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Trusting in the "Eye in the Sky"? Farmers' and Auditors' Perceptions of Drone Use in Environmental Auditing

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Abstract: Worldwide, the agricultural sector is under pressure to demonstrate environmental sustainability. In New Zealand, farm environment plans (FEPs) and their auditing were intended to guide farmers towards sustainable practices by meeting regulations. However, on-farm audits can be time consuming, costly, and stressful for farmers. Meanwhile, the advancement of drone technology has made it possible to incorporate such tools in environmental audits. By means of field observation and in-depth interviews with both farmers and auditors, this research investigated the processes and perceptions of incorporating drones in environmental audits. The aerial views provided additional, high-quality information for the audit. However, flying a drone is subject to weather conditions. Additionally, reductions in audit time were dependent on farm scale, topography, and the auditor's knowledge of the farm and the farmer. Farmer-auditor relationships are critical for enabling the benefits of drone use within the FEP audit process. Such relationships require a high level of interaction-based trust between farmers and auditors. Further clarity around the use and ownership of drone images could enhance trust, enabling the benefits of drones in audits to be fully utilised, hence furthering the environmental management and compliance processes towards achieving their objectives of better environmental outcomes.

Keywords: drones/UAV; farm environment plan; trust; farmer; audit; technology adoption

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1. Introduction

Agriculture around the world is facing a growing number of environmental issues. These range from soil salinity [1] and the degradation of river water quality [2,3] to the loss of biodiversity [4]. These issues have caught the attention of the public, who now require more environmentally sustainable farming practices and systems [5], or, in some cases, pose a challenge to farmers' social licence to operate [6]. Consequently, agriculture and environmental sustainability have increasingly become conflicting concepts around the world, drawing attention to much of the scholarly endeavours in recent years [7–9]. Governments have also been trying different ways to regulate agriculture, with the aim to reduce its environmental footprint while sustaining the economic and social gains from agriculture [10].

As a developed nation in the South Pacific, New Zealand's economy has relied much on its agricultural outputs over the last century, with agriculture often being attributed as the "backbone" of the nation's economy [11]. For the year ending June 2020, agriculture contributed New Zealand Dollars (NZD) 48 billion (approximately USD 34 billion) to the country's export earnings [12]. To put this in perspective, the total New Zealand GDP for the year ending June 2020 was NZD 247 billion (approximately USD 173 billion) [13], placing agriculture's contribution at 19.4 percent. This strength in agricultural production and exports, however, has been building upon decades of production intensification, including increased stock density and yields, as well as fertiliser and pesticide inputs [14].

Meanwhile, there has been growing evidence suggesting that agricultural intensification is linked to the increasing level of nutrients, sediments, and *E. coli* in the waterways [3]. Consequently, the environment and ecosystems have suffered, which is evident in the degraded quality of some of the freshwater bodies in New Zealand [2]. All of these have put the sustainability of New Zealand agriculture in question.

To address the growing problem of environmental degradation, the New Zealand Government issued a National Policy Statement for Freshwater Management in 2014. This was subsequently amended in 2017 and updated again in 2020. This governmental statement sets a national framework for how freshwater is to be managed across the country [15] and mandates the implementation of a catchment-scale approach by regional councils in New Zealand to manage surface water and groundwater [16]. Each regional council then implements the national policy by first setting up their own regional policy statements and then providing the mechanisms by which these regional policies can be implemented [15].

With each amendment and update of the National Policy Statement for Freshwater Management, the New Zealand Government has set more and more strict guidelines around freshwater management [15]. In response, regional councils around New Zealand have developed their own policies and mechanisms to implement, with the aim to mitigate negative impacts on the environment from human activities, particularly farming.

Canterbury Regional Council, named as Environment Canterbury (ECan), adopted the use of farm environmental plans (FEPs), with associated audits as their mechanisms for freshwater management [17]. FEPs are tools that allow actions specific to individual farming contexts to be developed, while balancing environmental and economic aims. If the plans are farmer centric, they can also encourage farmer behaviour change to more sustainable practices, which are referred to as good management practices (GMPs) in the FEP audit processes. However, FEP's effectiveness in terms of environmental outcomes has been somewhat mixed [16].

The present study is set within the context of these FEP audits in Canterbury, New Zealand. Specifically, this research looked into the use of drones within these FEP audits to explore the benefits and concerns from both farmers' and auditors' perspectives and to investigate the possible drivers or causes of these benefits and concerns.

1.1. Auditing

Auditing can be a challenging task when evaluating information with a high degree of uncertainty and complexity [18]. Auditors in the financial field have been reported as using a mechanistic approach, or as Bucaro [19] describes, "a linear list-based, tick box, approach", known in system thinking as a reductionist thinking perspective. Contrastingly, professional judgement enhanced by a systems thinking perspective is better able to evaluate and audit complex situations [19], such as biological and farming systems. Auditors are different to advisors, who move through a diagnostic process in order to move to a problem resolution for their client. Auditors, in contrast, are looking for confidence around information to assign an audit grade and, if necessary, remedial actions [20]. In an agricultural context, Barbati et al. [21] clarified the following:

> *While auditors identify areas to improve, to reduce risks and allow progress towards an outcome, and may suggest approaches to address issues identified and where support and advice can be obtained, however they are not advisors, nor can they mandate specific solutions or changes to farming practices.*

FEP auditing has been described by Barbati, Brown, and McHugh [21] as the following:

> *An assessment of the performance of a farming activity against the objectives and targets of a Farm Environment Plan, and includes identifying any remedial actions to be carried out to achieve the objectives and targets of the Farm Environment Plan, and an overall grading based on the assessment of the farming activity.*

A traditional audit follows a fairly standard procedure, from the selection of reference points, the collection of data, data recording, and analysis to the ascertaining of an organisation compliance with the reference points [22]. The FEP audit process follows the same process, with data collected from documents (e.g., fertiliser recommendations) prior to the farm visit, as well as data collected from discussions with the farmer and a visual inspection of the relevant areas during the farm visit [21]. The effectiveness of an audit, however, is governed by the quality and timeliness of the data utilised [23].

The veracity (or accuracy), precision, or truthfulness of the data can be enhanced by technology improving the accuracy and objectivity of the data collected. In addition, technology has also been used to enhance two other key aspects of data quality, namely the volume and variety used in environmental and social audits [23]. Specifically, drones with automated counting software have been used by auditors to improve audit quality [24].

1.2. Hybrid and Remote Auditing

Technological advances have led to the increased use of unmanned aerial vehicles (UAVs), or drones, for multiple roles in agriculture. These uses range from moving livestock [25] and spraying weeds to data monitoring [26] and data gathering, such as monitoring crop health [27]. With drones starting to be used in audits in general, there is also the potential to use them in on-farm audits.

The effects of COVID-19, with its physical distancing requirements and labour shortages, have made traditional on-site auditing visits difficult to conduct, leading to increased interest in remote and hybrid auditing [28]. An example of this is a voluntary sustainable farming practices assurance scheme, where farmers uploaded relevant environmental data to an online portal, while the traditional on-farm visit from the auditor was replaced with a remote, virtual interview with the auditor [29]. While this approach could save time and be financially cost effective, removing the auditors' on-farm visit with visual farm inspection risks reducing the veracity, volume, and variety of the data and, thus, audit quality.

Meanwhile, FEPs are becoming compulsory in countries such as New Zealand. A key challenge for such programs is to minimise the cost of compliance, of which auditing is a key component. This raises the questions as to whether drones can be used for environmental compliance for greater accuracy and efficiency and, hence, reduced costs. However, what do farmers and auditors think of this?

1.3. The Human Face of Auditing

To investigate the thoughts of farmers and auditors on incorporating drone use in environmental audits, it is worthwhile to first consider the human interaction aspect of the auditing process, which requires, firstly, an understanding of what the FEP audit results mean to farmers.

Environmental compliance involves multiple levels of legislation, regulation, and implementation. However, at the farm level, these are often translated into various aspects of an FEP. In the situation of Canterbury, New Zealand, the audit grade awarded can have a significant impact on a farm business. The higher the grade, e.g., A grade, the less frequently a farm needs to be audited. Poor grades, on the other hand, lead to more frequent audits, and potentially an abatement notice from the regional council if the actions required are not followed through in time. These abatement notices bring major risks of financial penalties or, in extreme cases, cessation of businesses [17]. To ensure the legitimacy of the audits, credentials are required for the FEP auditors, as only a Certified Nutrient Management Advisor approved by ECan can carry out an FEP audit [17].

Understandably, the seriousness of FEP audit grades can cause apprehension in those audited, and FEP audits are compulsory for those who have land of 10 ha or greater [17]. Even in voluntary agri-environmental schemes, this apprehension can reduce farmer participation [30]. In addition, Rosin et al. [31] noted that the use of metrics, in the promotion of sustainable agriculture through assurance programs, can operate on three different levels: firstly, as simple measures; secondly, as tools signifying the power of

institutions and organisations; and thirdly, arguably, as exerting the metrics' own power as 'material agents' within economic networks. Both the second and third levels could go some way to understanding farmers' uncomfortableness with FEP audits and the power balance within the auditing relationship.

The intricacies of such power balance between farmers and auditors cannot be separated from the regulatory environment that such relationships reside within. In other words, the institutional arrangements surrounding environmental compliance have a fundamental influence on the interaction, or relationship building, and, subsequently, trust building between farmers and auditors.

Bachmann [32] suggests that two types of trust exist, institutional-based trust and interaction-based trust. Bachmann [33] and Bachmann and Inkpen [34] further suggest that institutions are specifically important in processes of trust creation, "where limited or no previous interaction exists between the (potential) trustor and the (potential) trustee".

As farmers face the potentially costly FEP audit, the outcome of which can be highly influential to their farming businesses, how would they develop such trust towards auditors and the audit process, and how would this influence the development of the Farmer-auditor professional relationship, especially when drone use is thrown into the mix?

1.4. Research Questions

The purpose of this research was to investigate the perceptions of farmers and FEP auditors regarding drone usage for environmental compliance purposes. Specifically, this paper seeks to address the following questions:

1. How are drones currently used during on-farm audits of agricultural practices?
2. What do farmers and auditors perceive as the benefits and concerns with regard to utilising drones within the on-farm audit process?
3. How does the Farmer-auditor professional relationship influence the use of drones within on-farm audits?

2. Materials and Methods

The preliminary literature review at the conception of this research project revealed that very little scholarly endeavours had investigated the interface between the use of drones or UAVs and environmental management, particularly in relation to compliance processes. The "greenfield" nature of this research area, in which aerial technology interfaces with environmental compliance, therefore, warrants an inductive-led, theory-building methodological approach. As Eisenhardt [35] pointed out, "given the strengths of this theory-building approach and its independence from prior literature or past empirical observation, it is particularly well-suited to new research areas or research areas for which existing theory seems inadequate", later adding that inductive-led, theory-building approaches "excel in situations for which there is limited theory and on problems without clear answers" [36].

Field observations and semi-structured interviews were conducted with farmers and auditors following the principles of selective sampling and theoretical sampling [37]. This was for the purpose of obtaining rich data from a variety of farm systems that are commonly seen in Canterbury.

2.1. Study Area

The study area selected for this research was Canterbury, in New Zealand's South Island (Figure 1). This region was selected due to its importance in the country's agricultural sector, with approximately 20 percent of the agricultural land [38]. The region also includes land with a range of topography, from flat- through to steep-hill farms of differing scale, and a variety of farm systems (i.e., cropping, dairy, sheep, beef, and a mix of some or all of these), thus providing a range of investigative contexts for the study.

Figure 1. Canterbury region (coloured/darkened), New Zealand (Creative Common).

In addition, the region has undergone substantial intensification of the flat land, resulting in environmental difficulties [38]. Traditionally, farming in the region comprised dryland sheep, beef, and arable farming systems. With the arrival of large-scale irrigation in the 1990s, farm systems were converted into more intensive dairy systems; this intensification has continued with increasing numbers of dairy livestock farmed. The consequent environmental degradation from nitrogen (N) leached into receiving waterways has been drawing greater attention from the general public and regulatory bodies [39]. This led to the region being one of the first in the country to require farmers to both implement and audit FEPs. The frequency of audits depends on the grade received from the previous audit. This ranges from farmers receiving A grade having their audits every 3 to 4 years to those receiving D grade having theirs every 6 months [17].

2.2. Participants

The farm systems investigated in this research included dairy, arable, intensive sheep/beef, and extensive sheep/beef systems. The elevation of the farms investigated ranged from 50 to 700 m.a.s.l.. Farmers were approached using existing networks and the client base of the auditors involved in this project (Table 1). Their willingness to participate in the project was the only criterion required for informant recruitment.

Table 1. Description of auditor participants.

Auditor Code	Auditing Experience (Years)	Drone Flying Experience
A1	Over 10	Moderate
A2	5–10	Little
A3	Less than 5	Extensive
A4	Over 10	None
A5	5–10	Little
A6	5–10	Little

Field observations were conducted on farm during FEP audits when a drone was used to visualise the farm. Researchers observed the audit process and the farmers' and auditors' reactions to the process. After the audit, semi-structured interviews with the farmers and auditors were conducted, focusing on their views of the strengths/benefits and weaknesses/disadvantages of using drones within the audit process and any associated concerns. On one occasion (Farm F in Table 2 below), researchers were advised not to observe the audit due to a windy weather forecast, which meant that the drone was unlikely to be used. The actual weather condition on the day allowed drone flying, therefore the auditor was interviewed after returning from the audit visit, but the farmer was not interviewed.

Table 2. Description of farmer participants.

Farm	Farm Type	Farm Topography	Farm Size (Hectares)	Farmer Code	Farmer's Experience with Drones
A	Dairy support	Hilly	Under 500	F1a, F1b	None
B	Arable	Flat	Under 500	F2	Little
C	Dairy support	Flat	Under 500	F3	None
D	Dairy, dairy support, arable	Flat	Under 500	F4	None
E	Deer, dairy support	Flat to rolling	Under 500	F5	None
F	Sheep, beef	Hilly	Over 1000	F6 (not interviewed)	None
G	Sheep, beef, dairy support	Hilly	Over 500	F7	None
H	Arable	Flat	Over 1000	F8	Some

In Phase I of this research, eight farmers and three auditors were observed and interviewed for the project between the months of December 2020 and March 2021. Two farmers declined to be recorded, so detailed notes were taken in place of recording. In Phase II of this research, three additional auditors were interviewed without field observation in September 2021 to triangulate the results from Phase I. A summary of all of the informants is shown in Tables 1 and 2 below.

The observation and indicative interview guides for both farmers and auditors are summarised in Tables 3 and 4 below.

Table 3. Observation and indicative interview guide for farmer participants.

Observation Guide	Interview Guide
What are the steps of using the drone in the audit process?	What do you think that are the pros and cons of the process of using drone to assist an FEP audit that has just happened?
What is the farmer's first response when he/she saw the live images of his/her farm shown on a computer (connected via Bluetooth) without physically driving there?	Do you have any concerns of using a drone for the FEP audit process? If so, what are they, and why?
How does the farmer interact with the rural professional during the time when the drone is flying and showing live images?	(If answered "yes" to the question above), then do you have any suggestions as to how we can address these concerns?

Table 4. Observation and indicative interview guide for auditor participants.

Observation Guide	Interview Guide
How does the rural professional run the process of FEP audit when using a drone? How does the rural professional engage with farmers during this process? What is the rural professional's reaction to the farmer's first response when he/she saw the live images of his/her farm shown on a computer (connected via Bluetooth) without physically driving there? If there were signs of concerns/worries on the farmer's face, how does the rural professional respond?	What do you think of the process of using drone to assist an FEP audit, as it happened on this farm [that is currently being audited]? What do you think that are the pros and cons of using drones in such a process? Do you have any concerns of using a drone for the FEP audit process? If so, what are they, and why? (If answered "yes" to the question above), then do you have any suggestions as to how we can address these concerns?

The observations generally took around one to two hours on farm. The majority of the subsequent interviews with the farmers took place in the farmer's house or, in the case of the auditor interviews, at a separate, mutually agreed convenient meeting place. The interviews ranged from 30 min to 60 min in length.

2.3. Research Materials

The drone used in this study was DJI Phantom 4 Pro, which had been purchased and used for FEP audit purposes by one of the auditors interviewed. The drone weighs about 1.4 kg, including the battery and propellers, and has a 4K RGB camera. The camera is equipped with a FOV 84° 8.8 mm/24 mm (35 mm format equivalent) f/2.8–f/11 auto focus at 1 m–∞ lens, with the capacity to record cinema 4K footage at the resolution of 4096 × 2160 and 24, 25, or 30 frames per second at 100 Megabyte per second. All of the drone footage and still images obtained during this study were taken at this resolution setting. The top flying speed of the drone is 72 km per hour [40]. The tablet used by the auditors to operate the drone was a Samsung Galaxy Tab A, and the separate computer used for farmers to view the footage on was an Acer Aspire V15 Nitro Black Edition laptop. Both the tablet and the laptop had Bluetooth capability, so they were able to share screens for the auditor and the farmer to view live footage taken by the drone at the same time.

2.4. Data Processing and Analysis

Interviews were transcribed and, along with the detailed notes, imported into NVivo12 Plus and coded for thematic analysis [41]. Data from the interviews were coded to nodes based on ideas from the interview guides. The coder was alert for additional themes or codes that may have emerged from the data. Whenever a new theme emerged, a review of already coded texts was performed to ensure the internal validity of the results. To improve rigour, the coder and researchers discussed the coding regularly to triangulate the emerged themes. A list of the key themes drawn out from this analysis is shown in Table 5 below.

Table 5. List of key themes.

Themes
Audit process
Farm context specificity
Control over audit process
Data ownership and permission
Different proof of evidence
Different view/perspective
Drone technical requirements
Environmental regulations and industry
Future monitoring
Farmer acceptance of the images
Interpretation of images
Farmer-auditor relationship
Auditor's confidence in farmer's decision making
Health and safety benefits
Time-saving benefits

3. Results

The following results are presented with the aim of providing answers to the research questions set out earlier. Given the small number of auditors interviewed within a highly specialised field, the auditors' quotes were not attributed to individuals in order to protect their identity.

3.1. Use of Drones in the FEP Audit Process

The on-farm audit process consisted of six key stages (Figure 2). Four of these stages, from ice breaking and rapport building through to wrap-up discussion, were observed on farm by the researchers, while the first and last stages were reported by the auditors as occurring off farm. The drone was utilised in the farm tour stage, with auditors reporting that the other stages in the process were undertaken in a similar fashion regardless of whether a drone was used or not. During the farm tour stage, the drone was flown by the auditor over key areas of interest on the farm for the audit, such as rivers and areas where livestock had been grazing nearby. This was in lieu of the traditional farm tour, where the farmer would drive the auditor to those areas. The drone footage was viewed by both the auditor and the farmer in real time, with the auditor considering both the visual inspection of the drone footage and related discussion with the farmer in making their audit decisions.

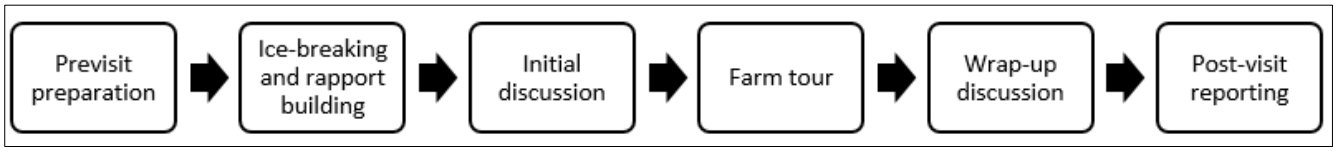

Figure 2. Stages in the FEP audit process.

Based on the information collected, auditors make a judgment on farmers' decision making on farm in relation to the impact of farming activities on the environment, such as soil and waterways. For example, has the farmer allocated a buffer zone of plants near the edge of the waterways to prevent sediments being washed into a natural stream? Because each farm system is unique due to its own biophysical characteristics, such as land contour and natural waterway distributions, auditors cannot make a judgement based on hard and fast rules. Rather, the judgement by the auditors is circumstantial to the farm system, which is unique to each specific audit, and focused on the farmer's decision making and related actions rather than their actions alone.

Two key themes emerged from the data with regard to how drones are currently used in on-farm audits of agricultural practices (Table 6). The first theme, enabling factors,

consists of conditions that must be met before the drone can be used in the audit. The first of the enabling factors was the farmers' permission to fly the drone over their properties. As an auditor described:

> *We're very careful about how we ask farmers; we don't just assume that they're happy for us to fly a drone around . . . that sort of thing.*

Farmers were also offered the opportunity to fly the drone; however, in each of the observed visits, the farmer declined due to the value of the drone and their fear of damaging it.

The second enabling factor was suitable weather conditions to fly the drone, such as little or no wind and no rain.

Table 6. Factors that influence the use of a drone during an on-farm environmental audit.

Theme	Sub-Theme	Description of Sub-Theme
Enabling factors	Farmers' permission	Farmers' permission to use the drone
	Suitable weather conditions	Wind—speeds less than 40 km/h
		Dry conditions
Operational factors	Technical factors	Auditor efficient at setting up the drone
		Footage visibility to farmer
	Drone flying procedure	Initial aerial orientation of the farm
		Clarification of farm boundaries

The second theme that emerged was related to the operational factors associated with using a drone during the on-farm audits. The sub-theme, technical factors, was related to how efficiently the auditor could set up the drone, as this was observed to be a somewhat awkward and uncomfortable waiting period for the farmer. Another technical factor that emerged was the ease of viewing the drone footage for the farmer. In all of the observed audits, the auditor flew the drone and had his/her own screen/tablet, while the farmer viewed a separate screen that was Bluetooth-connected to the auditor's screen/tablet. However, the footage could be difficult for the farmer to view if the screen was in the wrong position for the sun or shade, if there was insufficient space for more than one farmer to watch the screen comfortably, or if the Bluetooth connection did not work. The second operational sub-theme was related to the auditor's drone flying procedure. Farmers reported that the aerial view of their farm could be disorientating, and they preferred that when the drone was launched, it did a slow 360^{o} panorama of the farm, as this allowed the farmer to orientate themselves. The auditors were also observed to have continually clarified where the boundaries of the farm were with the farmer, as the farmers were anxious to ensure that the areas of interest being audited were in fact on their farms and not a neighbouring farm.

3.2. Benefits and Concerns Regarding the Use of a Drone in FEP Audits

Three key benefits of using drones in an on-farm audit process were reported by farmers and auditors. These benefits included, firstly, improved confidence in decisions made during the audit process; secondly, a reduction in time and, hence, the cost of conducting the on-farm audit; and thirdly, improved health and safety whilst conducting the audit (Figure 3). The farm context, both in general and on the day of the audit, influenced the degree of the latter two benefits.

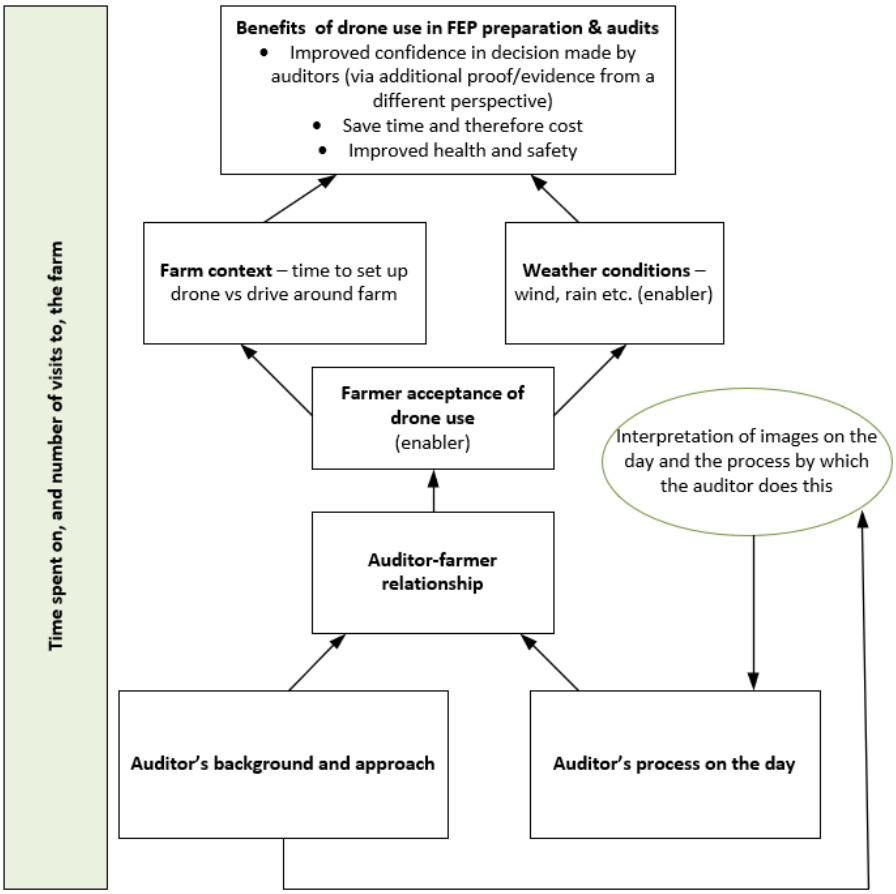

Figure 3. Benefits of and concerns surrounding drone use in FEP audit process.

Improved confidence in audit decisions was achieved via additional information from a different source, an aerial view of areas of interest on the farm, being incorporated into the decision-making process. For example, in the image taken by a drone (Figure 4) below, auditors were able to see the native planting that a farmer had carried out near a natural swamp. This was not accessible via any established farm roads and was therefore difficult to see from the ground.

Figure 4. An example of a drone image showing the native planting that a farmer had carried out around a natural swamp, to which there was no access via a farm road.

This additional information boosted both the farmers' and auditors' confidence in the auditor's assessment of the farmer's decision making regarding environmental management, as demonstrated by the quotes in Table 7.

Reducing the time required, and hence the cost, to conduct an FEP audit was a key potential benefit of drone usage reported by farmers and auditors. The time saved by using a drone instead of driving to the areas of interest could range between 0 and 1.5 hours. This difference in time saved depended on the scale and topography of the farm audited. In some situations, where the farm was on a smaller scale or had highly drivable internal farm roads, using a drone had no time-saving advantage over driving to view the areas of interest for the audit.

Both the improved confidence in decision making and the potential reduction in time taken to conduct the audit using drones seemed to diminish as the level of knowledge that the auditor had about a particular farm increased. As an auditor detailed:

> *I don't see a need [for a drone] . . . for the farms that I've visited multiple times and things like that. You understand their systems and how they're operating it and what that looks like, and you can easily identify any issues as you're driving around.*

Improved health and safety was also recognised by the auditors as an advantage of drone use, especially on farms with a challenging topography or when the conditions on farm make moving around the farm difficult or dangerous (Table 7).

The interviews with farmers and auditors and the observation of the audit process identified potential benefits of utilising drones; however, a number of concerns surrounding their use were also revealed. The first concern reported by farmers and auditors was that drones cannot provide information for certain senses. The hearing and smelling senses can only be perceived by an in-person visit to the sites, not by flying a drone above.

The second and arguably more serious concern was that the specific areas of interest could look different from an aerial perspective when compared to being viewed at ground level. The auditors interviewed shared the same sentiment, insisting that while a drone could be very useful in identifying potential areas of environmental problems on-farm, any particular problems identified by a drone still needed to be "ground-truth-ed" by an in-person visit to the problem site. This validation process gives both the farmer and the auditor the opportunity to further discuss what the actual problem might be. Indeed, a key component of the process that the auditor used on the day of the audit was taking the step of clarifying potential issues identified by the drone with an in-person visit to the site, which also contributed to a positive auditor-farmer relationship (Figure 3).

The third concern expressed by farmers was related to the potential use of the drone footage for non-FEP auditing purposes. This concern rose from a lack of clarity in the ownership of the drone footage, as F1b expressed:

> *Well, the question is where is the legality [about the footage]? That's a risky one.*

3.3. Critical Role of the Farmer-Auditor Professional Relationship

The importance of the auditor-farmer relationship in achieving positive environmental outcomes was reported by both farmers and auditors. A farmer's perspective is illustrated by F4:

> *You can give us feedback and tell us what we're doing wrong, and we get it right next time. And that's the whole idea of this process.*

Auditors also recognised that a positive professional relationship fundamentally drives the behavioural change for better environmental outcomes. As an auditor explained:

> *The building of relationships . . . is really, really important because if you don't build a trusting relationship with a farmer, they're less likely to actually do the actions that you give them and strive for good management practice and actually put the effort in [which] quite often, it's got a big financial implication.*

Table 7. Factors contributing to the perceived benefits and concerns of using a drone during an on-farm environmental audit.

Theme	Sub-Theme	Sample Quotes from the Textual Data
Benefits	Improved confidence in decision making	Farmer (F2, Farm B) *It's the transparency that can back up what you say. So, it's a visual for him [auditor]. He can quickly shoot across the water race, and it's all those little things that we can tell a nice story . . . We can make ourselves seem really trustworthy and have all the paperwork in correct order, but unless we practice what we preach, how do you back up? . . . A visual quick fly around is probably the easiest way to do that.* Auditor *You find out more things because you've got an aerial perspective, so you've got more spatial recognition and detail that you can access from being in the air, picking up on things that you wouldn't normally see, and then just getting that high quality evidence.* Another auditor *The way the auditing program works is that you look at a representative portion of the farm to give you the level of confidence to make a judgement on the overall management and infrastructure. By using the drone, you can give a more accurate indication, or you had more confidence in the accuracy of the decision you're going to make.*
	Time and cost efficiency	High level of time and cost efficiency Farmer (F1a, Farm A)—large scale farm, hilly topography *I think we probably saw more just with the drone, especially this place . . . [is] more hilly, and that I think I can see advantages to get to areas that you probably couldn't drive to easily, and you get an overview of what's going on. I think [the auditor] could see straight away what was going on on-farm in a matter of minutes rather than driving around for an hour to learn the same information.* None or low level of time and cost efficiency Farmer (F2, Farm B) *It's probably much the same. I mean, we've stopped here. You get a fairly good overlook. Now, this property is so simple, because it's just . . . here.* Auditor (Farm B) *This is an example when a drone actually takes longer, because you've got the set-up time, and the take-down time.*
	Health and safety	Auditor *The track [internal farm road] might be treacherous, or because it might be raining, or it might be a long way to get there, or it might be rough, or there might be dangers in getting there. Flying across the gully to look at something is a lot faster with the drone.*
Concerns	Reduced senses	Auditor *With the drones, that's only one of the senses; that's the vision, you know. . . . the hearing, you know, to listen to things are working properly, you know, if you listen to it . . . We'll look at an irrigator going. Also smell, smell's a big one around effluent discharge, so you're missing a couple of senses.*
	Issue verification	Farmer (F1a, Farm A) *There's going to be some sort of pugging, and from the photo, it can look really bad. But then when you actually physically walk in the paddock and you think, "Oh, that is actually not," it's like [the auditor] suggested, the depth—he said when he measured it himself, physically measured it— . . . it's actually not as bad as it looks.* Farmer (F7, Farm G) *Its fine using whatever image you want, you know, for the audit, as long as those images weren't used by other . . . groups . . . and then someone . . . takes a photo . . . and boom!... so that'd be more of a concern.*
	Use of footage outside auditing purposes (linked to ownership of imagery)	Auditor *So, the privacy, at what point do the images become private? That seems to be grey, isn't it? If an auditor is taking an aerial photo of the paddock, or whatever it is . . . Whenever I asked Josh or Neil [pseudonyms], they were saying that they think technically the image is owned by the auditor, but the permission has to be sought before using the image for anything else. How did that work? . . . It seemed to be vague . . . Who owns the image?*

The themes identified on the factors that influence such Farmer-auditor relationships can be categorised into auditors' and farmers' perspectives. These are illustrated in Table 8.

Table 8. Factors that influence Farmer-auditor professional relationships.

Theme	Sample Quotes From The Textual Data
Purpose of audits—driving behavioural change	Auditor *I want to see a farm meeting environmental goals. And building that rapport and helping them along that journey is crucial. Because if you don't, then you get them backing against the process, then it's going to be really difficult to get the outcomes you want. So, we've got to get farmer collaboration in all this for it to work.*
Prior encounter with the auditor	Farmer (F7) *If you're getting the same person, I think first time—cause [the auditor] already been down there—then the second time, you know, if you're just doing an overview, you can use your drone. I think maybe first time you'd probably want to . . . drive over it.*
Auditor's farm system knowledge	Auditor *Understanding the complexity of a farm system is crucial to getting this to go forward . . . That [farm] system knowledge is crucial in building that rapport.*
Auditor's process on the day	Auditor *You'll actually guide them through the process, and it's not stressful for them.*

The purpose of driving behavioural change towards better environmental outcomes encourages auditors to engage with farmers on a positive note, as only such positive engagement will lead to trust building, which sets the foundation for guiding behavioural change.

On the other hand, building such trust takes time, and this is reflected in the timing of drone use in relation to the FEP audit procedure. The permission of drone use given by the farmer appeared to be subject to prior visits of the farm by the auditor. There was a belief that a drone should be used when the auditor had previously visited on site and the farmer had already driven them around the farm.

Additionally, an auditor's background and their knowledge of farm systems were identified as critical to building the initial rapport with farmers. Evidently, this requirement for farm system knowledge has also been reflected in the survival of auditors in their trade, as it appears that only those auditors who can build a positive rapport will continue to be engaged by farmers, while others would not, as described by an auditor:

> *We started off with over 20 auditors, and some just don't get very much work, so they've sort of dropped out. These factors are taken into consideration by farmers and auditors when audits take place.*

As an auditor, building a positive professional relationship with the farmer can be challenging, as explained by one auditor:

> *Auditing and trust don't normally go together.*

On the day of the audit, auditors put much effort in the actual process. When the auditor arrives on farm, they were observed to only have a short time, five to ten minutes, to "break the ice" and build rapport with farmers at the start of the audit process (Figure 2), as the farmers want the audit completed quickly and are conscious of being charged an hourly rate.

To reduce the stress of the audit, and hence better rapport building, auditors were observed to use open questions, such as "tell me about your farm", during the initial discussion phase in Figure 2. This encouraged the farmer to describe their farm system and allowed the auditor to steer the conversation through areas relevant to the audit.

One unintended consequence of this trust building, however, is that the time efficiency of drone use could be negated. It was observed and reported by auditors that when there was a strong positive rapport between the farmer and auditor, the drone-flying stage of the audit process could take longer than otherwise expected. As an auditor explained:

> *When the rapport is that good with a farmer, can end up taking quite a long time, because you talk about what you see, and it's not just an audit, it's an 'audit plus'.*

4. Discussion

This research set out to explore the integration of a new technology, drones, within environmental compliance. The specific research questions that this study sought to answer included those surrounding the current practices of drone use adopted within on-farm environmental audits, the benefits and concerns regarding such uses of drones, and the extent of the influence of Farmer-auditor relationship in this process.

The research results indicate that auditors followed a procedure that ensures it is equitable for farmers who choose to use drones and those who do not. For example, auditors emphasised the need to "ground-truth" the images seen through a drone, so that no misinterpretations are made. However, there are distinct benefits of engaging drone use for on-farm environmental audits, including improved confidence in auditors' decision making via the provision of additional evidence from a different perspective, saving time, as well as improved health and safety. However, these benefits can only be realised if two categories of conditions, the technical conditions, and the Farmer-auditor relationship conditions, are met. These are further elaborated on in the sections below.

4.1. The Technical Conditions

The technical conditions refer to the suitability of the weather conditions, the farming context to fly the drone, a drone's technical capabilities, and the pilots' drone-flying skills, as well as the viewing arrangements for the farmer.

With the farmer's permission and suitable flying weather conditions, flying the drone was a relatively straightforward substitute for the traditional tour of the farm in a vehicle. However, if the farm scale is small and the land contour is flat with easy vehicle access all around, it could potentially take more time to set up the drone than to drive around the farm. On the other hand, extensive farms and/or those with steep topography for vehicle access would make it worthwhile to utilise drones. The drone used, nevertheless, needs to be capable of flying in these conditions, and the pilot needs to have the necessary skills to operate the drone. Farmers also need the viewing platform (of the drone images) to be fully accessible and functional under the right lighting. As technologies continue to advance, some of the flying weather conditions, such as wind and rain, will become less limiting.

Compared to the advanced technologies incorporated in other drones [24–27], it was relatively simple drone technology, i.e., the footage from the drone's in-built camera that was utilised in the FEP audit process. The technical limitations associated with these advanced technologies were thus avoided.

Within the present study, the auditors who flew the drones were competent and relatively experienced pilots, and as such, they were not necessarily representative of most of the FEP auditors. This indicates that one of the limitations could be an individual's interests in, and ability to, fly a drone. This limitation could be reduced, however, if there are more farmers who are already experienced drone pilots who opt to fly their own drones during the audit.

The technology under investigation, in this case, drones, provided additional aerial views that increased the veracity, variety, and volume of data for the audits. This led to a higher audit quality, or increased confidence in audit decisions, which is in agreement with Christ, Emett, Summers, and Wood [24]. In addition, drone usage fitted efficiently into the existing traditional audit process. The traditional drive around the farm was substituted with flying the drone around the farm. From this viewpoint, farmers, auditors, and regulators could be encouraged to utilise this technology to improve audit quality, just as other new technologies, such as block chain, have been incorporated into supply chain audits [23].

4.2. The Farmer-Auditor Relationship Conditions

If the technical conditions are met, then there are still Farmer-auditor relationship conditions that need to be met before the advantages of drone use can be realised. These conditions are mostly linked to the concerns surrounding drone use in environmental

audits, and they represent the centrepiece that the present research revealed—the trusting Farmer-auditor professional relationship. To attain such trust, rapport building right at the start of the audit is crucial. Specifically, there are two perspectives in this trust-building endeavour, the auditors' and the farmers' perspectives.

4.2.1. The Auditors' Perspective

To understand the auditors' perspective, a further contemplation of their motives for audits is necessary. The auditors interviewed saw the purpose of FEP audits as more for directing genuine behavioural change towards enabling better environmental outcomes (as opposed to simply "box ticking" [19]). It is therefore evident that FEP audits in New Zealand follow a different path from commonly recognised routine audits, such as financial audits [18]. Because of this clear motivation for behavioural change, for most auditors, their first interaction with farmers must establish trust with the farmer, and especially so if drones are to be used as part of the process. In particular, the very first audit of a particular farm is important for establishing the foundation of a trusting Farmer-auditor relationship as several auditors testified. As the farm environmental management improves throughout the course of the Farmer-auditor relationship building, the subsequent audits can become a more routine exercise, particularly for those farms that have already achieved A grades. Nevertheless, the end goal of the FEP audit process is improved environmental outcomes, making farmer buy-in critical, as only with farmers' commitments to good management practices (GMPs) can the actual environment be improved. Such a requirement for farmer buy-in explains the need to build rapport and gain trust from farmers, as all auditors interviewed insisted.

4.2.2. The Farmers' Perspective

From the farmers' perspective, it is this trust that enables the benefits of drone use to be taken advantage of in the FEP audit process. A critical level of trust is required between the two parties before farmers will allow the drone to fly on their farms. In general, the audit process is stressful for farmers, with interviewed farmers expressing a sense of relief at the completion of the audit and the auditor's subsequent exit from their property. In addition, the imposition of drone usage meant that the farm tour changed from the "farmer driving the auditor around" to the "auditor flying the farmer around", which significantly changes who is, literally, driving that part of the audit process. This paradigm shift suggests that any pressure to use a drone during the audit process could lead to increased stress and a sense of loss of control on the part of the farmer. Even without the use of the drone, the audit process implies a power pendulum that swings control in the auditor's favour, as farmers see that an auditor essentially holds the power of the farmer's "right to farm". Overlaying the use of the drone onto the audit process could make this seeming power imbalance more pronounced. One possible solution to this power imbalance is to allow and even encourage farmers to operate their own drones. In doing so, the farmer is "back in the driver's seat" and, therefore, in greater control of what is to be seen during the audit visit. Nevertheless, the use of the drone itself will still enable aerial views of the farm and any areas of potential interest to be seen for auditing purposes.

Regardless, a high level of farmer trust towards the auditor is a key means of overcoming the fear of this potential power imbalance in the FEP audit process. Even though the regulations placed upon auditors to comply with continuous training and certification [21] may provide some farmer confidence regarding the auditor's understanding of their farm systems, the level of trust and rapport between individual auditors and farmers is paramount. In the end, a farmer must hold a level of confidence in the transparency of the audit process, especially when drones are being used.

A further study on the type of trust required may shed light on what can be carried out to assist this trust building between farmers and auditors. Bachmann and Inkpen [34] suggest that the key mechanism through which institutions foster the development of trust

include (1) legal provision; (2) corporate reputation; (3) certification of exchange partners; and (4) community norms, structures, and procedures.

Before applying these concepts suggested by Bachmann and Inkpen [34], there is a need to first reconsider the general institutional environment surrounding environmental management that is current in New Zealand. Over the past decade, environmental regulations have increasingly tightened in New Zealand, with more and more limits placed upon farming operations in order to mitigate the negative impact on the environment from farming. While farmers acknowledge that the ultimate goals of these regulations are good, many do feel unfairly targeted, resulting in the rural–urban divide in New Zealand continuing to increase. Additionally, regulations surrounding the privacy of drone images of farms are vague, as seen by the farmers and auditors interviewed in this research. This further casts doubt in the farmers' minds regarding drone use by an FEP auditor. Essentially, the trust from farmers towards institutions around environmental management has eroded over the past decade [16], and farmers' trust towards drone use for environmental purposes is further exacerbated by the lack of clarity surrounding privacy issues on the use of drone images.

Consequently, it is possible that the institutional-based trust that farmers form towards an auditor within the current environmental regulative context is not high. This prediction is evidenced by applying the concepts of the key mechanisms through which institutions foster trust development, as suggested by Bachmann and Inkpen [34]: (1) there is some trust by farmers on the protection of the farmer's basic rights within the legal system; (2) the corporate reputation, in the case of this research the New Zealand Government and regional councils, such as ECan, is not highly regarded, although the third party auditor's reputation is less questionable; (3) the Certified Nutrient Management Advisor credential held by the auditor gives farmers some confidence in the auditor's ability to make a just assessment; and (4) the community norms, structures, and procedures, by which the auditors approach and audit farmers, are within the expectations of farmers. Additionally, given the importance of institutional-based trust in processes of trust creation, farmers tend to prohibit drone use on an auditor's first visit, because this low or medium level of institutional-based trust does not warrant the risk that farmers perceive through drone use.

Furthermore, farming operations have high specificity, arising from the fact that every farm system is uniquely formed based on its own biophysical and socio-economic endowment. This multiplicity further weakens the level of institutional-based trust that farmers form towards auditors because such trust is seen to only increase the efficiency of transactions involving low-level asset specificity. Consequently, the combined outcome of these multiple aspects is that the institutional-based trust formed by farmers towards the audit process is low to medium, or at least not high. In contrast, a commonly known routine audit, such as a financial audit, can have greater reliance on institutional-based trust and, hence, less requirement for relationship building between auditors and auditees [34]. Such a contrast echoes the discovery of Cook et al. [42], in that "environmental auditing is a special case because it is often difficult to assess improvements in environmental quality in specific sites on the basis of generic standards and criteria and even more difficult to demonstrate that these improvements are the result of specific measures". This comparison is also illustrated in Figure 5 below.

To compensate this low or medium level of trust based on current environmental institutions, farmers resort to interaction-based trust, whereby the individual auditor's rapport-building capacity becomes vital for trust building. An auditor who can demonstrate a good level of understanding of the unique farm system that the farmer is operating and who can interact with the farmer in a non-intrusive manner will have the ability to gain a greater level of trust on the farmer's part. Only under such circumstances will the farmer place themselves in a vulnerable position and permit the auditor to fly a drone, which is potentially risky to the farm business. Drawing on the works of Castaldo et al. [43] and Edwards et al. [44], farmers are only so willing to trust drone use because the consequences

of drone images being misused will bring unwanted outcomes, negatively impacting their right to farm.

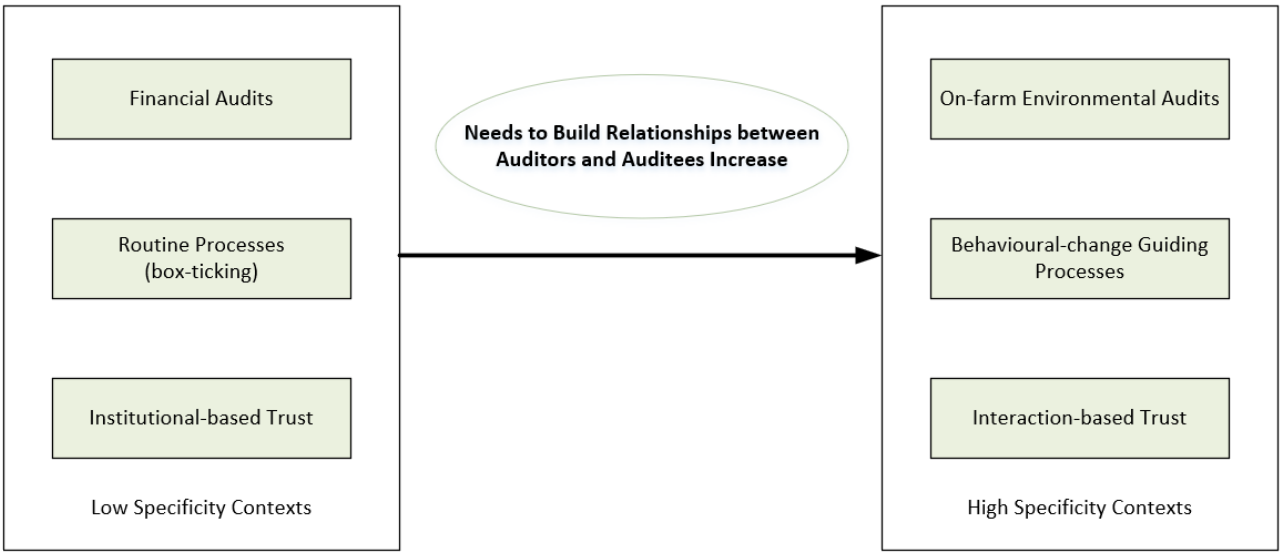

Figure 5. Comparison of routine (e.g., financial) audits and on-farm environmental audits.

5. Research Limitations

The limitations of this research extend from the small number of farmers and auditors interviewed, as well as the focus on one particular region of New Zealand. Although a variety of farm system types were investigated under the guidance of theoretical sampling, which was then aided with interviews with auditors who did and did not use drones in FEP audits, possible bias introduced by such a small sample is inevitable. Future research could target more participants, as well as other regions and/or countries, in order to draw a comparison and gain a deeper understanding.

6. Conclusions

Drones, "eyes in the sky"—can they really be trusted? This exploratory study of farmers' and auditors' perceptions of the use of drones in on-farm environment audits has revealed some valuable insights into drone technology as well as trust within the Farmer-auditor relationship. The live drone footage was used as a relatively straightforward replacement for the tradition of driving around the farm in a vehicle, providing additional information from a different aerial perspective to aid the auditors' decision-making processes.

Whilst it was generally agreed by all parties that the benefits of a shorter, and hence more cost effective, audit increases confidence in audit decisions and reduces health and safety concerns, there was still an underlying hesitancy from farmers. This caution was due to uncertainty around the drone footage, with issues such as whether the aerial view reflected what was actually happening on the ground, where the footage would be stored or who would store the footage, and what could the footage be used for, reflecting the critical issues of trust and confidence in the auditor and auditing organisations. In order to fully utilise the advantages that drones can offer to environmental management and compliance processes, clarity around the data usage (particularly drone images) and ownership is needed. Although the high specificity of individual farm systems encourages farmers' reliance on interaction-based trust towards auditors, such clarity on data usage and ownership would foster stronger institutional-based trust on the farmers' part, making the compliance process more robust and transparent.

Drones can only enhance environmental compliance provided that the critical level of trust and confidence that farmers and auditors have for each other exists, indicating that the Farmer-auditor relationship is fundamental for the FEP audit process. Without such trust,

there will be a lack of rapport between farmers and auditors, which consequently prevents the positive influence for behavioural change that FEP audits set to achieve. Policies could also be developed for future situations in which farmers wish to submit their own drone footage, thus reducing the need for auditors to make on-farm visits.

In summary, this study has highlighted three key issues that need to be accounted for when considering drone use in FEP audits: first, the weather conditions; secondly, the farm context, i.e., farm scale, topography, and infrastructure, such as roading; and thirdly and most importantly, the trust within the Farmer-auditor professional relationship. In other words, the trust does not reside with the "eye in the sky". Rather, the trust lies within the Farmer-auditor relationship, which is the key enabler for the benefits of drone use to be taken advantage of.

This research makes four key contributions to the literature: (i) it utilises an inductive approach to identify how drones can be effectively used in an on-farm environmental audit process; (ii) it describes the perceived benefits and concerns from both the farmers' and auditors' perspectives of using the technology in the audit process; (iii) it analyses the critical role of a strong, positive Farmer-auditor professional relationship in order to facilitate drone use and less stressful audits; and (iv) it provides recommendations for policy to reduce potential barriers to drone use in on-farm audits (i.e., to not make drone use mandatory but rather to leave farmers with some control in the process) to enable the industry, farmers, and auditors to take advantage of the benefits of the effective use of drones in an on-farm audit context.

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References

1. Daliakopoulos, I.; Tsanis, I.; Koutroulis, A.; Kourgialas, N.; Varouchakis, A.; Karatzas, G.P.; Ritsema, C. The threat of soil salinity: A European scale review. *Sci. Total Environ.* **2016**, *573*, 727–739. [CrossRef]
2. Moller, H.; MacLeod, C.J.; Haggerty, J.; Rosin, C.; Blackwell, G.; Perley, C.; Meadows, S.; Weller, F.; Gradwohl, M. Intensification of New Zealand agriculture: Implications for biodiversity. *N. Z. J. Agric. Res.* **2008**, *51*, 253–263. [CrossRef]
3. Julian, J.P.; de Beurs, K.M.; Owsley, B.; Davies-Colley, R.J.; Ausseil, A.-G.E. River water quality changes in New Zealand over 26 years: Response to land use intensity. *Hydrol. Earth Syst. Sci.* **2017**, *21*, 1149–1171. [CrossRef]
4. Dudley, N.; Alexander, S. Agriculture and biodiversity: A review. *Biodiversity* **2017**, *18*, 45–49. [CrossRef]

5. Hall, C.; McVittie, A.; Moran, D. What does the public want from agriculture and the countryside? A review of evidence and methods. *J. Rural. Stud.* **2004**, *20*, 211–225. [CrossRef]
6. Edwards, P.; Trafford, S. Social licence in New Zealand—what is it? *J. R. Soc. N. Z.* **2016**, *46*, 165–180. [CrossRef]
7. Sabiha, N.-E.; Salim, R.; Rahman, S.; Rola-Rubzen, M.F. Measuring environmental sustainability in agriculture: A composite environmental impact index approach. *J. Environ. Manag.* **2016**, *166*, 84–93. [CrossRef]
8. Skinner, J.; Lewis, K.; Bardon, K.; Tucker, P.; Catt, J.; Chambers, B. An Overview of the Environmental Impact of Agriculture in the U.K. *J. Environ. Manag.* **1997**, *50*, 111–128. [CrossRef]
9. van der Werf, H.M.; Petit, J. Evaluation of the environmental impact of agriculture at the farm level: A comparison and analysis of 12 indicator-based methods. *Agric. Ecosyst. Environ.* **2002**, *93*, 131–145. [CrossRef]
10. Dasgupta, S.; Mody, A.; Roy, S.; Wheeler, D. Environmental Regulation and Development: A Cross-country Empirical Analysis. *Oxf. Dev. Stud.* **2001**, *29*, 173–187. [CrossRef]
11. John, B.; Ralph, L. Farming in New Zealand: The State of Play and Key Issues for the Backbone of the New Zealand Economy. In *NZ Trade Consortium Working Paper No. 32*; 2004. Available online: http://hdl.handle.net/10419/66092 (accessed on 24 November 2021).
12. Ministry for Primary industries. Situation and Outlook for Primary Industries (SOPI) June 2021. Available online: https://www.mpi.govt.nz/dmsdocument/45451-Situation-and-Outlook-for-Primary-Industries-SOPI-June-2021 (accessed on 8 November 2021).
13. Reserve Bank of New Zealand. Gross Domestic Product (M5). Available online: https://www.rbnz.govt.nz/statistics/m5 (accessed on 24 November 2021).
14. MacLeod, C.J.; Moller, H. Intensification and diversification of New Zealand agriculture since 1960: An evaluation of current indicators of land use change. *Agric. Ecosyst. Environ.* **2006**, *115*, 201–218. [CrossRef]
15. Environment Guide. National Policy Statement for Freshwater Management. Available online: https://www.environmentguide.org.nz/issues/freshwater/freshwater-management-framework/national-policy-statement-for-freshwater/ (accessed on 12 November 2021).
16. Stokes, S.; Macintosh, K.A.; McDowell, R.W. Reflecting on the journey of environmental farm planning in New Zealand. *N. Z. J. Agric. Res.* **2021**, *64*, 463–470. [CrossRef]
17. Environment Canterbury. Farm Environment Plans. Available online: https://www.ecan.govt.nz/your-region/farmers-hub/fep/ (accessed on 21 October 2021).
18. MacTavish, C.; McCracken, S.; Schmidt, R.N. External Auditors' Judgment and Decision Making: An Audit Process Task Analysis. *Account. Perspect.* **2018**, *17*, 387–426. [CrossRef]
19. Bucaro, A.C. Enhancing auditors' critical thinking in audits of complex estimates. *Account. Organ. Soc.* **2019**, *73*, 35–49. [CrossRef]
20. Gray, D.I.; Kemp, E.A.; Gardner, J. The problem solving processes used by farm management consultants: Implications for training. In Proceedings of the 12th International Farm Management Congress, Durban, South Africa, 18–24 July 1999.
21. Barbati, A.; Brown, I.; McHugh, J. Canterbury Certified Farm Environment Plan (FEP)—Auditor Manual, Canterbury Regional Council. 2020; p. 66. Available online: https://www.ecan.govt.nz/document/download?uri=3649541 (accessed on 5 November 2021).
22. Byrnes, P.E.; Al-Awadhi, A.; Gullvist, B.; Brown-Liburd, H.; Teeter, R.; Warren, J.D.; Vasarhelyi, M. Evolution of Auditing: From the Traditional Approach to the Future Audit. *Contin. Audit.* **2018**, 285–297. [CrossRef]
23. Castka, P.; Searcy, C.; Mohr, J. Technology-enhanced auditing: Improving veracity and timeliness in social and environmental audits of supply chains. *J. Clean. Prod.* **2020**, *258*, 120773. [CrossRef]
24. Christ, M.H.; Emett, S.A.; Summers, S.L.; Wood, D.A. Prepare for takeoff: Improving asset measurement and audit quality with drone-enabled inventory audit procedures. *Rev. Account. Stud.* **2021**, 1–21. [CrossRef]
25. Krul, S.; Pantos, C.; Frangulea, M.; Valente, J. Visual SLAM for Indoor Livestock and Farming Using a Small Drone with a Monocular Camera: A Feasibility Study. *Drones* **2021**, *5*, 41. [CrossRef]
26. Mogili, U.R.; Deepak, B.B.V.L. Review on Application of Drone Systems in Precision Agriculture. *Procedia Comput. Sci.* **2018**, *133*, 502–509. [CrossRef]
27. Stehr, N.J. Drones: The Newest Technology for Precision Agriculture. *Nat. Sci. Educ.* **2015**, *44*, 89–91. [CrossRef]
28. ISEAL Fund. Lessons Learned from Four Pilot Projects in Remote Auditing. 2021. Available online: https://www.isealalliance.org/sites/default/files/resource/2021-07/ISEAL_Remote%20Auditing%20Case%20Study%20Compilation%202021_June%202021.pdf (accessed on 16 October 2021).
29. Leitner, C.; Vogl, C. Farmers' Perceptions of the Organic Control and Certification Process in Tyrol, Austria. *Sustainability* **2020**, *12*, 9160. [CrossRef]
30. Falconer, K. Farm-level constraints on agri-environmetnal scheme participation: A transactional perspective. *J. Rural Stud.* **2000**, *16*, 379–394. [CrossRef]
31. Rosin, C.; Campbell, H.; Reid, J. Metrology and sustainability: Using sustainability audits in New Zealand to elaborate the complex politics of measuring. *J. Rural. Stud.* **2017**, *52*, 90–99. [CrossRef]
32. Bachmann, R. Trust, Power and Control in Trans-Organizational Relations. *Organ. Stud.* **2001**, *22*, 337–365. [CrossRef]
33. Bachmann, R. At the crossroads: Future directions in trust research. *J. Trust. Res.* **2011**, *1*, 203–213. [CrossRef]

34. Bachmann, R.; Inkpen, A.C. Understanding Institutional-based Trust Building Processes in Inter-organizational Relationships. *Organ. Stud.* **2011**, *32*, 281–301. [CrossRef]
35. Eisenhardt, K.M. Building theories from case study research. *Acad. Manag. Rev.* **1989**, *14*, 532–550. [CrossRef]
36. Eisenhardt, K.M.; Graebner, M.; Sonenshein, S. Grand Challenges and Inductive Methods: Rigor without Rigor Mortis. *Acad. Manag. J.* **2016**, *59*, 1113–1123. [CrossRef]
37. Draucker, C.B.; Martsolf, D.S.; Ross, R.; Rusk, T.B. Theoretical Sampling and Category Development in Grounded Theory. *Qual. Health Res.* **2007**, *17*, 1137–1148. [CrossRef]
38. Dynes, R.; Burggraaf, V.; Goulter, C.; Dalley, D. Canterbury farming: Production, Processing and Farming Systems. In *Proceedings of the New Zealand Grassland Association 72*; 2010; pp. IX–VIII. Available online: https://www.grassland.org.nz/publications/nzgrassland_publication_5.pdf (accessed on 5 November 2021).
39. Chapman, D.F.; Dalley, D.E.; Edwards, G.R.; Cameron, K.C.; Malcolm, B.J.; Clement, A.; Romera, A.J.; Pinxterhuis, I.B.; Beukes, P.C.; Di, H.J.; et al. Production, profit and nitrogen flows in irrigated dairy systems representing different industry development pathways: The Pastoral 21 experience in Canterbury. *N. Z. J. Agric. Res.* **2021**, *64*, 3–35. [CrossRef]
40. DJI. Phatom 4 Pro Specs. Available online: https://www.dji.com/nz/phantom-4-pro/info#specs (accessed on 24 November 2021).
41. Fereday, J.; Muir-Cochrane, E. Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *Int. J. Qual. Methods* **2006**, *5*, 80–92. [CrossRef]
42. Cook, W.; van Bommel, S.; Turnhout, E. Inside environmental auditing: Effectiveness, objectivity, and transparency. *Curr. Opin. Environ. Sustain.* **2016**, *18*, 33–39. [CrossRef]
43. Castaldo, S.; Premazzi, K.; Zerbini, F. The Meaning(s) of Trust. A Content Analysis on the Diverse Conceptualizations of Trust in Scholarly Research on Business Relationships. *J. Bus. Ethic* **2010**, *96*, 657–668. [CrossRef]
44. Edwards, P.; Fleming, A.; Lacey, J.; Lester, L.; Pinkard, E.; Ruckstuhl, K.; Bezuidenhout, C.; Payn, T.; Bayne, K.; Williams, T.; et al. Trust, engagement, information and social licence—insights from New Zealand. *Environ. Res. Lett.* **2019**, *14*, 024010. [CrossRef]