather than once a year to be effective. Interestingly, partners from the beef industry also followed a similar approach to training in interpersonal communication, succession planning and animal management (Parnell *et al.,* 2008).

Self-study: Some partners received the catfish manual, printed copies, and distributed them among themselves or shared chapters on production, breeding, and nutrition for self-study purposes. A training workshop at a college could not go ahead because the coordinator was on leave, so an alternative training venue had to be found. The local university made the venue available, and the training could take place. Partners in this study showed an increased willingness to learn and share during performance assessment sessions. Griffith *et al.* (2008) emphasise the high benefit of partners who willingly share their experiences with others, in formats that differ from passive information events such as farmers days. However, this type of willingness is very slow to emerge. CI&I ensure that gathering information is not done just for its own sake, but that it is meaningful (Parnell *et al.,* 2008).

Table 5: Outcomes of action implemented and results assessment

Focus	Critical Success Factors	Key Performance Indicators	Key Actions	Action implemented	Results Assessment
Improve water access in order to improve profit and create jobs.	Drilling a borehole (water surveyor and driller, pipes, generator, electricity, and water pump). Obtain water permit from Department of Water Affairs (DWA). Obtain funds	Water assessment report; quotations; invoices, funding approval and water permit approval	Search for water drilling companies and request for quotation. Enquire from DWA on how to obtain water permit. Obtain water licence from traditional house to deliver water from the river to fishponds. Obtain funds to drill borehole and request assistance from extension.	Quotation from water drillers was R24 810, 00 for borehole machine, control box, pipes and electric equipment. Others reported that water drillers never pitched. Water permit was not obtained from DWA, while others already had from other agricultural activities. Funds were not obtained.	Quotations for water equipment were achieved. Certificate from water Affairs was not achieved due to lack of travelling funds. Water surveyor was found and quoted a lot of money for a borehole. Water test kit was purchased but not received on-site.
Improve market access to improve profit drivers.	Secure off-takes for all products at required price. Active market liaison to fit product to market. Market survey for local community. Secure market from restaurants, feeding schemes and prisons Branding and advertise on radio, social media and billboards. Obtain health certificate; assistance from public economists.	Signed orders; Market questionnaire and report; business cards; confirmed meeting for radio; printed billboard; letter of intent from prisons and feeding scheme and health certificate; attendance register and minutes.	Identify potential customers; provide samples and prices, secure orders. Provide samples; obtain inputs, product adjustments and acceptance of products. Administer market questionnaire. Obtain graphic designer and advertise on radio and restaurants. Enquire from department on the billboard and obtain funds.	Questionnaires were administered in various communities, while others failed because their community was aware of their projects. Meeting with radio station manager was scheduled and requires funds for advertisement slot. Social media adverts, business cards and business stickers were achieved. Billboards were not achieved since government failed to erect them during project construction.	Newly built processing plant was a secured market and questionnaires were not completed. Other partners reported that youth refused to complete the questionnaire saying they are not for employment. Partners did not advertise due to fear of giving people false hope when there is no fish. Market will make partners succeed. Wholesalers from China were interested in purchasing their

				Others liaised with their secured crop market to fit their fish product. Letter of intents from feeding schemes were not obtained. Wholesalers preferred 50-70 g catfish.	fish. Signed orders from potential customers and active market liaison were achieved. Fish were sold out from communities. Sourced fish market from existing crop market. Questionnaires were successfully administered in Phetwane and Kaapmuiden and reported as a separate paper.
Increase food supply in order to reach market size quicker.	Collect locally available food such as earthworms, chicken dung; traditional brewery, chicken intestines; pig waste; cow-dung, fig tree, mulberry, Mozambique tilapia, sunflower and maize meal. Conduct an experiment of earthworms and tilapia on catfish.	Cash slip/ quotation; Signed agreement; Research report.	Collect alternative food from community members to feed African sharptooth catfish. Approach stores and obtain quotations for chicken intestines and maize meal. Conduct an experiment of earthworms and tilapia on catfish.	Earthworms, cow-dung, pig, and chicken waste were locally available free of charge. Materials for conducting an experiment of feeding catfish with earthworms and tilapia fry were collected. Probing revealed that some members were not appearing on the business certificate and that caused conflicts.	The experiment to feed catfish with earthworms and prey of tilapia fry were completed and reported as a separate paper. Chicken, pig and cow waste were not fed to catfish to assess growth rates.
Secure equipment	Search for stores that sold aquaculture equipment such as nets, scales, waders, containers, knives, and pliers.	Quotation/ cash slip	Access internet and search for aquaculture equipment stores and purchase equipment.	Partners were able to obtain quotations from the hardware stores and they required support with transport to travel to shops were these items were sold in bulk. Others failed to meet as a cooperative to purchase equipment. Water quality equipment was purchased by government and was not delivered to projects.	Equipment was not purchased due to lack of funds. Follow-ups with government were made regarding water test kits and they were not delivered.
Construct ponds	Construct ponds in the projects and revamp existing ponds	Completed ponds	Construct earthen ponds and strengthen pond wall	Ponds were constructed and lacked fence. Pond walls were not strengthened due to commitments on poultry farming. Probing revealed that partners lacked fish permits causing lack of recognition from chief.	Ponds were achieved. Pond walls were not strengthened due to lack of funds

Improve technical skill in order to operate viable businesses	Self-study on the culture of catfish manual. Improve capacity on catfish breeding. Implement continuous professional development (CPD)	Copy of a manual. Attendance register, Assessment form. Implement training plan, attendance register	Conduct self-study on manual "the culture of catfish". Organise with the local college/department to be training to partners. Organise training venue. Assess training need analysis, design training programme, source fund and implement	Training was already received from Chinese trainers and partners wanted refresher course. Self-study: on catfish production, breeding, and nutrition. Training workshop was not successful since the coordinator was on leave.	Training was attended at the university. Those that failed to attend training indicated that managers refused to train them again. The training was in 2015 was theory and not practicals. Others wanted to be in possession of the product more than training. CPD was achieved and on-going. Self-study on catfish manual was achieved.

Support:

- Government assistance to obtain funds and water licences.
- Training on new technology.
- Find a suitable experimental site. Funds to cover overhead costs.
- Funds to purchase equipment and transport for easy access to town.
- Assistance with new business registration certificates.
- Government assistance with fish licences. Funds to refurbish old ponds.
- Source aquaculture refresher training courses.
- Department of education feeding schemes off – takes.
- R & D funding for product development, pet food market development.
- Funds for training.

Observation, questions, ideas, and opportunities (OQIO): Partners were requested to share their observations, questions, ideas and identified opportunities during every feedback session. They subsequently shared 23 observations, 43 questions, 35 ideas and 25 opportunities (Figure 2). The data were collected from documents that were utilised during sessions, tools worksheets and audio recordings. Partners' thinking was enhanced. The first CI&I cycle involving Australian agricultural businesses generated 480 observations, 16 questions, 503 ideas and 125 opportunities (Gray, 2013), which were higher than the numbers obtained in this study. In South African beef profit partnership, CI&I led to developments in the areas of capacity-building, economic performance, empowerment, culture, and self-reliance (Madzivhandila *et al.,* 2008).

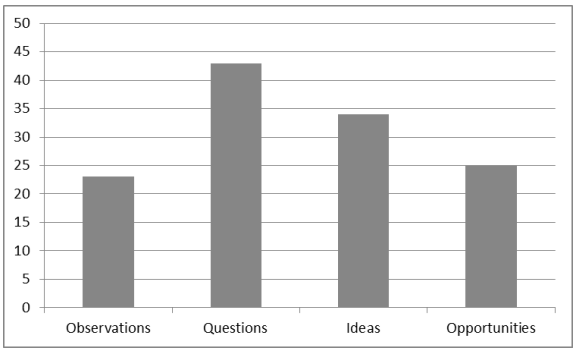

Figure 2: Number of generated observations, questions, ideas, and opportunities in cycle 1

Performance Assessment

Action implementation was followed by performance assessment after an additional 30 days. The results are discussed below:

***Improved water access*:** Boreholes were not drilled owing to a lack of funds (Table 5). Partners did not apply for water licences because they could not afford to pay the administration fee. Water

test kits were purchased by the government but were not delivered to the project. The drilling of boreholes to overcome a water shortage was an essential part of this study as water is a scarce resource in South Africa (Van Vuuren, 2012). Madzivhandila *et al.* (2008) reported that the application of CI&I led to improvement of natural resources such as land, water and biodiversity during their study which contributed to an increase in sales. Griffith and Mullen (2016) report that water management was one of the constraints that they had come across and that required intervention by a group of Australian economists after CI&I had been applied.

***Improved market access*:** According to Britz (2014), information about the market for catfish is not readily available, therefore extensive research leading to marketing plans and the calculation of genuine production costs is required. In this study, signed orders from potential customers were secured. Signed orders were obtained, which facilitated active market liaison and a better product-market fit. This was critical as farmers could have fish stocks for six to eight months without potential buyers. Large amounts invested in aquaculture would therefore be inaccessible. Market questionnaires were distributed in communities. Some partners who did not distribute questionnaires reported that they had already secured a market in the form of newly built processing plant. Other participants in the study reported that participants would not respond to the questionnaires because no job opportunities were offered. Fish would be processed and canned in the new processing plants. Wholesalers were interested in purchasing fish, but some partners could not approach wholesalers because they do not have the funds to travel to meet the wholesalers. Even though the formal market is not familiar with catfish products (Britz, 2014), access to markets is critical. In this study, partners could advertise on radio, but not on billboards as they feared billboards would create false hope of fish sales in the community due to lack of fish in the systems. Business stickers were also achieved. Laboratory Report (2014) cautions that there are negative perception stemming from religious beliefs. These perceptions affect catfish marketing negatively, and marketing efforts are generally fragmented. Britz (2014) emphasises that there is a huge market for processed catfish products, even though the economic feasibility of catfish has not been trialled.

***Improved technical skills*:** Catfish training was successfully organised and attended. Partners learned that fish could be farmed indoors with circulating water – if inside temperatures could be kept hot, fish could be bred all year round. Partners reported that it was very expensive to keep circulating the water in indoor systems. Some projects could not get training as they had already been trained in the past. A catfish manual was made available and used for self-study purposes. The need for a continuous professional development programme was identified and a training needs analysis was done. Ongoing training was offered. Setting an example to aquaculture, the beef industry developed new skills, new knowledge, and the ability of role-players to act and lead themselves, which led to higher incomes for beef farmers (Madzivhandila *et al.,* 2008). In another example, developing and building the capacity of subsistence farmers and newcomers were prioritised by Egyptian government to ensure that businesses could be operated successfully (Laboratory Report, 2014). In South Africa, there is currently only one commercial project that offers training in aquaculture (Laboratory Report, 2014). Capacity-building involving soft technology (i.e., thinking and action) is even more valuable to enable farmers to improve their practices and to innovate, but this is not often witnessed in Agriculture (Clark *et al.,* 2001). Gray *et al*. (2015) also report the improved ability of agricultural business owners to expand and remodel with CI&I tools.

***Alternative food*:** Chicken, pig, and cow waste could not be fed to catfish to assess their growth rates. The experiment to feed catfish with earthworms and tilapia fry was completed and reported in a separate paper. A group of Australian economists identified food security and productivity as constraints that had to be resolved to achieve success (Griffith and Mullen, 2016). A lack of access to high-quality inputs such as high-quality seeds, fingerlings and feeds is critical to the health and quality of fish products (Laboratory Report, 2014). Ponds were constructed, but

equipment could not be secured owing to a lack of funds and the failure of government officials to deliver equipment that had been purchased by the Department of Agriculture.

Tool Assessment Outcomes

Partners were asked to assess the following variables on a scale from 1 to 10 (1 = 10; 10 = high): liked; ease of use; thinking enhanced; time; cost of not doing; value; and motivation. The tools used were action monitoring; OQIO; results assessment; and achievement stacker.

Liked: The results assessment; action monitoring; OQIO; and achievement stacker tools were highly liked by partners, with mean scores ranging from 8- to 9 (Figure 3). The median was high in both results assessment and achievement stacker, with a score 9. Partners stated that they had an excellent understanding of how the tools functioned.

> '*We understood them, and I think they were very important and easy. I liked them as high percentage; they were easy at a higher level (45*). *I liked these tools; they were important and they opened our minds. They taught us about planning and opened our minds; they taught us about how to plan and how to do something, where to start and not jump to the middle (44)'.*

Ease of use: Ease of use obtained the second highest mean score in this study, namely 8 for both mean and median. Partners stated that the performance assessment tools provided them with a lot of information, and they were easy to apply – *'It was informative, it was good to learn and making us think and very understandable. I can give it 10 marks on the like and on ease of use because I understood them (43)'*.

Thinking enhanced: Thinking was greatly enhanced, with mean and median scores ranging from 8- to 9. Action monitoring had the third highest median, namely 7. Partners said that the way they thought had been improved – '*I understand thinking enhanced; my mind improved truly (43)'.*

Action monitoring: The action monitoring tool took a long time to apply and achieved the third highest mean score, namely 7. It was followed by OQIO, while results assessment and achievement stacker took partners a medium amount of time and both got a borderline mean score of 5. Action monitoring had the third highest score, namely 7.

Cost of not doing: According to this study, the mean and median scores for OQIO, achievement stacker and results assessment were between 8- and 9. In contrary, OQIO tool had the third highest mean and median scores, namely 7 in the Australian agricultural businesses study (Gray, 2013; Gray *et al.,* 2015).

Value: Partners found high value in all the tools with a mean score between 8- and 9. The median was the highest for result assessment and OQIO, with a score of 10. In contrast, action reporting and support framework scored a low value in the Australian agricultural businesses study (Gray, 2013).

Motivation: In this study, motivation to apply the tools again was very high, with mean scores between 9- and 10. Motivation to apply the tools again had the highest median score, namely 10, for both results assessment and achievement stacker. In contrast, achievement stacker obtained the lowest mean and median scores in the Australian agricultural businesses study (Gray *et al.,* 2015).

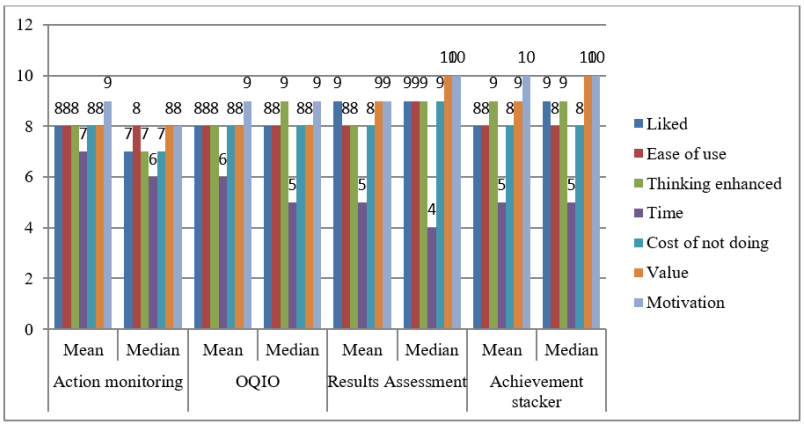

Figure 3: Value assessment of action monitoring; OQIO; results assessment; and achievement stacker on a scale from 1- to 10 (1 = low; 10 = high)

Conclusion

The objective of action implementation was to determine what specific actions were to be taken and how their effects could be tracked. The results showed that the actions targeted included: *improved water access*, with its effects tracked based on the drilling of boreholes, obtaining water pipes to deliver water from the river to the projects and obtaining water permits from the Department of Water Affairs (DWA); *improved market access*, with its effects tracked via market questionnaires and based on securing potential customers, active market liaison, achieving product–market fit, and advertising on radio and billboards; *alternative food options*, with its effects of sourcing locally available food, feeding it raw to catfish and determining the growth rates of the fish; *obtaining equipment*, with its effects based on the sourcing and acquisition of aquaculture equipment; *ponds*, with effects including the construction of more ponds and strengthening the walls of old ponds. The effects of the actions were investigated every 30 days, and brief reports were written on achievements and further support required.

The objective of performance assessment was to determine which goals had been achieved and which still had to be achieved. The achieved goals were: the completion of market questionnaires by local community members; the identification of potential customers; obtaining signed orders; achieving a product–market fit; liaising with radio station managers and airing radio advertisements; securing a contract between a number of fish farmers and a processing plant; printing business materials (cards and stickers); experimenting successfully with earthworms and tilapia fry as catfish feed; constructing fish ponds; and getting quotations for boreholes and equipment. Some goals that could not be achieved were mainly owing to limited financial resources. These included: drilling new boreholes; putting up marketing billboards; purchasing equipment; strengthening pond walls; and exploring alternative catfish feed such as cow dung, pig waste, chicken intestines, brewery waste and mulberries. Aquaculture research and development should invest in resolving issues such as access to markets; access to water; cheaper alternative feed; equipment; production systems; and capacity development for the growth of small businesses in South Africa.

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