Key Takeouts From The White Paper:

Safer by Design: The Role Of Technology In Farm Safety

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safer farms

Let's design out danger

Too many good people are getting hurt or killed doing the everyday work of farming.

Not because they do not care.

Not because they do not know the risks.

But because risk is often built into the work itself.

New Zealand agriculture has always adapted. We have improved genetics, pasture, machinery, data, production systems and environmental performance.

Now we need to apply that same innovation to safety.

Not by adding more paperwork.

Not by blaming people after harm occurs.

Not by relying on perfect judgement in tough conditions.

But by designing farms, tasks, tools and systems that make harm less likely in the first place.

That is how we build farms where people can do great work, produce great food and fibre, and get home safe and well every day.

The human cost of farming is too high.

17,000+ farming-related injury claims accepted by ACC in 2024

$120M+ in recovery and rehabilitation costs in 2024

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1 in 4 workplace fatalities occur in agriculture

1,300+ people estimated to be injured by livestock each year in New Zealand

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82 days is the average amount of time off work after a quad bike accident

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From behaviour-led to system-led safety

Farming has always relied on skill, judgement and experience. But even experienced people get hurt.

That is because farm work often happens in conditions that make perfect judgement difficult: steep terrain, bad weather, fatigue, livestock movement, time pressure, machinery, long hours and financial stress.

Safety has traditionally focused on preventing failure (Safety I), but the next step is designing systems where the right outcomes happen by default (Safety II).

Technology is most effective when it supports and enhances human capability, rather than attempting to replace it. Trust, practical judgement, and strong leadership remain essential to ensuring that systems are used effectively.

Safety I	**Safety II**
"She'll be right" / Relying on perfect judgement	Failing safely
Reactive, compliance-heavy, blame-focused	Proactive, system-led, designing danger out
Managing danger in the moment	Removing hazards before work begins
Tools: Paper hazard registers, high-vis, helmets	Digital dashboards, autonomous tech, smart sensors

The white paper explores technology solutions across the following areas:

- Vehicles and mobile plant
- Livestock handling
- Workload, fatigue and wellbeing
- Chemical and airborne hazards
- Reporting and governance

Read on to find out more about the technology solutions available and the benefits on-farm.

Technology: Not a silver bullet – but still a game changer

Technology will not replace good leadership, good judgement or good stockmanship. And it should never become another compliance burden.

Modern farming technology helps:

- remove people from high-risk areas.
- replace risky manual tasks with safer processes.
- detect danger earlier.
- make invisible risks measurable.
- turn scattered safety information into practical insight.

In other words, technology can help farms move up the Hierarchy of Controls – from relying mainly on training and PPE, toward elimination, substitution and engineering controls.

Hierarchy of Controls for safer farms

Control level	What it means on farm	Examples
Eliminate	Remove the person or hazard from the task	Autonomous machinery, drones, laser weeding
Substitute	Replace a higher-risk task with a safer one	Virtual fencing, closed chemical transfer, automated drafting
Engineer	Build safety into the machine or system	Seatbelt interlocks, stability sensors, gas monitors, smart PTO systems
Admin	Improve planning, reporting and decision-making	Digital dashboards, training, reporting apps, VR training
PPE	Protect the person if exposure remains	Helmets, respirators, wearable alerts

The strongest gains come when safety technology is not treated as an add-on, but as part of better farm system design.

Vehicles and mobile plant

Vehicles and mobile plant remain one of the biggest sources of fatal and serious harm on New Zealand farms. Tractors, quad bikes, side-by-side vehicles and mobile machinery are often used in difficult environments: steep slopes, wet ground, low light, dust, livestock movement and remote areas.

The problem

Training, helmets, seatbelts, ROPS, maintenance and safe procedures all matter. But they still rely on people choosing and using the right controls in conditions where fatigue, urgency and terrain can work against them.

Technology solutions

Automation and remote operation
Autonomous machinery, remote-controlled equipment and drones can remove people from high-risk terrain, spray zones and repetitive vehicle work.

Drones and robotic vehicles
Drones can help with mustering, water-point checks, property surveys and infrastructure inspections – reducing the need for quad bikes, motorbikes or helicopters in hazardous conditions.

Seatbelt interlocks and smarter SSVs
Some side-by-side vehicles can restrict speed if a seatbelt is not fastened. This shifts safety from advice to engineered control.

Stability and rollover monitoring
Tilt sensors, stability systems and active rollover protection can detect risk earlier and, in some cases, intervene before a rollover develops.

VR vehicle training
VR can help farmers practise high-risk scenarios in a safe, repeatable environment – especially where real-world training is risky, expensive or inconsistent.

Technology benefits

Technology	Safety benefit	Farm benefit
Drones	Less vehicle use in steep or remote areas	Faster checks, less travel time
Autonomous platforms	Removes operator from high-risk tasks	Reduces labour pressure
Seatbelt interlocks	Makes restraint use harder to ignore	Supports safer vehicle habits
Stability sensors	Earlier warning of rollover risk	Better decision-making on terrain
VR training	Safer exposure to high-risk scenarios	Better learning without judgement

Livestock handling: Redesigning the human-animal interface

More than 1,300 people are estimated to be injured by livestock each year in New Zealand. Many injuries happen during routine tasks: drafting, loading, weighing, drenching, tagging, pregnancy scanning and veterinary work.

The problem

Livestock can move faster than people can respond. During peak periods, fatigue and time pressure can increase exposure.

Technology solutions

Virtual fencing and smart collars

GPS-enabled collars can guide stock movement and reduce the need for physical mustering by quad bike, motorbike or on foot.

Remote animal monitoring

Smart collars and sensors can identify changes in animal health or movement earlier, reducing emergency handling when animals may already be stressed.

Automated drafting

EID-linked drafting systems can sort animals by weight, age, sex or health status without handlers standing beside gates during high-flow movement.

Advanced restraint systems

Hydraulic, pneumatic and automated crush systems can reduce physical effort, improve control and allow people to work further from crush zones.

Video and AI monitoring

Camera systems can show where animals hesitate, where bottlenecks form and where handlers are forced into unsafe positions. Some AI camera systems can recognise individual cows with around 97–98% accuracy.

Technology benefits

Technology	Safety benefit	Farm benefit
Virtual fencing	Less physical mustering	Better pasture control
Smart collars	Fewer emergency handling events	Earlier animal health insight
Automated drafting	Less gate-side exposure	Faster sorting, less labour
Advanced crushes	Better restraint, less strain	Easier vet work and treatment
Yard video / AI	Identifies risky flow points	Better yard design and training

Workload, fatigue and wellbeing: Designing work around human capacity

When people are tired, overloaded or under pressure, they are more likely to miss a risk, rush a job, misjudge terrain, mishandle stock or make a poor call around machinery.

The problem

Farming has intense seasonal peaks. Calving, lambing, harvest, spraying and extreme weather events can all create long hours over consecutive days or weeks. Farmers are also managing weather, animal health, pasture, machinery, staff, finances, regulation and family life – often in the same place.

Support services are important. So are peer networks, counselling and Farmstrong-style wellbeing programmes. But the deeper opportunity is to reduce pressure at the source.

Technology solutions

Workload visibility
Farm management and scheduling tools can help make seasonal pressure visible before it peaks.

Task redistribution
Better planning systems can help identify when non-critical jobs can be delayed, extra labour is needed, or high-risk tasks should be moved.

Wearable fatigue monitoring
Wearables can track indicators such as sleep, heart rate variability, heat stress and movement patterns. Used carefully, they can help identify when people may be at higher risk of error.

Digital support tools
Digital wellbeing tools can make support easier to access, especially where time, stigma or geography get in the way.

Automation that reduces fatigue
Autonomous machinery, virtual fencing and robotic systems can reduce repeated mustering, long operating hours and physically demanding manual work.

Technology benefits.

Technology	Safety benefit	Farm benefit
Workload planning tools	Identifies pressure before it peaks	Better scheduling
Fatigue monitoring	Early warning of reduced alertness	Smarter task allocation
Digital support	Easier access to help	Less isolation
Automation	Reduces repetitive or tiring tasks	Frees time and labour
Dashboards	Makes wellbeing part of safety	Better governance

Chemical and airborne hazards: Making invisible risks visible

Chemical and airborne hazards can be invisible and odourless. Harm may not show up until symptoms develop – sometimes after repeated exposure over months or years.

The problem

Agriculture requires the routine handling, mixing, loading, spraying and storage of hazardous substances. Training, SDS sheets, PPE, respirators, chemical registers and safe procedures are all important. But they depend on people recognising the risk and using controls correctly every time.

Technology solutions

Closed transfer systems
Sealed couplers can transfer chemical concentrates from container to sprayer without open pouring, reducing splash, skin contact and vapour exposure.

Autonomous or remote spraying
Drone-based and autonomous spraying systems can remove the operator from the immediate spray zone.

Precision application
Spot-spraying and targeted application can reduce chemical volume and exposure frequency.

Cab filtration and pressure monitoring
Modern cabs can protect operators from dust and spray drift, but only if filtration and pressure are working. Sensors can verify protection in real time.

Gas and air-quality monitoring
Portable detectors can alert workers to hydrogen sulphide, methane, ammonia, carbon monoxide, volatile organic compounds and fine particulates before exposure becomes dangerous.

Technology benefits

Technology	Safety benefit	Farm benefit
Closed transfer	Less manual chemical contact	Cleaner, faster mixing
Drone spraying	Removes operator from spray zone	Better access to difficult terrain
Spot spraying	Reduces chemical use	Lower input costs
Cab sensors	Confirms protection is working	More confidence during application
Gas detectors	Alerts to invisible hazards	Safer confined or semi-confined work

Reporting and governance: From paperwork to safety intelligence

Too often, safety reporting is treated as paperwork after something has gone wrong. But reporting should help farms spot patterns, act earlier and learn faster.

The problem

Paper forms, spreadsheets and disconnected systems can hide patterns. Vehicle data may sit in one place, contractor records in another, and chemical registers somewhere else. Near-miss reports may not be recorded at all.

Technology solutions

Mobile and offline-first reporting
Hazards and near misses can be logged in the paddock, even without signal, then synced later.

Voice-enabled reporting
Workers can record hazards without stopping to type, especially when they are wearing gloves, working in dust or moving between jobs.

Telematics and dashboards
Vehicle speed, hard braking, terrain use, maintenance alerts and incident logs can be pulled into one system.

Contractor and visitor systems
Digital inductions, QR check-ins and competency records can help farms know who is on site, what they are doing and what risks they have acknowledged.

Safety intelligence dashboards
The goal is not more data. It is the right information, connected in a way that helps farmers, managers and boards act sooner.

The three audiences for safety data

Audience	What they need
The operator	Practical insight in the moment
The farm owner / manager	Patterns, priorities and actions
The regulator / governor	Evidence that risks are being managed

Breaking down barriers to adoption

Farmers are more likely to adopt technology when it solves real problems. If a tool is expensive, complex, poorly supported, or out of step with farm practice, it will struggle – even if the safety benefit is clear.

Farm technology should:

- reduce workload
- save time
- improve visibility
- support animal care
- lower input costs
- make decision-making easier
- work in remote areas
- connect with existing systems
- feel useful, not intrusive.

> Safety tech must make farm work better.

The real barriers

Cost
Farmers have to weigh safety technology against other capital priorities.

Connectivity
Some tools depend on reliable internet, GPS or cloud systems that may not work well in remote areas.

Compatibility
Older machinery and infrastructure may be difficult or costly to retrofit.

Trust
Data ownership, privacy and surveillance concerns need to be handled openly.

Usability
Technology must be easy to use in mud, dust, rain, gloves, noise and time pressure – not just in a demo.

Proof
Farmers need to see what works on farms like theirs.

What we need to do next

The future of farm safety will not be shaped by asking people to be perfect in imperfect conditions. It will be shaped by better systems.

For farmers and growers
Start with the tasks that create the most exposure.

- Where are people closest to moving vehicles, machinery, animals, chemicals or invisible hazards?
- Where do fatigue and time pressure show up most?
- Which jobs are repeated often enough that a small improvement could make a big difference?
- Which technology could reduce the need to be in the danger zone?

The goal is not to overhaul everything at once. It is to start where the risk is highest and the practical value is clearest.

For industry and funders
Help make safer systems easier to adopt. That means supporting demonstration projects, peer learning, rural connectivity, capital investment, practical guidance and cost-benefit examples grounded in real farm conditions.

The more farmers can see the productivity and workload benefits, the more likely safety technology is to scale.

For technology providers
Design for the realities of New Zealand farms. That means systems that work offline, handle rough environments, integrate with other tools, protect privacy, and make life easier rather than adding another dashboard to check.

Scan the QR code to download the full white paper

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