Western Cape Government

Agriculture

FOR YOU

FruitLook: An Evaluation Study

July 2022

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Contents

Tables

Figures

1 Introduction

Eight of the ten top export products of the Western Cape are fully reliant on irrigation[1] and are key drivers of the Province's economy and job creation. At the same time the Western Cape is a water-scarce region with a history of droughts having negative effects on agricultural output and food security. In an effort to mitigate the effects of water shortages, the Western Cape Department of Agriculture (WCDOA) engaged a Dutch firm, eLeaf to develop FruitLook, a satellite based solution for optimising irrigation water management. Since 2011-2012 the WCDOA has provided FruitLook to Western Cape farmers at no cost.

In September of 2021 the WCDOA engaged Agri-Africa Consultants CC to provide an evaluation of FruitLook as a support mechanism to help irrigation farmers better conserve water. Beyond an assessment of the efficacy of the initiative, the Evaluation was also to consider alternative funding mechanisms that would be appropriate for its further continuance.

The principal objectives of the Evaluation as contained in the ToR can be briefly stated as the following:

1) Determine the value that FruitLook offers its users (farmers and other interested parties)
2) Determine whether FruitLook achieves the WCDOA objective of water conservation.
3) Report on the need for an alternative practical and implementable funding model for FruitLook.

The report outlines the methodologies for the study, explores the concept of value in the irrigation domain, canvasses the value perceptions and perspectives of irrigators (especially FruitLook users), analyses the data that emerge, and argues, supported by Theory of Change and SWOT, for a reset of the existing business model. Briefly this is how the questions posed in the Terms of Reference for the Evaluation study are answered.

2 Methodology

The methodology employed by Agri-Africa follows the proposed framework and sequence of activities outlined in the firm's original response to the Evaluation Tender, further expanded upon in the Inception Report. Briefly it consists of the following sequential phases:

a) Desktop research to establish an historical background to the FruitLook initiative and develop an understanding of the original intentions, drivers, and technical possibilities that prompted its adoption by WCDOA. [An important aspect of this and other earlier fact-finding phases would be to create the foundation for an (implied) Theory of Change – an exercise necessarily undertaken towards the conclusion of the study.]
b) Inception planning and reporting which stems from the desktop research and is intended to highlight the study priorities and principles which underpin the Initiative. The process details how information essential for the evaluation will be extracted in the field, examined and formulated into a final evaluation report.
c) In field investigation to understand the operational and market environment in which FruitLook resides. This is a three part process:
    1. Online survey directed at irrigation farmers and distributed principally through their Water Users Associations. The survey was distributed to all irrigators to include those that used FruitLook and those that did not, specifically to understand why FruitLook was or was not taken up.
    2. Structured interviews with farmer-users to assess the use and level of usefulness of the FruitLook offering to farm decision makers.

[1] Terms of Reference FruitLook Project

3. Structured interviews with those in advisory or academic fields concerned with aspects and support of irrigation technology. This group offers a disinterested outside perspective on water management.

d) Positioning of FruitLook in the irrigation management domain. This is to provide an understanding of the current practice of irrigation management with particular focus on the extent of the role that FruitLook plays. The information has added value coming directly from both irrigators and their service providers.
e) Developing perspectives of value from FruitLook. Once positioned as a management tool within the irrigation context it becomes possible to infer its value through the lens of alternative technologies and management strategies.
f) Undertaking Theory of Change and SWOT analyses. The overall findings will be gathered together into a Theory of Change framework (a retrospective ToC will need to be inferred) and a SWOT analysis applied. The intended purpose of these exercises is to prepare for future planning.
g) Considering alternative funding options. The FruitLook operation is funded by WCDOA making the Department the effective client. The effect of this existing funder/client relationship will be contrasted against alternative funder/client business models.
h) Writing the final report. A final report outlining the key components of the study will be drafted, presented for comment and finalised.

3 Value and price – a project view

We believe a broad discussion around the concept of value to be a useful precursor to any meaningful evaluation analysis. Through it the evaluation process can be framed in a way that addresses the specifics of a project, in this case, FruitLook.

3.1 Concepts of value and price.

It is important at the outset to distinguish between value and price. This is particularly relevant for FruitLook as the service carries a zero price tag although it has a positive value for the many farmers who spare the time to use it.

The zero price is thanks to a R10 million subsidy paid by the WCDOA from whose viewpoint the amount is effectively the price for the provision of FruitLook to farmers. To help make sense of the value concept, here is a simple definition of value and price germane to an understanding of the FruitLook initiative.

> *Value is a subjective assessment of benefit made by a beneficiary, potential beneficiary or beneficiary group with need for such benefit. Value may be specific (monetary) or implied (e.g. added peace of mind).*
> *Price is the agreed settlement between a provider of a benefit and its recipient in exchange for the benefit received. Price is specific and normally expressed in monetary terms.*
> *Corollary of sustainability: In normal circumstances, a provider of benefit is motivated to continue producing that benefit where its price is greater than its cost of production – i.e. the provider profits and his/her enterprise is sustained.*

In dealing specifically with FruitLook there are several factors that contribute to value.

3.2 Perspective on value.

We have implied that there is more than one party with an interest in what the FruitLook service can achieve – the irrigation farmers and the WCDOA being the most influential. As a group, farmer-users of FruitLook have several interests in its offerings: How does FruitLook help them plan, contain their risk, improve the efficacy of their water application, improve their yields, save

on costs and, even beyond their boundaries, compare their own crops with those of their neighbours? Perhaps even allow them sleep better at night! Each individual user will have a different take on the value of these potential benefits depending, for instance, on perceived shortfalls in service delivery, delayed reports, poor resolution, cloud cover, and even the effort of becoming familiar with the technology and spending time on the portal.

WCDOA's perspective is differently arrived at. The department's original and principal objective in undertaking the FruitLook initiative was to save scarce water resources. Following due process of testing, development and negotiation with eLeaf, a price for providing a satellite imaging footprint covering the intensive farming areas of WC and made available in field-size units to farmers, was agreed upon. This price (R10 million at present) was paid for by WCDOA to provide the FruitLook service free to the farmers in the belief that free access to a product offering the potential to save water could meaningfully address the water scarcity problems of the WC.

3.3 Areas of influence

There are certain factors that influence the value of a proposition or benefit. Value changes for instance for the owner of a car as it ages, or of a home if its view is obstructed, or at a more complex level, of a deprived community not at peace with itself. These factors can change the perception of value, often immeasurably, as time progresses or the dynamics alter. In the FruitLook case there are a several such factors that influence value.

Competition in the market is one of the first that comes to mind. In the field of irrigation scheduling there are several alternative systems available to farmers (discussed in depth in Appendix 3). These are offered at a price, which in the subjective judgement of farmers taking up a particular technology, delivers value in excess and is therefore worth buying. Within this active market, FruitLook has a competitive advantage in being free.

Other influencers on FruitLook value are those on the periphery that directly and indirectly support the programme. These are the advisors and researchers who inform the development and use of the product, and the marketing and technical support engineered through the eLeaf/WCDOA collaboration that contribute to its uptake.

There are many more factors that influence the value of FruitLook. Changing weather patterns, shifting farming trends led by produce markets and technology, costs of water and electricity are examples.

3.4 Operational Context

The oft-repeated water saving goal behind the FruitLook initiative is chiefly about more efficient irrigation scheduling. Three entities are involved each with their own objectives: eLeaf and its partners, motivated by profit and growth; WCDOA, motivated by the desire to help farmers optimise their use of water; and the irrigation farmers motivated by profit and reduction of risk (important in farming). These three bodies and their drivers form the core around which the operational context is built and goals fulfilled. As long as the respective motivations of the parties concerned achieve the overarching objective of water conservation (see implied Theory of Change – Section 6.1) the arrangement could be regarded as productive and sustainable. If not, any realignment that might follow an unproductive relationship could be expected to affect the value of the FruitLook. In the interests of sustainability, the aspect of mutual advantage becomes critical.

The context around water usage at a general level consists of other elements too. To illustrate, here are a few:

- Contractual arrangements between water user associations and its members and the effect of these arrangements on the price and use of water.
- The price of electricity affecting energy efficiency of individual irrigation designs.
- The value in terms of overall farm revenue of more efficient water use – i.e. achieving an optimal balance on-farm between water use and irrigable land.
- Trends in intensive crop production systems like shade nets and plastic covers; and as mentioned previously,
- Alternative competing irrigation management strategies.

3.5 Benefit versus need

It is a truism that the *value of a product or service is a function of the benefit it offers its users in relation to the users' need for it*. The balance of benefit versus need is central. Given the overarching goal of water conservation, FruitLook's perceived benefit for WCDOA is the encouragement of farmers to take up the service and help optimise the use of water. Two questions arise: Do farmers use FruitLook, and does using it achieve the purpose for which the idea was launched, i.e. improved water efficiency?

'Need' is the foundation of value. The success of FruitLook is totally dependent upon the company fulfilling farmers' needs. Such needs are directly linked to the profit and risk reduction motives that drive farming and which in turn are dependent on farmers' choices over competing inputs and technologies. As will be discussed later (Section 4.4.3), in recent years especially since the drought of 2018/19, farmers have become increasingly aware of the value of good water management. This has manifested itself in several ways, by enabling a better return on available water by allowing more land to be used and/or better harvests achieved as well as saving on costs. This in turn has created a market for technologically-directed irrigation scheduling systems accompanied by software and specialised advice for farmers. FruitLook resides in this market, together with several other players, all effectively contributing to the WCDOA water goals.

The need for effective irrigation scheduling technology is not in dispute: the question of a value for FruitLook is, however, a function of how well it performs in that market.

3.6 Effect of scale

One of the objectives of the Evaluation study is to offer suggestions for alternative funding options for FruitLook. In the event of new and/or alternative funders becoming involved (including users), the importance of scale comes into play. Scale is a critical factor for FruitLook because, in keeping with most digital technologies, the cost of providing the service is dominated by a central IP-based component, comprising data gathering (satellite imagery, weather data etc.), interpretation (algorithms) and information distribution (portal development, communication media). The more users tagging on to FruitLook, the greater the cost spread and therefore the cheaper the service for users. Numbers become important. This differs from some of the alternative technologies, such as soil probes, where the cost has a high variable component per probe installed.

Our investigations show any consideration of alternative funding options would need to include a user-pay or commercialized option. For this to succeed, the price of a commercialised FruitLook user-pay package should be low enough to encourage a sufficient number of farmers to take it up, yet high enough for the business model to be sustainable (provider revenue to exceed cost). A successful price would naturally reflect the true value of the FruitLook package.

4 Perception of FruitLook

4.1 Historical background and purported impact

Water Watch was the predecessor to eLeaf and conducted the earliest feasibility studies of a remote sensing technology in 2003 – 2004. This evolved into GrapeLook in 2010 and subsequently into FruitLook in 2014. Below, in brief, are the timeline and project partners.

- 2004 – 2010 proposal and feasibility with CSIR and European Space Agency
- 2010 inception of GrapeLook with University of KWA Zulu-Natal
- 2011 – Inception and validation of FruitLook with University of KWA Zulu-Natal, eLeaf (formerly Water Watch)
- 2014 – 2021 FruitLook rollout and expansion with eLeaf, Caren Jarmain (left in 2021) and BlueNorth (from 2020)
- 2021 – 2022 Blue North takes over in-country management

The initial stated goal of FruitLook was 'to provide relevant and timeous information to farmers that will lead to improved water use efficiency'[2]. Flowing from those goals were the following anticipated benefits: cost savings on inputs (water, electricity, labour), increased profits by increasing yields and quality, and the early identification of problems and abnormalities. From its inception FruitLook has been fully funded by the WCDOA and has remained free to any potential user but particularly focussed on irrigation farmers and those with an interest in agricultural water management.

Delivery of the FruitLook service, takes place via the proprietary website www.FruitLook.co.za which provides weekly updated data for subscribers on the following:

- Actual Evapotranspiration
- Evapotranspiration Deficit
- Biomass Water Use Efficiency

By 2015 this information was available over a 161 800 hectare footprint in the Western Cape. At the end of July of 2021 coverage had increased to 9.5 million hectares. By June 2014, 246 FruitLook users had ordered block data[3] for 18 330 hectares. One year later, thanks to the extension of its footprint to include farmers other than grapes, the number of users had increased to 592 with over 9 000 orders for 227 200 hectares[4].

4.2 Current *status quo*

The most recent figures from eLeaf and partners are contained in the May 2022 report which shows the number of users at 605 covering 44 000 hectares of subscribed blocks and a footprint of 244 000 hectares. Tables illustrating the make-up of the areas and crops covered by users and derived from eLeaf are contained in Appendix 1.

One of the problems in interpreting data from eLeaf arises from 'double counting', where a field or block is registered more than once by different users. Whilst this does not affect the overall number of users, it does affect the area of land registered. Recently, the 'double counting' problem has been quantified by using shape files; the shape file identifies identical blocks ordered by different users thereby enabling 'doubles' to be identified.

This exercise affects the area assumed to be covered by FruitLook, in turn affecting the interpretation of its impact. Based upon the most recent information received by eLeaf, the actual

[2] *Final Report FruitLook 2012 – 2014*
[3] Out of 592 subscribed users which include users ordering blocks as consultants and researchers – which matter is explained further in Sections 4.2
[4] *Final Report FruitLook 2020 – 2021*

area covered is 25358[5] hectares whilst the user-registered area is 44271 hectares. Proportioning the number of users by these amounts it is estimated that of the 605 users referred to in the May report, around 350 have a direct responsibility for the land registered.

We have used the 'total user' figure (605 in May) in interpreting the integrity of the data obtained from the Online Survey (discussed below) but it needs to be understood what that number represents as well as what it doesn't. When, in further discussion the impact of FruitLook in a physical, area-based context is to be gauged, the lower shape-file inferred number of 'users responsible' or 'primary users' (350 in May) will used.

4.3 Anticipated benefit – WCDOA, farmers, consultants

The perceived value of FruitLook to WCDOA, irrigators and consultants during the early phases of the programme could not be determined from available reports and online sources. However, several pertinent reports from prospective users during that period were available:

- In 2014 Nelius Kapp of Prophyta[6] and Anton Muller of Kromco[7] reported FruitLook potentially helpful in irrigation scheduling and placement of soil probes.
- A 2013 survey[8] on the application of irrigation scheduling research knowledge noted two items of value at field level: planning irrigation management strategies and irrigation scheduling.
- A 2016 SIZA newsletter stated that 'farmers are relying on FruitLook's remote sensing and reporting capabilities to view their crops, analyse their performance, and make well informed decisions...'[9]
- A 2020 FruitLook survey indicated 'more than half' of respondents indicated a greater than 10 % increase in water use efficiency.

The above values (scheduling, probe placement, management strategies, water use efficiency, crop monitoring, analysis and information) may have presaged the expectations and resultant uptake of later potential FruitLook users.

The goals and associated expectations of the initiators of FruitLook have been expressed in condensed diagrammatic form in the implied Theory of Change (Section 6.1) along with accompanying commentary in Appendix 5.

4.4 Value perceived

4.4.1 Online survey

With the exception of a 2020 in-house FruitLook survey, later data regarding users' expectations of its value/benefit were sparse. To provide an updated profile of these expectations an online survey was conducted among the 4000 irrigators in the Western Cape among whom, based on recent eLeaf reporting, were about 350 users in a decision-making role out of a total of 600 users.

The distribution of questionnaires was routed via Water Users Associations and through FruitLook. Three iterations of the distribution process were performed. Response was also encouraged by producer associations. Of the 4000 irrigation farmers, 383 responded. The response rates were statistically significant: 8.3% of the irrigators accessed responded and of these, 14.7% were FruitLook

[5] This data is a recent eLeaf correction of the information provided in Appendix 1 which implied a total farmed area of just over 19 000 ha.
[6] Early FruitLook user/consultant
[7] Large deciduous fruit packer
[8] Stevens JB and PS van Heerden *Quantifying the Impact of WRC-Funded Research in Irrigation Scheduling,* Water Research Commission 2013 Pretoria
[9] Farrell D, *Sustainable Agriculture in South Africa Focus Newsletter* 2016

users. The total number of hectares represented by all 383 respondents was 23 900 hectares or 9.5% of irrigated land in the Western Cape. Findings drawn from such a level of response could be seen as meaningful.

4.4.2 Online survey findings

The overall purpose of the survey was to assess: whether irrigation farmers use FruitLook, how they use FruitLook, how useful it is to them and where it can be improved.

Several questions were asked of respondents. Readers seeking greater detail on these questions and responses are referred to Appendix 2 for a comprehensive report on the online survey. Central to the evaluation theme, however, are several observations derived from survey data, for instance, the use of FruitLook as compared with existing irrigation management practices:

- The most relied upon existing irrigation scheduling practices were in-field observation and soil probes accounting for 65% and 48% respectively, trailed by seasonal scheduling at 19% and FruitLook at 11%.
- Importantly, 79% of survey respondents did not use FruitLook at all.

A significant factor that speaks to the market development of FruitLook, is illustrated in the difference between FruitLook users and non-users in terms of their familiarity with FruitLook. Perhaps surprisingly,

- 51% of respondents who do not use FruitLook did not know what FruitLook was
- 49% of respondents who do not use FruitLook were familiar with FruitLook but did not use it.

For those respondents who were familiar with FruitLook but did not use it, it is likely that the imputed[10] and economic costs associated with FruitLook outweigh its value as a management tool – notwithstanding that FruitLook is available for free. Such imputed costs may be:

- The time required to master what is effectively new technology
- The time required to extract useful information, but finding oftentimes that it is inaccurate, incomplete or outdated
- The potential cost of replacing functional existing technologies which are effectively an already sunk or intrinsic cost.

For the 21% respondents who adopted and continued to use FruitLook, values can be divided into objective and subjective. Objective reasons whose value is tangible and can be quantified are:

- Improved yields or more cropping land from better water utilisation
- More efficient irrigation scheduling
- Cost savings in water and electricity

Subjective reasons whose value is intangible and difficult to quantify:

- Curiosity/interest in new technology
- Ability to ‘farm better’
- Convenience.

Two reasons fell into a grey area between objective and subjective

- Free access to FruitLook
- The more effective use of consultants’ advice.

[10] Hypothetical costs assigned to goods or services that do involve a cash outlay

The above values only become meaningful when a causal link between free access to FruitLook and more effective use of professional advice can be *objectively determined* through improved yields, optimised use of irrigation water and actual cost savings.

4.4.3 Structured interviews with farmer users

The principal purpose of interviewing past and present FruitLook users was to understand, conversationally, individual user's motivations for registration and subsequent use or abandonment of the programme. The interviewees were active farmers or farm managers cultivating a variety of crops in locales across the Western Cape. These users or 'prime users' are farmers or farm managers who have registered some or all of his or her fields on the FruitLook system and have used or considered using the data obtained to support or monitor irrigation management decisions.

Interviews were based on a structured format using for each interviewee a standard set of questions, many open-ended, with the intention of eventually eliciting each interviewee's expressed view regarding the usefulness and value of FruitLook.

As with the online survey, a full report on the findings is contained in Appendix 3 which gives a profile of the interview sample and further information on the answers to questions. The comments below highlight the key aspects directly pertinent to the Study.

A contingent purpose of the interviews was the investigation of the alignment, if any, between the broader questions[11] motivating the evaluation of FruitLook and the on-farm experience of interviewees. In this process three FruitLook informal user profiles emerged:

- Those who registered fields on FruitLook but chose not to use it
- Those who registered on FruitLook but stopped using it after one or more growing seasons
- Those who registered on FruitLook and continue to use it.

Unlike the online survey, the interview concluded with questions (inviting discussion) about the economic value of FruitLook including any willingness to self-fund the programme should it no longer become free.

The interviewees represented a cross-section of hectarages under irrigation and water use within the principal crop sectors in the Western Cape. In total 35 farmer-users whose names were supplied by consultants, by FruitLook, and by referral were interviewed.

- The total area covered by these users' registrations was 3825 hectares.
- Hectarage irrigated by interviewees ranged from two (2) to six hundred (600) accounting for 18 691 000 cubic metres of irrigation water consumption per year
- The interviewees' business structures ranged from small sole proprietorships to large agribusiness enterprises.

Two of the three underlying questions of the FruitLook evaluation, *(1) the extent to which the cost-free provision of FruitLook influences users' attitudes toward the programme, and (2) the extent to which the use of FruitLook influences irrigation management practices,* were generally answered in the affirmative. These answers appear to have had a significant effect on which profile users located themselves within groups identifiable as:

[11] To what extent does the fact that FruitLook is provided as a free service impact upon farmer's perspectives?
To what extent does FruitLook impact on the irrigation policies of farmers and by extension water utilisation generally?
Is there a sense that FruitLook actually (tangibly) impacts the bottom line of farming enterprises?

- FruitLook 'curious'
- Former users
- Current users.

However, the third and pivotal question towards which the interview process deliberately led, *an awareness of the economic value of FruitLook driven by increased yields, water savings and/or reduced input costs*, could not be confidently quantified by former or current users. In fact, of 132 possible economic data points contained in 35 interview scripts, interviewees were only able to provide values for 29.

Interviewees acknowledged the importance of irrigation management in attaining production goals in terms of yield and crop quality as well as the desirability of making efficient use of available water but could not readily furnish specific cost or price data on a per hectare basis to support their acknowledgements.

It should be noted that yield and quality increases and input savings, if any, are likely to be affected by the entirety of interviewee's water management strategy and on-farm menu of existing irrigation technologies and practices. Nevertheless, the majority of interviewees were largely unable to express the value of irrigation management practices, including the use of FruitLook, in economic terms.

An important recurrent theme among interviewees, impacting on the water saving goals of FruitLook, was the need to *make more efficient on-farm use of existing water rather than simply save it.* This, depending on the individual concerned, is done by:

- Putting more land into production
- Planting more profitable crops per unit area, albeit more water intensive ones
- Investing in additional storage capacity
- Buying farms for their water allotments rather than their land

Following several open-ended discussions on the merits or otherwise of FruitLook, interviewees were asked towards the conclusion of the interview: If FruitLook were no longer free what would you pay? Most (80%) responded with a figure anywhere between R50 per ha per year and R2000 per ha per year – an average for those willing to pay approaching R700 per ha per year.

From the interviewer's perspective, these prices appeared, despite an apparent sincerity on the part of the interviewee, to be arbitrary and uncalculated. Whilst the value of increased production was recognised as a basis for paying for the service, interviewees were unable to determine the advantage of this increased production in economic terms. Nine of the 35 interviewees indicated the price they were willing to pay for FruitLook should be consistent with the setup, outsourcing and annual labour costs of existing technologies and practices.

4.4.4 Consultants, researchers and designers

Twenty one consultants, researchers and interested parties over a cross-section of technical expertise in the intensive cropping domain were interviewed. These represented the Cape Winelands, the Elgin-Villiersdorp axis, Ceres and the Breede River. The interviewees included:

- Consultants and researchers in crop production
- Irrigation systems designers and controls
- An environmentalist with an interest in 'green' water management in agriculture.

The members of the above group were interviewed telephonically. As with the Farmer-user group, consultant/researcher interviews were partly structured and partly open-ended via a predesigned

questionnaire which included personal questions such as field of expertise and professional vision; and subjective questions concerning theory and practice of water management and the perceived role of FruitLook in irrigation practice.

A detailed report on the findings of these interviews is provided in Appendix 4 from which the following is a summary of the key points.

Despite the range of interviewees' knowledge of FruitLook, their diverse perspectives on irrigation technology and varying estimations of its influence, considerable similarity existed in their responses regarding the project's usefulness and role in crop management.

According to the cohort of consultants interviewed, the value of 'knowing' was seen as the pathway to optimal water use, the means of avoiding guesswork around the sensitive relationships between plants, soil and weather. Understanding these relationships needed objective measurement; it is how, the consultants said, irrigation is able to be optimally scheduled. This is where technology plays a role.

The cohort of consultants confirmed that the irrigators' preferred technology for soil moisture measurement, especially for perennial crops, lies in the use of capacitance probes – their usefulness and resultant wide usage is owed to their accuracy, real-time data collection and wireless transmission of data. Countering their value is their expense, calibration demands, maintenance requirements and limited zone of direct measurement. However, competing technologies such as tensiometers and neutron probes are significantly less popular owing to their unreliability and time consuming monitoring schedules.

When questioned regarding the direct role of FruitLook in their consultancies and/or research, none of the interviewees were existing subscribers to FruitLook nor did they indicate any level of dependency on the programme. The majority did suggest though that farmers subscribed to and used the service as a supplement to consultants' advice and several said they recommended their client farmers use FruitLook. Based upon the views of the group interviewed, it would suggest that the advice giving, peripheral players in irrigation management see little usefulness in FruitLook in their own undertakings, but meaningful value for the decision-makers on the farms.

The positive values for irrigators ascribed to FruitLook by the interviewee group are as follows:

- A kind of 'safety net' or 'insurance policy' allowing irrigators the ability to detect problems at an early stage
- A monitoring tool allowing an overview on the development of a crop
- Regular inter-field comparisons
- Inter-seasonal comparisons to support annual planning
- An addition tool for crop management

However, the above values are partially offset by some perceived FruitLook negative values:

- Data not completely reliable
- Data not delivered in real or near real time
- Lack of portal friendliness for user clients
- Conflation of crop canopy and leaf area with weeds, ground cover and shade cover
- Uncompetitive with more technically precise, existing technologies

Whilst acknowledging some value for FruitLook in a supporting role in farm water management, interviewees found little beyond a subsidiary position for FruitLook in the domain of irrigation

management. According to this cohort of interviewees FruitLook is not on the leading edge of irrigation optimisation and is unlikely to recover the pivotal role it may have had in the past.

The peripheral position of the interviewees provides little access to specific considerations of economic value by their clients particularly as the technology is provided at no cost; by virtue of their inability to directly derive benefit from FruitLook they are unable to place a measurable economic value on it.

4.4.5 Overview of survey and interviews

What important lessons have been learned about the usefulness of FruitLook in the irrigation domain from our exploration of the subject through surveys and interviews. These can be summarised as follows:

4.4.5.1 From the online survey

- Survey was aimed at all 4000 irrigators in WC; an 8.3% response was obtained covering 9.5% of the irrigation land; of these respondents 15% used FruitLook. The response produced a meaningful profile of the irrigation farmer group.
- Over 50% of non-users in the sample did not know what FruitLook was – an indication of ineffective marketing and a low market diffusion momentum.
- 11% of respondents use FruitLook for scheduling versus 47% for sensors and 65% for in-field observation, thereby illustrating that despite being free, FruitLook lags far behind as a front-line irrigation scheduling methodology.
- Four fifths of FruitLook users use it frequently. Such frequent, serious use would seem to indicate a high level of loyalty among established users.
- Offering the product free was not the principal reason for taking FruitLook up in the first instance; the wish to farm better was.

4.4.5.2 Farmer-user interviews

- The interviews were directed at 35 users mainly farming in the horticulturally dense areas around Stellenbosh, Elgin, Breede River, Ceres and Villiersdorp with some from outlying districts. A good cross-section of crops was covered over an area of 3 825ha.
- The influence of FruitLook as a tool in irrigation scheduling depends upon the users' confidence in it and the use to which it is put; three levels of influence were identified – a) little, or passing interest; b) temporary, often waning interest; c) interest as a monitoring tool over more 'trusted' water management systems.
- Direct in-field observation remains the most practiced means of water scheduling and the basis for the calibration of soil probes.
- Soil probes are the most used technological device for water management purposes.
- The goal of farmers is not so much saving of water as using it efficiently. This runs counter to the earlier thinking that FruitLook could save water. That most irrigation water is allocated on the basis of quotas would seem to add grist to such interviewee thinking.

4.4.5.3 Consultants, designers and researchers

- The particular service-orientated interviewee group is relevant because it comprises people and organisations with a serious interest in intensive farming but without any decision-making role on the farms. As outsiders looking in they are able to provide an unbiased perspective on FruitLook.
- The group consisted of 21 members and included amongst others irrigation system designers, software designers, soil scientists, drone engineers, environmentalists, horticulturalists, viticulturists and researchers.

- The group confirms the other survey findings, namely, that FruitLook does not play a pivotal role in irrigation scheduling.
- FruitLook fulfils a supportive and monitoring role, useful to the farmer though not essential. Its earlier image as a major player in the conservation of water, strengthened during the 2018 drought, now needs adjustment and decisions around its future need to be consistent with this adjustment.
- Companies and other interests operating in support of irrigation management are disparate, competitive entities. Some interviewees believe that within this body of interests there may be a place for FruitLook, as a key 'support' player.
- The marketing input of FruitLook was questioned by some interviewees, suggesting the need for a review of business strategy.
- Funding for FruitLook was discussed, with little overall unanimity, opinions varying from 'user pays' to users being subsidized either by producer associations or by WCDOA. The general view persisted, however, that the current funding model was due for change.

5 Pointers toward value

Before offering an opinion on the value of FruitLook, it needs to be underlined (again) that value is a subjective view of a particular good or benefit by a potential recipient; the recipient's thinking is subject to many influences (as noted in Section 3). Moreover, an exploration on value of a product or service can only happen in the context of a market environment where both the need for and provision of the benefit exist.

Given the WCDOA goal of 'greater water conservation in irrigation' with the focus on FruitLook as a means of achieving it, it is in the arena of irrigation scheduling that its value resides, noting that this is a market in which other competing technologies also serve.

5.1 FruitLook competition

FruitLook faces four types of competition for primacy in soil moisture measurement and reporting and irrigation scheduling. The first and principal technological competition is capacitance probes which precisely measure soil moisture up to 60 cm deep (with some suppliers looking at one metre) and transmit data wirelessly in real time. The principal operating constraint is the limited radius measured by each probe which makes the location of one or more probes within larger irrigation blocks sometimes necessary. Given the capital requirements and operating expenses of individual probes, the affordable number of probes in a block (normally one) requires a thorough knowledge of the soil structure and drainage of each block in order to draw reliable inferences regarding soil moisture for the entire block.

The use of capacitance probes varies in intensity. Usually one probe serves an irrigation block making it cheaper (extensive) for larger blocks and more expensive for smaller (intensive) blocks. Costs are also influenced by the amount of software support taken up and by the use of an irrigation consultant. A spectrum of intensity and therefore costs exist between these two poles.

The costs of the two styles of capacitance utilisation for irrigation scheduling, taking into account on-farm costs, servicing and probe depreciation are contained in Table 1.

Table 1 Cost of capacitance probes

	Intensive	Extensive
Hectares per probe	*2,5*	*10,0*
Depreciate over 8 years	567	142
Software and advice	960	315
Farm/staff monitoring cost	900	450
Farm maintenance cost	160	40
Insurance	45	11
Total	2 632	958

The second, and principal, competition FruitLook faces are the traditional practices of soil sampling and direct observation. Soil sampling is accomplished by extracting a plug of soil approximately 60 cm deep using an augur or a probe and examining the sample for various levels for perceptible moisture. Typically, a handful of the sample is squeezed. If on release the soil retains its shape and crumbles only slightly it is said to be frangible and have an approximately correct moisture level. Reliable determination of soil moisture using this method is directly influenced by experience and a knowledge of soil types in the area of the sample.

The third competitor is direct observation which entails regular inspection of blocks usually weekly and on foot or by farm bike. The objective is the detection of abnormalities in plant growth or condition and possible pooling of water or excessive dryness of surface soil. It needs to be said, that this kind of observation is not as fully reliable as the more 'direct-measuring' systems.

The cost of any observation based system is obviously difficult to pinpoint because of the various ways, levels of detail and visit frequency which are applied which in turn affects the time and staff costs involved – and of course, its efficacy. Based on a once per week per block per summer season, the staff cost to augur or dig a hole works out at around R250 per ha per yr. The management time is difficult to compute for reasons indicated and because more than irrigation-based information is gathered.

Sampling is soil-centric and observation is plant-centric. In the opinion of most farmer-interviewees the combination of regular soil samples and observation provides the experienced irrigator the most accurate overall determination of soil moisture in a block.

A fourth and emerging method for irrigation scheduling is the use of drones or UAV's (Unmanned Aerial Vehicles) which collect geospatial, spectral and visual imagery in real time from low altitude. Drone sourced data can provide information on pest/fungal infestation, plant anomalies, vegetative growth, leaf coverage, plant density, fruit count and water stress. Imagery is either stored on the drone for later analysis or transmitted directly to the user.

Advantages:

- Quick deployment.
- Plant/tree/vine level resolution.
- Real time, actionable data.
- Flexible sensing systems.

Disadvantages:

- Time gaps between data collection
- Limited coverage area.
- Vulnerable to surface weather conditions.
- Expense.
- Poor data continuity.

According to both the interviews and the on-line survey, very few farmers use drones for the purpose of irrigation management – high cost being the main reason cited, added to which are the disadvantages listed above.

Drones are typically scheduled for three sessions per season at a cost according to one supplier of around R300 per ha per session – i.e. R900 per hectare annually. Some farmers interviewed confirmed a cost of R30 000 per session covering 100 ha.

Drone sensor resolution is available at the individual tree/vine level which enables accurate fruit counts and the tracking of individual trees or vines. Despite drones' advantages in resolution, flexible scheduling and real-time data depiction, FruitLook retains a competitive advantage in coverage, historical/comparative data, ease of use, cost and continuity of data collection. Many irrigators do not require tree/vine level resolution or real time data and may find the time lag associated with weekly FruitLook reporting to be less onerous than one to two month gaps in the collection of irrigation block data inherent in the use of drones.

Despite a relatively low uptake currently, drones show considerable future promise. Their fine resolution and resultant ability to provide a host of useful information would incentivise farmers to have and employ an own drone. Barriers to ownership are the cost of drones plus camera, learning to use the technology and obtaining effective software to interpret the information.

5.2 FruitLook impact and value

5.2.1 Value to WCDOA

Let us now examine the full cost of the FruitLook programme set against the overarching WCDOA objective of water conservation/savings. The information obtained from the surveys and discussions that resulted from them, does not allow us to pinpoint with acceptable accuracy how much agricultural water was saved in the Province through the use of FruitLook. No actual saving was measured, or even estimated, that could be clearly attributable to the service. What remains is to provide a deduced indication of the cost-to-government of various possible water-saving outcomes where FruitLook is used. From this it is possible to obtain a sense of the possible value achieved in water conservation as stewarded by WCDOA in the national interest.

Assumptions

350 farmer users – based on a rounded average calculated from data provided by eLeaf
35 use FL for scheduling – 10% of on-line surveyed respondents indicate using FruitLook as their prime method for water scheduling decisions
72 ha per user – 350 users on 25358 ha irrigated crops (eLeaf data)
5800 cu m applied per ha per year – based on farm interview data
Total area under irrigation in WC approximately 250 000ha – based on FruitLook/WCDOA data

Deduction

Total water used for irrigation in WC: 250 000x5800 cu m = 1 450 mill cu m/year
Total water used by the 10% of users who use FruitLook for scheduling: 10%x25358x 5800 = 14.7 mill cu m/year.

Table 2: Effect of different savings levels on cost

Water saved by FruitLook users	Amount saved (m^3/yr)	Proportion of WC water saved	Cost of saved water per m^3
5%	735 000	0.05%	R13.6
10%	1 470 000	0.10%	R6.80
15%	2 205 000	0.15%	R4.53
20%	2 940 000	0.21%	R3.40

As to what the savings experienced by FruitLook schedulers actually are, information is scanty and unreliable. As we have seen, most farmers now see irrigation scheduling as less a water saving exercise *per se* than a means of enhancing crop production or maximizing revenue earned per cu m of water. Indeed, of the sample of farmer users surveyed by the Agri-Africa team, approximately 60% believed that more efficient water management may have created savings but that rewards mostly came through increased crop production.

In 2020 a small sample survey conducted by FruitLook/WCDOA indicated water savings of over 10% were achievable; such savings represent a cost of nearly R6.80 per m^3, one that compares to the relatively high cost of around R7.00 per m^3 of recycled wastewater. If 20% is saved, the cost (R3.50 m^3) becomes comparable to some of the existing irrigation water supply systems[12]; but such savings, even at 10% appear to be extremely unlikely given the evidence emerging from user surveys.

Matching this analysis to the WCDOA 'national interest' objective of water conservation, it would seem that because of a low uptake by farmers, the water (if any) saved by FruitLook is being conserved at a cost that is excessive compared to other water sources. Added to this, as we have noted, are alternative systems of improving the efficiency of irrigation that are not subsidised yet are technically able to achieve the water efficiencies and production advantages that FruitLook is purported to do.

Stated differently: Taken at a national interest level, the cost of FruitLook as a water conservation mechanism would seem to be greater than its value. Its continuation depends therefore on its value to the farmer.

5.2.2 Value to farmers

Various systems for assisting farmers with their irrigation management are discussed in Section 4 of the report and, in more detail in Appendix 4. To repeat the list briefly: soil moisture probes of various types, personal observation in the field using augur/digging to access lower soil zones, drones and FruitLook. These each incur a cost for the farmer, as we have shown above in Sub-section 5.1.

These choices within the scheduling market are compared in Tables 3 and 4. The first, Table 3 dealing with FruitLook compares on a Rand per hectare basis the effects of 'double-counted' block orders by comparing their inclusion in the total user numbers with their exclusion. The outcomes are sharply contrasting and indicative of the effect of double counting on costs per unit of area and, indeed, on the interpretation of value.

The effects of two further assumptions are also compared in Table 3. These concern overall FruitLook costs at farm level and are: 1) the cost of the existing service, and 2) the cost required to sustain a 'user-pay' (commercialised) scheme. The assumed user-pay cost is provided by eLeaf; it is an adjusted version of the existing cost structures with WCDOA and is based upon the estimated

[12] Very limited new water is available in Western Cape the cost of which is in the region of R2.50 to R5.00. The Berg River, Riviersonderend River systems, for instance, cost R4.29.

Work Performances that such a scheme would require. The annual cost for a user-pay model is less than that presently charged, because the 'client service' work programme (WP) component is no longer needed. The saving this creates is believed to be greater than anticipated cost increases that will be required for other work performance areas.[13] The number of users and areas are those currently reported.

Table 3: Effect of double counting and funding model on cost

	No. users	Area (ha)	Funded by	Overall cost (R mill)	Cost R/ha/yr
Primary users*	350	24500	WCDOA	10,0	408
			User-pay	8,4	343
All users	600	42000	WCDOA	10,0	238
			User-pay	8,4	200

** Users where double counting is excluded*

The costs per hectare contained in Table 3 speak for themselves given the different scenarios illustrated. They must now be seen in conjunction with the comparisons, presented in Table 3 below, under different user uptakes.

Table 4: Comparisons of costs of scheduling systems vs uptake- R/ha/year

		No. of users					Excl. man.
		200	400	600	800	1000	time*
FruitLook	WCDOA funding (all users, 100%)	667	357	256	202	167	200
	User pay (all users, 100%)	560	300	215	169	140	200
	WCDOA funding (primary users only, 54%)	1222	655	470	370	306	200
	User pay (primary users only, 54%)	**1027**	**550**	**394**	**310**	**257**	**200**
	80% Users say will pay (ave)	*695*	*695*	*695*	*695*	*695*	*200*
Probes	Hi-end value with advice	2632	2632	2632	2632	2632	100
	Low-end value with advice	958	958	958	958	958	100
	Hi-end value without advice	2332	2332	2332	2332	2332	250
	Low-end value without advice	658	658	658	658	658	250
Drones	3 visits year at R300/vist	900	900	900	900	900	450
	9 visits year at R300/vist	2700	2700	2700	2700	2700	1350
Observation	To confirm std season scheduling	250	250	250	250	250	2000

**Rough estimate of time and cost ha/yr of farmer/manager at R800/hr*

The Table is intended to highlight the effect of scale and of system choice on cost. Using a cascade of possible 'uptakes' the costs of alternative irrigation systems can be calculated. The table also includes, for comparative purposes, the average price the farmer-users interviewed said they would be prepared to pay under a user-pay scenario.

The costs provided for other systems are based on those outlined in Subsection 5.1 and which need little further elucidation except to comment on 'owners time' shown in the last column of the Table, and explain simulation modelling of FruitLook at different scales.

[13] Importantly, the estimated FruitLook user-pay cost was provided by eLeaf on an explicit understanding that such information (relating to a change in the operating model) is offered without any commitment on the part of eLeaf or its employees.

Owner's time is the imputed cost of administrative time associated with managing the selected system. Given the multifarious approaches of farmers to the many functions they have to perform, these are at best rough guesstimates of cost per hour and time spent. Arguably, depending on your view of how owners' time should be costed (opportunity, salary, returns) this could be at several levels for a farm and among farms. The cost is inserted principally to remind readers that it exists and forms an indirect part of the thought processes behind the decisions farmers make on irrigation management systems.

As to the effects of scale of uptake on FruitLook costs: by using the baseline information provided by eLeaf and the rationale therefor, the Consultants have modelled costs in a way that assumes a footprint-linked fixed cost component which does not change with scale and variable components linked to land area and user-numbers that do change with uptake.

The crux of Table 3 is that it informs on the cost of the full range of competing technologies in irrigation management. Central to its interpretation is the line in bold type which is effectively the price for a given user uptake that would need to be charged by FruitLook if it is to remain viable under a user-pay scenario. For instance, at an assumed uptake level of 400 paying users each user would have to pay in the region of R550 per ha per year to keep the service. This would compare favourably with the average amount most users say they would pay, notwithstanding that faced with the reality of payment this might not happen. But then there are some upsides:

- That double counted users (e.g. consultants) *have not been* included in the calculation, a group from which further users might be attracted to pay a sustainable price.
- That in conversation with the Consultants many of the interviewees expressed loyalty to FruitLook (80% were long term users),
- That if the notion identified by some interviewees is correct that marketing, until recently, has been ineffective, then improvement in this direction could leave room for growth,
- That around 50% of irrigators surveyed online had not even heard of FruitLook (unexplored market)
- That other alternatives carry a high cost and
- That an adjusted funding model could provide the motivation towards a greater sales-based business culture for the longer term.

Finally, recognising that WCDOA is seeking certain specifics around value for FruitLook one can conclude, given that FruitLook performs a monitoring service to irrigators at around half the cost (carried by WCDOA) of the more popular probe option, a value of around R400 to R500 per ha per year attracting 300 to 400 users might be considered to be reasonable. In offering this information it needs to be clearly understood that given FruitLook's limited performance *as a free offering* in a competitive, elusive and complex market (as discussed in Section 3), such a value judgement cannot be made with confidence.

The reality is that the only effective way to test the value of FruitLook is to place a potentially sustainable price upon it and then test the market in a meaningful way. Given the business environment in which FruitLook presently operates, 'phased-in commercialisation' would seem to be the most appropriate option for the company's future – one that is consistent within a competitive context and which recognizes the relatively muted impact of FruitLook on the 'national interest' water conservation goals.

6 FruitLook: Conceptual Frameworks

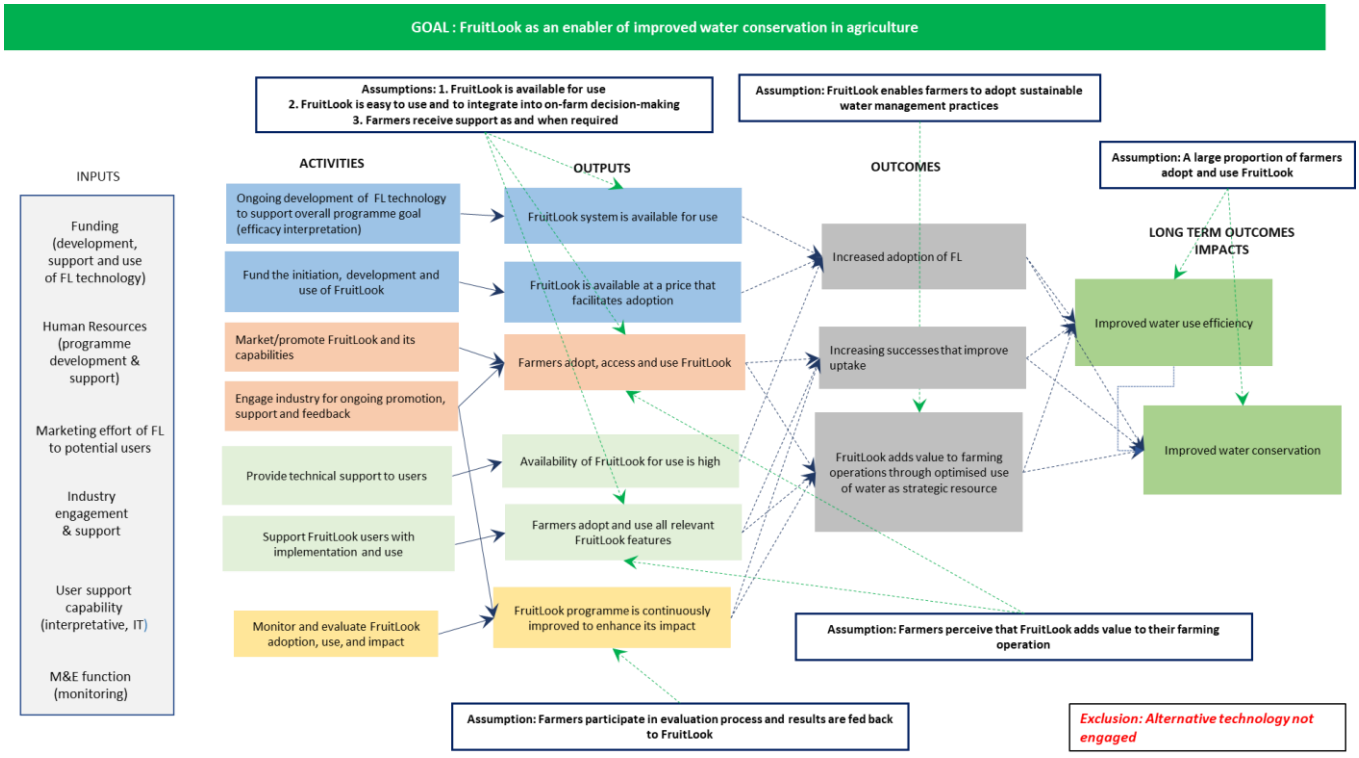
Contained in the WCDOA ToR for the FruitLook Evaluation is the request to undertake an analysis of the project using the analytical frameworks of Theory of Change and SWOT. These have been carried out against the background of the study findings.

6.1 Theory of Change

The FruitLook project (originally GrapeLook) was launched before the Theory of Change (ToC) – a platform which fuses various elements of business planning, development and control into a flexible framework – became a standard part of project initiation. For this reason, the Agri-Africa team found it necessary to compile a 'retrospective' ToC compiled from the earlier narrative around anticipated goals, outcomes and impacts. The full explanation, analysis and discussion around the retrospective ToC and level of attainment of its goals is contained in Appendix 5. The Appendix offers a critical, empirically-based examination of FruitLook's intended business trajectory in relation to the position it now occupies.

The key diagram encapsulating the ToC analysis and laying out the various goals, assumptions, drivers and expected outcomes of the project together with their interlinkages is presented as Figure 2. A brief summary of the explanation of the ToC and associated critique follows.

Figure 1 FruitLook: Implied (retrospective) Theory of Change



6.1.1 Theory of Change – in brief

The implied Theory of Change for the FruitLook initiative as illustrated above expresses the intention for FruitLook to contribute to improved water use efficiency and improved water conservation based on certain givens: that funding, human resources, marketing, industry engagement, are sufficient, through the resulting user support, to enable and support the deployment and use of the system. The effective functioning of these 'drivers' was how the hoped-for goal of water conservation could be achieved through using the improved irrigation techniques encouraged by FruitLook. Because of the dependency on user uptake, the exploration of user attitudes toward FruitLook forms a central

feature of the Evaluation study. (It should be mentioned relevant to our assessment of the ToC, that the influence of competitive technologies did not, for lack of participants in the field, receive consideration in the initial planning stages – an important omission when seen from the present. See observation in Figure 2 in red type.)

The empirical evidence unearthed by the study and placed within the ToC framework indicates that the system is not adapted to the extent that it could support the outcomes to be realised. Of particular concern is the low and non-growing uptake of FruitLook among irrigation farmers and the consequent low impact on the water conservation/optimisation goals. Levers for improvement towards future impact include awareness creation and marketing, industry collaboration, enhanced support, and integration of FruitLook into on-farm decision-making. The latter may, as the surveys inform, be constrained by the time lag in reporting data from FruitLook relative to the need for real time decision-making. Importantly, all these are matters that suggest an adjustment to the company's business model and accompanying updates to the ToC once its future is decided.

6.1.2 SWOT analysis: Strengths, Weaknesses, Opportunities and Threats

A SWOT analysis locates the current and potential value of FruitLook within the operating and market environment in which it is sited. *Strengths and weaknesses* inherent in the programme highlight its achievements and shortfalls to date. *Opportunities and threats* point to how FruitLook can maximise its value to users and respond to competition in the future. To be viewed against the preceding discussions, here is the SWOT analysis in diagrammatic format.

Figure 2 SWOT analysis: Commercialising FruitLook

Business objective: Sustainable commercialisation of FruitLook	**Strengths** *Flexible delivery platform* *In-country experience* *Long term relationship w/client* *Interest of producer groups* *Longterm-user loyalty* *Some uniquely useful features*	**Weaknesses** *Low market penetration* *Uncompetitive vs probes* *No real time data delivery* *Ineffective outreach* *Lack of quantifiable impact* *Difficult user interface*
Opportunities *Large potential user base* *Provincial water limitations* *Rapid technological change* *Expanding agri export market* *Consumer sustainability bias* *Fill gaps in legacy technologies*	***Strategic Inferences - Opp. vs Str.*** Business integration w/competitors Producer group support Delivery platform enhanced User education/workshops Funder assists off-ramp to user-pay Identify new markets	***Strategic inferences - Opp. vs Wkn.*** Imrove contact in the market Outreach support via producers Link with marketers Sell on monitoring ability Develop assessment capability Link with consultants
Threats *Legacy technologies* *Potential user fees* *Emerging technologies* *Client budgetary constraints* *Stagnant user growth* *Consultant decision control*	***Strategic inferences - Thr. vs Str.*** Planned timing/ pricing strategy Producer group support Reward/encourage loyalty Long term relationship w/client Encourage consultants to use FL Uniquely useful features extended	***Strategic inferences - Thr. vs Wkn.*** Sell on data regularity User education/workshops Fill monitoring needs (vs legacy tech) Tools to quantfy impact Study reason for low penetration Develop user friendly data reporting

Figure 3 is based on data from eLeaf, the online survey, farmer-user and consultant/researcher interviews and provides an overview of FruitLook's singular operating context. It illustrates that the value of FruitLook as tool for optimising agricultural water use and delivering tangible benefits to users is not clearcut. But importantly, SWOT provides a concise framework for strategic planning. Here is a summary of the tactics generated by the SWOT analysis to enable FruitLook to transition into a commercial future in the event that this be decided upon by WCDOA.

- Exploit the untapped market among farmers that did not know of FruitLook
- Apply resources (funds and people) to achieving a consumer-orientated (user) approach to the business in general and to marketing in particular
- Strengthen communication channels with loyal users - as through a reward system
- Plan to sell desired components of the services menu as well as the full package currently offered
- Develop and strengthen ties – even agency partnerships – with producer associations and produce marketers
- With user help, develop a more user-friendly reporting system
- Sell the product as a monitoring system, which offers regular reporting, rather than a management system
- Seek working relationships with the consulting, irrigation designing and academic community
- Devise/plan for media-based education for users based on FruitLook offerings
- Seek integration with complementary technologies in order to mutually round-off certain services to the farmer
- Plan future changes carefully and transparently – especially when pricing (see section 7 below).

7 Seeking an effective commercial model

In South Africa water has been treated as both a semi-public and semi-private commodity. Semi-public in that it is a commodity that 'Everyone has the right to have access to…'[14] and semi-private in that water has a commercial value.[15] Commercial value is particularly relevant when considering the benefits and costs of irrigation water.

Since the inception of FruitLook in 2011 'relevant and timeous information...that will lead to improved water use efficiency'[16] has been provided in the 'national interest' to irrigators as a public good by the WCDOA at no cost. The costs of this public good are, as we have seen, a matter of record: R26.5 million from 2014 through 2021, R10.0 million in 2022, whilst as a private good its tangible benefits to irrigation farmers have not been able to be quantified. (The matter of public value versus private value is explored in Sub-section 5.2.2.)

In the final analysis, if WCDOA remains determined that the cost of providing FruitLook to the irrigation fraternity as an unalloyed public good is outweighed by the benefits of meaningful water conservation, then the current funding scheme could continue. However, as we have seen, our exploration around the costs of water saving through the agency of FruitLook throws some doubt on such a conclusion. Alternative funding strategies are therefore to be considered and a pricing mechanism identified between funding parties that appropriately balances FruitLook's value as a public good with the willingness of irrigators to pay for it as a private benefit.

7.1 Seeking a user price

The design of a balanced pricing mechanism should be preceded by the following:

- An amended FruitLook workplan and cost structure from eLeaf reflecting the transition from public funding to either joint public/user funding, user funding or user/commercial partner funding

[14] *Constitution of the Republic of South Africa* 1996
[15] Tewari DD *A detailed analysis of evolution of water rights in South Africa: An account of three and a half centuries from 1652 AD to present* Water SA vol.35 n.5 Pretoria Oct 2009
[16] *Final Report FruitLook 2012 – 2014*

- A funding plan from the WCDOA reflecting transition to the selected alternative funding scheme
- An estimation of a target price users might be willing to pay based on data obtained via the interview surveys along with data from competitors in the irrigation scheduling market

With regard to the last point, a potential pricing mechanism, akin to a modified 'Dutch Auction' could be considered in which the buyers (FruitLook users in this case) indicate a price they are willing to pay (bid), and the seller (eLeaf) calculates a price they are willing to take (ask). The difference between the two could be funded in the interim by the WCDOA.

If the gap between the bid and the ask is too wide to be bridged by WCDOA funding no price can be determined and the 'auction' fails. Outcome: FruitLook continues to be offered at no cost to users until the WCDOA/eLeaf contract period expires in July 2024.

If the difference between the bid and the ask is narrow enough to be acceptably funded by the WCDOA the price is set and the 'auction' succeeds. Outcome: depending on available funding, user participation and Departmental priorities, FruitLook could be offered indefinitely at the discretion of the WCDOA or phased out over the remaining life of the WCDOA/eLeaf contract.

If the bid and ask overlap, this means the buyer and seller agree on the price and the 'auction' succeeds. Outcome: the WCDOA withdraws primary funding and acts as a guarantor of service to the paying users for the remaining life of the WCDOA contract should the number of subscribed hectares fall below that required to support the agreed upon price.

The primary factor in determining the initial target price that eLeaf would be willing to take (the ask) is the estimated number of hectares to be subscribed. The secondary factor would be the number of hectares committed to a one-year subscription by users (the bid).

To illustrate: Based on Table 3, Section 5.2.2, a target price *sustainable to FruitLook* of R300 per hectare per year might represent 30 000 subscribed hectares or approximately 400 paying users. Based on this uptake level, R300 per ha per year could become an agreed base price underwritten for the remainder of the contract period by WCDOA. If the number of hectares initially committed to by users is say, 20 000 (almost 300 paying users) the target price for FruitLook to be sustainable would rise to R418 per hectare, in which case WCDOA would fund FruitLook the difference of R118 per hectare until the agreement expires. Conversely, if the number of initially committed hectares is say, 40 000, the target price per hectare would decline to around R 215. In this case WCDOA would pay eLeaf R75 (R300 less R215) per hectare – thereby creating an economic incentive for every additional hectare subscribed over the initial number. A portion of that bonus could be rebated to users by eLeaf at their discretion as a retention bonus or deferred discount.

7.2 Marketing and sales

The present FruitLook customer base can be defined as consisting of 600 users of which around 350 are directly responsible for 24 000 irrigated hectares[17]; this leaves 250 'second-line' users, i.e. those duplicating orders for blocks for which they are not responsible. The number of all types of FruitLook users[18] reported annually has remained relatively flat since the introduction of FruitLook in 2011[19] although the number of reported hectares ordered through the portal has increased substantially[20]. Unexpectedly, the online survey revealed that more than 50% of the 79% non-FruitLook users had

[17] Ibid
[18] Irrigators, advisors, consultants, researchers and students
[19] 537 in 2011, 592 in 2021
[20] 18 332 to 227 210

not heard of FruitLook – a factor which adds considerable potential should the 'message' spread. All this would seem to indicate that apart from settling on a market-testing price, significant funding would need to be applied to developing and enlarging the market.

A potentially helpful strategy towards developing the market would be an affinity marketing and sales campaign. This is a partnership between a supplier (eLeaf) and an organization (producer group or fruit packer/exporter) that has influence with buyers, i.e. farmers in a particular crop sector (pome, grape or citrus).

Such an organisation could provide a third-party endorsement creating a shared (negotiated) incentive that could be a) the more efficient use of water (national interest), b) increased yields from the irrigated lands of members of the producer group (private interest), and c) an increase in hectares subscribed for FruitLook with increased revenue for eLeaf.

The ultimate objective of an affinity marketing partnership would be a private label version of FruitLook tailored for a specific partner. In the case of a major pome fruit packing/marketing enterprise, for instance, this might include customisation of the portal with an emphasis on pome fruit production, dedicated part or fulltime technical assistance and joint field consultations with the entity's horticulturalists. A long-term exclusivity arrangement for eLeaf and a revenue sharing arrangement for the entity could provide a joint incentive for such an arrangement. [A suggestion worth consideration was made by one interviewee that the FruitLook stamp of approval could be used to endorse as 'water-wise' fruit exported by farmers that use FruitLook to monitor their orchards.]

Assuming willing partners, affinity marketing has an advantage over direct marketing due to compatibility with social media, lower selling cost, effective branding and greater customer loyalty.

Nevertheless, any marketing or sales strategy, direct or affinity based, should take into account the likely reluctance of producer groups and grower-owned enterprises to themselves directly fund or impose levies on their members/shareholders for a service not all would willingly use given choices presently in the market.

The decision whether to subscribe to FruitLook is that of the individual farm decision maker. We have suggested a framework (as distinct from an action plan) by which an acceptable price for FruitLook could be uncovered. The price will be determined in part by eLeaf's cost to provide the service, farmers' sensitivity to price and the WCDOA's willingness to financially support the evolution of FruitLook from a public to a private good. We believe the proposed commercially directed funding option forestalls the temptation to delay a difficult decision as well as provide a fair and objective method of addressing the interests of the current and future users, the service provider and the current funder.

8 Concluding comments

This evaluation report examines the efficacy of FruitLook in conserving agricultural water in the Western Cape. The starting point for this evaluation was the development of context around the initiative. This required canvassing the perspectives and motivations of irrigation farmers at three levels: (1) an online survey of all irrigators, (2) structured interviews with FruitLook users (carried out mainly on-farm), and (b) structured interviews with interested parties involved in irrigation at a service level. The latter were peripheral, non-executive role-players in water use management.

The surveys and resulting exploration of the driving forces within the domain of irrigation management produced some significant information overarched by the differing impacts of the goals and purposes of the three central players in the initiative.

1. *WCDOA.* Role: funder and originator; Goal: water conservation through better irrigation
2. *FruitLook.* Role: provider of a technical service for irrigation managers; Goal: to profit by fulfilling 'work programme' requirements for WCDOA (a single client) rather than through sales performance;
3. *Irrigation farmers.* Role: decision makers in irrigation; Goal: profitable water use (versus saving) through selection of available technologies suited to purpose.

These goals/drivers are not fully aligned. WCDOA is driven by stewardship in the 'national interest' without a hard commercial incentive; it is not organisationally a body geared towards product development and marketing. As to FruitLook, payments to that company are not linked to market performance, but to their response to WCDOA needs via negotiated work programmes. And as to the irrigation farmers, the ultimate decision makers and conservators of agricultural water (and the arbiters over irrigation systems), they are concerned only with the most profitable use of water for which purpose they have an array of technical choices to help.

The study revealed that the WCDOA goal of water conservation is unlikely to be realised at an acceptable cost, that the uptake of FruitLook by farmers has not progressed meaningfully, and that farmers are showing a strong preference for alternate scheduling systems, notwithstanding the cost of such systems compared to FruitLook.

Which brings us to the questions posed by the Terms of Reference:

1) *What value does FruitLook offer its users?* Based upon responses received and discussions held, FruitLook presently occupies a secondary or monitoring role (as distinct from primary decision-generating role) in the arena of irrigation practice. Only a small proportion of irrigators actually use FruitLook as a primary aid. Based on comparative technologies, revenue generating and risk reduction possibilities as well as indicated price offerings, its perceived value (if privatised and marketed effectively) could be in the region of R400 to R500 per ha per year attracting 300 to 400 users. [Given the circumstances, complexities and wide perspectives of the market served by FruitLook, this value must, however, be regarded as tentative.]
2) *FruitLook's value in water conservation*. The low uptake of FruitLook is a reason why its impact on water conservation is severely limited. At an assumed level of 10% savings in water used, FruitLook savings approach the cost of recycled waste water. Such a cost needs to be compared with alternative methods of saving water, like removing invasive vegetation. Once more it should be pointed out that other methods of water management, at least as efficacious as FruitLook (e.g. capacitance probes), are being used at significant cost. The Consultants' view is that funding earmarked for FruitLook should be redirected at some point to other avenues of water conservation.
3) *Revision of FruitLook funding*. The Evaluation points toward the need for a change to the current funding arrangement. One feature of the surveys is that they reveal a market for irrigation management and scheduling that is developing rapidly and generating traction. The products and services offered in this market are not subsidised yet are taken up in many instances in preference to FruitLook which is offered free. As we have indicated, this does not mean that FruitLook has no value, it simply indicates that FruitLook, as part of a flourishing market, should become commercialised and eventually weaned from WCDOA funding. This will need careful planning and, with interim funding assistance from WCDOA, the creation of workable off-ramp from the current arrangements.