

Review

Determinants and Control Strategies of FMD in Japan and Indonesia

¹Tri Anggraeni Kusumastuti, ²Ikuo Kobayashi, ³Ahmad Juwari and ¹Lovin Dika Antari

¹Department of Livestock Social Economics, Faculty of Animal Science, Universitas Gadjah Mada, Indonesia

²Division of Livestock Production Research and Support, Center for Animal Disease Control, University of Miyazaki, Japan

³Department of Leadership and Policy Innovation, Graduate School of Universitas Gadjah Mada, Indonesia

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Corresponding Author:

Lovin Dika Antari

Department of Livestock Social Economics, Faculty of Animal Science, Universitas Gadjah Mada, Indonesia

Email: lovindikaantari@mail.ugm.ac.id

Abstract: Foot and mouth disease is an infection caused by the aphthae epizootica virus which is easily transmitted to cloven-hoofed animals, including cattle, sheep, goats, and pigs. Over the last 25 years, the disease has widely spread in Asian countries, including Japan in 2010 and Indonesia in 2022. We aimed to review the determinants and control strategy for handling FMD in Japan and Indonesia based on aspects of financial policy and the coordination relationship between central and local in each country. Concerning policy response, we find that the two countries have similar characteristics; restrictions on livestock traffic, culling dead livestock, and vaccination but there are differences in tightening the policy response which has implications for the spread of the FMD virus. In Japan, it only attacked one area in Miyazaki prefecture, while in Indonesia FMD has spread to 27 out of 38 provinces. In the financial aspect, the spread of FMD in each of these countries has an impact on the treatment budget in Indonesia which is larger (0.23% of GDP) than in Japan (0.02% of GDP). Both countries have different budget schemes. During the first outbreak, local governments in Indonesia relied on unexpected spending budgets to cope with the outbreak, while in Japan, government financial support tended to be structured from the central government (MAFF) to support the effectiveness of handling the affected areas in Miyazaki. On the aspect of central and local government relations, the Indonesian government tends to be centralized in dealing with the impact of FMD because of the limited budgets and a lack of technical preparation and infrastructure for handling FMD in the local governments. However, Japanese local governments tend to have greater authority and are organized to carry out detection so that they respond quickly through policies, surveys, inspections, and even have an FMD vaccination team. Besides the above aspects, Japan and Indonesia have different livestock scale conditions and local institutional support, which also affect the success of both countries' policies to control FMD viruses.

Keywords: Central and Local Government, Foot and Mouth Disease (FMD), Policy Response

Introduction

Foot and Mouth Disease (FMD) is a viral disease caused by the Aphthae epizootica virus and is one of the most contagious diseases in livestock with the potential for high economic losses (RSPH, 2021). The disease attacks ruminant animals including cattle, sheep, goats,

and pigs can spread quickly, and is characterized by paralysis and lack of enthusiasm in pigs, mouth sores in cattle, and several mild symptoms, especially in sheep and goats (Alexandersen *et al.*, 2003).

Every country needs to implement policies for handling FMD to minimize or even eliminate the impact of economic losses. Policymakers need a variety of

interventions to control the pandemic in an uncertain situation (Probert *et al.*, 2018).

Several countries that have experienced extraordinary incidents of FMD, such as the UK, have taken policies such as tightening sanitation and/or vaccination. The UK was the first country to implement a policy of limited animal slaughter mobility at the end of the 19th century and achieved success despite being constrained by the scale of slaughter exceeding organizational limits and capacity. (Paton *et al.*, 2009). Furthermore, during the FMD outbreak in 2010, the UK took steps including banning the feeding of scrap/waste to pigs, preventing sheep movement within five days of the previous move, and declaring an immediate nationwide halt to animal movements immediately after the first outbreak confirmed (Paton *et al.*, 2009).

Apart from Europe/UK, the FMD outbreak has also spread to Asian countries. Japan and Indonesia are two archipelagic countries that have increasing livestock capacity over time. The livestock industry in Japan is an important sector covering one-third of agricultural production in Japan or around 3.2 trillion yen in 2020 (MAFF, 2021). Table 1 shows a comparison of livestock capacities in Japan and Indonesia.

Indonesia and Japan have different socio-economics of livestock. The contribution of the agriculture, forestry, and fisheries sectors, which include livestock, to Gross Domestic Product (GDP), shows that Indonesia has a fairly high proportion with 12.4% of GDP with a value of 1,186 trillion USD, while in Japan, although the value is much greater than Indonesia with 4,646 trillion USD has a contribution to GDP of only 1% (World Bank, 2023). Japan's largest economic contribution is in the service and industrial sectors.

Specifically in ruminant animal husbandry, Japan has an advanced average business scale with a business model that includes average ownership of 98 dairy cattle and 62 beef cattle (MAFF, 2022). The average ownership of cattle in Indonesia is relatively smaller with one to three cows accounting for 95% of the total farmers (Tawaf, 2017). Several areas in Japan that are centers for cattle include Hokkaido, Iwate, Tochigi, Gunma, Kumamoto, Miyazaki, and Kagoshima prefectures. Meanwhile in Indonesia, the provinces of East Java, Central Java, South Sulawesi, and West Nusa Tenggara are the regions with the highest cattle populations. Regarding the FMD virus spreading, the strategies of the two countries are different because they have different livestock characteristics. In Japan, efforts to avoid endemics can be made by culling livestock because livestock is only distributed on large farms. Meanwhile, in Indonesia, livestock distribution tends to be evenly distributed, especially on the island of Java, making it impossible to avoid an FMD endemic. Meanwhile, livestock culling is carried out on a limited basis with the potential for very large losses.

Table 1: Comparison of the livestock populations of Japan and Indonesia in 2021 (BPS and MAFF)

Animal	Japan	Indonesia
Beef cattle	2.605.000	18.053.710
Dairy cattle	1.356.000	578.579.000
Pig	9.290.000	8.010.000
Total	13.251.000	26.642.289

In the last case, the emergence of FMD extraordinary events, Japan and Indonesia have different ranges. In April 2010, an FMD outbreak was reported in Miyazaki Prefecture, Japan after previously appearing in 2000 (three farms in Miyazaki and a farm in Hokkaido were infected with FMD) (Sugiura *et al.*, 2001). As of July 2010 (the last outbreak), 292 confirmed cases were reported while around 290,000 were culled. (Muroga *et al.*, 2012). In 2017, Hayama *et al.* calculated direct losses to the livestock industry at 51.2 billion yen, while indirect losses reached 25.5 billion yen, while the costs incurred to control the outbreak reached 8.2 billion yen, so the total costs incurred as a result of the FMD reached 85 billion yen (Hayama *et al.*, 2017).

Meanwhile in Indonesia, the last extraordinary incident appeared in March 2022 in East Java since the last appearance was in 1986. As of mid-October, 2022 FMD had spread to 15 provinces, where 557,804 livestock were infected, 9,580 died and 12,451 were subjected to conditional slaughter. (Ministry of Agriculture, 2022). Meanwhile, the death rate for adult livestock is 1-3%, young livestock (1-5 months) is 50% and the recovery rate is 98% (AIHSP, 2021). If we look at the losses, research conducted by Sudrajad (Tawaf, 2017) estimated that FMD which spreads nationally will incur quite large costs reaching 22.59 trillion rupiah or the equivalent of 1.4 billion USD (not including the costs of handling and eradicating it).

The costs that must be incurred to overcome FMD are an indication of how policies at both national and local levels to overcome the FMD outbreak are implemented. This policy will be more effective if the policy objective is achieved to overcome the FMD outbreak which is economically detrimental. This review explains how both countries responded through policy by not necessarily looking at the technical efforts of each country but also examining institutional aspects (national/regional) and the economic conditions of the people, especially in areas directly affected. The purpose of the review was to determine the policy response in dealing with the FMD outbreak in Indonesia and Japan, both strategy and the role of central and local governments, as well as to determine the socioeconomic characteristics of livestock, including livestock ownership and its contribution to national income.

Many previous studies on FMD have been conducted, one of which is a study conducted by Seitzinger *et al.* which is about a strategic response in dealing with livestock disease outbreaks including FMD, Seitzinger *et al.* mentioned the importance of a strategic response in dealing with FMD in order to minimize losses in Australia (Seitzinger *et al.*, 2022). In addition, another study entitled "Foot and Mouth Disease (FMD) Incidence in Cattle and Buffaloes and its associated farm-level Economic Costs in Endemic India" (Govindaraj *et al.*, 2021). The study contains the losses experienced by India during the FMD outbreak and strategic handling responses that can reduce losses due to FMD. Sansamur *et al.* also conducted a similar study on the factors that caused the spread of FMD in Chiang Mai, Thailand (Sansamur *et al.*, 2020). In Japan itself, studies on FMD have been conducted by Hayama *et al.* (2017); Probert *et al.* (2018). Meanwhile, in Indonesia, the potential economic impact has been studied by Tawaf (2017). In addition, research that focuses on comparisons between Japan and Indonesia has never been conducted. A comparison of the two countries in Asia was previously researched by Yagasaki in preventing FMD in Japan and Chinese Taipei in 1999. There has been no research on the response of both institutions and society (social and economic) to see FMD handling policies in two countries, Indonesia and Japan.

This review used secondary data from both the Ministry of Agriculture in Indonesia, the Ministry of Agriculture, Forestry and Fisheries (MAFF) in Japan, and also from Miyazaki prefecture. The quantitative data obtained were then analyzed and described for both the financial impact of FMD and the role of central-local governments in controlling the FMD virus. Meanwhile, the results of the analysis are presented in tables and maps to illustrate the impact and distribution of FMD.

Distribution of the Latest FMD Outbreak in Both Countries

Since its first appearance in March 2022, the FMD outbreak in Indonesia to date has spread to 27 out of 38 provinces (Fig. 1). These provinces include West Java, East Java, DI Yogyakarta, Riau, West Sulawesi, Central Sulawesi, South Sulawesi, Southeast Sulawesi, Bangka Belitung, Aceh, Riau Islands, North Sumatra, West Sumatra, South Sumatra, Bengkulu, Jambi, Lampung, West Kalimantan, Central Kalimantan, East Kalimantan, South Kalimantan, North Kalimantan, West Nusa Tenggara, Banten, Central Java, Bali and DKI Jakarta.

Indonesia has its zoning divisions relating to the spread of FMD between districts/cities as stated in

Circular Letter Number 4 of 2022 concerning control of zoning-free foot and mouth Disease-prone animal traffic (STPPMDK, 2022a). Red zone districts/cities are those where FMD cases have been recorded and were found on the red zone Island, whereas if the district/city has not been registered and FMD cases have been found but are on the red zone island then it becomes the yellow zone. Apart from that, there is also a green zone where the district/city did not record any cases. The regulation also states that there are red and green zone island categories. Green zone island is an island whose administrative area has not recorded any FMD cases, while red zone island has recorded FMD cases in its administrative area.

Meanwhile, in Japan as shown in Fig. 1, the spread of the outbreak which began in April 2020 was only in Miyazaki Province/Prefecture in the regions/cities Miyazaki City, Kunitomi, Ebino, Takanebe, Shintomi, Kijo, Kawaminami, Tsuno, Hyuga, Saito, and Miyakonojo. Japan implemented a zoning policy within a 10 km radius from the emergence of cases to carry out livestock culling.

Response and Handling of FMD in Japan and Indonesia

In general, the handling of FMD in both countries, is relatively similar, including livestock traffic restrictions, livestock culling, and vaccination, but there are differences in tightening the policy response which has implications for the spread of the FMD virus. After the emergence of cases and the declaration of outbreak areas in four districts in East Java, Indonesia on 9 May 2022, the spread in an area of 48,037 km² has spread to 26 other districts/cities by 5 June 2022 (Detikcom, 2022). Outside of East Java, Central Java province, which is a neighboring province, also had FMD suspects in May 2022. Meanwhile, in Japan, the government managed to localize the spread of FMD only in Miyazaki prefecture with strict control of livestock movement.

Apart from efforts to prevent the spread of the outbreak, the governments of both countries also provided compensation for losses to affected livestock farmers. Table 2 illustrates the policy response and government expenditure to overcome the impact of FMD.

Handling of FMD in Indonesia

Government policy was issued to deal with the spread of FMD in Indonesia by stipulating Extraordinary Events (KLB) in outbreak areas through the issuance of a Decree of the Minister of Agriculture of the Republic of Indonesia

Number: 403/KPTS/PK.300/M/05/2022 concerning Determining Outbreak Areas for FMD in several districts in East Java Province which include Gresik, Mojokerto, Lamongan and Sidoharjo districts (Kementerian Pertanian, 2022g) and the issuance of Decree of the Minister of Agriculture of the Republic of Indonesia Number: 404/KPTS/PK.300/M/05/2022 concerning Determination of FMD Outbreak Areas in Aceh Tamiang Regency, Aceh Province (Kementerian Pertanian, 2022c). With the designation of an area as a KLB, the area is closed to livestock. Several actions were then taken including observing and identifying, preventing, securing, eradicating, and treating animals. Nowadays, FMD cases

still appear in 125 districts/cities in Indonesia with 615,570 infected livestock. With the existence of FMD, the Ministry of Agriculture is targeting FMD-free in Indonesia by 2035 through the Roadmap for Eliminating Foot and Mouth Disease (Kementerian Pertanian, 2023b). The five provinces with the most FMD cases in beef cattle in Indonesia are East Java (171,591 cases), West Nusa Tenggara (119,548 cases), Central Java (47,465 cases), Aceh (40,591 cases) and Java West (22,749 cases). In total, there are 27 out of 38 provinces that are exposed in Indonesia. Based on zoning divisions relating to the spread of FMD between districts/cities, the current FMD status by province in November 2023 can be seen in Fig. 2.

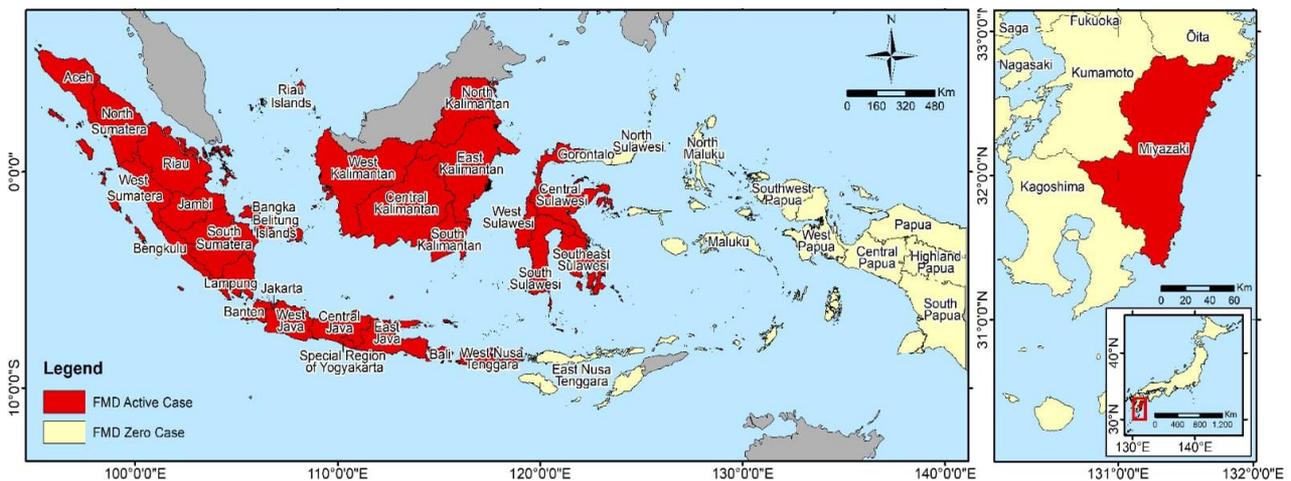


Fig. 1: Mapping the location of areas affected by FMD in Indonesia and Japan

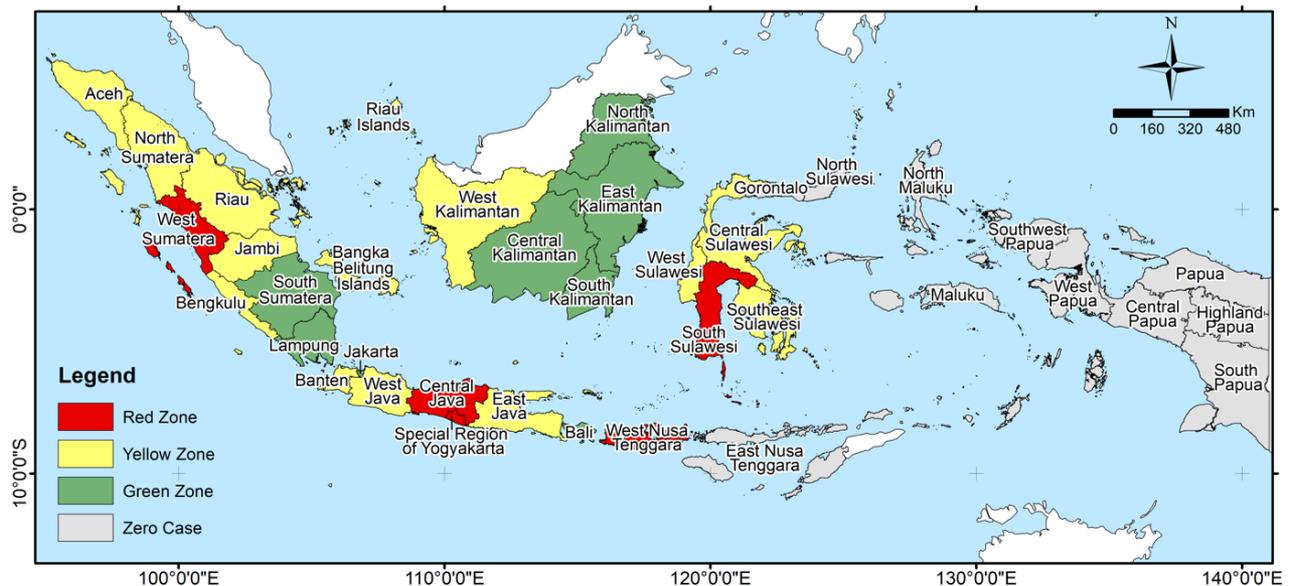


Fig. 2: Distribution of FMD per Province in Indonesia by Zoning Divisions (SiagaPMK.id/16 November 2023)

Table 2: Comparative comparison of FMD treatment based on indicators in Japan and Indonesia

No.	Indicator	Indonesia	Japan
1.	Policy responses	<p>The national policy response is through regulations issued by the FMD handling task force and the Ministry of Agriculture. Foot and mouth disease management task force (STPPMDK, 2022b) including:</p> <ol style="list-style-type: none"> 1. Determination of green, yellow, and red zones indicating high/low transmission of FMD bucks has implications for livestock traffic 2. Decontamination (sterilization using disinfectant to eliminate the source of FMD transmission 3. Conditional slaughter of livestock that are positive for FMD in the red/yellow zone 4. Destruction of livestock that are positive for FMD in green zone areas <p>Meanwhile, the ministry of agriculture has a broader policy response including:</p> <ol style="list-style-type: none"> 1. Determination of Foot and Mouth Disease Outbreak Areas 2. Providing emergency vaccination (in areas affected by FMD outbreaks) and blanket vaccination in all susceptible animal Populations (Kementerian Pertanian, 2022d) 3. Providing compensation and assistance in certain emergencies of Foot and Mouth Disease (Kementerian Pertanian, 2022e) and 4. Establishment of 12 laboratories to carry out examinations and tests for Foot and Mouth Disease (Kementerian Pertanian, 2022a) 	<ol style="list-style-type: none"> 1. Establishment of the movement restriction zone 2. Stamping-out (within 24 h) 3. Disposal of all carcasses (within 72 h, burial/incineration) disinfection 4. Epidemiological investigation 5. Surveillance (including wild animals) 6. When necessary, emergency vaccination and pre-emptive culling (SEACFMD, 2022)
2.	FMD impacts	<ol style="list-style-type: none"> 1. Beef Cattle: Confirmed Cases: 505.836 heads Recovered: 473.623 heads Slaughtered: 7.606 heads Death: 7.100 heads 2. Dairy Cattle Confirmed Cases: 73.366 heads Recovered: 62.722 heads Slaughtered: 6.732 heads Deaths: 4.150 heads 3. Pig Confirmed Cases: 88 heads Recovered: 85 heads Slaughtered: 0 heads Deaths: 3 heads <p>Source: Siagafmd.id (24th October 2023) (Kementerian Pertanian, 2023f)</p>	<p>The spread of FMD in Japan can be localized in Miyazaki prefecture with a total of 297,808 livestock culled</p> <p>Consisting of beef cattle with 69,454 heads, pigs with 227,949 and others (deer and wild boar) with 405 heads (Miyazaki Prefecture, 2012)</p>
3.	Economic losses	<p>Firman <i>et al.</i> estimated direct losses resulting from the outbreak at around IDR 8.90 trillion for a year (Firman <i>et al.</i>, 2022) or USD 57.24 million</p>	<p>Hayama <i>et al.</i> calculated total costs incurred as a result of the FMD (direct and indirect losses) reached 85 billion yen (Hayama <i>et al.</i>, 2017) or USD 570.73 million</p>
4.	Financial impacts	<p>The total budget for handling FMD is IDR 4.42 trillion (0.278 billion USD) sourced from the APBN, including vaccination of 43.67 million doses (2 vaccine doses and 1 booster vaccine for each livestock animal) (Katadata, 2022)</p> <p>Most of the FMD handling in Indonesia is allocated to carry out vaccination programs and other supports (2.84 trillion) apart from other budgets used for vaccination operations (866.22 billion), livestock data collection (570.1 billion), livestock replacement (225 billion), and treatment and prevention (159.53 billion). This amount represents 0.234% of GDP in Indonesia</p>	<p>8.2 billion yen (0.088 billion USD) or 0.018% of GDP</p>
5.	Current FMD Status	<p>Suspension of FMD-free status without vaccination from April 12, 2022 (WOAH Bulletin, 2022)</p>	<p>Free from FMD without Vaccination since 5 February 2011</p>

Table 3: Comparison of the global impact of FMD based on direct losses and vaccination costs

Region	Impact US \$			
	Production losses	Vaccination	Total	
	Median	Median	90% range	Median
China	1.9 billion	2.2 billion	2.5-7 billion	4 billion
India	1.9 billion	0.2 billion	1-4 billion	2.1 billion
Rest of Asia	1.2 billion	70 million	0.7-3 billion	1.3 billion
Africa	2.3 billion	20 million	1-5 billion	2 billion
Europe and Turkey	35 million	20 million	0.03-0.1 billion	0.06 billion
The Middle East	0.2 billion	30 million	0.1-0.5 billion	0.22 billion
South America	0.1 billion	0.7 billion	0.5-1.4 billion	0.8 billion
Total	7.6 billion	2.5 billion	6.5-21 billion	11 billion

Source: Knight-Jones and Rushton (2013)

On the map, four provinces are still in the red zone, i.e. Central Java, West Sumatra, West Nusa Tenggara, and South Sulawesi. Meanwhile, the FMD yellow zone is located in most of Sumatra in Aceh, North Sumatra, Riau, Riau Islands, Jambi, Bengkulu, and Banka Belitung Islands. Outside the island of Sumatra, the yellow zones are in Banten, West Java, East Java, West Kalimantan, Southeast Sulawesi, West Sulawesi, Central Sulawesi, and Gorontalo. The green zone with no FMD cases is in South Sumatra, Lampung, Jakarta, Central Kalimantan, Bali, South Kalimantan, East Kalimantan, and North Kalimantan.

Financial Impacts

The Ministry of Agriculture has a projected budget allocation plan for handling FMD nationally which will be submitted to the House of Representatives (DPR) in June 2022 with a total proposed budget of IDR 4.42 trillion sourced from the APBN, including 43 vaccinations, 67 million doses (two vaccine doses and one booster vaccine for each livestock) (Katadata, 2022).

Most of the FMD handling in Indonesia is allocated to carry out vaccination programs and other supports (2.84 trillion US\$) apart from other budgets used for vaccination operations (866.22 billion US\$), livestock data collection (570.1 billion US\$), livestock replacement (225 billion US\$). and treatment and prevention (159.53 billion US\$). The vaccination program is a budgeting priority in handling the FMD virus in Indonesia in 2022 which is also recommended by the World Animal Health Agency/OIE to carry out this vaccination (OIE, 2022).

If we look at the global comparison, as revealed by Rushton and Jones (Knight-Jones and Rushton, 2013), Vaccine costs are the main costs for reducing direct losses in livestock production (cattle deaths, weight loss, and milk production). Table 3 shows the total costs of

livestock production losses and vaccine costs incurred in major countries/regions in the world.

In the case of FMD occurring in Indonesia in 2022, direct losses resulting from the outbreak are estimated at around IDR 8.90 trillion US\$, calculated based on the sum of the direct impacts (decrease in milk production, infertility, abortion, cow death, calf death, and weight loss) in cattle and buffalo and other livestock for a year (Firman *et al.*, 2022). If the total is between direct production losses and vaccinations for one year in Indonesia, it reaches IDR 11.74 trillion US\$. In the long term aspect, the vaccination program has a positive impact in minimizing greater losses/costs. Apart from vaccination, FMD is handled in the form of social assistance and medication/vitamins carried out not only by local governments in Indonesia but also together with the Indonesian Red Cross (PMI). In the Emergency Plan of Action (EPoA) Indonesia: FMD Outbreak in July 2022 PMI is targeting affected areas in the provinces of East Java, Aceh, North Sumatra, and West Nusa Tenggara with a total of 20,000 target people being assisted (Reliefweb, 2022).

At the provincial/regency/city level in Indonesia, handling FMD from a budget perspective is charged to the Regional Revenue and Expenditure Budget (APBD). This is demonstrated by the Circular Letter Number 440/2530/SJ concerning Support and Anticipation of FMD Outbreaks in Livestock issued by the Ministry of Home Affairs. The Circular provides directions regarding funding to be budgeted in the APBD for programs, activities, sub-activities, for related regional apparatus according to their duties and functions. If the APBD is not yet available, you can shift the budget from unexpected spending (Bantuan Tidak Terduga/BTT) (Negeri, 2022).

BTT itself in the Regulation of the Minister of Home Affairs of the Republic of Indonesia Number 77 of 2020 concerning Technical Guidelines for Regional Financial Management has provisions that can be

allocated, such as in the case of the FMD outbreak. Some of the provisions in this regulation include: Database Perature (2020): (1) Unexpected expenditure is used to budget expenditures for emergencies including urgent needs that cannot be predicted in advance and refunds for excess payments on regional revenues in previous years as well as for social assistance that cannot be planned, (2) Urgent needs following the characteristics of each regional government are implemented following the provisions of statutory regulations.

Meanwhile, the emergencies referred to in the Minister of Home Affairs are natural disasters, non-natural disasters, social disasters and/or extraordinary events; implementation of search and rescue operations; and/or damage to facilities/infrastructure that could disrupt public service activities.

Several affected areas then used the BTT to handle FMD. Districts in East Java allocate BTT funds in varying amounts, some of which are Mojokerto with a BTT allocation of IDR 1.8 billion US\$ (Radar Mojokerto, 2022), Malang district with BTT IDR 3 billion US\$ (Tribun Jatim, 2022), Situbondo district with BTT IDR 1.5 billion US\$ (Suara Indonesia, 2022) all of which are taken from the APBD. The allocation is budgeted according to the financial capacity of each region which was previously proposed by the Agriculture/Animal Husbandry Service in each district/city and then discussed with the DPRD. The proportion of budget use also varies, which is used for purchasing medicines/vitamins and compensation for livestock that die due to FMD. In the supervision aspect, the use of BTT in the case of East Java, for example, was supervised by the Financial and Development Supervisory Agency (BPKP) through the issuance of a letter from the Deputy Head of BPKP for PIP for Economic and Maritime Affairs Number PE.08.02/S-587/D1/02/2022 on August 12, 2022 (BPKDP, 2022). This supervision is important to maintain the principles of transparency and accountability in the use of emergency funds for handling FMD.

Reflecting on the handling of the COVID-19 pandemic, the use of regional budgets, especially in emergency budgets, needs to be carried out carefully by local governments, especially in the aspect of procurement of goods and services. In this process which includes planning, implementation, settlement of payments, and audits-discrepancies are often found, which creates opportunities for corruption. One of the recommendations given by the Indonesian Corruption Watch (ICW) in the process of procuring goods and services during the COVID-19 pandemic which can be

replicated in the process of handling FMD includes: (Mansur, 2021); (1) Making policies related to the centralization of procurement carried out by the task force/BNPB in the context of consolidating procurement of goods/services, (2) Opening data access to the public via online portals to increase transparency and strengthen supervision, (3) Optimizing the use of search engines to find providers who have collaborated with the government such as the LKPP e-catalog to prevent manipulation by provider companies, (4) Create an effective and efficient priority scale in procuring goods/services and (5) The government must ensure that the need for medical equipment is the result of a rapid study based on conditions in the field.

Role of Local Government in Indonesia

The involvement of local governments, both provincial/district/city, in handling non-natural disasters in cases of FMD outbreaks is relatively small compared to the central government, especially since the FMD virus last appeared in 1983. This has implications for the financial management of the APBN, which is mostly managed by the central government. through the Ministry of Agriculture and BNPB. Local governments have an important role in disaster management (Kusumasari *et al.*, 2010), including FMD non-natural disasters, because the government at that level knows the conditions on the ground. One example of the important role of regions in handling FMD is the policy on the movement of livestock infected with FMD. The Ministry of Agriculture itself has a policy after the outbreak of FMD with the issuance of Circular Letter Number 2/SE/PK.300/M/5/2022 concerning Arranging the Traffic of Vulnerable Animals, Animal Products, and Other Carrier Media in Foot and Mouth Disease (FMD) Outbreak Areas which prohibits the movement of livestock, animal products and high-risk FMD carrier media between regions on the same island or different islands. If the policy is truly implemented, the spread of FMD can be managed and localized. Government policy needs to look at the capacity of local governments as the main supporting factor in handling the outbreak.

The low role of local government was also explained by Putra and Matsuyuki in a journal entitled the disaster management capabilities of local governments: A Case Study in Indonesia which concluded that the role of local government in Indonesia was limited. One of the indicators that received the lowest score among the scores of other

indicators (institutions, human resources, policies, technical aspects, and leadership) was the budget allocation aspect. The limited role of regional budgeting aspects in disaster management is the key to increasing the capacity of local governments to handle disasters. Apart from the limited budget, in the case of FMD in East Java, Widayana *et al.* (2023) highlighted the limited Human Resources (HR) as experts and livestock medical personnel. Apart from human resources, the provincial government in East Java is also limited in providing facilities, especially for testing the FMD virus. The aspect of unpreparedness related to the FMD endemic is also related to the period of the last endemic which occurred in 1986 or 36 years since Indonesia was declared FMD-free, according to the Ministry of Agriculture (Rezkiari, 2022). This has implications for the readiness of facilities and vaccines.

An example of local government preparedness is when several provinces made efforts to control FMD outbreaks by providing disinfectants at the sub-district level through animal health centers that were distributed to livestock groups. In this program, each livestock group receives two liters of disinfectant. The amount was considered insufficient so the livestock groups initiated to make coenzyme for sanitation. This was carried out as an effort to reduce the cost of purchasing chemicals at the farmer level.

Handling of FMD in Japan

Japan has regulations relating to the handling of FMD which are contained in special guidelines for preventing FMD disease in livestock which were established on December 1, 2004 (MAFF, 2004). These guidelines include actions during case discovery, contact tracing of livestock, and livestock movement and restrictions. Prevention efforts, in the guidelines issued by the minister of agriculture, forestry, and fisheries, are also strengthened by developing management when a crisis occurs, collaboration with research and testing institutions, and guidelines for proper management of livestock hygiene.

On April 20, 2010, the first case of FMD was confirmed in Miyazaki Prefecture, Japan. The Japanese government issued an extraordinary policy through the Basic Response Policy on May 19, 2010 (Headquarter of FMD Control, 2010), which means almost a month since the first case was discovered. The contents of the policy include: (1) Preventing the spread through limiting movement and eliminating it as well as carrying out disinfection by increasing the number of disinfection points by mobilizing Japanese self-defense

forces, (2) Considering the affected area (Miyazaki) which relies on the livestock sector, the government instructed all possible actions carried out for the sustainability of farmers including economic protection for farmers, (3) Local governments provide special expenditure allocations to affected farmers as well as subsidies from the central government, (4) The establishment of a local response headquarters led by the deputy minister of agriculture, forestry and fisheries of Japan (Fig. 4). The aim was to listen to requests from local governments so that coordination is faster with the relationship as shown in Fig. 5. The basic response policy set by the government on May 19 was also the kick-off for the start of emergency vaccination on farms infected with FMD. At the time of the initial emergence of FMD, epidemiological investigations in Miyazaki showed late detection. The FMD virus was suspected to have been introduced initially in a water buffalo (*Bubalus arnee*) farm located approximately 600 m from the index case showing symptoms such as fever, diarrhea, and a decrease in milk production at the end of March. From RT-PCR testing of buffalo samples, FMD virus infection was confirmed even though the government's determination of the first case was on April 20, 2010. Moreover, from estimations of the clinical development date, infection was presumed to have already been present on at least ten farms on April 20 (Muroga *et al.*, 2012). However, the spread of FMD in Miyazaki was successfully localized to Miyazaki Prefecture with distribution areas in the regions/cities of Miyazaki City, Kunitomi, Ebino, Takanabe, Shintomi, Kijo, Kawaminami, Tsuno, Hyuga, Saito, and Miyakonojo in Fig. 3.

Financial Impacts

The Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF) had a financial policy when FMD was endemic as happened in 2010 in Miyazaki (Takehisa, 2014). This financial support is an important aspect so that FMD can be controlled effectively. Some of Japan's MAFF policies include full compensation (100%) for infected and culled livestock, covering the costs of destroying livestock (burning/burying) and contaminated goods, compensation for decreased sales due to restrictions on livestock movement, and a reduction in the amount of compensation to farmers who fail to take precautions. During the 2010 epidemic in Miyazaki, the Japanese government issued a total compensation of around \$550 million (1\$85¥) (Muroga *et al.*, 2012). The government expenditure above was used to fulfill the following activities (Hayama *et al.*, 2017): (1) Costs of materials and equipment used on the farm

or burial site (e.g. Personal protective clothing, equipment and syringes, disinfectants, heavy equipment, and waterproof sheets), (2) Costs of establishing and operating disinfection stations, which are set up on main roads to disinfect vehicles in and around movement restriction zones; these costs mainly include the costs of disinfectants, electric sprayers, car sprinklers and operating consignment costs, (3) Human

resource costs during the epidemic, a large number of staff were deployed from all over the country to assist with disease control measures, including veterinarians from the prefectural and national governments as well as the private sector, livestock technicians, construction workers, members of the Self-Defense Forces (Japanese armed personnel), police officers and other support staff, (4) Vaccination costs.

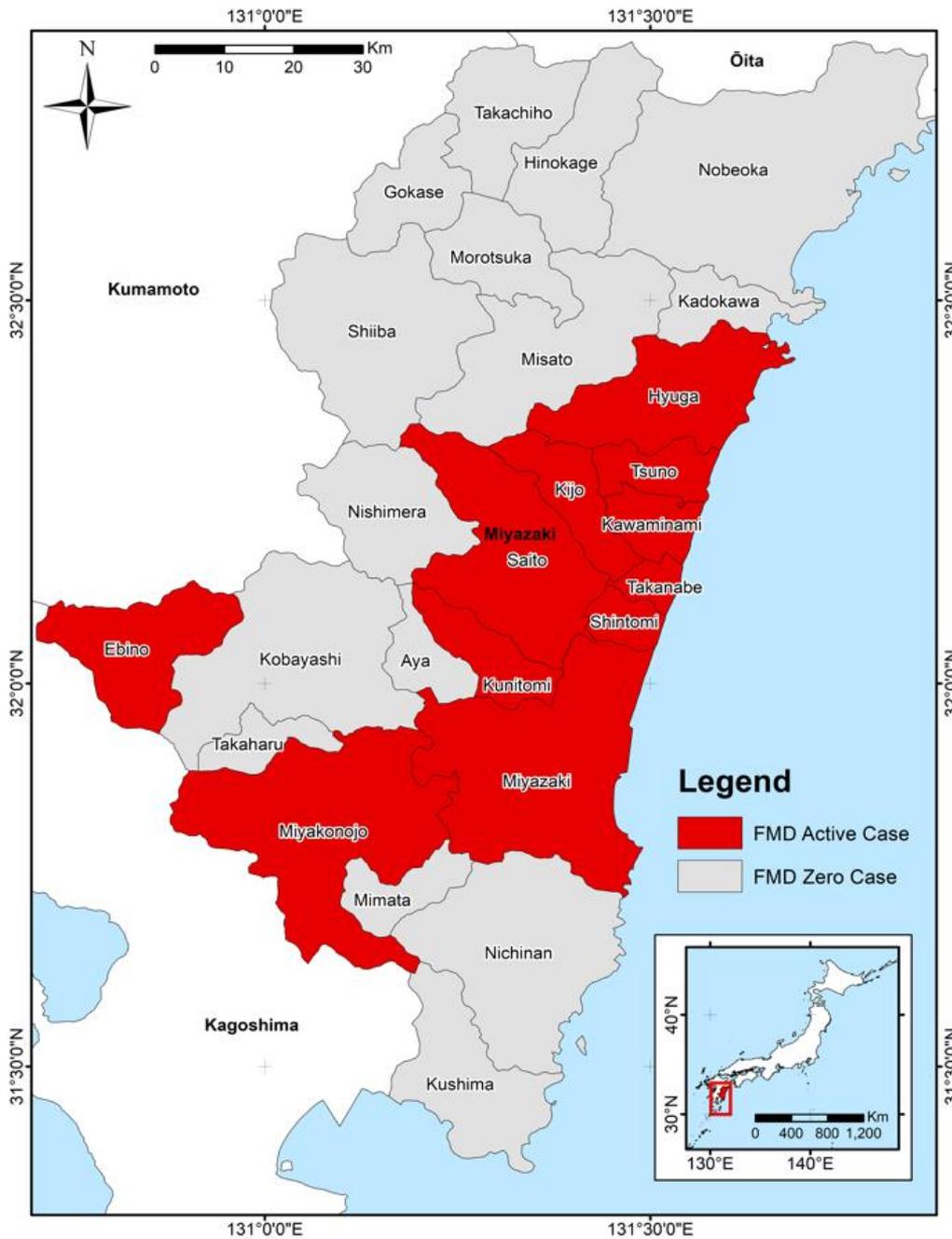


Fig. 3: Distribution of FMD in Miyazaki Prefecture

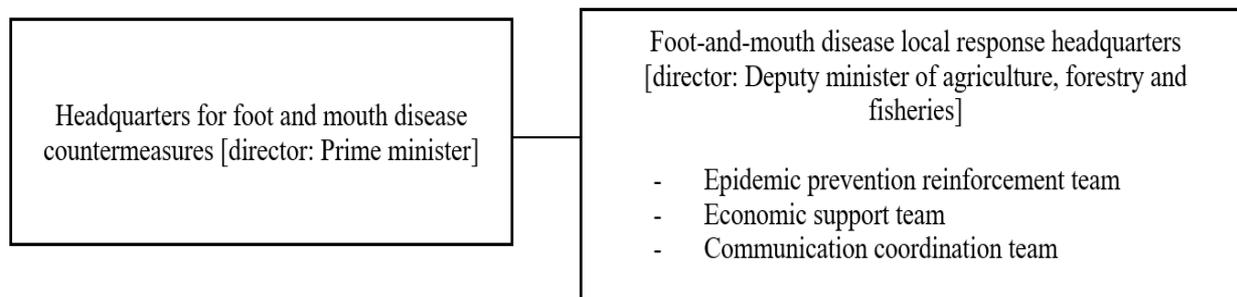


Fig. 4: Organizational structure for handling FMD nationally; *At the beginning of the outbreak, the minister of agriculture, forestry, and fisheries was in charge of the head of the headquarters

In the aspect of budgeting chronology, records of epidemic prevention, regeneration, and reconstruction of FMD compiled by Miyazaki Prefecture (2012) stated that there were nine additional budgets issued for the prevention and stabilization of livestock conditions in Miyazaki. First, on April 28 2010 with a budget allocation of 3.3 billion Yen which was used at the start of the epidemic. Second, on May 12, 2010, with a budget allocation of 200 million Yen. This budget is used to subsidize livestock farmers due to the spread of FMD and the policy of limiting livestock traffic. Third, at the extraordinary congress in May 2010, the budget issued was larger, including 5 billion Yen to support business recovery due to livestock culling, 1.58 billion Yen for subsidies, 100 million Yen for the recovery of affected production areas, and 8.1 billion Yen for epidemic prevention measures. Fourth, at the congress in June 2010, there was a budget allocation of 42.6 billion Yen which was used for compensation and burial of livestock.

Fifth, in July 2010, budgeting continued to be increased to reconstruct the livestock business and prevent FMD from spreading. Sixth, in September 2010, there was 3 billion Yen used for recovery funds. In September 2010, the endemic was declared over, so the government's efforts were more focused on restoring livestock farmers. There was a budget allocation of 120 million Yen used for recovery subsidies. Seventh, in November 2010, there were broader efforts to promote tourism and commercial and industrial support which had been affected by the outbreak of FMD in Miyazaki. Eighth, in January 2011, the focus of recovery continued with livestock revitalization, while the last budgeting (ninth) in February 2011, there was an allocation of 1.5 billion Yen which was used as a seed revitalization fund.

Role of Local Government (Prefektur Miyazaki)

In the aspect of local government authority, following the special guidelines for preventing FMD issued by the

Ministry of Agriculture, Forestry and Fisheries (MAFF, 2004), The government established headquarters for pandemic prevention both at the central level in ministries and in prefectures (prefectural control headquarters). In its implementation, communication links with the center are complemented by special emergency communications between the center and the prefecture. Various stakeholders including animal markets, slaughterhouses, veterinarian associations, etc., are involved through written communications or notifications regarding the formation of the task force.

The structure of the prefectural task force includes (1) Initial response. Initially, the task force was formed with the head of the Livestock and Fisheries Policy department as chairman, but because the FMD outbreak was suspected to affect the economy in the prefecture, the task force was chaired by the governor with the hope that communication with various stakeholders at the prefecture-level could run smoothly, (2) Strengthening institutions. The task force requested disaster relief personnel for non-natural disasters from the Japanese self-defense forces as well as carrying out vaccinations as the first step in efforts to prevent FMD. In the institutional aspect, a "Comprehensive Support Department" was also established under the Prefectural response headquarters and (3) Towards the end, the prefectural task force was responsible for culling livestock in each city which was targeted for completion by June 20, 2010.

A system and structure are needed that allows for adequate coordination between each prefectural task force group and with related organizations. In the Prefectural Epidemic Prevention Manual, it was decided that each group of the Prefectural Countermeasures Headquarters would work on the same floor and related organizations would also participate in liaison and coordination. As FMD infections continue to spread, further cooperation with

the central government is needed to strengthen measures to prevent the spread of the disease and restore the prefecture's economy. In addition, many requests were submitted to the prefecture from agricultural organizations and other organizations requesting measures to prevent the spread of the disease and measures to support economic activities. Therefore, the

Prefectural Countermeasures Headquarters took advantage of opportunities such as visits by government officials to prefectures and actively encouraged governors and other parties to do so. In collaboration with prefectural task forces, local task force headquarters were established in areas where FMD is prevalent to prevent the spread of FMD and eradicate it as soon as possible.

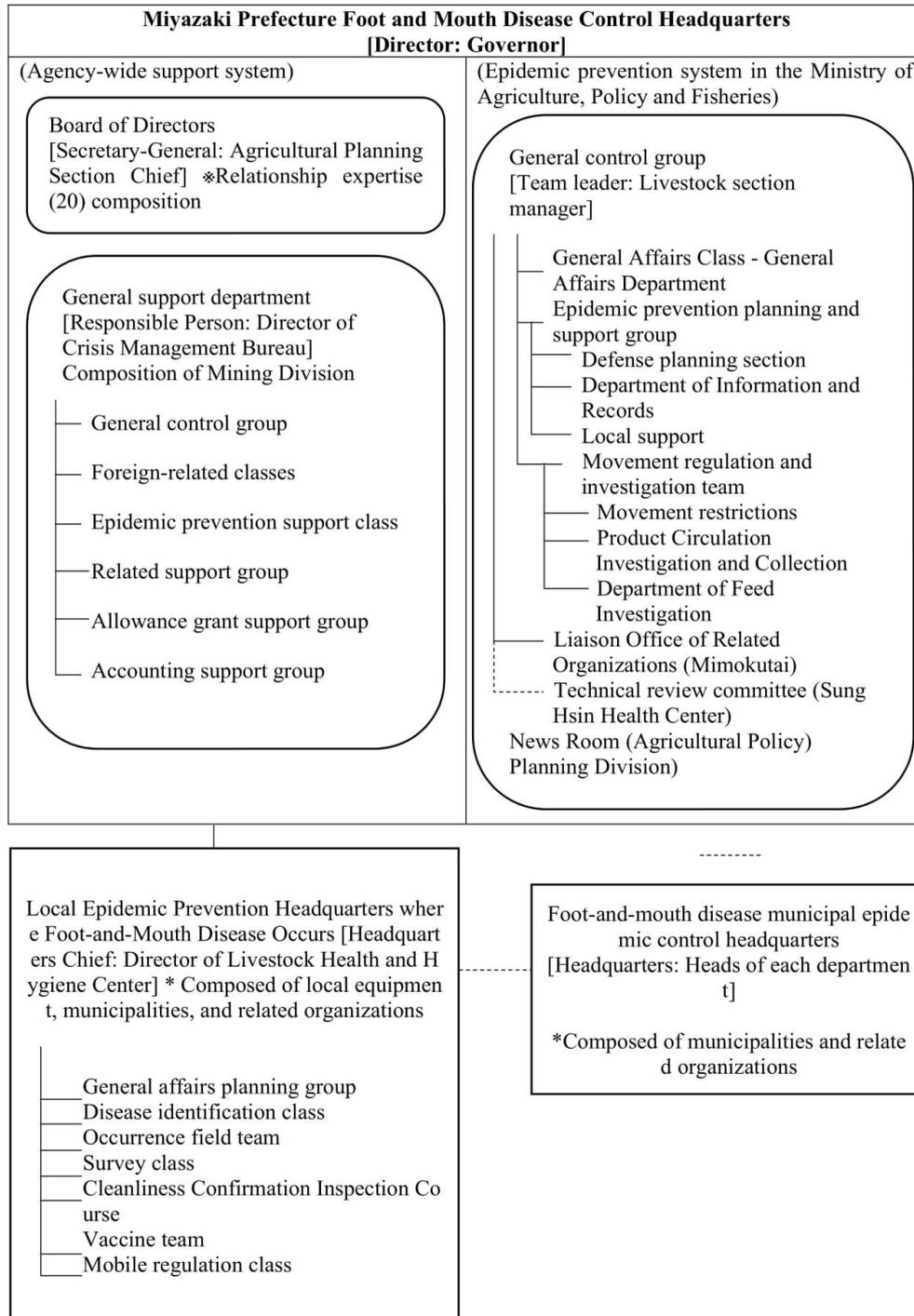


Fig. 5: Miyazaki Prefecture FMD handling organizational structure (Miyazaki Prefecture, 2012)

Conclusion

The policy response in dealing with the FMD outbreak in Indonesia and Japan have similar characteristics; restrictions on livestock traffic, culling dead livestock, and vaccination but there are differences in tightening the policy response which has implications for the spread of the FMD virus. The livestock culling policy in Japan in 2010 was carried out by stamping via destroying livestock infected with the FMD virus and also livestock that had been vaccinated. This effort is aimed at avoiding the epidemic status of FMD in Japan. Meanwhile, in the 2022 endemic in Indonesia with 615,570 infected animals, livestock culling was carried out on livestock that died as a result of the outbreak. It is difficult for Indonesia to avoid epidemic status because the livestock structure in Indonesia is dominated by small-holder farms, while the form of livestock in Japan is dominated by industrial livestock and is easy to control.

This study shows the differences between Japan and Indonesia in determinants and control strategies of FMD outbreaks, in terms of financial aspects and the role of local government, which correlate with economic losses due to FMD. In the financial aspect, Indonesia budgeted 0.234% of GDP, while Japan budgeted 0.018% of GDP for the handling of FMD. The percentage of Indonesia's budget is higher because the contribution of its agricultural sector is higher at 12% of GDP while Japan's is only 1%. In budget schemes during the first outbreak, local governments in Indonesia relied on unexpected spending budgets to cope with the outbreak, while in Japan, government financial support tended to be structured from the central government (MAFF) to support the effectiveness of handling the affected areas in Miyazaki.

On the aspect of central and local government relations, Japan's institutional strategy also has the advantage of strong institutions and a clear division of roles between central and local governments. Japanese local governments tend to have greater authority and are organized to carry out detection so that they respond quickly through policies, surveys, inspections, and even have an FMD vaccination team. Meanwhile, the handling of FMD in Indonesia tends to be carried out using a centralized system from the national government. The involvement of local governments in making policy decisions is relatively limited, especially in the aspect of budgeting for affected farmers. With the differences in livestock characteristics and relationship patterns, the spread of the FMD virus in Japan can easily

be localized in Miyazaki Prefecture, whereas in Indonesia it spread to 27 provinces.

With the explanation of the review, we recommend that countries need to consider factors that affect the effectiveness of FMD management policies such as the socio-economic conditions of farmers, budget schemes, and strengthening local institutions in FMD handling.

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Author's Contributions

Tri Anggraeni Kusumastuti: Designed and drafted the article, performed and interpreted the analysis, and wrote the manuscript.

Ikuo Kobayashi: Reviewed and analyzed the article, and provided feedback and suggestions.

Ahmad Juwari: Drafted and analyzed the article, and reviewed the manuscript for accuracy and clarity.

Lovin Dika Antari: Drafted the article, collected and organized the data, and wrote the manuscript.

Ethics

All the authors have read, approved, and declared no ethical issue involved.

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