Tables

Table 1. Cattle herd demographics in Rukwa region

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Herd composition** | **Units** | **Nota-**  **tion** | **Small**  **(1 to 10)** | **Medium (11 to 49)** | **Large**  **(50 or more)** | **Nkundi Ranch** | **Kalambo Ranch** | **Kalambo Ranch blocks** |
| Total cattle per herd | Heads | NCT | Pert (1,5,10) | Pert (11,30,49) | Gamma (4,12,Shift(80)) | 714 | 660 | 11,761 |
| Proportion of cows | % | PC | 0.50 | 0.55 | 0.60 | 0.68 | 0.68 | 0.68 |
| Proportion of bulls | % | PB | 0.03 | 0.03 | 0.30 | 0.02 | 0.02 | 0.02 |
| Proportion of oxen for draft | % | PO | 0.20 | 0.30 | 0.05 | 0.04 | 0.04 | 0.04 |
| Proportion of steers | % | PS | 0.02 | 0.05 | 0.07 | 0.03 | 0.03 | 0.03 |
| Proportion of calves | % | PCV | 0.15 | 0.15 | 0.15 | 0.10 | 0.10 | 0.10 |
| Proportion of heifers | % | PH | 0.10 | 0.10 | 0.10 | 0.29 | 0.29 | 0.29 |

Table 2. Input variables used to estimate FMD production losses and expenditures

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Unit** | **Notation** | **Small farm (1-10 cattle)** | **Medium farm (11-49 cattle)** | **Large farm (≥50 cattle)** | **Ranches** | **Derived from** |
| **Morbidity** | | | | | | |  |
| Proportion of animals clinically affected (morbidity) | % | Mb | 0.20 | 0.20 | 0.20 | 0.20 | Official statistics |
| Duration of clinical symptoms in days | d | DO | Pert(7,20,90) | Pert(7,20,90) | Pert(7,20,90) | Pert(7,20,90) | (Mersie et al., 1992; Jemberu et al., 2014) and expert opinion |
| **Decrease in milk yield** | | | | | | |  |
| Proportion of cows in lactation, % | % | PL | 0.40 | 0.40 | 0.40 | 0.40 | (Barasa et al., 2008) |
| Proportion of clinically ill, lactating cows affected with milk loss | % | PMLA | 0.92 | 0.57 | 0.22 | 0.22 | (Mersie et al., 1992; Jemberu et al., 2014) and expert opinion |
| Number of days of acute FMD milk loss | d | NMLA | Pert (7,29,90) | Pert (7,26,63) | Pert (7,23,35) | Pert (7,23,35) | (Bayissa et al., 2011; Jemberu et al., 2014) |
| Reduced milk yield per affected cow and day of clinical illness | % | RMYA | Pert  (0.077,0.54,1) | Pert (0.077,0.54,1) | Pert (0.077,0.54,1) | Pert (0.077,0.54,1) | (Bayissa et al., 2011) and expert opinion |
| Proportion of acute FMD cases that develop chronic FMD | % | PCFMD | 0.13 | 0.13 | 0.13 | 0.13 | (Bayissa et al., 2011) |
| Number of days of chronic FMD affecting lactation | d | NMLC | Pert (61,116,458) | Pert (61,116,321) | Pert (61,116,183) | Pert (61,116,183) | (Bayissa et al., 2011) |
| Reduced milk yield per affected cow, chronic FMD | % | RMYC | 0.832 | 0.832 | 0.832 | 0.832 | (Bayissa et al., 2011) |
| Average milk yield per cow and year | l | MY | Pert (365,424,986) | Pert (365,424,986) | Pert (365,424,986) | Pert (365,424,986) | (Tolera and Abebe, 2007; Bayissa et al., 2011) |
| Milk price per litre milk | TSh | MP | 1,000 | 1,000 | 1,000 | 1,000 | Pers. comm. J. Mghwira |
| **Mortality and premature culling** | | | | | | |  |
| Young stock mortality, acute FMD | % | MTY | 0.08 | 0.05 | 0.03 | 0.03 | (Mersie et al., 1992; Jemberu et al., 2014) |
| Adult stock mortality, acute FMD | % | MTA | 0.00 | 0.00 | 0.00 | 0.00 | Expert opinion |
| Value calf | TSh | VCV | Pert (200k, 300k,400k) | Pert (200k, 300k,400k) | Pert (200k, 300k,400k) | Pert (200k, 300k,400k) | Assumption |
| Market value large cattle (bulls, oxen) per head | TSh | MVLC | 1,100,000 | 1,100,000 | 1,100,000 | 1,100,000 | Scoping study, expert opinion |
| Market value medium cattle (cows, small bulls or oxen) per head | TSh | MVMC | 600,000 | 600,000 | 600,000 | 600,000 | Scoping study, expert opinion |
| Market value small animals (small cows, heifers, young bulls) per head | TSh | MVSC | 400,000 | 400,000 | 400,000 | 400,000 | Scoping study, expert opinion |
| **Reproductive disorders** | | | | | |  |  |
| Proportion of cows and heifers pregnant | % | PP | 0.3 | 0.3 | 0.3 | 0.3 | (Barasa et al., 2008) |
| Abortion rate in clinically ill, pregnant cows | % | AR | 0.08 | 0.08 | 0.08 | 0.08 | (Ellis and Putt, 1981) |
| Cost per abortion | TSH | CA | Calf value plus treatment costs (assumed to be the same as for FMD ill animals getting veterinary treatment) | | | | Assumption |
| **Reduced growth** | | | | | | |  |
| Weight loss during outbreak | kg | wl | 23 | 23 | 23 | 23 | (James and Rushton, 2002) |
| Ratio live-weight to slaughter-weight \* proportion of lost weight not regained | n/a | rw | 0.13 | 0.13 | 0.13 | 0.13 | Assumption |
| Rate of weight loss | % | RWL | 3.07 | 3.07 | 3.07 | 3.07 | Calculated |
| Value per kg of beef meat | TSh | VM | 6500 | 6500 | 6500 | 6500 | Scoping study, expert opinion |
| **Loss of draft power** | | | | | | |  |
| Land area ploughed by ox pair per day | Ha | AP | 0.2 | 0.2 | n/a | n/a | (Okello et al., 2015) |
| Land area under crop, input variable | Ha | AC | 0.5 | 2 |  |  | Derived from (Okello et al., 2015; Anonymous, 2016) |
| Proportion of land used for use for each crop. | % | PLand | 0.5 | 0.5 | n/a | n/a | Assumption |
| Average number of days worked on own farm, 1 planting season | d | NDP | 8 | 8 | n/a | n/a | Derived from (Okello et al., 2015) |
| Rate of reduced income per day from crop due to late planting | % | RRI | 0.01357 | 0.01357 | n/a | n/a | Derived from (Nyagumbo, 2008) |
| Value of average rice crop per Ha | TSh | VRC | 5,735,740 | 5,735,740 | n/a | n/a | Ratin.net and (Anonymous, 2016) |
| Value of average maize crop per Ha | TSh | VMC | 2,581,965 | 2,581,965 | n/a | n/a | (Anonymous, 2016) |
| Time oxen cannot be used for traction due to FMD outbreak | days | DTL | Pert(7,25,84) | Pert(7,25,84) | n/a | n/a | (Mersie et al., 1992; Jemberu et al., 2014) |
| Oxen working time lost in days due to FMD | days | WTL | 8 | 8 | n/a | n/a | Assumption1 |
| Probability of outbreak during planting season | n/a | POP | 0.16 | 0.16 | 0.16 | 0.16 | Assumption2 |
| Average income from crop | TSh | IC | 2,079,426 | 8,317,705 | n/a | n/a | Assuming 50% rice, 50% maize |
| **Veterinary treatment rate** | | | | | | |  |
| % of clinically ill young stock getting vet treatment | % | VTRY | 0.2 | 0.3 | 0.4 | 0.4 | Assumption |
| % of clinically ill young stock getting vet treatment | % | VTRA | 0.1 | 0.15 | 0.2 | 0.2 | Assumption |
| Expenditures of veterinary treatment per clinical FMD case adult stock | TSh | EVY | 20,000 | 20,000 | 20,000 | 20,000 | Expert opinion |
| Expenditures of veterinary treatment per clinical FMD case young stock | TSh | EVA | 10,000 | 10,000 | 10,000 | 10,000 | Expert opinion |

1 This reflects the average number of working days during planting season. Oxen will be unfit to work for longer, but they are not needed for that many days

2 One planting season per year in study area. Duration of outbreak is 20 days. 20days/365 \*number of outbreaks per year (assumed to be three).

Table 3. Number of households keeping cattle in Rukwa region. MC = municipal council, DC = district council

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Number of households with cattle stratified per district** | **Unit** | **Notation** | **Small**  **(1 to 10)** | **Medium**  **(11 to 49)** | **Large**  **(50 or more)** |
| Sumbawanga MC | HH | HSBCMC | 7423 | 620 | 17 |
| Sumbawanga DC | HH | HSBCDC | 11746 | 1898 | 448 |
| Kalambo DC | HH | HK | 9722 | 1333 | 276 |
| Nkasi DC | HH | HN | 4264 | 1045 | 575 |
| *Total* | *HH* | *HT* | *33155* | *4896* | *1316* |

Table 4. Number of FMD susceptible animals in Rukwa region (based on 2015 data).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Nkasi district** | **Kalambo district** | **Sumbawanga**  **District** | **Sumbawanga**  **municipality** |
| Total number of goats | 58,214 | 18,445 | 48,733 | 12,857 |
| Total number of sheep | 21,771 | 2,064 | 9,674 | 1,034 |
| Total number of cattle | 124,282 | 65,112 | 164,795 | 34,480 |
| Total number of pigs | 3,228 | 12,918 | 18,521 | 9,077 |
| *Total number of animals* | *207,495* | *98,539* | *241,724* | *57,448* |

Table 5 Input variables used to estimate cost for FMD outbreak investigation and control

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** | **Unit** | **Notation** | **Value / distribution** | **Explanation / source** |
| ***For outbreak investigation, control and intervention (mass vaccination and surveillance)*** | | | | |
| Price per vaccine dose for cattle | TSh | PVC | Pert(4000,4700,5600) | Based on prices received from three different providers in Tanzania and prices reported by farmers and veterinary staff in Rukwa region. |
| Price per vaccine dose for sheep and goats | TSh | PVSG | Pert(1333,1567,1867) | Assumption that smaller dose needed for sheep and goats, i.e. 1/3 of a cattle price |
| Price per vaccine dose for pigs | TSh | PVSP | Pert(1333,1567,1867) | Assumption that smaller dose needed for pig, i.e. 1/3 of a cattle price |
| Price per needle | TSh | PN | 600 | Estimate by MALF and ZVC Sumbawanga staff based on market prices for needles |
| Number of animals vaccinated per needle | Heads | NAVN | 50 | Estimate by MALF and ZVC Sumbawanga staff based on local vaccination experience |
| Price syringe | TSh | PS | 65,000 | Estimate by MALF and ZVC Sumbawanga staff based market prices for syringes |
| Number of animals vaccinated per syringe | Heads | NAVS | 7,500 | Estimate by MALF and ZVC Sumbawanga staff based on local vaccination experience |
| Price for identifying animal following injection | TSh | PMAs | 60 | Brush was considered the best option with purchasing tins of non-toxic water-based paint of 4 kg that would last for 500 animals. Estimate by MALF and ZVC Sumbawanga staff |
| Cost for sampling | TSh | CS | 10,000 | The average shipping costs to the laboratory were estimated by MoLF staff to be TSh 10,000 per package. |
| Costs for laboratory testing | TSh | CL | 20,800 | Testing suspected samples by PCR and virus isolation |
| Fuel per day | litre | Fd | 50 | Estimate by MALF and ZVC Sumbawanga staff |
| Price of fuel per litre | TSh | PF | 2,000 | <https://www.globalpetrolprices.com/> |
| ***For intervention (mass vaccination and surveillance) only*** | | | | |
| Number of injections per bovine animal per year/ | doses | dC | Uniform (2, 3) | The Kenya Veterinary Vaccines Production Institute that exports FMD vaccines to Tanzania recommends the following: revaccination every four months and for better protection every 4 months. |
| Number of injections per goat per year | doses | dG | 1 | Recommended practice by ZVC Sumbawanga |
| Number of injections per sheep per year | doses | dS | 1 | Recommended practice by ZVC Sumbawanga |
| Number of injections per pig per year | doses | dP | 1 | Recommended practice by ZVC Sumbawanga |
| Number of animals vaccinated per team and year | heads | NV | 123000 | 246 working days (i.e. possible vaccination days taking into account back holidays in Tanzania and weekends) per year with an average of 500 animals that can be vaccinated per day (estimate by MALF and ZVC Sumbawanga staff) |
| Costs of equipment per team | TSh | CE | 275,000 | Boots at TSh 15,000 per pair and overcoats at TSh 50,000 per piece; icepacks at TSh 178.6 per piece, coolboxes at TSh 3,571 per piece. All data from MSD. |
| Number of working days | days | NWD | 246 | Calculation: 52 weeks multiplied by 5 working days minus 2 days for Christmas, 3 days for Easter and 9 days of Public holidays. |
| Number of sets of tyres needed per year | set | NT | 3 | Estimate by MALF and ZVC Sumbawanga staff |
| Price per set of tyres | TSh | PT | 500,000 | Estimate by MALF and ZVC Sumbawanga staff |
| Number of car services needed per year | service | NCS | 2 | Estimate by MALF and ZVC Sumbawanga staff |
| Price per car service | TSh | PCS | 1,000,000 | Estimate by MALF and ZVC Sumbawanga staff |

Table 6 Cold chain facilities requirements for FMD mass vaccination campaign in Rwkua region Tanzania

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **District/Office** | **Refrigerator** | **Deep freezer (258 litres)** | **Cool boxes** | **Ice packs** |
| Sumbawanga DC | 0 | 0 | 4 | 16 |
| Sumbawanga MC | 0 | 0 | 4 | 16 |
| Kalambo | 1 | 1 | 4 | 16 |
| Nkasi | 1 | 1 | 4 | 16 |
| ZVC Sumbawanga | 3 | 3 | 12 | 48 |
| **Prices per piece (in TSh)** | 500k | 750k | 100k | 20K |

Table 7. Inputs used to estimate the surveillance awareness and FMD recognition training costs. DC=district council, MC=municipal council, DSA=daily subsistence allowance

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Unit** | **Value** | **Description** |
| Number of trainers | trainers | 3 | Trainers: subject matters specialists; animal health, production, marketing, etc. from the district teams |
| Number of trainees per training | trainees | 20 | 10 farmers, 2 traders, 2 community animal health workers, 5 processors/retailers |
| DSA trainers | TSh | 30,000 | Reflects the location of the training, i.e. district headquarters |
| DSA senior trainers | TSh | 45,000 | Reflects the location of the training, i.e. district headquarters, and the level of seniority |
| DSA stakeholder trainees | TSh | 50,000 | 30k plus their bus fare twice (10k max per bus fare) |
| DSA government trainees | TSh | 110,000 | 90k for veterinary officers attending training plus their bus fare twice (10k max per bus fare) |
|  |  |  |  |
| Cost of consumables for training per trainee | TSh | 10,000 | Pictorials, manuals, flipchart, videos, brochures and leaflets |
| Overhead projector hire per day | TSh | 50,000 | Regular ZVC Sumbawanga rate |
| DSA driver | TSh | 50,000 | Regular ZVC Sumbawanga rate |
| DSA communications leader | TSh | 80,000 | Regular ZVC Sumbawanga rate |
| DSA communications officer | TSh | 60,000 | Regular ZVC Sumbawanga rate |
| DSA village leaders | TSh | 10,000 | Regular ZVC Sumbawanga rate |
| Poster design and printing | TSh | 2,000 | Estimate MALF staff |
| Short radio message broadcast (per message) | TSh | 60,000 | Estimate MALF staff |
| Long radio message broadcast (per messages) | TSh | 550,000 | Estimate MALF staff |

Table 8. Inputs used to estimate the equipment costs for the surveillance stations

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Unit** | **Value** | **Number needed** |
| Price mobile phone | TSh | 500,000 | One per station, replacement needed every two years |
| Average price data airtime per year | TSh | 240,000 | One package per station every year |
| Price of power station | TSh | 150,000 | One per station, replacement needed every two years |
| Price computer, scanner, external drive | TSh | 4,400,000 | 8 sets in total distributed over the 10 years to replace old items |
| Price 4 Wheel Drive Car | TSh | 80,000,000 | One per station, initial investment, no replacement needed |
| Service and tyres costs per year | TSh | 3,500,000 | One unit per station and year replacement |

Table 9 Mean (5% and 95% confidence interval) cost avoided (in million TSh and USD) following intervention in Rukwa region

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **All susceptible animals vaccinated** | | | | | | | | | | | |
|  |  | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** |
| **Avoided outbreak** | **TSh m** | **61**  (54 – 69) | **61**  (54 – 69) | **61**  (54 – 69) | **61**  (54 – 69) | **61**  (54 – 69) | **61**  (54 – 69) | **61**  (54 – 69) | **61**  (54 – 69) | **61**  (54 – 69) | **61**  (54 – 69) |
| **costs (undiscounted)** | *USD m* | **0.027**  (0.024 – 0.031) | **0.027**  (0.024 – 0.031) | **0.027**  (0.024– 0.031) | **0.027**  (0.024– 0.031) | **0.027**  (0.024– 0.031) | **0.027**  (0.024– 0.031) | **0.027**  (0.024– 0.031) | **0.027**  (0.024– 0.031) | **0.027**  (0.024– 0.031) | **0.027**  (0.024– 0.031) |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **Avoided outbreak** | **TSh m** | **61**  (54 – 69) | **60**  (52 – 67) | **58**  (51 – 65) | **56**  (49 – 63) | **54**  (48 - 61) | **53**  (46 – 59) | **51**  (45 – 58) | **50**  (44 – 56) | **48**  (42 – 54) | **47**  **(41 – 53)** |
| **costs (discounted)** | *USD m* | **0.027**  (0.024 – 0.031) | **0.026**  (0.022 – 0.029) | **0.025**  (0.022 – 0.028) | **0.025**  (0.022 – 0.028) | **0.025**  (0.021 – 0.027) | **0.023**  (0.020 – 0.027) | **0.023**  (0.020 – 0.026) | **0.023**  (0.020 – 0.026) | **0.022**  (0.019 – 0.025) | **0.021**  (0.019 – 0.024 |
| **Only cattle vaccinated** | | | | | | | | | | | |
|  |  | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** |
| **Avoided outbreak** | **TSh m** | **37**  (32 – 41) | **37**  (32 – 41) | **37**  (32 – 41) | **37**  (32 – 41) | **37**  (32 – 41) | **37**  (32 – 41) | **37**  (32 – 41) | **37**  (32 – 41) | **37**  (32 – 41) | **37**  (32 – 41) |
| **costs (undiscounted)** | *USD m* | **0.017**  (0.014 – 0.019) | **0.017**  (0.014 – 0.019) | **0.017**  (0.014 – 0.019) | **0.017**  (0.014 – 0.019) | **0.017**  (0.014 – 0.019) | **0.017**  (0.014 – 0.019) | **0.017**  (0.014 – 0.019) | **0.017**  (0.014 – 0.019) | **0.017**  (0.014 – 0.019) | **0.017**  (0.014 – 0.019) |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **Avoided outbreak** | **TSh m** | **37**  (32 – 41) | **36**  (31 – 40) | **35**  (30 – 39) | **34**  (29 – 38) | **33**  (29 – 37) | **32**  (28 – 36) | **31**  (27 – 35) | **30**  (26 – 34) | **29**  (25 – 33) | **28**  **(25 – 32)** |
| **costs (discounted)** | *USD m* | **0.017**  (0.014 – 0.019) | **0.016**  (0.014 – 0.018) | **0.016**  (0.014 – 0.018) | **0.015**  (0.013 – 0.017) | **0.015**  (0.013 – 0.017) | **0.014**  (0.013 – 0.017) | **0.014**  (0.013 – 0.017) | **0.013**  (0.013 – 0.017) | **0.013**  0.013 – 0.017) | **0.013**  (0.013 – 0.017) |

Table 10. Mean (5% and 95% confidence interval) estimated costs for the vaccination campaign in Rukwa region in million TSh and USD.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **All susceptible animals vaccinated** | | | | | | | | | | | |
|  |  | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** |
| Vaccines | TSh m | **1953**  (1751-2165) | **5182**  (4621- 5772) | **6407**  (5671- 7185) | **6601**  (5785- 7474) | **6803**  (5890- 7783) | **7011**  (5989- 8115) | **7227**  (6081- 8479) | **7450**  (6171 – 8855) | **7681**  (6267- 9255) | **7920**  (6360- 9678) |
| Consumables | TSh m | **53**  (53 – 54) | **116**  (112 – 120) | **141**  (134 – 149) | **145**  (135 – 156) | **150**  (137 – 163) | **154**  (138 – 171) | **159**  (140 – 179) | **163**  (141 – 187) | **168**  (143 – 196) | **173**  (145 – 205) |
| DSA for all teams | TSh m | **291**  (286 – 297) | **763**  (736 – 791) | **941**  (891 – 993) | **970**  (901 – 1041) | **999**  (911 – 1092) | **1030**  (921 – 1145) | **1062**  (932 – 1200) | **1094**  (942 – 1259 | **1128**  (953 – 1320) | **1163**  (964 – 1384) |
| Vehicle/transport | TSh m | **107**  (105 – 109) | **281**  (731 – 291) | **347**  (328 – 366) | **357**  (332 – 384) | **368**  (336 – 402) | **379**  (339 – 422) | **391**  (343 – 442) | **403**  (347 – 464) | **416**  (351 – 486) | **429**  (355 – 510) |
| **Total vaccination**  **costs (undiscounted)** | **TSh m** | **2005**  (2202 – 2619) | **6341**  (5764 – 6950) | **7836**  (7060 – 8655) | **8074**  (7191 - 9010) | **8320**  (7312 – 9396) | **8575**  (7419 – 9814) | **8838**  (7533 – 10251) | **9111**  (7649 – 10720) | **9393**  (7756 – 11214) | **9685**  (7864 – 11736) |
| *USD m* | ***1.08***  *(0.99 – 1.18)* | ***2.85***  *(2.59 – 3.13)* | ***3.53***  *(3.18 – 3.89)* | ***3.63***  *(3.24 – 4.05)* | ***3.74***  *(3.29 – 4.23)* | ***3.86***  *(334 – 3.42)* | ***3.98***  *(3.39 – 4.61)* | ***4.10***  *(3.44 – 4.82)* | ***4.23***  *(3.49 – 5.05)* | ***4.36***  *(3.54 – 5.28)* |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **Total vaccination**  **costs (discounted)** | **TSh m** | **2405**  (22.02 – 2619) | **6156**  (5596 – 6747) | **7386**  (6655 – 8158) | **7389**  (6581 – 8245) | **7392**  (6497 – 8348) | **73.97**  (6400 – 8465) | **7402**  (6309 – 8585) | **7408**  (6219 – 8716) | **7415**  (6122 – 8852) | **7423**  (6027 – 8994) |
| *USD m* | ***1.08***  *(0.99 – 1.18)* | ***2.77***  *(2.52 – 3.04)* | ***3.32***  *(2.99 – 3.67)* | ***3.32***  *(2.96 – 3.71)* | ***3.33***  *(2.92 – 3.76)* | ***3.33***  *(2.88 – 3.81)* | ***3.33***  *(2.84 – 3.86)* | ***3.33***  *(2.80 – 2.92)* | ***3.34***  *(2.76 – 3.98)* | ***3.34***  *(2.71 – 4.05)* |
| **Only cattle vaccinated** | | | | | | | | | | | |
|  |  | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** |
| **Vaccines** | TSh m | **1515**  (1202 – 1850) | **4062**  (3213 – 4979) | **5028**  (3957 – 6184) | **5180**  (4047 – 6408) | **5338**  (4143 – 6644) | **5502**  (4236 – 6917) | **5671**  (4320 – 7190) | **5846**  (4402 – 7482) | **6028**  (4489 – 7792) | **6215**  (4566 – 8122) |
| **Consumables** | TSh m | **40**  (35 – 45) | **82**  (68 – 96) | **100**  (83 – 119) | **103**  (84 – 123) | **106**  (86 – 128) | **109**  (88 – 133) | **113**  (89 – 138) | **116**  (91 – 144) | **119**  (93 – 150) | **123**  (94 – 156) |
| **DSA for all teams** | TSh m | **198**  (163 – 234) | **532**  (436 – 630) | **659**  (537 – 785) | **678**  (549 – 815) | **699**  (561 – 847) | **721**  (572 – 882) | **743**  (583 – 919) | **766**  (594 – 959) | **790**  (604 – 1000) | **814**  (615 – 1043) |
| **Vehicle/transport** | TSh m | **73**  (60 – 86) | **196**  (161 – 232) | **243**  (198 – 289) | **250**  (202 – 300) | **258**  (207 – 312) | **266**  (211 – 325) | **274**  (215 – 339) | **282**  (219 – 353) | **291**  (223 – 368) | **300**  (226 – 384) |
| **Total vaccination**  **costs (undiscounted)** | **TSh m** | **1826**  (1464 – 2208) | **4872**  (3885 – 5915) | **6028**  (4782 – 7354) | **6212**  (4896 – 7618) | **6402**  (5013 – 7915) | **6597**  (5124 – 8228) | **6800**  (5222 – 8565) | **7010**  (5326 – 8916) | **7227**  (5421 – 9288) | **7452**  (4414 – 9683) |
| *USD m* | ***0.82***  *(0.66- 0.99)* | ***2.19***  *(1.75 – 2.66)* | ***2.71***  *(2.15 – 3.31)* | ***2.80***  *(2.20 – 3.43)* | ***2.88***  *2.26 – 3.56)* | ***2.97***  *(2.31 – 3.70)* | ***3.06***  *(2.35 – 3.85)* | ***3.15***  *(2.40 – 4.01)* | ***3.25***  *(2.44 – 4.18)* | ***3.35***  *(2.48 – 4.36)* |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **Total vaccination**  **costs (discounted)** | **TSh m** | **1826**  (1464 – 2208) | **4730**  (3772 – 5743) | **5682**  (4508 – 6932) | **5685**  (4480 – 6972) | **5688**  (4454 – 7033) | **5691**  (4420 – 7097) | **5695**  (4373 – 7173) | **5700**  (4330 – 7249) | **5705**  (4280 – 7332) | **5711**  (4226 – 7421) |
| *USD m* | ***0.82***  *(0.66- 0.99)* | ***2.13***  *(1.70 – 2.58)* | ***2.56***  *2.03 – 3.12)* | ***2.56***  *(2.02- 3.14)* | ***2.56***  *2.00 – 3.16)* | ***2.56***  *(1.99 – 3.19)* | ***2.56***  *(1.97 – 3.23)* | ***2.56***  *(1.95 – 3.26)* | ***2.57***  *(1.93 – 3.30)* | ***2.57***   * 1. *– 3.34)* |

Table 11. Total estimated costs for the surveillance activities in Rukwa region in million TSh and USD.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** |
| Training of stakeholders | TSh m | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| Village communication visits | TSh m | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| Radio and poster messaging | TSh m | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 |
| Training of officials | TSh m | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Equipment | TSh m | 413 | 10 | 4 | 1 | 4 | 10 | 13 | 1 | 4 | 1 |
| Sampling and testing surv. | TSh m | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| **Total surveillance costs** | **TSh m** | **554** | **151** | **145** | **142** | **145** | **151** | **154** | **142** | **145** | **142** |
| **(undiscounted)** | USD m | 0.249 | 0.068 | 0.065 | 0.064 | 0.065 | 0.068 | 0.069 | 0.064 | 0.065 | 0.064 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **Total costs surveillance (discounted)** | **TSh m** | **554** | **146** | **137** | **130** | **129** | **130** | **129** | **115** | **115** | **109** |
|  | USD m | 0.249 | 0.066 | 0.062 | 0.058 | 0.058 | 0.059 | 0.058 | 0.052 | 0.052 | 0.049 |

Table 12 Current situation and main challenges for an FMD control program to be feasible

|  |  |
| --- | --- |
| **Feasibility considerations** | **Current situation and main challenges at the time of the study** |
| Vaccine supply | • Vaccination is left to the individual farmers and the private sector. As such the market for FMD vaccines is thin on both the supply and demand side, with demand peaks occurring during outbreaks.  • Six private distribution companies were mentioned during the interviews. These companies have the capacity to import the vaccines if asked to do so, but they would only import on demand. Government requirements when they arise, would normally be met through tendering and competitive bidding by those who have the capacity to produce and import the vaccine.  •Most vaccines are not registered for sale and use in Tanzania. Therefore, if a vaccine that is not register is required, justification for imports have to be made in an application to get an importation permit to the TFDA through the DVS.  •The two main FMD vaccine producers in the region are the Botswana Vaccine Institute (BVI) and the Kenya Veterinary Vaccine Production Unit (KeVeVAP). For a large project contractual arrangements have to be made to procure the required quantities in a timely manner. The mechanism of choice would most likely be a public tendering process. |
| Staffing | As part of the CBA presented here it was assumed, based on discussion with stakeholders that most of the activities to be conducted as part of the surveillance and vaccination campaign were to be undertaken by the current staffing as part of their regular duties. However, some of the activities (e.g. vaccination campaigns) would require most of the staff time and if another animal health event or outbreak was to happen more staff will need to be hired. |
| Animal traceability | • Tanzania has been implementing relevant measures to establish a Livestock Identification and Traceability System (LITS) and there is appropriate legislation and regulations to guide both registration and traceability in the proposed FMD free zone.  • The LITS has been piloted in three districts (Muheza, Bagamoyo, Kibaha urban and rural), a database is in place and ready to be established in other districts. Main challenges found as part of the pilot were:   * Funding was the main limiting factor. Sharing the cost between private and public stakeholders is a question under discussion as some farmers might be willing to make small contribution. * Pastoralists were not in favor of their animals being branded; in particular the Maasai and the Barbaig. The Sukuma (who tend to be agropastoralists), did not object to identification during the pilot testing phase, but were not willing to bear the full cost of identification.   The LITS system had not yet been rolled out in Rukwa region. |
| Trade benefits | At the time of the study the export trade in Tanzania was small scale and mainly regional live animal export. Potential to export beef to higher value markets in the near future seemed unlikely. |
| General implementation risks | •An associated export abattoir and export premium market is required, before the control program starts, to provide the incentives for control.  •Based on previous experiences and attempts to control FMD in Tanzania, demonstration of technical possibilities and cost effectiveness of the control program is not enough to guarantee the program would be ahead and materialise. People willingness to implement it, as well as staff and institution continuity and support are required to follow through the process. |