Dairy Australia

Australian Government
Department of Agriculture, Water and the Environment

VIRTUAL HERDING RESEARCH UPDATE

TECHNOTE 10: ADOPTION PATHWAYS FOR VIRTUAL HERDING TECHNOLOGY

Background

Virtual herding technology (VHT) is in its initial stages of commercialisation as a form of automated and digitised livestock management. The decision to adopt and apply this new technology is likely to require livestock producers to navigate a range of opportunities, uncertainties, risks and complexities. In Australia, the commercial use of VHT is permitted in Queensland and Tasmania. Other States are considering changes to allow the commercial use of VHT.

The following VHT adoption pathways have been formed through a series of engagements with 67 stakeholders across the livestock value chain. In addition, 13 Agtech adoption experts have been consulted through written and verbal feedback to an extensive Discussion Paper based upon the findings from workshops and interviews that asked stakeholders to consider the opportunities and challenges with adopting VHT. Three possible approaches for enabling VHT adoption were identified from stakeholder and expert opinion:

1 The VHT adoption approach should include some form of governance to manage the perceived public concerns for animal welfare, social licence to operate and on-farm implementation risks. *(societal-driven)*

2 The VHT adoption approach should provide the commercial developer and livestock producer an unrestricted environment in which to access and experiment with VHT for innovation to thrive. *(market-driven)*

3 The VHT adoption approach should facilitate working collaborations between producers, advisers, researchers and the commercial developer as an ongoing learning and capability building network for co-developing the adoption pathways. *(customer support-driven)*

While there was no clear consensus about the best way to support the adoption of VHT, each approach has its merits and is integrated into the design principles and suggested VHT adoption pathways. Regardless of the approach, each adoption pathway needs to provide a dedicated role for science to inform what applications are valid as well as an acknowledgement of the animal behaviour elements of this technology. The implementation and outcomes of VHT is essentially a learning process that is reliant on developing an understanding of livestock responses to the virtual herding system for each herd.

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Design principles for the VHT adoption pathways

These design principles guide the features and trajectory of the suggested adoption pathways for VHT.

Enhancing the commercial reality of virtual herding technology	While there is acknowledgement of the commercial route for VHT in terms of selling a product, there is scope to incorporate additional resources, support and participation from the industry, private and public sectors along the adoption pathway.
Identifying the governance required	VHT adoption would benefit from some coordination, monitoring and guidance on best practices to manage and share the potential animal welfare and social risks as a responsible innovation.
Enabling customer support-driven adoption	Forming VHT Communities of Practice (CoP) could provide valuable support and learning to work through the complexities and enable the producer community to build capacity in assessing/trialing VHT alongside technical assistance.
Customizing the pathway to respond to production diversity	The value proposition for adopting VHT is likely to vary according to livestock industry, production region, farming system, and producer attitudes. It needs to solve particular problems or generate specific advantages for each adopter.
Building the value proposition	Since VHT is an emerging technology, there is a need to keep developing the business, production, environmental and social case for adoption through scientific and experiential evidence and economic analysis. (See Technote 9 for a break-even cost analysis of three case study farms applying to VHT).
Incorporating a degree of flexibility and adaptability	Approaches to VHT adoption are likely to change over space (no one approach will suit all adoption and application scenarios; extension and advisory capacity varies across Australia), and over time (technological functions and the value proposition may evolve from simple/single applications to more complex/multiple applications) therefore flexibility in approaches and resourcing should be enabled along the adoption pathway.

Time-sensitive adoption pathways for VHT

Prime target for initial adoption: The adoption pathway for the beef industry aims to build capabilities in assessing and applying virtual herding technology while increasing support for adoption over time to ensure end-users make informed decisions about this innovation (see Table 1). This pathway is likely to be actioned first considering the beef industry is the target market for the commercial developer. Over time, VHT for beef could eventually be offered as an 'adoption package' offering a suite of proven applications with a level of integration with other digital systems and technologies that are commonly used in the beef industry as well choosing different levels or options for support.

Prepare for adoption over the next 3 years: A similar adoption pathway has been suggested for the dairy industry. Rolling out the pathway over the next few years will allow for more testing in the field, production of new knowledge about the capability of the technology and greater insight into how it can be adapted to the dairy industry. Over time, VHT for dairy could eventually be offered as an 'adoption package' like beef.

Maintain interest over the decade: An adoption pathway for the sheep industry could follow the process proposed for beef and dairy, however this will be highly dependent on developing a VHT system specifically for sheep. Significant investment in R&D to design and trial a VHT prototype suitable for sheep is required. A commercial VHT product is unlikely to be available for adoption by the sheep industry for at least 5-10 years.

Table 1: Suggested adoption pathway – Beef Industry: prime target for initial adoption

VISION: to provide beef producers with enough evidence and support for making an informed decision about adopting virtual herding technology (VHT) for their farming system.

Enabling VHT adoption at a policy level

State regulations: to permit commercial use in Victoria, NSW, ACT, South Australia, Western Australia and Northern Territory

Public education campaigns: to manage public perceptions and minimize misconceptions about VHT

National protocols: for ownership, access and use of on farm Big Data to ensure clear benefits for producers

Industry strategy: to improve the uptake of new technologies in the red meat industry

VHT adoption at the farm level

General applications:

automation of livestock movements (with reduced labour inputs), better pasture and fodder crop allocations to maximize the utilization of the feed-base, small herd management, animal health monitoring, and NRM

Additional applications for northern beef: performing clean musters and managing bull movements for joining

Additional applications for southern beef: managing pugging and applying strip grazing

Adoption Stage	1 Target - beef industry to specify	2 Awareness and interest raising	3 Entry point	4 Developing and proving the value proposition	*Next steps if producers proceed with investing in VHT through trial-buy option, full purchase, or co-investment scheme* 5 Installation	6 Application and integration	7 Adaptation and best practices
Early 2021-2023	• Producers with a close interest in VHT/ open to adopt early	• Commercial marketing • Scientific publications • VHT project industry information • Word of mouth/ social media	• Reseller, referral or online services • Early Adoption Program through commercial developer	• Set up demonstration properties to virtually/ physically show generic and specific applications for northern/southern beef systems • Customisation of cost-benefit analysis withtrusted agricultural consultants • Seek research funding for VHT beef cattle experiments	• Technical support by reseller, referral or online services • Producer training on how to use software and train animals – this could include a role for animal behaviour scientists to work with producers in understanding livestock responses to VHT	• Reseller, referral or online services to provide ongoing troubleshooting and advice on feasible applications • Trial a process for integrating VHT with other digital farm systems via Agtech consultants and VHT developer	• Experimentation with VHT system to adapt to property conditions and desired uses • Building knowledge on how to use VHT for consistent outcomes and benefits
Established 2023-2025	• Producers who need to establish and align their interests with VHT	• All media channels	• Reseller, referral or online services • Establish an online VHT Communities of Practice (CoP) via local producer networks e.g. FutureBeef (north) BetterBeef (south) or State Ag Department	• Proven value proposition for certain applications for the northern/ southern beef industry • Customisation of cost-benefit analysis with certified beef and Agtech consultants/ advisers • Conduct further beef cattle experiments	• Technical support by reseller, referral or online services • Commercial developer to provide certified training to beef and Agtech consultants/advisers in VHT installation and application procedures	• Continued commercial provision of trouble-shooting services • VHT CoP to share experiences with applying VHT • Industry bodies coordinate the integration of digital systems for the beef industry	• Trained beef and Agtech consultants/ advisers to support VHT adaptation • VHT CoP to consolidate ways to adapt VHT to a variety of beef production systems
Mature 2025+	• Producers who need a matured value proposition	• All media channels	• Reseller, referral or online services to offer VHT as an 'adoption package' for beef • Invitation to join formed online VHT CoP	• Visiting a suite of demonstration properties to represent beef system diversity • Developed method for producers to self-evaluate cost: benefit that takes into account specific production features • Finalise findings from VHT animal experiments	• Technical support by trained and certified beef and Agtech consultants/advisers in VHT installation/ application	• Trained beef and Agtech consultants/ advisers to provide VHT trouble-shooting services • VHT CoP consolidate experiential proof of applications • Seamless integration of VHT with other digital systems used in beef production	• VHT CoP to work with industry bodies to develop VHT Best Practices for beef to achieve 'triple-bottom-line' • Development of VHT Big Data analytics as a knowledge input to decision making

* A similar adoption pathway is recommended for dairy and sheep industries contingent on timing

Final recommendations

The final recommendations provide clear direction to government, industry, scientific community, VHT commercial developers, agricultural advisory sector, livestock value chain actors and producers for how to support VHT adoption through strong leadership, cross-industry collaborations and working at multiple levels (policy, program, on-ground services and participation). The successful implementation of VHT on-farm will be enhanced by a Communities of Practice (CoP) approach. More extensive details on the establishment of CoP groups are provided in Recommendation 21 at the end of this Technote.

Federal and state government

1 Recognise VHT as an effective mechanism for implementing effective grazing practices

2 Adoption may be funded under regional Natural Resource Management (NRM) schemes, Landcare Australia or Caring for Country when used for achieving environmental outcomes (public goods)

3 Incorporate VHT into current 'honest-brokering' roles that independently assess new agricultural technologies for adoption by agricultural industries

4 State governments to continue liaising with commercial developers, research institutes, industry bodies and animal welfare organisations to review state regulations controlling the commercial use of VHT

5 State governments to oversee monitoring programs for animal welfare compliance across industries

6 Co-establish VHT Communities of Practice (See Recommendation 21 for more details)

Industry bodies (research development corporations and farmer based organisations)

7 Coordinate industry responses to emerging adoption challenges and risks e.g. Co-establish VHT Communities of Practice (See Recommendation 21 for details) and develop a VHT education campaign to proactively inform the public about this technology for all livestock industries

8 RDCs to work with regional NRM bodies and/or food retailers to monitor the usage of VHT in compliance with any NRM Landholder Agreements and Farm Assurance Programs

9 RDCs to consider leading the development of industry guidelines or Best Management Practices for using VHT responsibly and ethically to minimize socio-ethical risks

10 Farmer Based Organisations (FBOs) to 'seed' this technology into mainstream farming systems targeting certain proven applications, which would help to build trust in the functionality of this technology

Scientific community

11 Seek funding (RDCs, Federal or State Government) for continued research on the long-term impacts on animal welfare and productivity outcomes from applying VHT in beef, dairy and sheep industries

Commercial developer

12 Lead the development of the VHT knowledge system through accessible and updated information

13 Consider building and expanding VHT technical and advisory services in the agricultural advisory sector by offering in-house training or certified training programs

14 Consider co-investing with RDCs or FBOs in setting up a suite of VHT Demonstration Farms across Australia's production regions in beef, dairy and sheep

Agricultural advisory sector

15 Continue building skills and knowledge in integrating and applying digital agricultural systems in the livestock industries, including VHT with the support of RDCs, FBOs and the commercial developer to acknowledge that agricultural advisers do not have abundant time or money for professional development

16 If possible, establish systems for monitoring and evaluating the adoption experiences of their producer clients and share any insights for cross-industry learning in partnership with the relevant RDC

17 Co-establish VHT Communities of Practice (See Recommendation 21 for more details)

Livestock value chain (processors, food retailers/distributors)

18 Work with producers, industry bodies and independent auditors to explore the possibilities for novel markets and branding opportunities from managing and tracking livestock responsibly and transparently using VHT

Livestock producers

19 Co-establish VHT Communities of Practice (See Recommendation 21 for details).

20 Consider hosting a VHT demonstration farm/property or participate in a VHT Focus Farm program

VHT communities of practice

21 Possible process for establishing VHT Communities of Practice: functions at an industry and cross-industry level

Who could initiate it:

- (formal) State government departments providing agricultural extension services who may embed a VHT CoP within a relevant project or RDC extension officer to embed in an RDC funded program
- (informal) Agtech consultant in production region or livestock producer as an opinion influencer

How it could be resourced:

- Public or industry funding
- Completely self-directed and voluntary – any customized one-on-one VHT advice to be paid for by producer

Who could manage it:

- CoP Chair/Network Broker- self-selected or nominated producer, agtech consultant, sector researcher, advisor, RDC or state department extension provider to manage the communications, development of a CoP charter, point of contact, administer activities
- CoP Leader to run activities – leader may change according to the topic, task & skills required

How it could operate:

- Using an online platform (e.g. Facebook Groups, AgriFutures CoPs hosted by Extensionaus or Learning Management System like Moodle)
- Invite CoP participants through an Expression of Interest process
- Some examples of CoP outputs: technical articles, producer case studies, videos, webinars, connections to blogs, dedicated newsletter, Q&A Help Forum and international expert panels to learn about implementing virtual herding technologies in other national contexts
- VHT CoPs to hold cross-industry webinars or workshops to enable learning across beef, dairy and sheep industries based on common issues and opportunities in livestock production

How could it be rolled out:

- Establish a VHT CoP for each industry (beef, dairy and sheep/mixed production) as a pilot by state government department or RDC – if successful make arrangements for continued resourcing of VHT CoPs (e.g. compensation for time given by CoP Chair/ Network Broker, IT and administration support) for each industry based on shared interests, with scope to develop VHT CoPs at a production-region level if there is a call for more place-based learning and support
- Establish a register for informal CoPs that emerge
- Given the timeline for VHT adoption, CoPs for the beef industry are likely to be piloted and established first

Useful resources:

AgriFutures (2018). Automated Milking Systems (CoP) – Milking Edge, access **extensionaus.com.au/automaticmilkingsystems/home**

Cambridge, D. and Suter, V. (2005). Step-by-Step Guide for Designing and Cultivating Communities of Practice, Educause, National Learning Infrastructure Initiative, access **msfhr.org/sites/default/files/Community_of_practice_guide.pdf**

State of Victoria, Department of Education and Training (2018). Leading Communities of Practice: Roles and Responsibilities. Regional Services Group, Department of Education and Training. Melbourne, September 2018, access **bastow.vic.edu.au/sites/default/files/2019-03/Leading-Communities-of-Practice-Roles-and-Responsibilities.pdf**

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