Challenges of using feed additives in Indonesia

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Abstract. The use of feed additives can significantly improve the efficiency of animal production, including the possibility of feed cost reduction and alternative feed raw material use. The number and type of feed additives with different purposes are widely available and provide alternatives to users. However, there are obstacles faced by livestock owners whether feed additives are chosen to fit according to their end target, as well as costs constrain. The challenges in the tropics such as in Indonesia are quite different especially after the government prohibits antibiotic growth promoter as a feed additive. There have been many efforts to get the best material to replace this antibiotic growth promoter, but there is still no one that can replace it in terms of effectiveness and cost.

1. Introduction
Antibiotics have been widely used in animal production for decades around the world. The use of antibiotics in animals for treatment, growth booster and improve feed efficiency began in the early 1950s [1]. Since then, the use of antibiotics as feed additives has grown rapidly. The discovery of antibiotics used for growth promoter which was found unintentionally had a major impact on the livestock industry to improve feed efficiency and growth [2].

The use of antibiotics not only has a positive impact but also a negative impact. Antibiotics used with high intensity can cause bacterial resistance and leave residues. Antibiotics are used in the long term and the possibility of their use that can not be controlled is a concern for human health. Castanon [3] states that in 2006, the European Union decided to ban the use of antibiotics as growth promoters. Antibiotic replacement as a growth promoter is still growing so far as is the feed additive for certain production targets.

2. Method
This study was conducted using a descriptive qualitative basic method, with a main focus on domestic trends related to the use of feed additives mainly in poultry as well as an analysis of the problems faced by businesses in this industry.

3. Results and discussion
3.1. Feed additives
Feed additive is an ingredient that is mixed in the feed that can affect the health, productivity, and nutritional conditions of livestock, even though the material is not to meet the nutritional needs [4]. This feed additive is an ingredient that is added to the feed but is not a source of nutrition so it cannot be used to replace the nutritional feed. While the definition according to the Ministry of Agriculture of
The Republic of Indonesia, feed additive is a substance that is naturally not present in feed for the purpose of its use primarily as a driver of livestock production (Minister of Agriculture Decree No.240 / Kpts / OT.210 / 4/2003).

In summary it can be concluded that feed additive is an ingredient that was not previously present in the feed and then added to the feed with the general aim of increasing efficiency and optimizing production. Based on its function, feed additives can be categorized as follows: a. Affects feed stability, production processes and feed characteristics, b. Improving growth, efficient use of feed, metabolism and appearance of livestock, c. Livestock health, d. For consumer acceptance.

The types of feed additives in each class can be seen in table 1.

| Affects feed stability, production processes and feed characteristics | Improving growth, efficient use of feed, metabolism and appearance of livestock | Livestock health | For consumer acceptance |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------------|-------------------------|
| - Antimold                                                             | - Flavour                                                                       | - Anti bacteria | - Coloring agent         |
| - Antioxidant                                                         | - Enzyme                                                                         | - Prebiotik     |                         |
| - Pellet binder                                                       | - Buffer agent                                                                   | - Probiotik     |                         |
|                                                                       | - Acidifier                                                                      | - Toxin Binder  |                         |
|                                                                       | - Methan remover                                                                 | - Anti Cocci    |                         |
|                                                                       | - Growth promotor                                                                | - Immune enhancer|                         |
|                                                                       | - Metabolic enhancer                                                             |                 |                         |

3.2. Feed Additives in the Poultry Industry
Success in the modern livestock industry still depends on commercial animal genetics. The use of feed additive become important to maximum utilization of feed ingredients that can help to achieve the genetic potential of modern animal breed and remaining feasible from the production to maintain the cost of production as lower as possible.

The availability of feed ingredients such as corn, soybean meal, tapioca, sorghum, meat and bone meal, and others can be a reference for the use of feed additives so that the optimization of the availability of nutrients from those raw materials can be maximized and available to animal. As for an example, phytase enzyme that are used to release phosphorus minerals is available in some vegetable origin such as corn has become common in the livestock industry. In addition, beside that other enzyme also can reduce anti-nutrition factor such as Xylanase enzyme, Cellulose, Beta Mannanase, and others, commercially called Non-Starch Polysaccharide enzymes. For example, the use of the Beta Mannanase enzyme which aims to hydrolyze beta mannan is commonly found in raw materials such as palm karnel meal and copra meal will release amount of energy which available for animal. Beside optimizing the utilization of nutrients available in raw materials, the industry also feels the need to improve the health of the digestive health. The use of prebiotics, probiotics, acidifiers and essential oils have been considering need to add in feed formulation. The main goal is to suppress as much as possible the factors that can cause absorption of food is inhibited either because of competition against harmful microorganisms as well as to maintain the digestive system can work optimally, for example improving the health of intestinal villi responsible for food absorption. High feed efficiency will be achieved if the digestive tract is in optimal condition to digest and absorb food substances.

The use of feed supplements as feed additives through molecular modification also shows great benefits to production and health. Inorganic minerals such as zinc sulphate, and copper oxide have been shown to have an impact on animal health, especially to boost the immune system and to suppress unwanted microorganisms in the digestive system. Salt bonds in these minerals are generally unstable during the digestion process so they must use doses large enough to get their mineral benefits. By applying technology these minerals can be bound with organic components such as amino acid...
products. Sheoran [5] revealed that the bond between minerals and organic components is more stable in the intestinal lumen, which causes their absorption to be relatively higher compared to inorganic minerals.

### Table 2. Distribution of total feed production and antibiotic usage

| Country / Region       | Feed (million ton) | % out of Total | Antibiotic Usage (tons/year) | % out of total |
|------------------------|--------------------|----------------|-----------------------------|---------------|
| China                  | 195                | 20%            | 14,500                      | 23%           |
| USA                    | 173                | 18%            | 14,800                      | 23%           |
| EU (25 countries)      | 153                | 16%            | 8,000                       | 13%           |
| Rest of World          | 439                | 46%            | 26,200                      | 41%           |
| Total (Global)         | 960                | 100%           | 63,500                      | 100%          |

Source: Trade and Agriculture Committee for Agriculture [6]

3.3. Feed additives in Indonesia

Antibiotics have been used in the poultry industry in Indonesia for many years. Supplementation of antibiotics as sub-therapeutics improves bird feed efficiency and maintain the gut health, growth and development. Antibiotic growth promoters (AGP), commonly used in the poultry industry include: Avilamycin, Enramycin, Monensin, Virginamycin, Bambermycin and Bacitracin methylene disalicylate (BMD).

Figure 1, shows AGP (BMD) in the diet enhanced early weight gain in the chicken. In contrast, at d36-42, improvement in BW, BWG and FI was observed in the control (BMD-free diet) group. These results indicate that although supplementing an antibiotic in the feed improves bird performance during the early growth period, this advantage was lost during the later stages of growth and at the time of commercial processing.

![BMD vs Non-BMD](image)

**Figure 1.** Effect of antibiotic withdrawal in feed on chicken body weight, body weight gain and feed intake. BW = Bodyweight (gram), BWG = body weight gain (gram), FI = Feed Intake (gram), BMD = Bacitracin methylene disalicylate treatment group 0.05% (BMD-50 - Zoetis) [7].

However, the use of antibiotics will increase antibiotic resistance to bacteria against livestock and humans. Aware of this, some countries have implemented restrictions and even banned the use of AGP in feed. Indonesia, the ban on the use of AGP has been regulated in Law No. 18/2009 juncto
Law No. 41/2014 concerning Animal Husbandry and Animal Health which states the prohibition on the use of feed mixed with certain hormones and / or feed additive antibiotics.

### Table 3. Number of Animal Drugs Register in Indonesia [8]

| Year | Number of Products |
|------|--------------------|
| 2014 | 6,115              |
| 2015 | 6,226              |
| 2016 | 6,396              |
| 2017 | 6,570              |
| 2018 | 6,874              |

Prohibition of the use of AGP has a major impact on the Indonesia livestock industry because no equivalent replacement has been found yet so that production costs are high. Trend substitute for AGP generally sees success in countries in Europe and America, but it must be recognized that there is no single product that completely replaces AGP's position.

Several group products have been used as replacement of AGP are:

3.3.1. **Acidifier.** Is organic acids as individual acid or blend of acids. The antimicrobial activity of organic acids is pH dependent. By the addition of these organic acids make pH of digesta decreases, increase pancreatic secretion and also have effect on intestinal mucosa. Acidifier have benefits related to uncontrolled variables such as buffering capacity of dietary ingredients and control growth of intolerance species such as E.coli, salmonella, and campylobacter.

![Body Weight Gain (gram)](image)

**Figure 2.** Effect of Using Organic Acids to Substitute Antibiotic Growth Promoters on Performance and Intestinal Microflora of Broilers [9].

From the research above, it can be concluded that the use of organic acids is an alternative to replace AGP. For commercial purposes, further research needs to be done on the combination of organic acids that are suitable for the environment and farm conditions.

3.3.2. **Essential Oil.** Essential oil is an aromatic component of herbs and spices and their biological activities. Use as feed additives for antibacterial, antifungal, anti-oxidant and anti-inflammatory. Phytogenic feed additives have accepted an alternative strategy to enhance animal performance. Since phytogenic substances have been shown to prevent the colonization and virulence of pathogenic in
concentrations even below their MIC, by interference and disturbance of the major bacterial regulation system ‘quorum sensing’ [10].

Figure 3. Body weight of phytonic feed additives as an alternative to antibiotic growth promotors in broiler chickens [11].

3.3.3. Medium chain fatty acid. The most known organic acids are acetic acid, propionic acid, and butyric acid, known as volatile fatty acids (VFAs) or short chain fatty acids (SCFAs). Among these, butyric acid possesses the interesting characteristic features. It is corrosive and volatile, therefore the sodium salt of butyric acid is used which allows easy handling, stability and is less odorous. The effect of sodium butyrate (SB) as replacement AGP have been common use in monogastric animal. Above study show average body weight significantly different as well as figure 6 on feed conversion ratio. Sodium butyrate is used as a source of butyric acid, which is known for its beneficial effects in the gut such as promote the development of intestinal villi and improve the function of hindgut.
4. Conclusion
The development types of feed additive are growing rapidly, especially in efforts to replace antibiotic growth promoters (AGP) that have been banned in almost all countries. In economic scale AGP substitution has several obstacles including the price is still expensive, availability, information, and applications that still need to be further investigated. Besides, a new type of feed additive also offering different approached to aim the best performance of potential genetic of livestock.

Industry in several countries has provided clear evidence, the use of feed additives can help increase production efficiency and at the same time can protect public health from antibiotic-resistant and residue.

Tropical countries like Indonesia, have the potential to develop feed additives replacing AGP as well. Natural resources such as herbs and spices production, as well as palm oil production can provide raw materials for feed additive. The role of universities and research institutes is expected to
be able to take part in the development of feed additives produced in the country, as well as support from the government and livestock industry. Government regulation also needs to adjust and follow the trend of feed additive used in the livestock industry. Anticipation of the industry requirements will be a high priority to make sure sustainable animal food production and public health standards achieved.

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