Supplementary material

Supplemental Figure 1. Representative segment of disease control fencing separating the FMD infected zone (right) from the protection zone with vaccination (left) in Mpumalanga Province, South Africa.

Supplemental Material: Questionnaire

The online questionnaire that was built and administered using SurveyGizmo. Respondents included foot-and-mouth disease (FMD) experts, government veterinarians, private livestock veterinarians, people involved in the wildlife sector, and other occupation groups including commercial farmers in the FMD free zone and the general public. Data from communal cattle owners and animal health technicians were collected via semi-structured interviews developed from this questionnaire.

Foot and Mouth Disease Control in South Africa

Introduction and Information

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Thank you for taking the time to complete this survey; your opinion plays an important part in achieving our goal.

The aim of the project is:
• To gain the opinions of the people affected by methods used to control foot-and-mouth disease (FMD).
• To build a broad picture of the way the methods are viewed and whether they are seen as effective, affordable and acceptable.
• To develop and test a framework that allows the views of all stakeholders to be taken into account when decisions are made about FMD control.

Please answer the questions as truthfully as possible; it is only your opinion that matters to us and there are no right or wrong answers. The questionnaire should take you a maximum of 20 minutes.
Please remember to provide an email address if you would like to be entered for the lucky draw for the online vouchers and/or to receive feedback about my results.

Many thanks for your participation,
Dr Laura Roberts

Veterinarian and MSc Epidemiology student
Department of Production Animal Studies
Onderstepoort Faculty of Veterinary Science
University of Pretoria
South Africa

Informed consent*

1. I understand that this survey will ask questions about my opinions and knowledge of foot and mouth disease (FMD) control measures in South Africa. Beyond demographics, all questions will be related to FMD control.
2. I understand that participation in this survey is voluntary and that I may discontinue the survey at any time or decline to answer any question that makes me feel uncomfortable, without suffering any consequences.
3. I understand that there will be no risk or discomfort associated with answering this survey.
4. I understand that all the information I provide in this anonymous survey will be kept strictly confidential and that if I choose to provide contact details, they will only be used to provide feedback and/or enter me in the lucky draw.
5. I understand that the data obtained through the survey will be used for research purposes. The data will be stored and may be used for future studies but no means of identifying me will be linked to the data.

By clicking "I agree", I freely provide my consent for The University of Pretoria to use my survey responses for research purposes and I acknowledge my rights as a voluntary survey participant as described above.
[ ] I agree

[ ] I do not agree

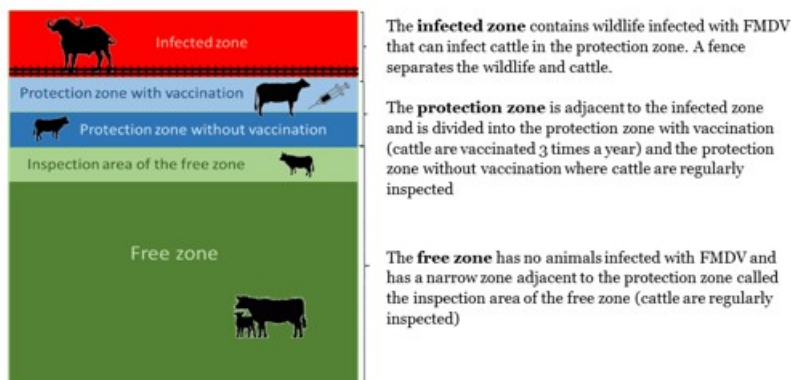# Foot and Mouth Disease in South Africa

Background Information

Foot-and-mouth disease is feared world-wide because:

- It can cause farmers serious losses due to decreased cattle growth rates, poor milk production and increased mortality rates.
- The virus is believed to be highly contagious, especially in certain parts of the world

There are 3 disease control zones in South Africa, as shown in the picture below

The **infected zone** contains wildlife infected with FMDV that can infect cattle in the protection zone. A fence separates the wildlife and cattle.

The **protection zone** is adjacent to the infected zone and is divided into the protection zone with vaccination (cattle are vaccinated 3 times a year) and the protection zone without vaccination where cattle are regularly inspected

The **free zone** has no animals infected with FMDV and has a narrow zone adjacent to the protection zone called the inspection area of the free zone (cattle are regularly inspected)

Personal information

1) Current employment

[ ] Game reserve staff

[ ] Cattle farmer

[ ] Government employee

[ ] Veterinarian in Kruger National Park

[ ] FMD researcher

[ ] State/regulatory veterinarian

[ ] Private veterinarian

[ ] Other: _____*

2) What year did you start working in this field?

[Dropdown menu- 1950-2014]

3) What is your highest qualification?

( ) Primary school

( ) Secondary School

( ) Diploma

( ) Undergraduate degree

( ) Honours degree

( ) Master's degree

( ) PhD

( ) Professional degree

4) Age

( ) under 18

( ) 18-24

( ) 25-34

( ) 35-54

( ) 55-64

( ) 65+

5) In which province do you work?

( ) Gauteng

( ) Mpumalanga

( ) Limpopo

( ) Northwest Province

( ) Northern Cape

( ) Eastern Cape

( ) KwaZulu- Natal

( ) Free State

( ) Western Cape

( ) Outside South Africa

6) If you work in a country <u>other than</u> South Africa please select:

[dropdown menu]

7) Does foot-and-mouth disease <u>control</u> directly affect your income or lifestyle?

[ ] Yes

[ ] No

[ ] I'm not sure

8) Please select, if you desire:

[ ] Send me feedback

[ ] Enter me in the lucky draw for 1 of 3 online vouchers (for example for Amazon.com) valued at US$50, $100 and $150 respectively

9) Please enter an email address if you would like to receive feedback on the results of this investigation or if you would like to be entered into the lucky draw.

_____

How important are the criteria used to assess the control methods?

In the following pages, you will be asked to use a number of different ways (criteria) to judge methods available to control a disease (in this case, foot and mouth disease).

We would like to rank these criteria. Please read the explanations of the criteria below and then answer the questions. ("Side effects" refer to other consequences of a control method, besides the intended decrease in disease)

Criteria	Explanation
Effect on **ecosystem** health	If the side effects of the control method damage or benefit the health of wildlife and the environment (soil and vegetation)
Effect on the welfare of local **cattle**	If the side effects of the control method cause cattle in the protection zone to suffer or benefit
Effect on the **quality of life** of local cattle owners	If the side effects of the control method improve or disrupt the daily lives of cattle owners in the protection zone
Effectiveness	If the control method is successful in preventing disease outbreaks
Feasibility	If it is realistic and possible to implement the control method
Financial effect on the cattle **industry**	If the side effects of the control method cause the cattle industry **in the free zone** of South Africa to lose or benefit financially. The industry includes those involved with trading in and exporting cattle and their products.
Financial effect on the **government**	If the side effects of the control method cause the government to lose or benefit financially
Financial effect on the local cattle owners	If the side effects of the control method cause cattle owners in the protection zone to lose or benefit financially

10) How important are these criteria when judging a disease control method?

Click on the sliders to indicate your answers (0= Not important, 100= Very important)

|		
Effectiveness	0 _____[__]_____	100
Feasibility	0 _____[__]_____	100
Financial effect on the local cattle owners	0 _____[__]_____	100
Financial effect on the cattle industry	0 _____[__]_____	100
Financial effect on the government	0 _____[__]_____	100
Effect on the quality of life of local cattle owners	0 _____[__]_____	100
Effect on the welfare of local cattle	0 _____[__]_____	100
Effect on ecosystem health	0 _____[__]_____	100

Vaccination against foot and mouth disease

All cattle in the protection zone with vaccination should be vaccinated every 4 months to protect them against foot and mouth disease. The vaccine is purchased and administered by the government.
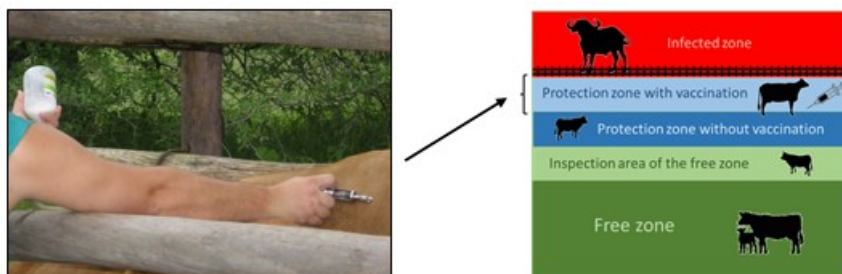
Please answer the following questions according to your own personal experience, knowledge or perception.

Use the slider to indicate your answer.

"No effect" is a relevant answer but please click on the slider to register your response.

11) Please speculate about the effect of removing vaccination from the current foot-and-mouth disease control program. How could this affect the annual number of outbreaks in the protection zone (there were 7 outbreaks in 2012)?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

We wish to gain an idea of the "side effects" of vaccination; the effects besides the intended effect of fewer foot and mouth disease outbreaks in the protection zone. **Please try** not **to include this aspect when answering the rest of the questions on this page.**

12) Irrespective of FMD outbreaks, what do you think is the financial impact of vaccination on cattle owners in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

13) Irrespective of FMD outbreaks, what do you think is the financial impact of vaccination on the cattle industry in the free zone of South Africa?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

14) Irrespective of FMD outbreaks, what do you think is the financial impact of vaccination on the government?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

15) Irrespective of FMD outbreaks, how do you think vaccination affects the welfare of the cattle in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

16) Irrespective of FMD outbreaks, how do you think vaccination affects the quality of life of cattle owners in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

17) Irrespective of FMD outbreaks, how do you think vaccination affects the health of the ecosystem (wildlife, plants and soil)?

-100 _____[__]_____ 100

**How confident were you in your answer to the previous question?**

0 _____[__]_____ 10

Movement control to prevent spread of foot and mouth disease

Live cloven-hoofed animals cannot be moved from the infected or vaccination zones to the free zone.

Animals cannot be moved from the inspection zone without vaccination to the free zone without a veterinary permit and quarantine.

There are also laws about the movement of animal products between the control zones.
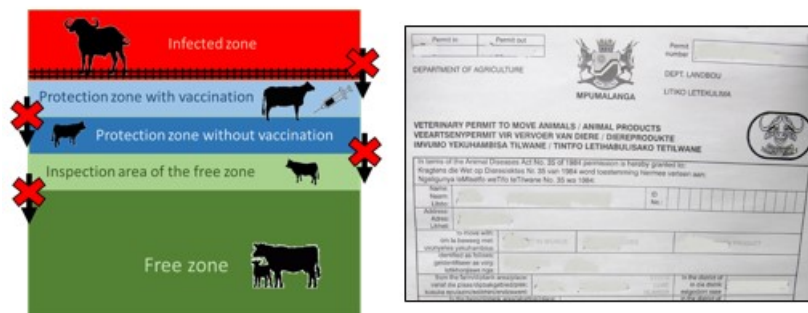
Please answer the following questions according to your own personal experience, knowledge or perception.

Use the slider to indicate your answer.

"No effect" is a relevant answer but please click on the slider to register your response.

18) Please speculate about the effect of removing movement control from the current foot-and-mouth disease control program. How could this affect the annual number of outbreaks in the protection zone (there were 7 outbreaks in 2012)?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

We wish to gain an idea of the "side effects" of movement control; the effects besides the intended effect of fewer foot and mouth disease outbreaks in the protection zone**. Please try** not **to include this aspect when answering the rest of the questions on this page.**

19) Irrespective of FMD outbreaks, what do you think is the financial impact of movement control on cattle owners in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

20) Irrespective of FMD outbreaks, what do you think is the financial impact of movement control on the cattle industry in the free zone of South Africa?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

21) Irrespective of FMD outbreaks, what do you think is the financial impact of movement control on the government?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

22) Irrespective of FMD outbreaks, how do you think movement control affects the welfare of the cattle in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

23) Irrespective of FMD outbreaks, how do you think movement control affects the quality of life of cattle owners in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

24) Irrespective of FMD outbreaks, how do you think movement control affects the health of the ecosystem (wildlife, plants and soil)?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

Clinical surveillance for foot and mouth disease

All cattle in the protection zone and the inspection area of the free zone are examined regularly for external signs of the disease by government employees.

> **Please answer the following questions according to your own personal experience, knowledge or perception.**
>
> Use the slider to indicate your answer.
>
> "No effect" is a relevant answer but please click on the slider to register your response.

25) Please speculate about the effect of removing clinical surveillance from the current foot-and-mouth disease control program. How could this affect the annual number of outbreaks in the protection zone (there were 7 outbreaks in 2012)?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

> **We wish to gain an idea of the "side effects" of clinical surveillance; the effects besides** the intended effect of fewer foot and mouth disease outbreaks in the protection zone**. Please try** not **to include this aspect when answering the rest of the questions on this page.**

26) Irrespective of FMD outbreaks, what do you think is the financial impact of clinical surveillance on cattle owners in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

27) Irrespective of FMD outbreaks, what do you think is the financial impact of clinical surveillance on the cattle industry in the free zone of South Africa?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

28) Irrespective of FMD outbreaks, what do you think is the financial impact of clinical surveillance on the government?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

29) Irrespective of FMD outbreaks, how do you think clinical surveillance affects the welfare of the cattle in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

30) Irrespective of FMD outbreaks, how do you think clinical surveillance affects the quality of life of cattle owners in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

31) Irrespective of FMD outbreaks, how do you think clinical surveillance affects the health of the ecosystem (wildlife, plants and soil)?
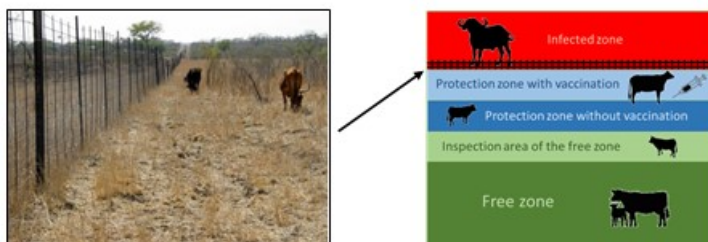
-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

Fencing between domestic cattle and wildlife infected with FMD virus.

A fence separates wildlife in the infected zone from susceptible domestic cattle.

> **Please answer the following questions according to your own personal experience, knowledge or perception.**
>
> Use the slider to indicate your answer.
>
> "No effect" is a relevant answer but please click on the slider to register your response.

32) Please speculate about the effect of removing the fence from the current foot-and-mouth disease control program. How could this affect the annual number of outbreaks in the protection zone (there were 7 outbreaks in 2012)?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

> **We wish to gain an idea of the "side effects" of the fence; the effects besides** the intended effect of fewer foot and mouth disease outbreaks in the protection zone**. Please try** not **to include this aspect when answering the rest of the questions on this page.**

33) Irrespective of FMD outbreaks, what do you think is the financial impact of the fence on cattle owners in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

34) Irrespective of FMD outbreaks, what do you think is the financial impact of the fence on the cattle industry in the free zone of South Africa?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

35) Irrespective of FMD outbreaks, what do you think is the financial impact of the fence on the government?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

36) Irrespective of FMD outbreaks, how do you think the fence affects the welfare of the cattle in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

37) Irrespective of FMD outbreaks, how do you think the fence affects the quality of life of cattle owners in the protection zone with vaccination?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

38) Irrespective of FMD outbreaks, how do you think the fence affects the health of the ecosystem (wildlife, plants and soil)?

-100 _____[__]_____ 100

How confident were you in your answer to the previous question?

0 _____[__]_____ 10

Assessing the feasibility of foot and mouth disease control methods

If implemented correctly, some control methods have the potential to work very well in preventing foot and mouth disease outbreaks. However, some control measures are not feasible because proper implementation is not always possible or realistic.

Please read the definitions of the control methods (some current, some hypothetical) and then answer the questions below.

Control method	Definition/Explanation
Clinical surveillance	Inspect all cattle in the inspection zone with vaccination zone every week, those in the inspection zone without vaccination every 2 weeks, and those in the inspection area of the free zone once a month.
Cull infected wildlife	Test all the wildlife known to carry FMDV and cull the infected individuals
Decrease wildlife populations	Cull a certain proportion of the infected wildlife population, irrespective of FMD status, in an effort to reduce population density.
Double fence	Separate wildlife in game reserves from cattle with two adjacent fences (approximately 3m apart), with no animals allowed between the fences
Fence	Separate wildlife in game reserves from cattle with a single fence
Full-time supervision of cattle	Supervise cattle during grazing and enclose them at night, to ensure that they do not contact wildlife
Cattle herd depopulation	Cull herds containing cattle infected with FMD virus
Movement control	Restrict cattle movement between FMD control zones
Serological surveillance	Test random cattle blood samples at least 3 times a year for exposure to FMD virus
Vaccinate wildlife	Vaccinate wildlife known to carry FMD virus
Vaccination of cattle	Vaccinate all cattle (approx. 150 000), in the protection zone with vaccination, every 4 months

39) Score the following control methods based on their feasibility when used to prevent FMD outbreaks in the free zone of South Africa. More difficult methods should receive more points.

Click on the sliders to indicate your answers (0= Easy, 100= Impossible)

Vaccination of cattle   0_____[__]_____100

Fence   0_____[__]_____100

Movement control   0_____[__]_____100

Clinical surveillance   0_____[__]_____100

Serological surveillance   0_____[__]_____100

Cattle herd depopulation   0_____[__]_____100

Double fence   0_____[__]_____100

Cull infected wildlife   0_____[__]_____100

Vaccinate wildlife   0_____[__]_____100

Decrease wildlife populations   0_____[__]_____100

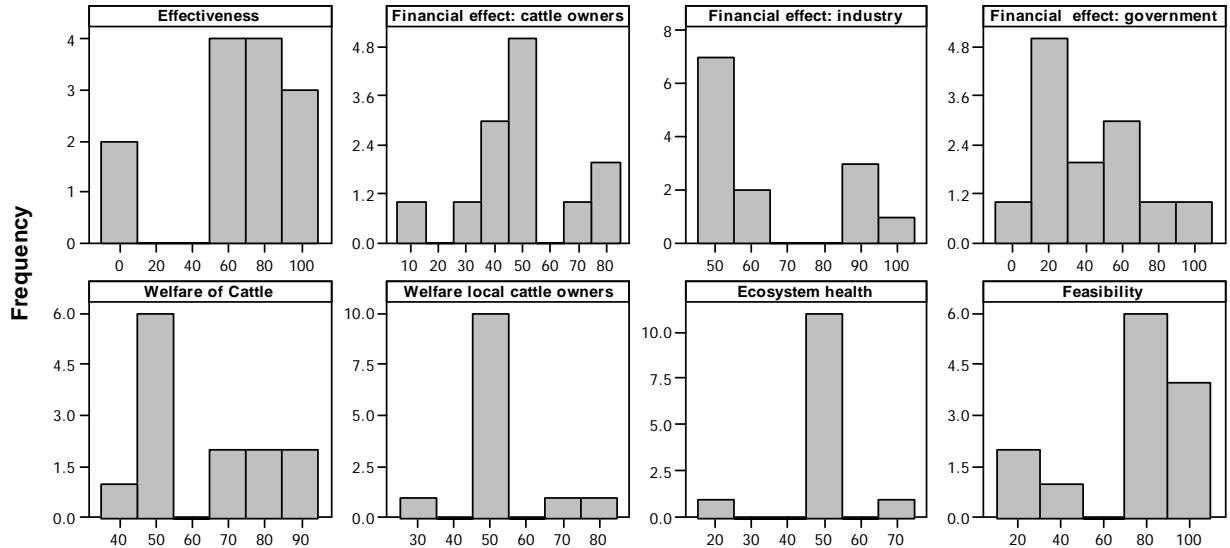Full-time supervision of cattle   0_____[__]_____100

Thank You!

Thank you for taking our survey. Your response makes a very important contribution to our research.

Supplemental Material: Inputs for stochastic multiple criteria decision analysis model

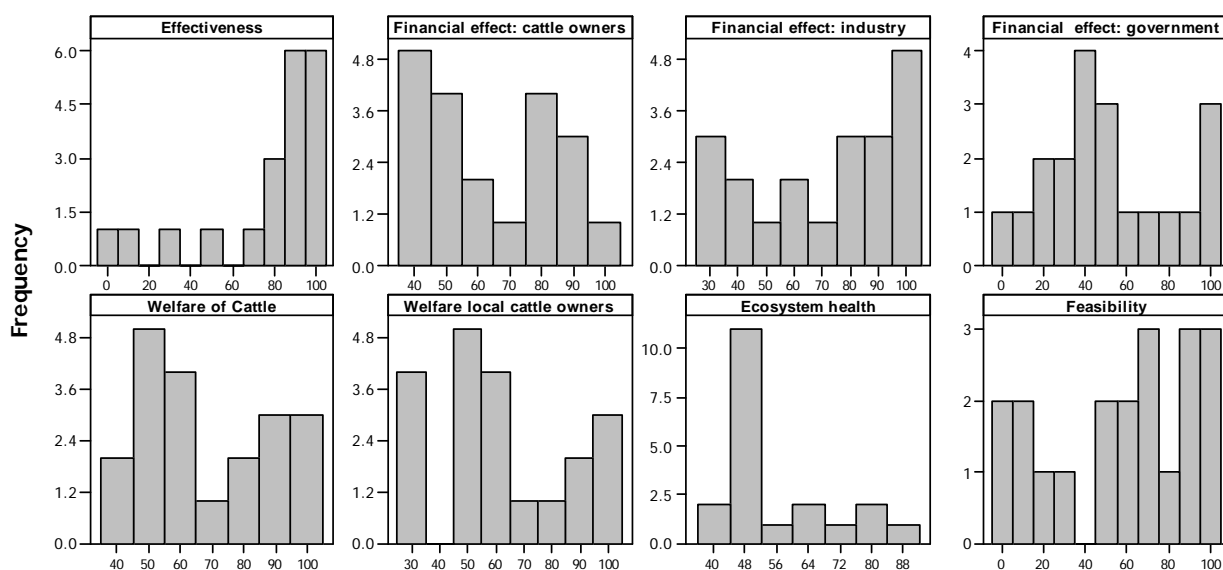Distributions of scores from expert group for vaccination

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	5	78	100	Triangular	Triangular (5,78,100)
Financial effect: cattle owners	11	50	84	Triangular	Triangular (11,50,84)
Financial effect: cattle industry	50	53	95	Triangular	Triangular (50,53,95)
Financial effect: government	0	33	95	Triangular	Triangular (0,33,95)
Welfare of cattle	38	50	91	Triangular	Triangular (38,50,91)
Welfare of local cattle owners	25	50	84	Triangular	Triangular (25,50,84)
Ecosystem health	15	50	75	Triangular	Triangular (15,50,75)
Feasibility	10	79	95	Triangular	Triangular (10,79,95)

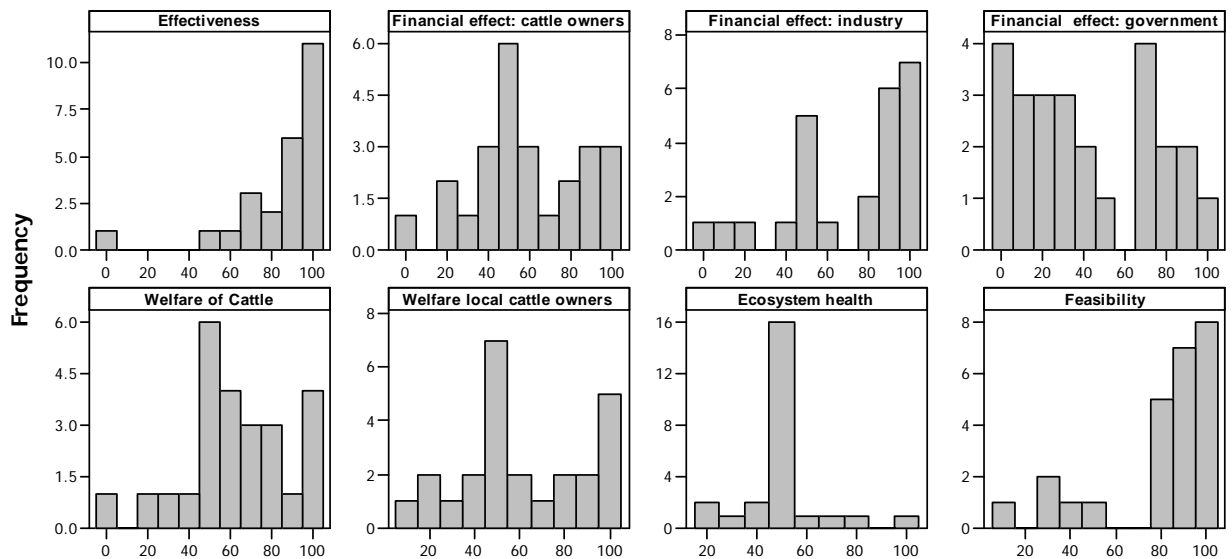## Distributions of scores from wildlife group for vaccination
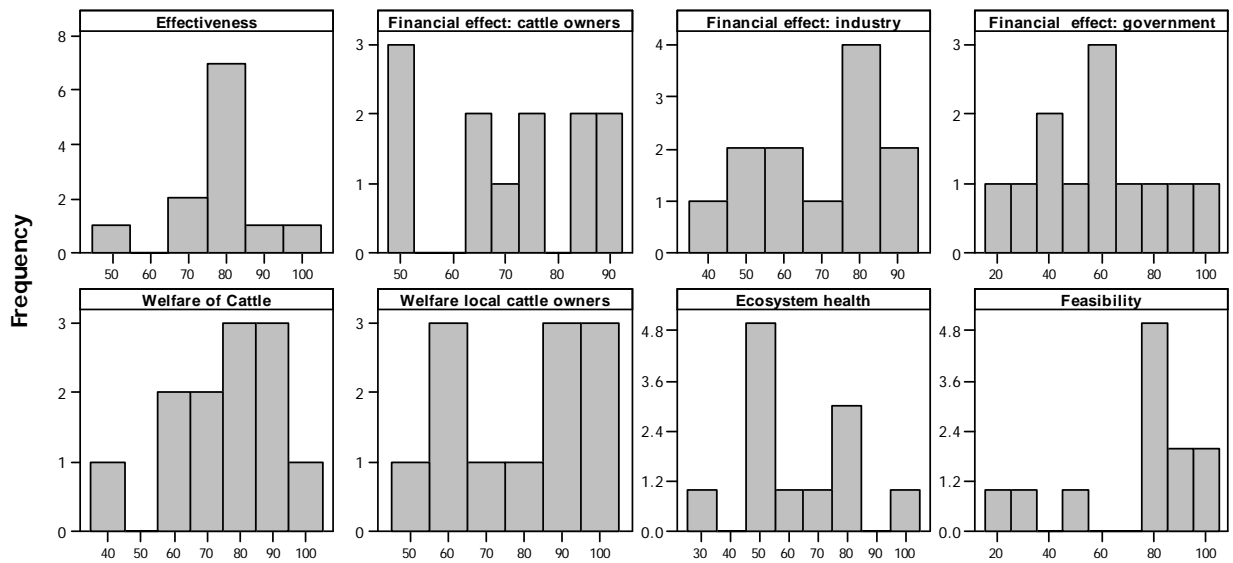
Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	54	78	96	Triangular	Triangular (54,78,96)
Financial effect: cattle owners	49	71	92	Uniform	Uniform (49,92)
Financial effect: cattle industry	40	71	90	Triangular	Triangular (40,71,90)
Financial effect: government	23	58	95	Triangular	Triangular (23,58,95)
Welfare of cattle	44	78	100	Triangular	Triangular (44,78,100)
Welfare of local cattle owners	54	80	100	Uniform	Uniform (54,100)
Ecosystem health	34	57	100	Triangular	Triangular (34,57,100)
Feasibility	20	84	100	Triangular	Triangular (20,84,100)

Distributions of scores from livestock veterinarian group for vaccination
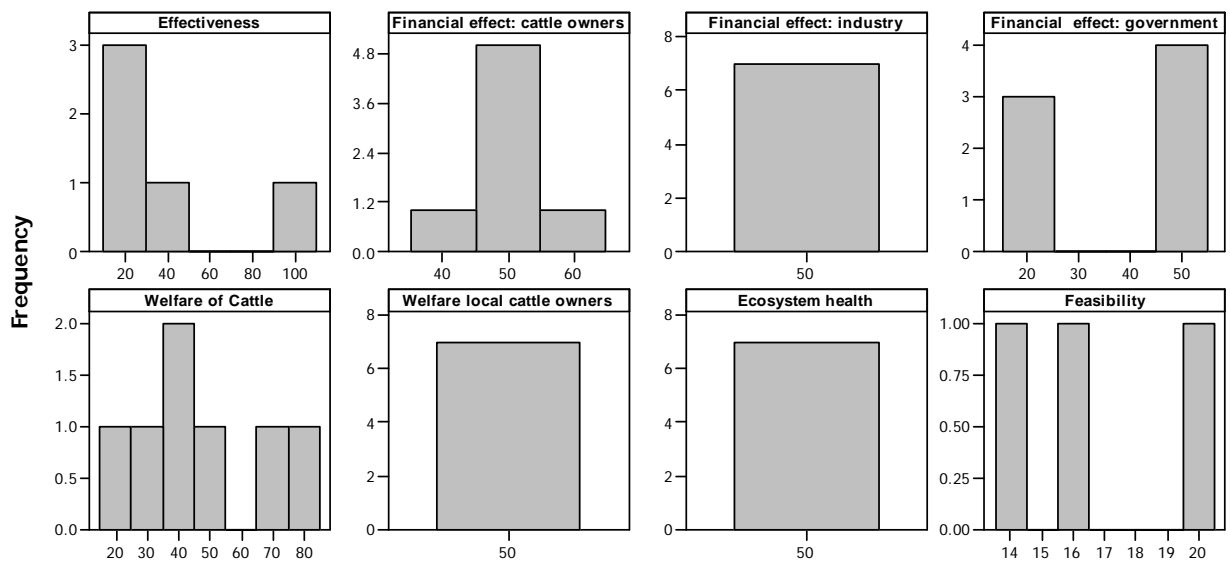

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	2	88	100	Triangular	Triangular (2,88,100)
Financial effect: cattle owners	37	56	100	Triangular	Triangular (37,56,100)
Financial effect: cattle industry	30	78	100	Uniform	Uniform (30,100)
Financial effect: government	0	44	100	Uniform	Uniform (0,100)
Welfare of cattle	40	62	100	Uniform	Uniform (40,100)
Welfare of local cattle owners	26	56	100	Uniform	Uniform (26,100)
Ecosystem health	40	51	90	Triangular	Triangular (40,51,90)
Feasibility	0	74	100	Uniform	Uniform (0,100)

Distributions of scores from state veterinarian group for vaccination
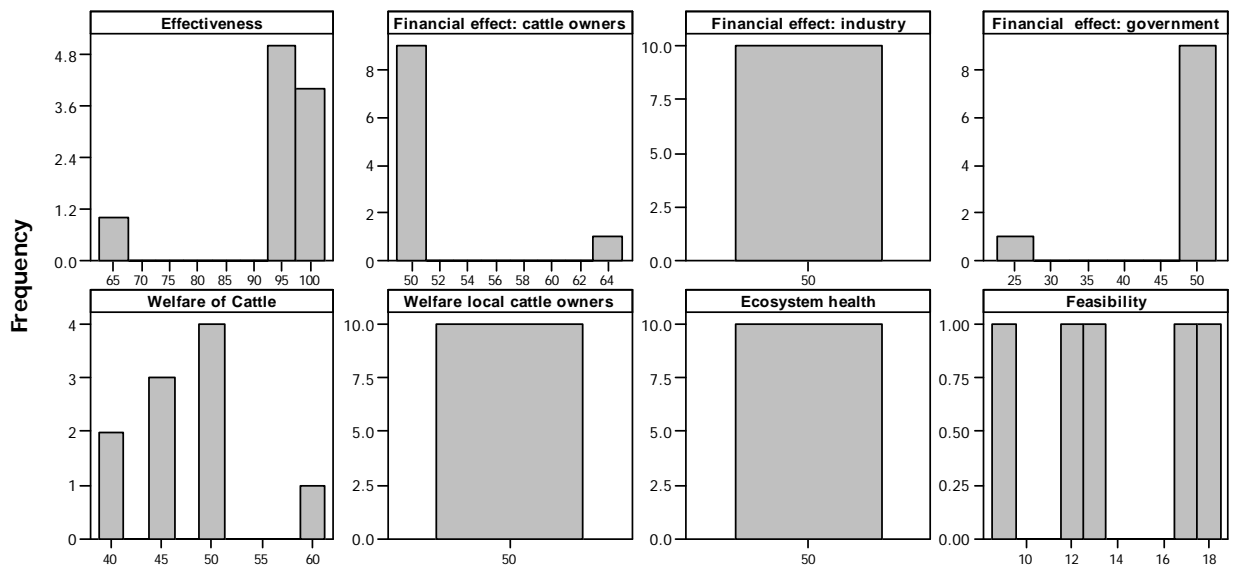

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	0	92	100	Triangular	Triangular (0,92,100)
Financial effect: cattle owners	1	50	100	Triangular	Triangular (1,50,100)
Financial effect: cattle industry	2	85	100	Triangular	Triangular (2,85,100)
Financial effect: government	0	32	99	Uniform	Uniform (0,99)
Welfare of cattle	1	65	100	Triangular	Triangular (1,65,100)
Welfare of local cattle owners	6	55	100	Uniform	Uniform (6,100)
Ecosystem health	24	50	100	Triangular	Triangular (24,50,100)
Feasibility	5	86	100	Triangular	Triangular (5,86,100)

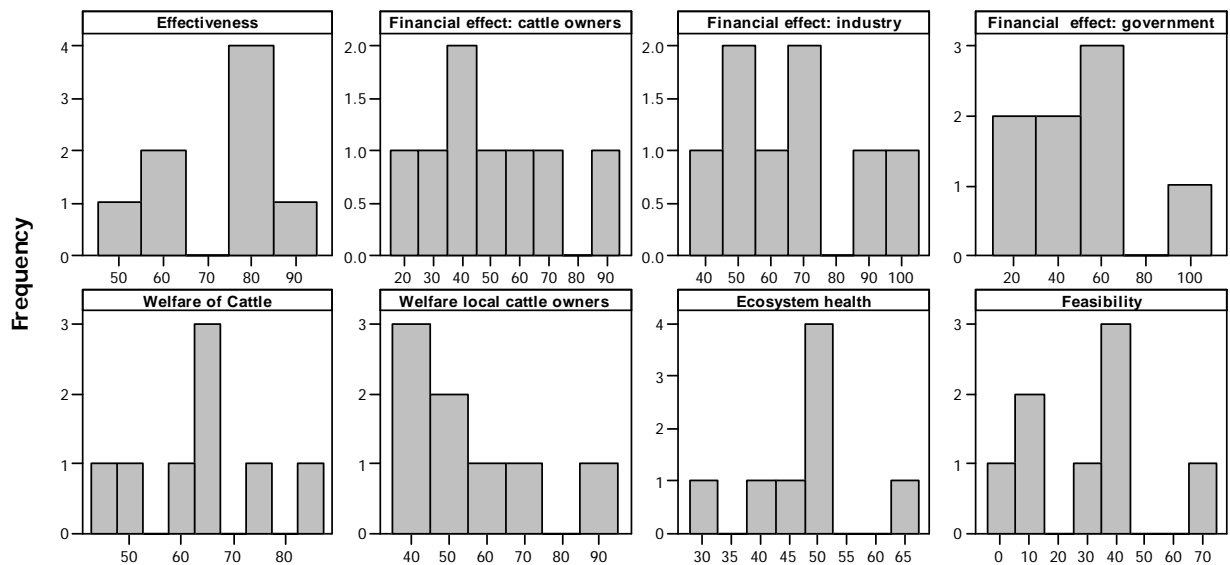## Distributions of scores from animal health technician group for vaccination

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	10	30	95	Triangular	Triangular (10,30,95)
Financial effect: cattle owners	40	50	60	Triangular	Triangular (40,50,60)
Financial effect: cattle industry	50	50	50	Uniform	Uniform (50,50)
Financial effect: government	15	50	50	Uniform	Uniform (15,50)
Welfare of cattle	15	35	75	Uniform	Uniform (15,75)
Welfare of local cattle owners	50	50	50	Uniform	Uniform (50,50)
Ecosystem health	50	50	50	Uniform	Uniform (50,50)
Feasibility	14	17	20	Uniform	Uniform (14,20)

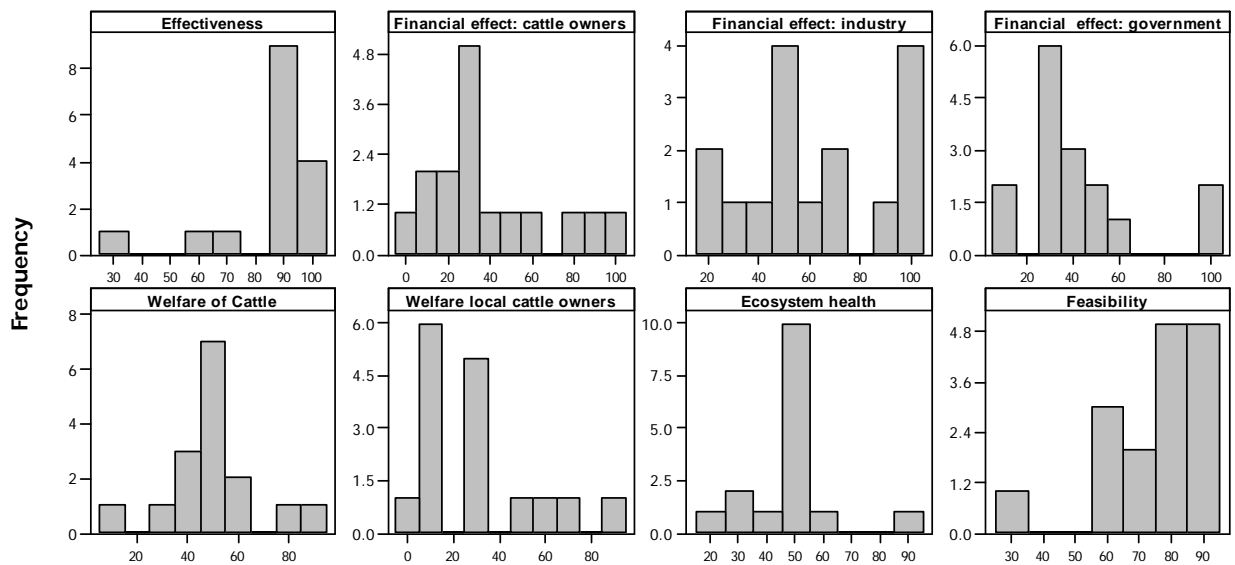## Distributions of scores from cattle owners group for vaccination

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	65	95	100	Triangular	Triangular (65,95,100)
Financial effect: cattle owners	50	50	65	Triangular	Triangular (50,50,65)
Financial effect: cattle industry	50	50	50	Uniform	Uniform (50,50)
Financial effect: government	25	50	50	Triangular	Triangular (25,50,50)
Welfare of cattle	40	48	60	Triangular	Triangular (40,48,60)
Welfare of local cattle owners	50	50	50	Uniform	Uniform (50,50)
Ecosystem health	50	50	50	Uniform	Uniform (50,50)
Feasibility	9	14	18	Uniform	Uniform (9,18)

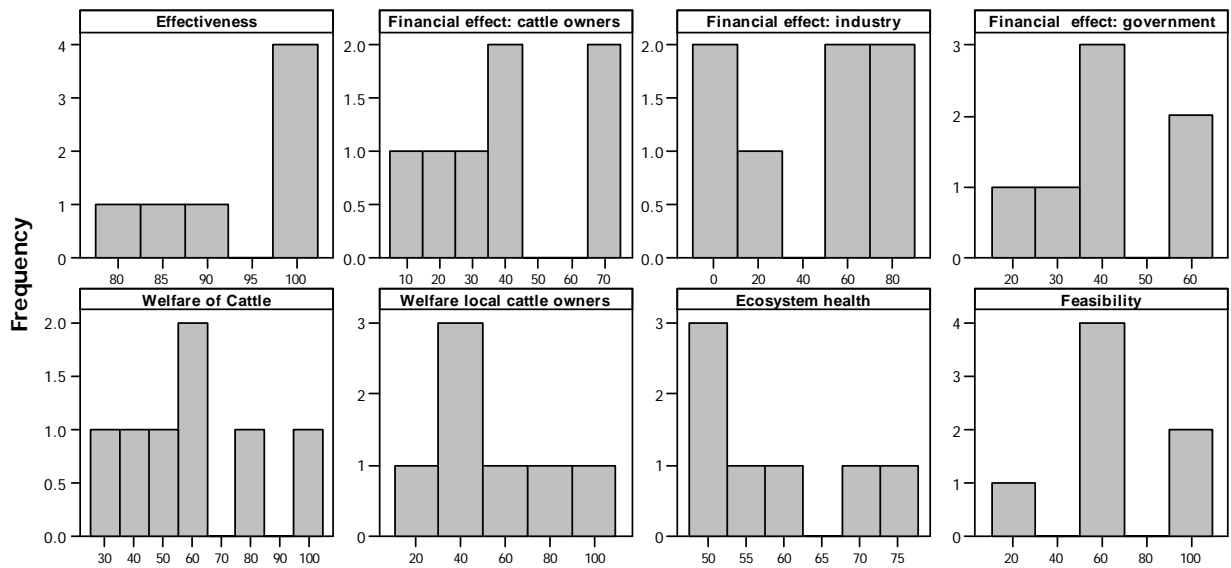Distributions of scores from public group for vaccination

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	46	78	88	Triangular	Triangular (46,78,88)
Financial effect: cattle owners	18	46	92	Uniform	Uniform (18,92)
Financial effect: cattle industry	44	64	100	Uniform	Uniform (44,100)
Financial effect: government	10	48	100	Uniform	Uniform (10,100)
Welfare of cattle	47	66	86	Triangular	Triangular (47,66,86)
Welfare of local cattle owners	35	49	94	Triangular	Triangular (35,49,94)
Ecosystem health	28	50	65	Triangular	Triangular (28,50,65)
Feasibility	2	36	100	Triangular	Triangular (2,36,100)

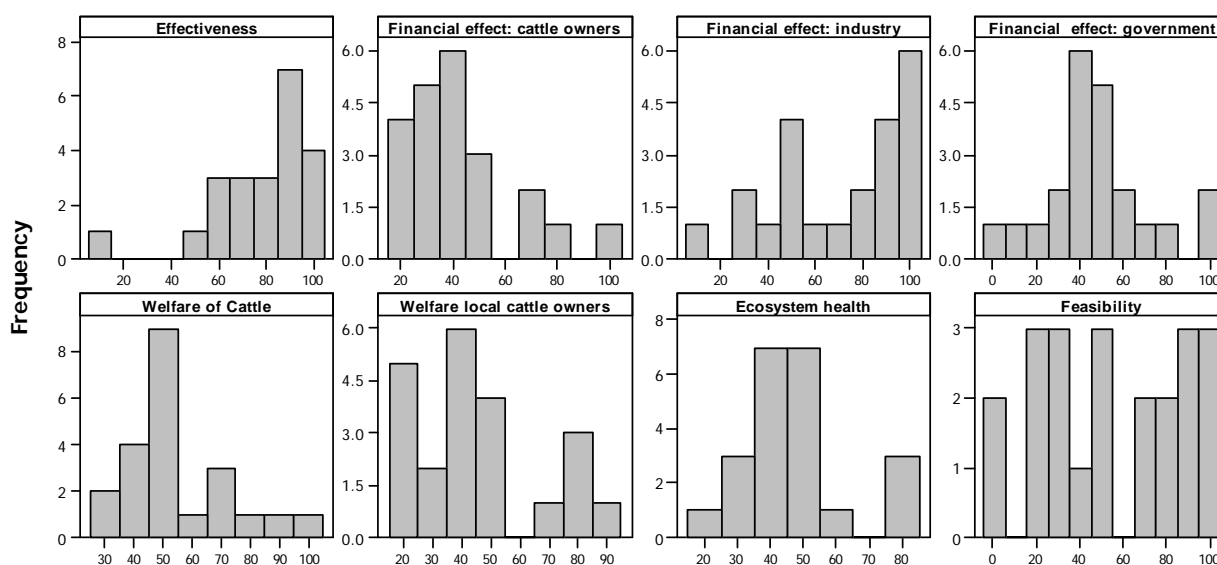## Distributions of scores from expert group for movement control

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	25	90	100	Triangular	Triangular (25,90,100)
Financial effect: cattle owners	0	31	100	Triangular	Triangular (0,31,100)
Financial effect: cattle industry	16	55	100	Uniform	Uniform (16,100)
Financial effect: government	8	35	100	Triangular	Triangular (8,35,100)
Welfare of cattle	14	50	88	Triangular	Triangular (14,50,88)
Welfare of local cattle owners	0	25	91	Triangular	Triangular (0,25,91)
Ecosystem health	20	50	88	Triangular	Triangular (20,50,88)
Feasibility	30	80	93	Triangular	Triangular (30,80,93)

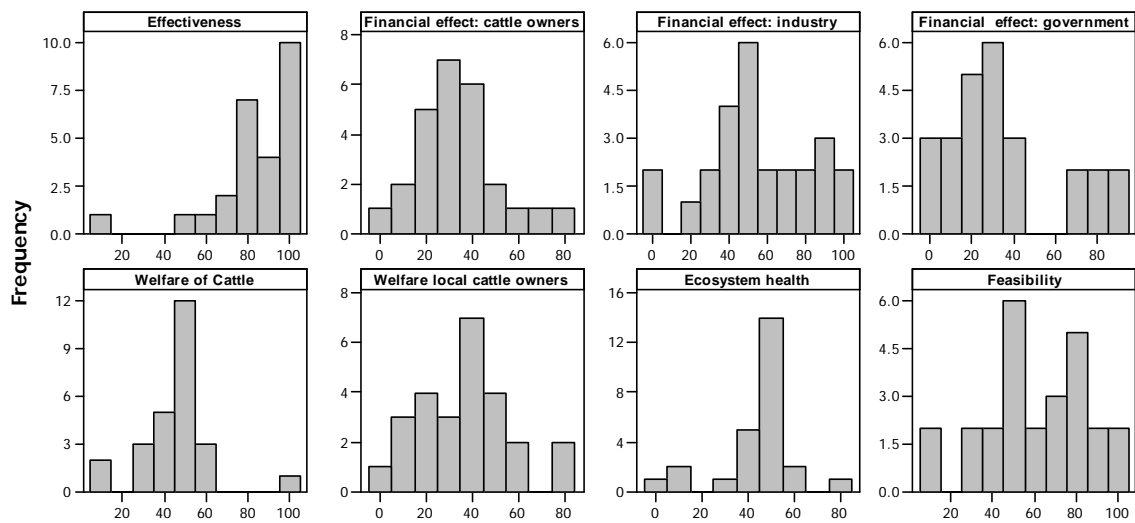Distributions of scores from wildlife group for movement control

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	79	100	100	Triangular	Triangular (79,100,100)
Financial effect: cattle owners	10	40	75	Uniform	Uniform (10,75)
Financial effect: cattle industry	0	50	80	Uniform	Uniform (0,80)
Financial effect: government	23	42	63	Uniform	Uniform (23,63)
Welfare of cattle	31	55	100	Uniform	Uniform (31,100)
Welfare of local cattle owners	25	40	100	Triangular	Triangular (25,40,100)
Ecosystem health	50	55	76	Triangular	Triangular (50,55,76)
Feasibility	10	58	100	Triangular	Triangular (10,58,100)

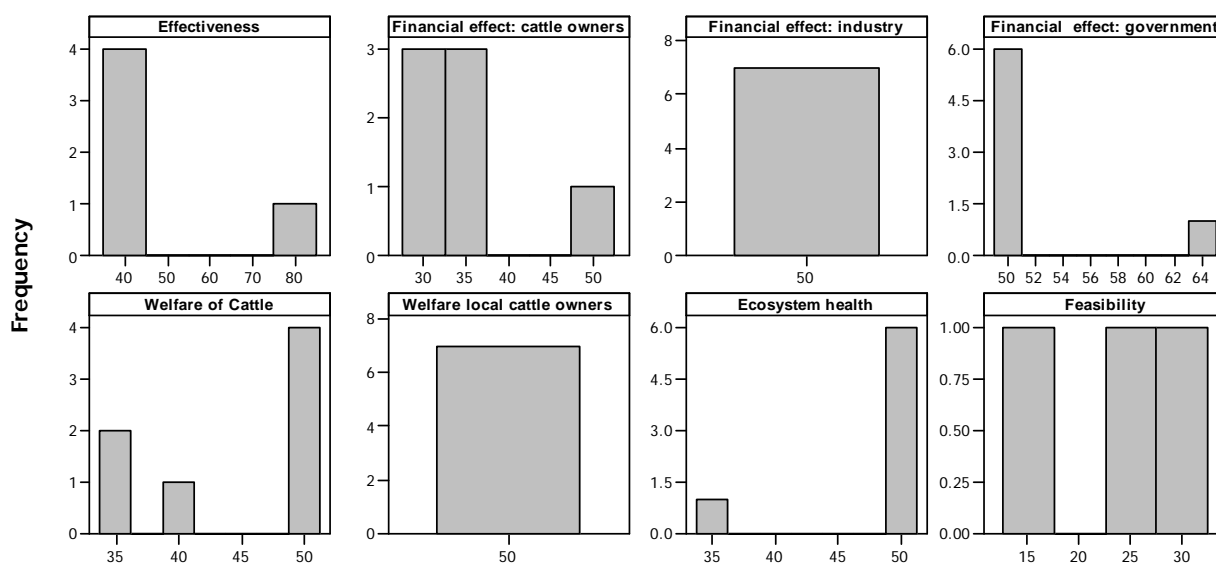Distributions of scores from livestock veterinarian group for movement control

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	13	83	100	Triangular	Triangular (13,83,100)
Financial effect: cattle owners	17	39	100	Triangular	Triangular (17,39,100)
Financial effect: cattle industry	13	78	100	Triangular	Triangular (13,78,100)
Financial effect: government	0	43	100	Triangular	Triangular (0,43,100)
Welfare of cattle	35	50	100	Triangular	Triangular (35,50,100)
Welfare of local cattle owners	15	39	92	Uniform	Uniform (15,92)
Ecosystem health	24	44	82	Triangular	Triangular (24,44,82)
Feasibility	0	50	100	Uniform	Uniform (0,100)

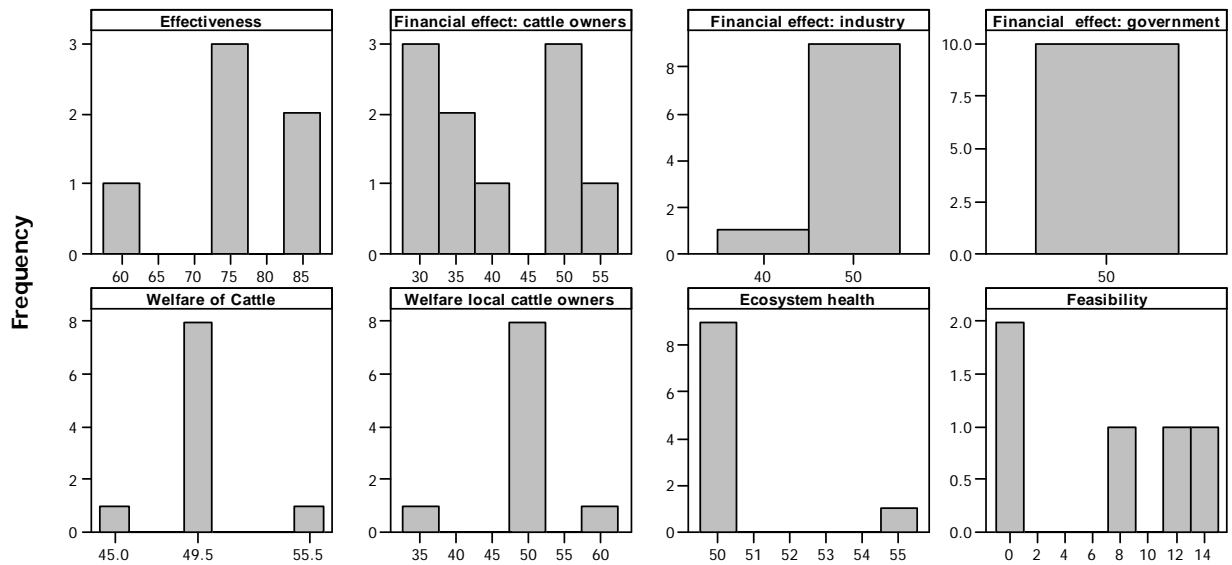Distributions of scores from state veterinarian group for movement control

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	10	89	100	Triangular	Triangular (10,89,100)
Financial effect: cattle owners	3	30	83	Triangular	Triangular (3,30,83)
Financial effect: cattle industry	2	50	100	Triangular	Triangular (2,50,100)
Financial effect: government	3	27	86	Triangular	Triangular (3,27,86)
Welfare of cattle	10	46	99	Triangular	Triangular (10,46,99)
Welfare of local cattle owners	4	36	80	Triangular	Triangular (4,36,80)
Ecosystem health	5	50	78	Triangular	Triangular (5,50,78)
Feasibility	8	59	100	Triangular	Triangular (8,59,100)

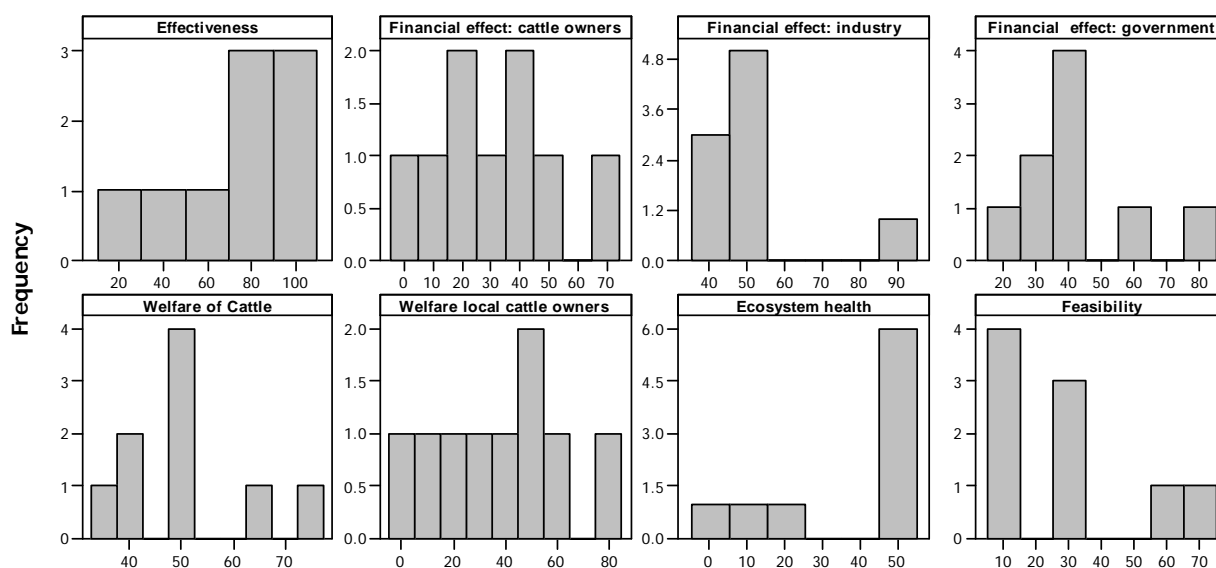Distributions of scores from animal health technician group for movement control

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	35	40	75	Triangular	Triangular (35,40,75)
Financial effect: cattle owners	30	35	50	Triangular	Triangular (30,35,50)
Financial effect: cattle industry	50	50	50	Uniform	Uniform (50,50)
Financial effect: government	50	50	65	Triangular	Triangular (50,50,65)
Welfare of cattle	35	50	50	Triangular	Triangular (35,50,50)
Welfare of local cattle owners	50	50	50	Uniform	Uniform (50,50)
Ecosystem health	35	50	50	Triangular	Triangular (35,50,50)
Feasibility	14	23	29	Uniform	Uniform (14,29)

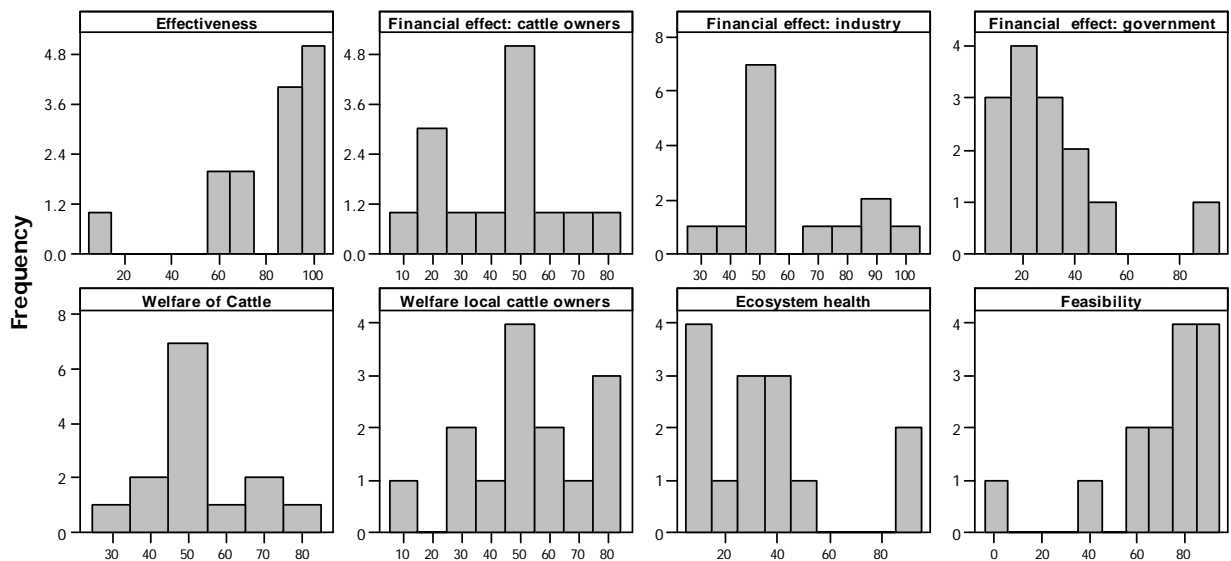Distributions of scores from cattle owners group for movement control

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	60	76	85	Triangular	Triangular (60,76,85)
Financial effect: cattle owners	30	38	55	Uniform	Uniform (30,55)
Financial effect: cattle industry	40	50	50	Triangular	Triangular (40,50,50)
Financial effect: government	50	50	50	Uniform	Uniform (50,50)
Welfare of cattle	45	50	55	Triangular	Triangular (45,50,55)
Welfare of local cattle owners	35	50	60	Triangular	Triangular (35,50,60)
Ecosystem health	50	50	55	Triangular	Triangular (50,50,55)
Feasibility	0	7	15	Triangular	Triangular (0,7,15)

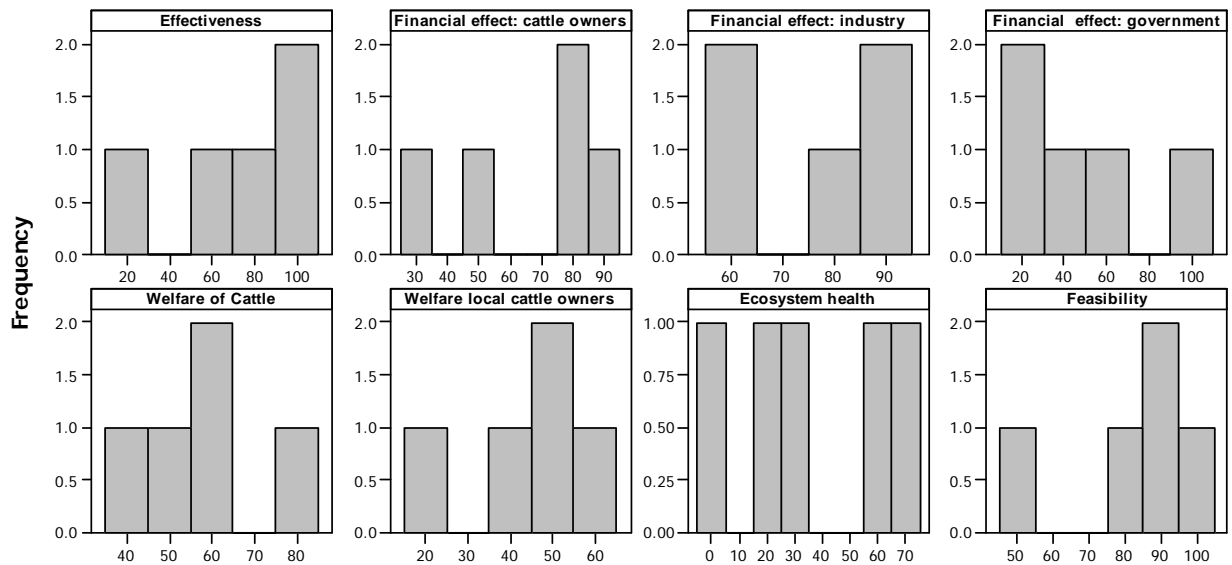Distributions of scores from public group for movement control

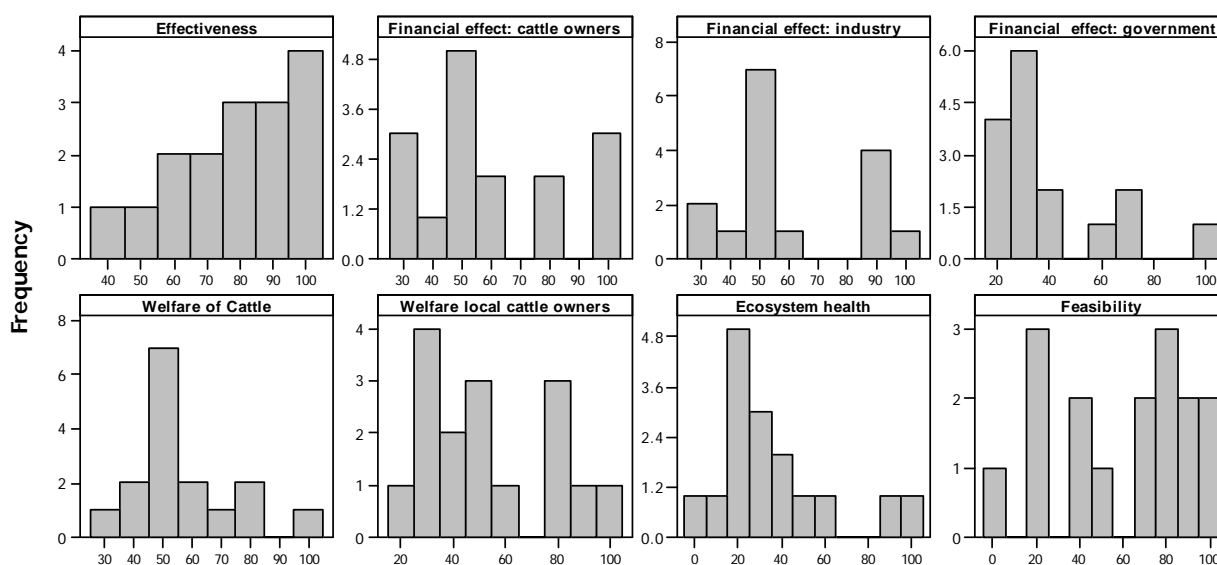| Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	12	80	100	Triangular	Triangular (12,80,100)
Financial effect: cattle owners	0	33	70	Uniform	Uniform (0,70)
Financial effect: cattle industry	35	50	87	Triangular	Triangular (35,50,87)
Financial effect: government	25	44	80	Triangular	Triangular (25,44,80)
Welfare of cattle	37	51	75	Triangular	Triangular (37,51,75)
Welfare of local cattle owners	0	40	75	Triangular	Triangular (0,40,75)
Ecosystem health	0	50	54	Triangular	Triangular (0,50,54)
Feasibility	8	27	65	Triangular	Triangular (8,27,65)

Distributions of scores from expert group for fence

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	14	89	100	Triangular	Triangular (14,89,100)
Financial effect: cattle owners	10	50	80	Triangular	Triangular (10,50,80)
Financial effect: cattle industry	32	50	96	Triangular	Triangular (32,50,96)
Financial effect: government	10	24	94	Triangular	Triangular (10,24,94)
Welfare of cattle	25	50	80	Triangular	Triangular (25,50,80)
Welfare of local cattle owners	13	50	84	Triangular	Triangular (13,50,84)
Ecosystem health	8	29	95	Triangular	Triangular (8,29,95)
Feasibility	1	79	95	Triangular	Triangular (1,79,95)

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	18	80	100	Triangular	Triangular (18,80,100)
Financial effect: cattle owners	25	76	95	Triangular	Triangular (25,76,95)
Financial effect: cattle industry	55	77	94	Uniform	Uniform (55,94)
Financial effect: government	14	45	91	Uniform	Uniform (14,91)
Welfare of cattle	43	56	77	Triangular	Triangular (43,56,77)
Welfare of local cattle owners	18	47	60	Triangular	Triangular (18,47,60)
Ecosystem health	0	25	75	Uniform	Uniform (0,75)
Feasibility	52	91	99	Triangular	Triangular (52,91,99)

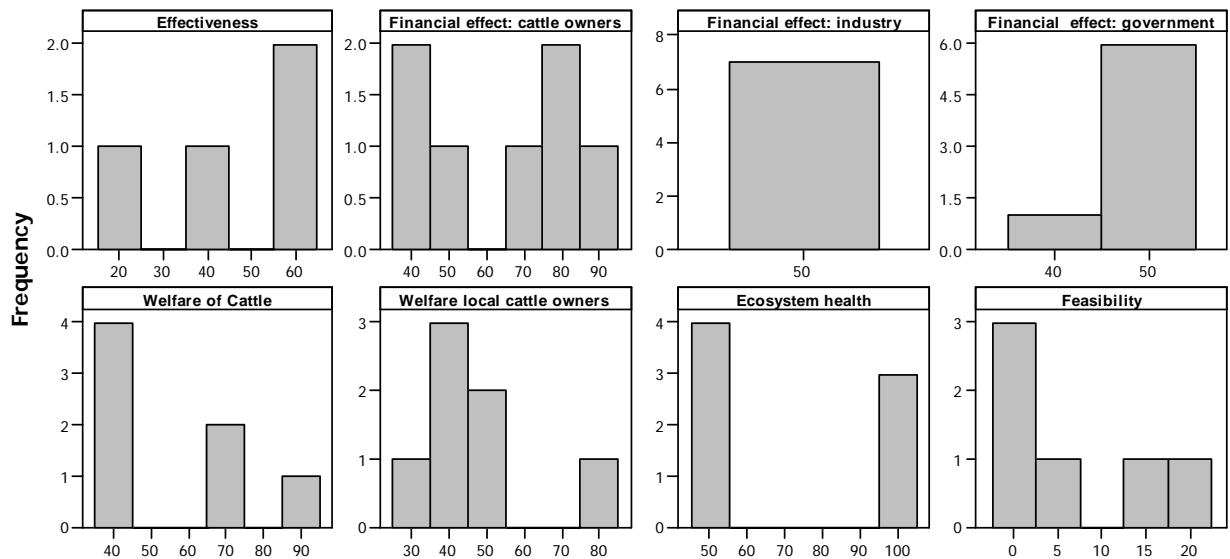Distributions of scores from livestock veterinarian group for fence

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	40	81	100	Triangular	Triangular (40,81,100)
Financial effect: cattle owners	30	50	100	Triangular	Triangular (30,50,100)
Financial effect: cattle industry	26	50	100	Triangular	Triangular (26,50,100)
Financial effect: government	15	32	100	Triangular	Triangular (15,32,100)
Welfare of cattle	26	50	100	Triangular	Triangular (26,50,100)
Welfare of local cattle owners	24	50	100	Triangular	Triangular (24,50,100)
Ecosystem health	0	29	100	Triangular	Triangular (0,29,100)
Feasibility	1	66	100	Uniform	Uniform (1,100)

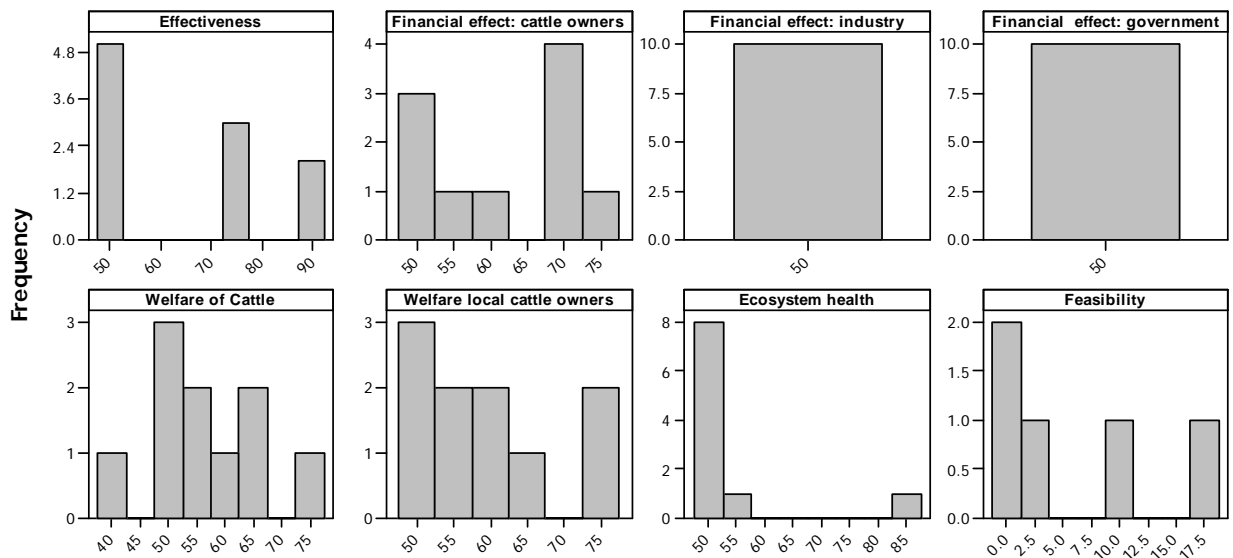Distributions of scores from state veterinarian group for fence
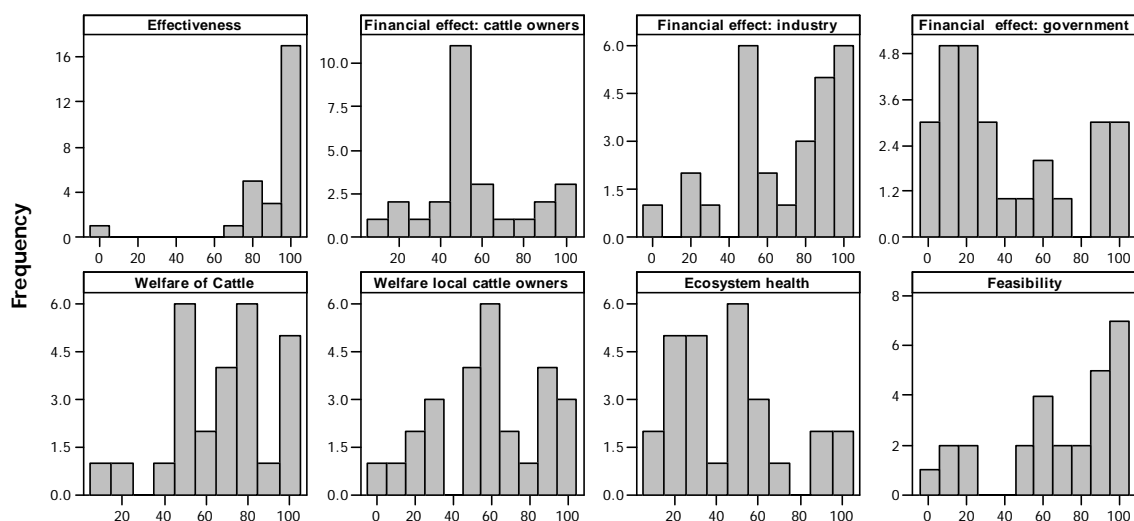
Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	1	99	100	Triangular	Triangular (1,99,100)
Financial effect: cattle owners	10	50	100	Triangular	Triangular (10,50,100)
Financial effect: cattle industry	4	75	100	Uniform	Uniform (4,100)
Financial effect: government	0	26	99	Uniform	Uniform (0,99)
Welfare of cattle	7	73	100	Uniform	Uniform (7,100)
Welfare of local cattle owners	1	60	100	Uniform	Uniform (1,100)
Ecosystem health	10	46	100	Uniform	Uniform (10,100)
Feasibility	0	78	100	Triangular	Triangular (0,78,100)

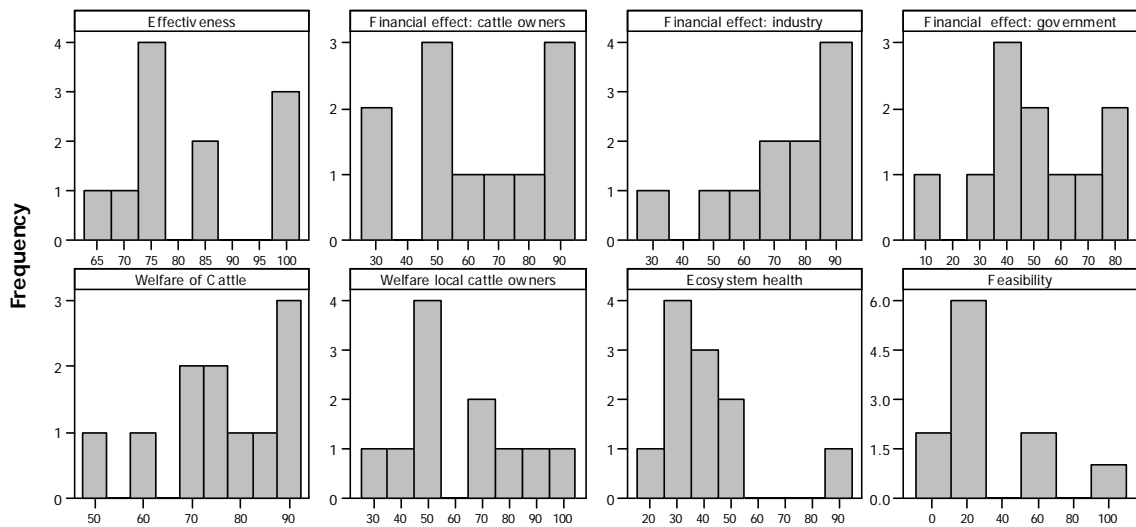Distributions of scores from animal health technician group for fence

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	20	47.5	60	Triangular	Triangular (20,47.5,60)
Financial effect: cattle owners	35	70	90	Uniform	Uniform (35,90)
Financial effect: cattle industry	50	50	50	Uniform	Uniform (50,50)
Financial effect: government	40	50	50	Triangular	Triangular (40,50,50)
Welfare of cattle	40	40	90	Triangular	Triangular (40,40,90)
Welfare of local cattle owners	30	40	80	Triangular	Triangular (30,40,80)
Ecosystem health	50	50	100	Uniform	Uniform (50,100)
Feasibility	0	3	20	Triangular	Triangular (0,3,20)

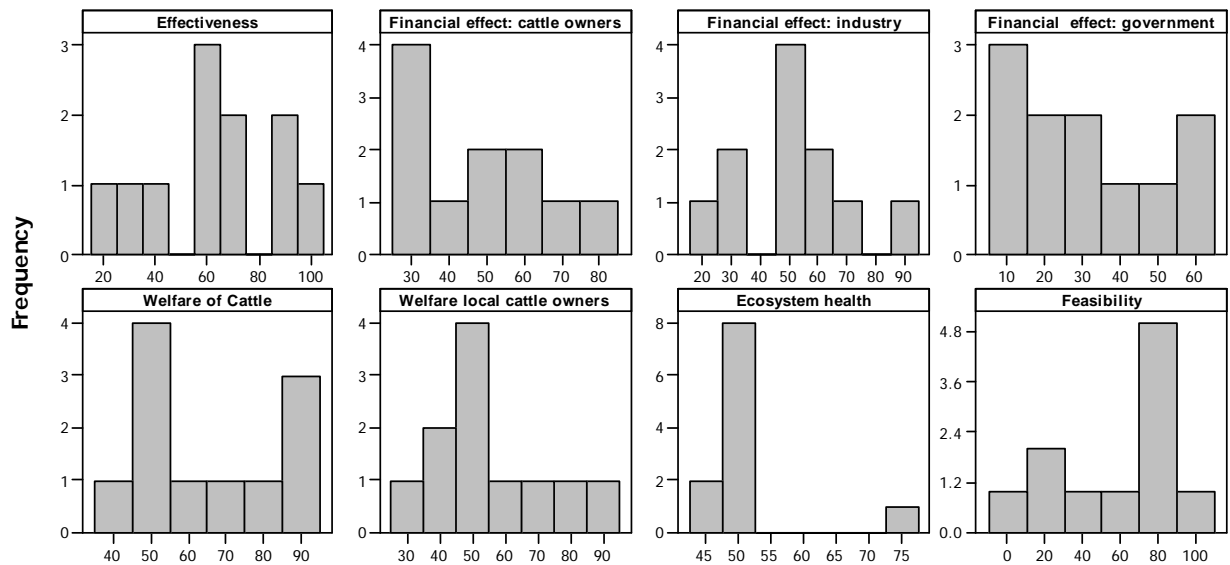Distributions of scores from cattle owners group for fence

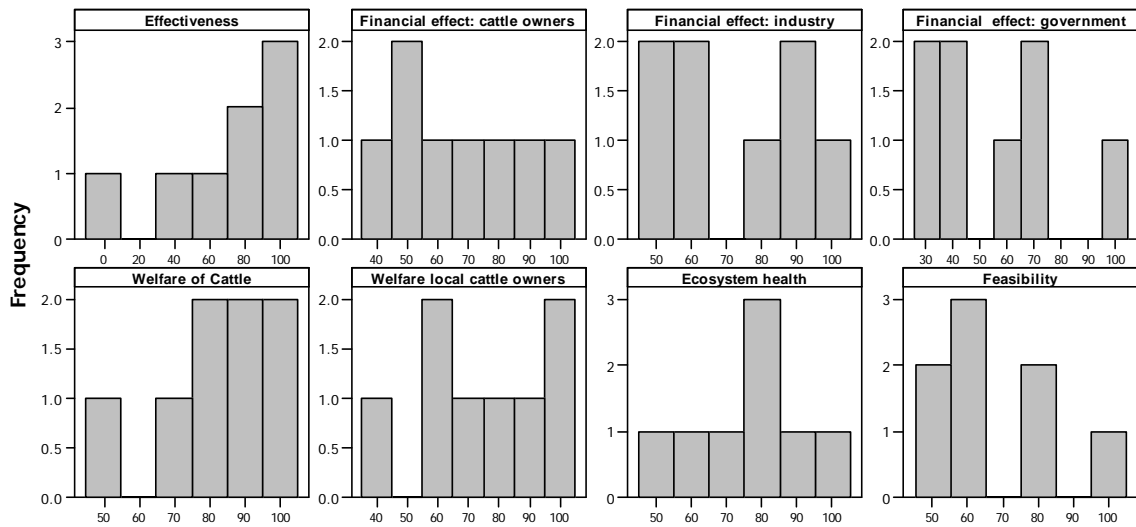| Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	50	62.5	90	Triangular	Triangular (50,62.5,90)
Financial effect: cattle owners	50	65	75	Uniform	Uniform (50,75)
Financial effect: cattle industry	50	50	50	Uniform	Uniform (50,50)
Financial effect: government	50	50	50	Uniform	Uniform (50,50)
Welfare of cattle	40	55	75	Triangular	Triangular (40,55,75)
Welfare of local cattle owners	50	58	75	Uniform	Uniform (50,75)
Ecosystem health	50	50	85	Triangular	Triangular (50,50,85)
Feasibility	0	2	17	Triangular	Triangular (0,2,17)

Distributions of scores from public group for fence

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	65	76	100	Uniform	Uniform (65,100)
Financial effect: cattle owners	29	61	88	Uniform	Uniform (29,88)
Financial effect: cattle industry	30	76	88	Triangular	Triangular (30,76,88)
Financial effect: government	13	50	80	Uniform	Uniform (13,80)
Welfare of cattle	50	74	93	Uniform	Uniform (50,93)
Welfare of local cattle owners	27	50	96	Triangular	Triangular (27,50,96)
Ecosystem health	15	36	88	Triangular	Triangular (15,36,88)
Feasibility	0	28	100	Triangular	Triangular (0,28,100)

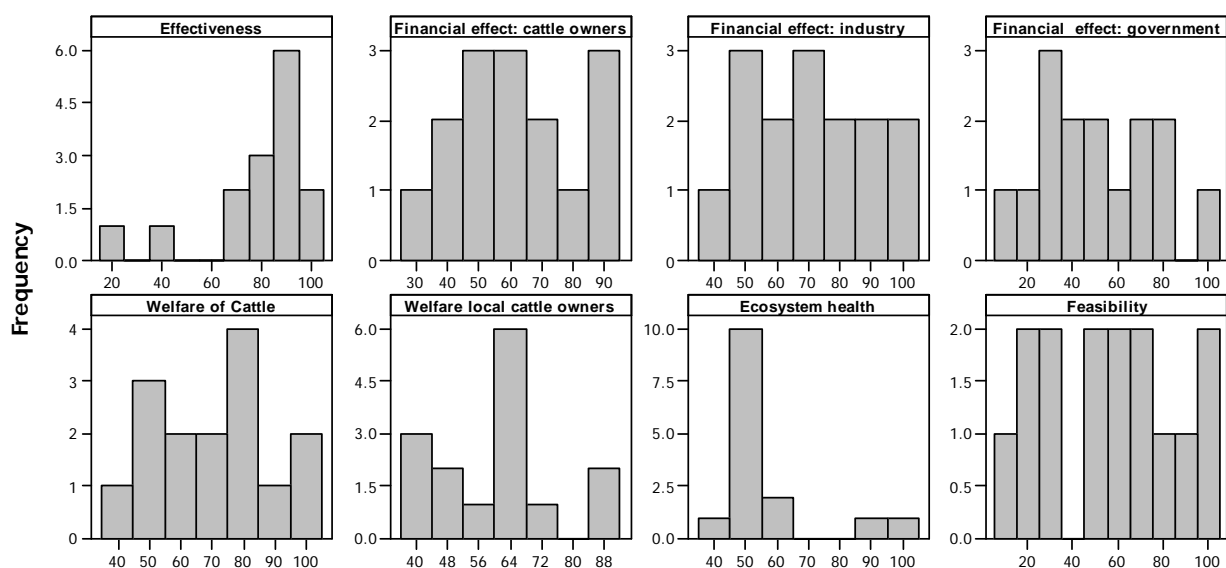Distributions of scores from expert group for clinical surveillance

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	17	64	100	Uniform	Uniform (17,100)
Financial effect: cattle owners	25	50	78	Triangular	Triangular (25,50,78)
Financial effect: cattle industry	23	50	89	Triangular	Triangular (23,50,89)
Financial effect: government	10	25	64	Uniform	Uniform (10,64)
Welfare of cattle	35	64	94	Uniform	Uniform (35,94)
Welfare of local cattle owners	33	50	86	Triangular	Triangular (33,50,86)
Ecosystem health	45	50	73	Triangular	Triangular (45,50,73)
Feasibility	0	78	95	Triangular	Triangular (0,78,95)

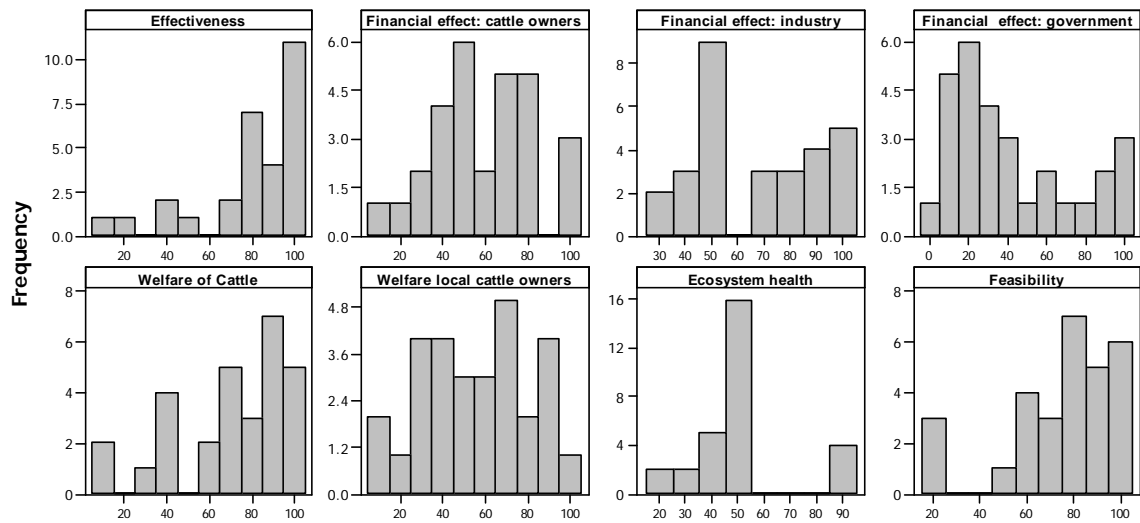Distributions of scores from wildlife group for clinical surveillance

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	0	88	95	Triangular	Triangular (0,88,95)
Financial effect: cattle owners	41	66	95	Triangular	Triangular (41,66,95)
Financial effect: cattle industry	51	68	98	Uniform	Uniform (51,98)
Financial effect: government	25	50	100	Uniform	Uniform (25,100)
Welfare of cattle	50	85	100	Uniform	Uniform (50,100)
Welfare of local cattle owners	41	73	100	Uniform	Uniform (41,100)
Ecosystem health	50	76	100	Triangular	Triangular (50,76,100)
Feasibility	52	59	95	Triangular	Triangular (52,59,95)

Distributions of scores from livestock veterinarian group for clinical surveillance
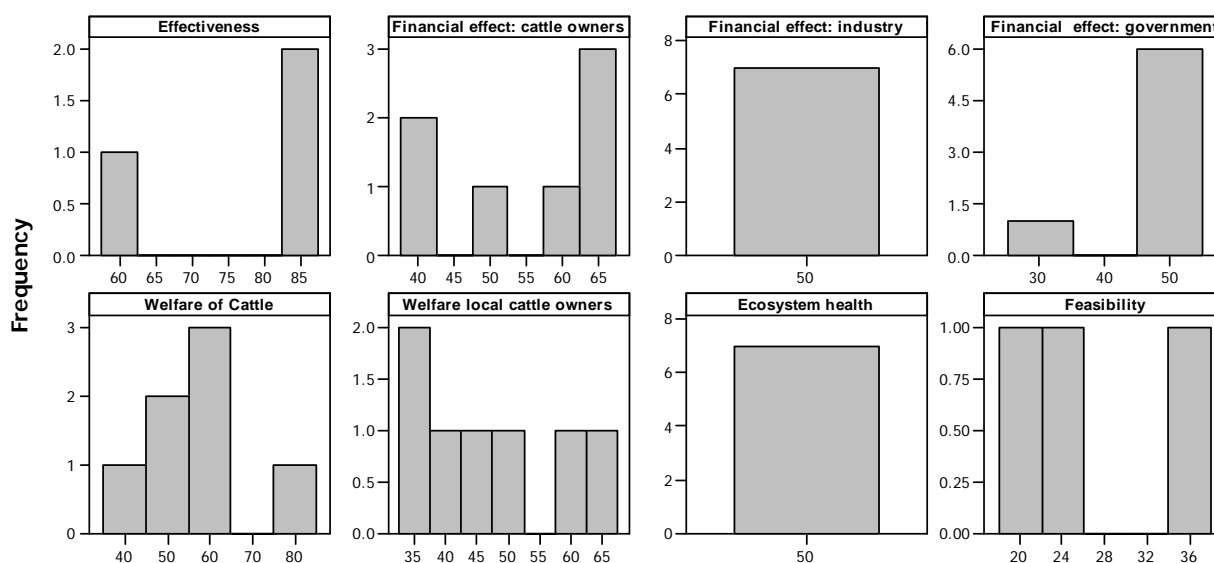

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	15	85	100	Triangular	Triangular (15,85,100)
Financial effect: cattle owners	25	56	90	Uniform	Uniform (25,90)
Financial effect: cattle industry	40	70	100	Uniform	Uniform (40,100)
Financial effect: government	10	47	100	Triangular	Triangular (10,47,100)
Welfare of cattle	42	70	100	Triangular	Triangular (42,70,100)
Welfare of local cattle owners	40	60	91	Triangular	Triangular (40,60,91)
Ecosystem health	40	50	100	Triangular	Triangular (40,50,100)
Feasibility	3	56	100	Uniform	Uniform (3,100)

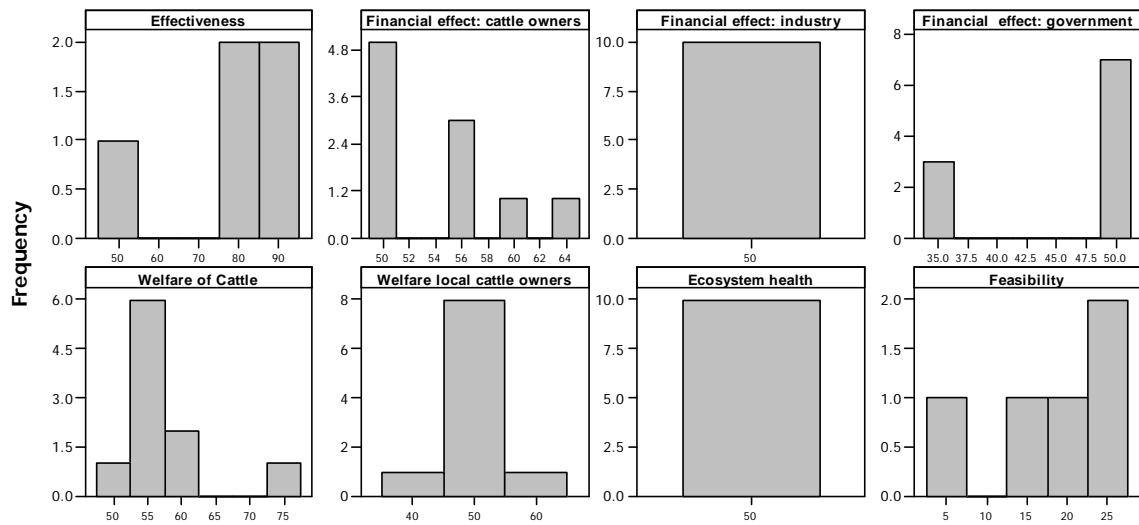Distributions of scores from state veterinarian group for clinical surveillance

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	10	85	100	Triangular	Triangular (10,85,100)
Financial effect: cattle owners	10	55	99	Triangular	Triangular (10,55,99)
Financial effect: cattle industry	30	65	100	Uniform	Uniform (30,100)
Financial effect: government	0	27	100	Uniform	Uniform (0,100)
Welfare of cattle	8	75	100	Uniform	Uniform (8,100)
Welfare of local cattle owners	7	55	100	Uniform	Uniform (7,100)
Ecosystem health	18	50	90	Triangular	Triangular (18,50,90)
Feasibility	20	79	100	Uniform	Uniform (20,100)

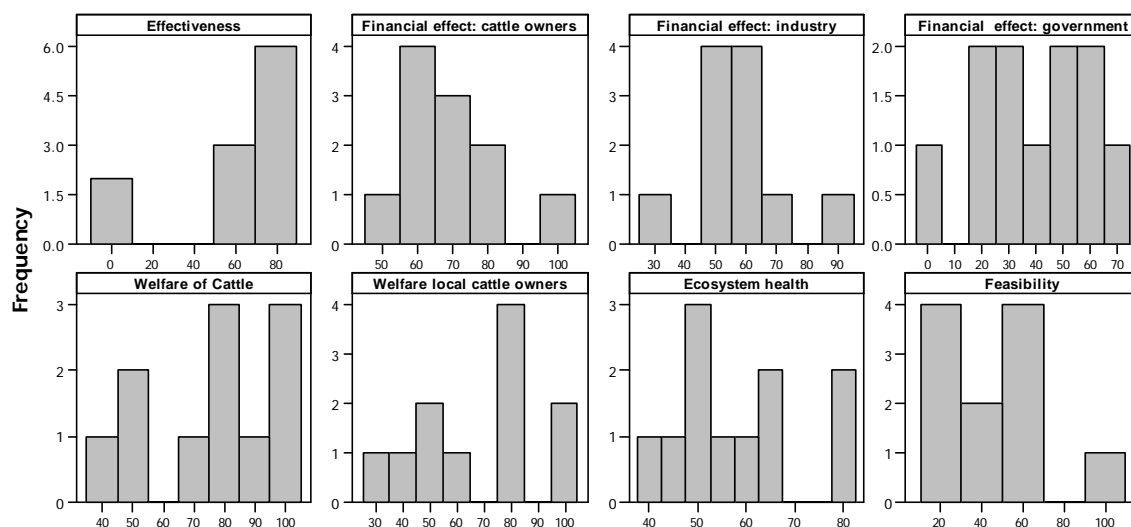Distributions of scores from animal health technician group for clinical surveillance

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	60	85	85	Triangular	Triangular (60,85,85)
Financial effect: cattle owners	40	60	65	Uniform	Uniform (40,65)
Financial effect: cattle industry	50	50	50	Uniform	Uniform (50,50)
Financial effect: government	30	50	50	Triangular	Triangular (30,50,50)
Welfare of cattle	40	60	80	Triangular	Triangular (40,60,80)
Welfare of local cattle owners	35	45	65	Triangular	Triangular (35,45,65)
Ecosystem health	50	50	50	Uniform	Uniform (50,50)
Feasibility	20	24	34	Uniform	Uniform (20,34)

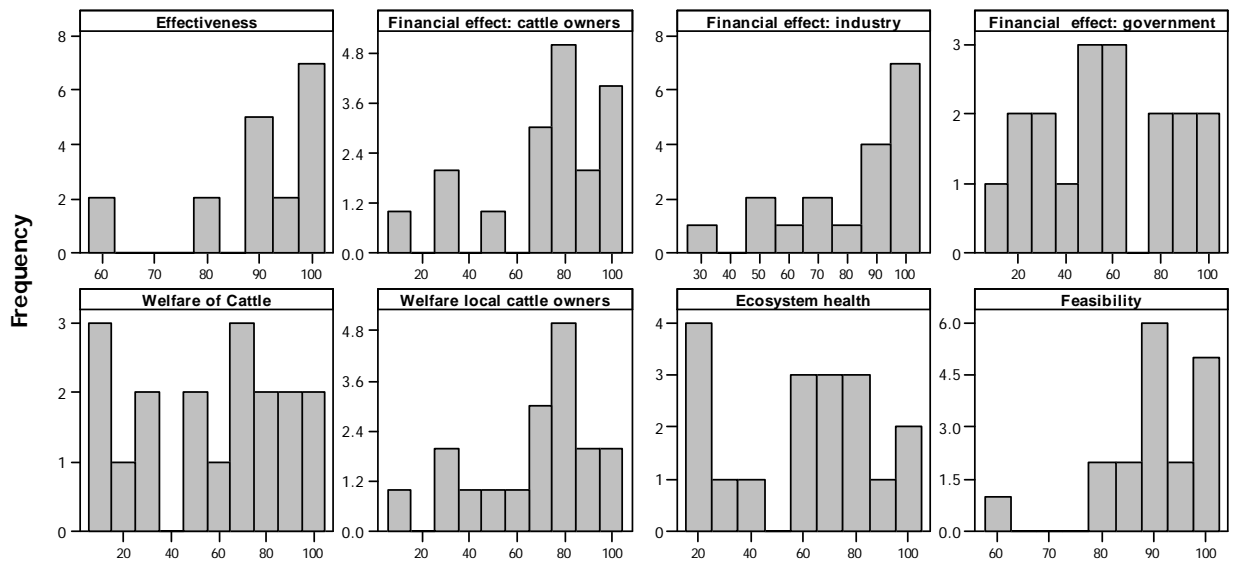## Distributions of scores from cattle owners group for clinical surveillance

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	45	75	90	Triangular	Triangular (45,75,90)
Financial effect: cattle owners	50	53	65	Triangular	Triangular (50,53,65)
Financial effect: cattle industry	50	50	50	Uniform	Uniform (50,50)
Financial effect: government	35	50	50	Triangular	Triangular (35,50,50)
Welfare of cattle	50	55	75	Triangular	Triangular (50,55,75)
Welfare of local cattle owners	40	50	60	Triangular	Triangular (40,50,60)
Ecosystem health	50	50	50	Uniform	Uniform (50,50)
Feasibility	3	22	27	Uniform	Uniform (3,27)

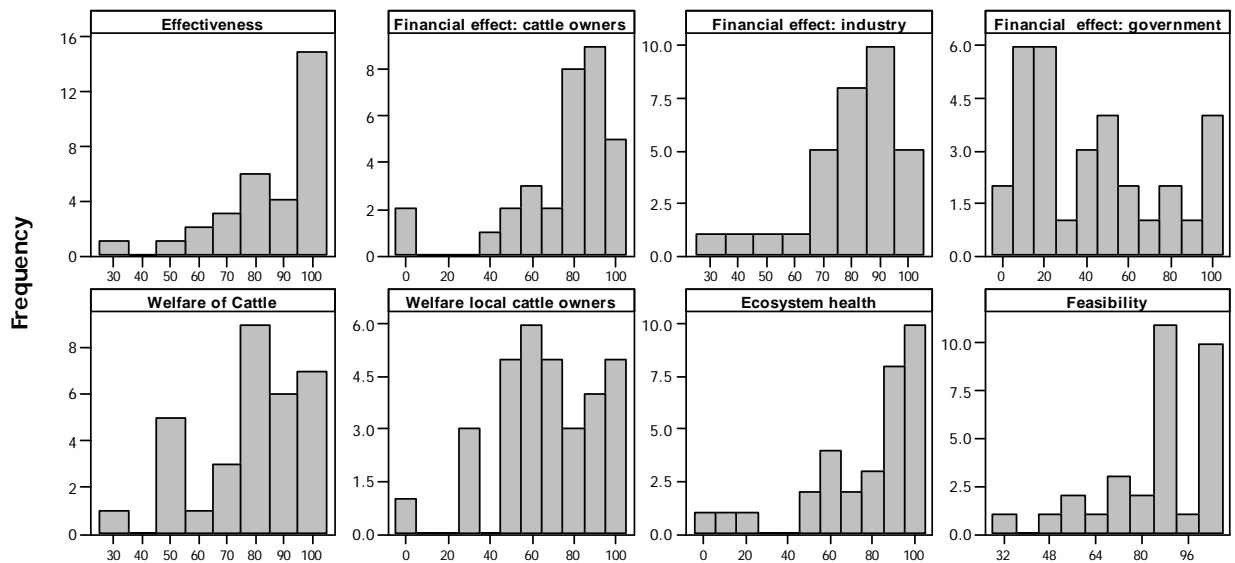Distributions of scores from public group for clinical surveillance

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	0	71	88	Triangular	Triangular (0,71,88)
Financial effect: cattle owners	50	67	100	Triangular	Triangular (50,67,100)
Financial effect: cattle industry	31	55	88	Triangular	Triangular (31,55,88)
Financial effect: government	0	36	69	Uniform	Uniform (0,69)
Welfare of cattle	40	81	100	Uniform	Uniform (40,100)
Welfare of local cattle owners	34	75	100	Triangular	Triangular (34,75,100)
Ecosystem health	39	55	82	Uniform	Uniform (39,82)
Feasibility	10	41	90	Triangular	Triangular (10,41,90)

Distributions of weights from expert group

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	59	93	100	Triangular	Triangular (59,93,100)
Financial effect: cattle owners	10	79	100	Triangular	Triangular (10,79,100)
Financial effect: cattle industry	29	90	100	Triangular	Triangular (29,90,100)
Financial effect: government	15	54	100	Uniform	Uniform (15,100)
Welfare of cattle	10	63	100	Uniform	Uniform (10,100)
Welfare of local cattle owners	9	73	100	Triangular	Triangular (9,73,100)
Ecosystem health	15	64	100	Uniform	Uniform (15,100)
Feasibility	59	90	100	Triangular	Triangular (59,90,100)

Distributions of weights from wildlife group

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	30	90	100	Triangular	Triangular (30,90,100)
Financial effect: cattle owners	2	80	100	Triangular	Triangular (2,80,100)
Financial effect: cattle industry	26	80	100	Triangular	Triangular (26,80,100)
Financial effect: government	0	39	100	Uniform	Uniform (0,100)
Welfare of cattle	30	80	100	Uniform	Uniform (30,100)
Welfare of local cattle owners	2	68	100	Uniform	Uniform (2,100)
Ecosystem health	3	88	100	Triangular	Triangular (3,88,100)
Feasibility	35	90	100	Triangular	Triangular (35,90,100)

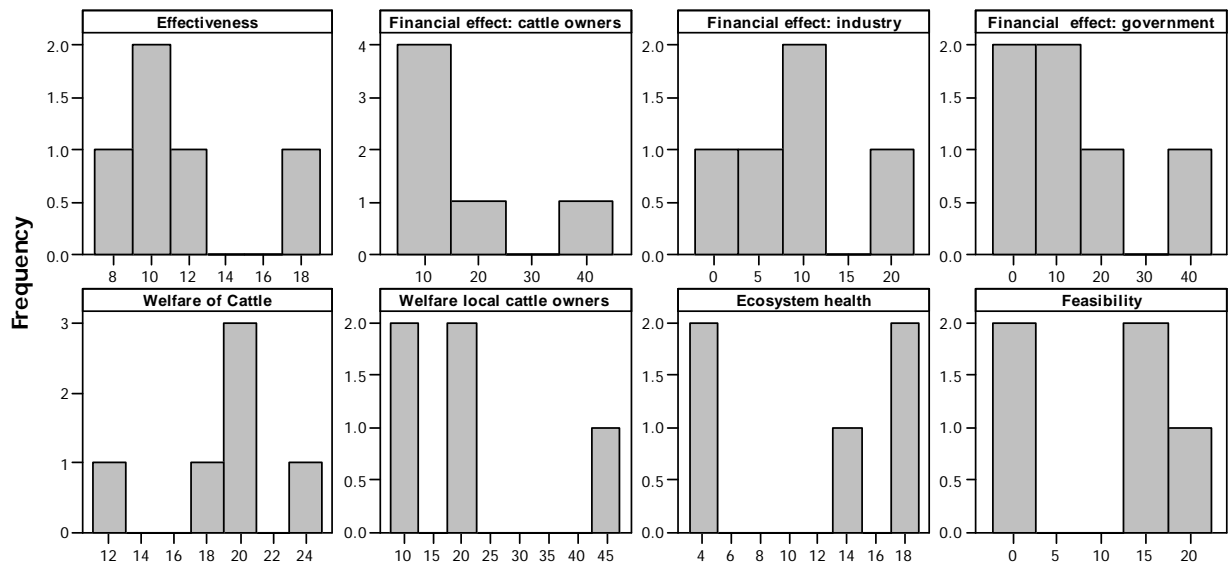Distributions of weights from livestock veterinarian group
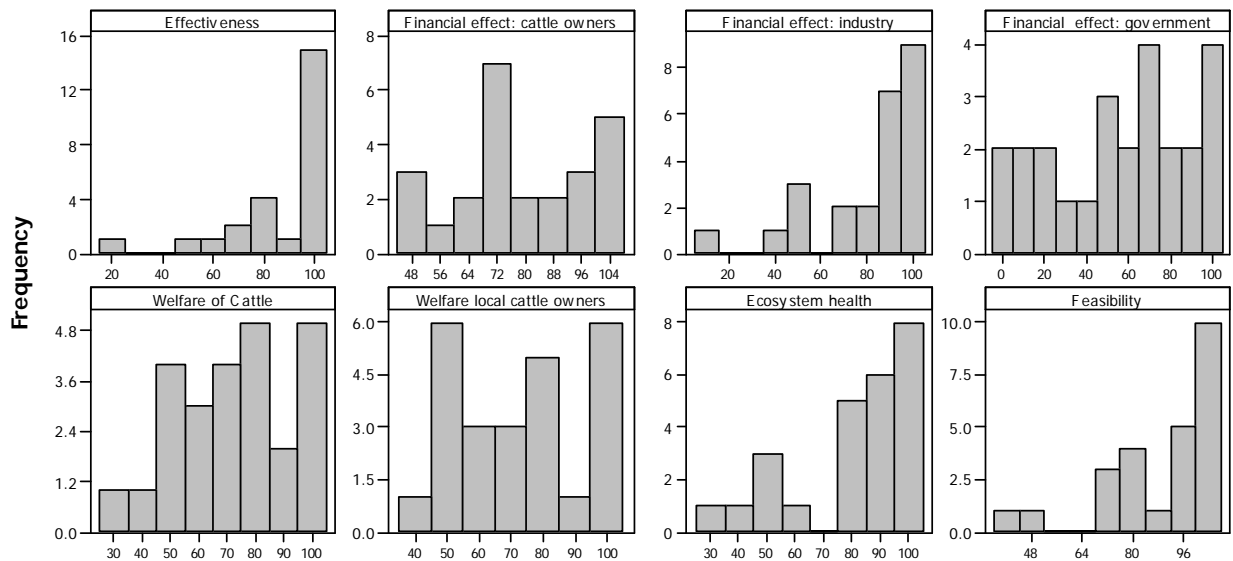
Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	18	98	100	Triangular	Triangular (18,98,100)
Financial effect: cattle owners	44	75	100	Uniform	Uniform (44,100)
Financial effect: cattle industry	5	90	100	Triangular	Triangular (5,90,100)
Financial effect: government	0	60	100	Uniform	Uniform (0,100)
Welfare of cattle	25	72	100	Uniform	Uniform (25,100)
Welfare of local cattle owners	35	70	100	Uniform	Uniform (35,100)
Ecosystem health	30	90	100	Triangular	Triangular (30,90,100)
Feasibility	43	97	100	Triangular	Triangular (43,97,100)

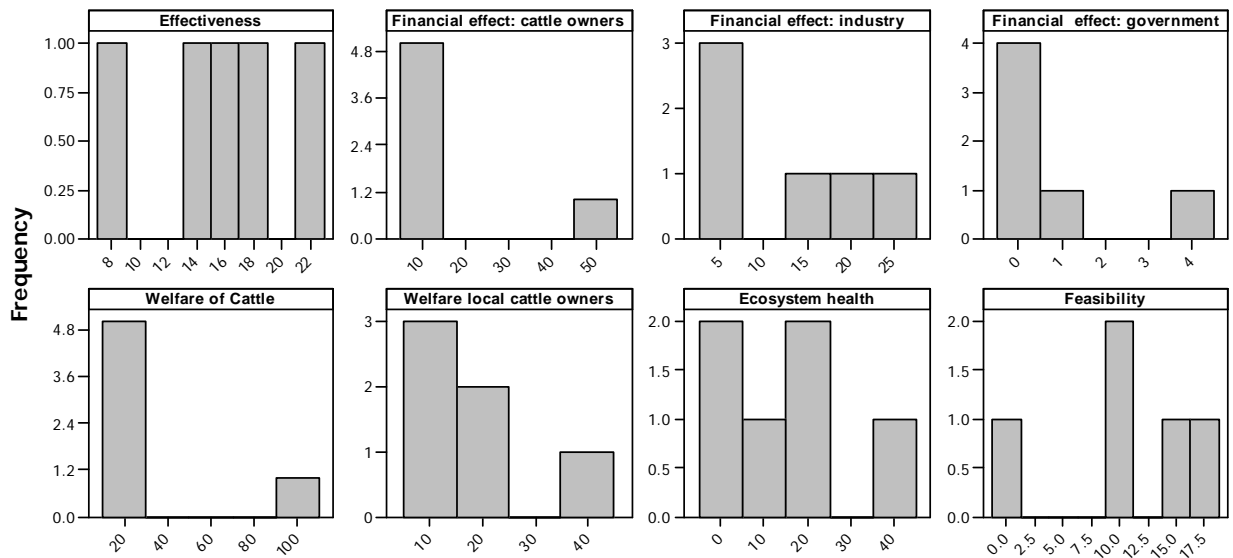Distributions of weights from state veterinarian group
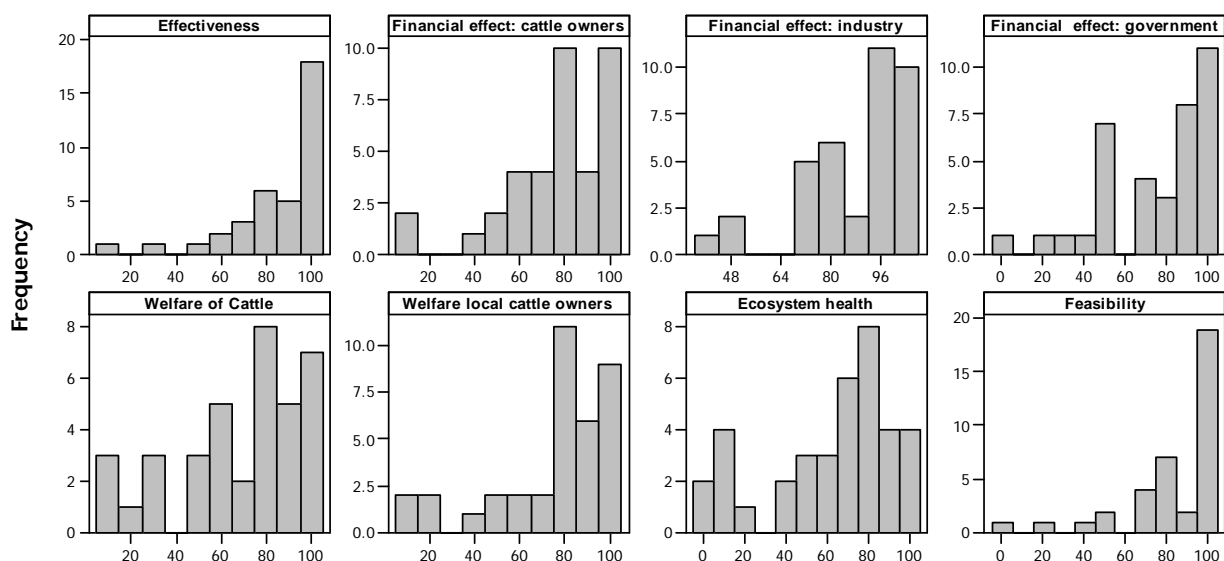
Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	5	94	100	Triangular	Triangular (5,94,100)
Financial effect: cattle owners	10	80	100	Triangular	Triangular (10,80,100)
Financial effect: cattle industry	40	95	100	Triangular	Triangular (40,95,100)
Financial effect: government	0	85	100	Triangular	Triangular (0,85,100)
Welfare of cattle	7	77	100	Triangular	Triangular (7,77,100)
Welfare of local cattle owners	5	80	100	Triangular	Triangular (5,80,100)
Ecosystem health	0	70	100	Uniform	Uniform (0,100)
Feasibility	0	96	100	Triangular	Triangular (0,96,100)

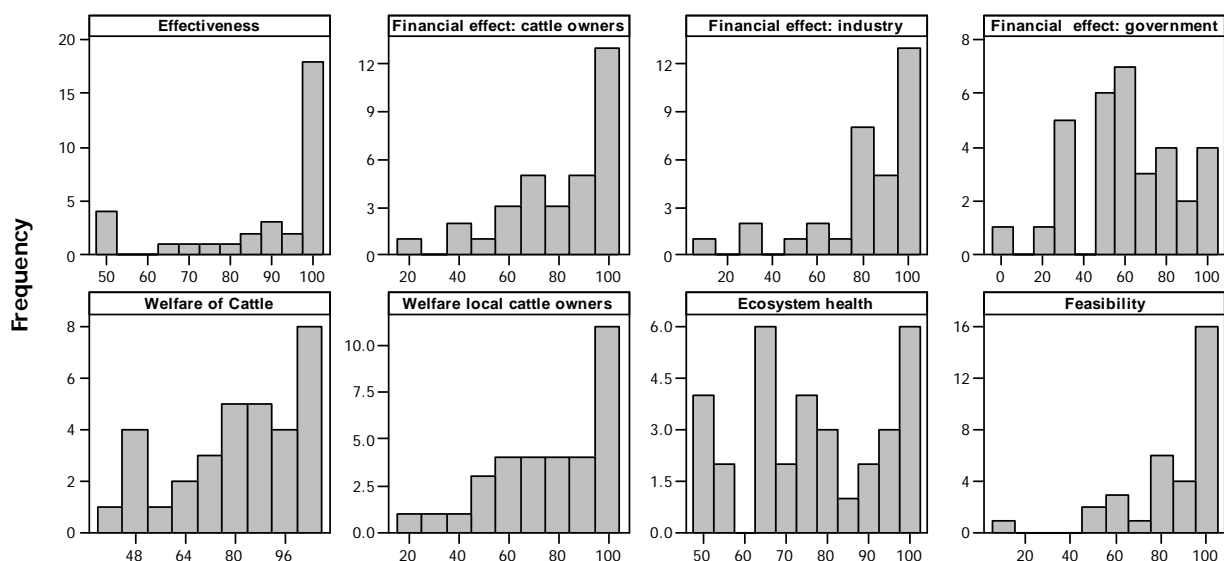Distributions of weights from animal health technician group

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	8	9	18	Triangular	Triangular (8,9,18)
Financial effect: cattle owners	5	13	40	Triangular	Triangular (5,13,40)
Financial effect: cattle industry	2	8	18	Triangular	Triangular (2,8,18)
Financial effect: government	1	12	40	Triangular	Triangular (1,12,40)
Welfare of cattle	11	20	25	Triangular	Triangular (11,20,25)
Welfare of local cattle owners	11	18	44	Triangular	Triangular (11,18,44)
Ecosystem health	3	14	18	Uniform	Uniform (3,18)
Feasibility	0	14	18	Uniform	Uniform (0,18)

Distributions of weights from cattle owner group

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	8	15	21	Uniform	Uniform (8,21)
Financial effect: cattle owners	5	9	45	Triangular	Triangular (5,9,45)
Financial effect: cattle industry	6	11	26	Triangular	Triangular (6,11,26)
Financial effect: government	0	0	4	Triangular	Triangular (0,0,4)
Welfare of cattle	14	21	100	Triangular	Triangular (14,21,100)
Welfare of local cattle owners	5	14	40	Triangular	Triangular (5,14,40)
Ecosystem health	0	15	40	Uniform	Uniform (0,40)
Feasibility	0	11	17	Triangular	Triangular (0,11,17)

Distributions of weights from public group

Criterion	Minimum	Median	Maximum	Distribution fitted	Distribution parameters
Effectiveness	48	99	100	Triangular	Triangular (48,99,100)
Financial effect: cattle owners	16	86	100	Triangular	Triangular (16,86,100)
Financial effect: cattle industry	10	88	100	Triangular	Triangular (10,88,100)
Financial effect: government	0	59	100	Triangular	Triangular (0,59,100)
Welfare of cattle	37	84	100	Triangular	Triangular (37,84,100)
Welfare of local cattle owners	16	75	100	Triangular	Triangular (16,75,100)
Ecosystem health	50	76	100	Uniform	Uniform (50,100)
Feasibility	10	90	100	Triangular	Triangular (10,90,100)