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MORALITY BEFORE KNOWLEDGE

Water consumption analysis across the life cycle of beef: Environmental impacts and mitigation strategies

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ABSTRACT

Background: Demand for beef is predicted to be risen by 74%, followed by the explosion of the global population by 9.7 billion in 2050. Australia as the most significant exporter of beef, together with America as the leading market, contribute vital roles. The increase in demand causes environmental impacts such as water scarcity. **Methods:** This study used a systematic literature review method to collect and disseminate relevant evidence from scientific sources related to air consumption in the beef and plant-based product supply chain. The process involved five main steps: problem formulation, data collection, data evaluation, evidence deduction, and interpretation of results. **Findings:** Based on the life cycle perspective, a kilogram of meat consumption from beef exported to America is 441.8–597.6 liters. The consumption includes processes such as nursery, fattening, cutting, transportation to Australian port, departure to America, and distribution within America. **Conclusion:** For instance, industrialization will reduce the water consumption, however, causes other environmental impacts. Therefore, dietary changes to vegetarianism combined with organic system becomes the best solution offered. **Novelty/Originality of This Study:** The novelty of this study lies in the life cycle analysis of water consumption in Australian beef exports to the US and highlights the trade-off between industrial efficiency and environmental sustainability while proposing dietary changes as a potential mitigation strategy.

KEYWORDS: beef; life cycle; organic; water consumption; water footprint.

1. Introduction

Sustainable development demands the fulfilment of existing generation needs without diminishing its capabilities for future generations. The principle of sustainable development is the integration of economic, social, and environmental pillars. This combination distinguishes decision-making in the context of sustainable development towards the decision-making in other policies (Emas, 2015). Sustainable development context set out in 17 key objectives (UN, 2015), including the goals of "Sustainable Consumption and Production" covering agricultural sector.

Agriculture is a field of utilizations of animal, plants and other forms of life for the production of food, fiber, raw materials, medicines, and other purposes, including aquaculture and forest management (SDSN, 2013). In other words, agriculture involves the use of life forms to meet human needs, including the utilization of the livestock. Beef becomes one of the leading commodities with the highest water consumption level (da Silva et al. 2016).

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World beef demand predicted to have a significant increase by 74% in 2050 (FAO, 2009). This phenomenon unseparated from the prediction of the United Nations Department of Economic and Social Affairs (UN, DESA) related to the world population reached 9.7 billion people in the same year. Improvement must be spread across the world with a concentration in some major countries. Australia and America are major contributors to this problem. After Brazil, Australia became the largest exporter of beef in the world (FAO, 2011a). Meanwhile, America became one of the main markets of meat (DFAT, 2012) with beef consumption of 25.6 kg/capita/year, the fourth highest after Uruguay, Argentina, and Brazil (OECD, 2016).

Today, food production responds to basic needs, social, cultural and even aesthetic needs and desires. However, with the need to feed seven billion people, this food production is accompanied by enormous environmental costs (Garnett, 2011; Tilman et al., 2001). The fulfilment of the livestock sector needs in general including the procurement process, processing up to distribution until. Procurement related to the livestock industry, ranging from breeding to fattening. Processing associated with the conversion process into meat that are ready to be distributed, either to retail or restaurants. This process is referred as the beef supply chain illustrated in Figure 1 (Wiedemann et al., 2015b).

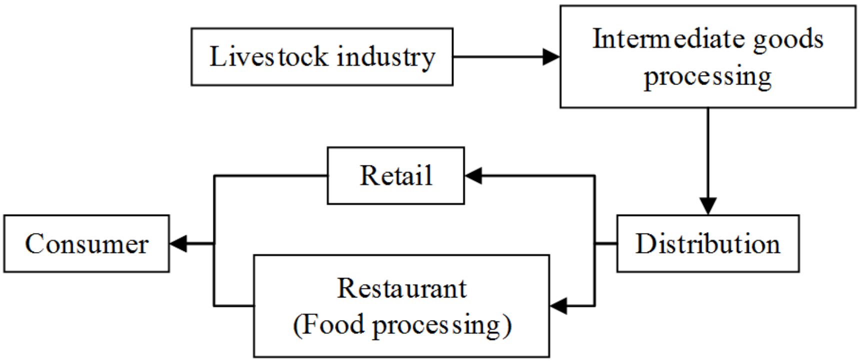

Fig. 2. Supply chain of beef (Wiedemann et al., 2015b)

The high demand for beef due to population explosion is against the target of environmental development. Global goals for reducing greenhouse gas (GHG) emissions and addressing resource scarcity such as water and fertile land are difficult to achieve without a thorough evaluation and change of the current system. For the production of one kilogram of beef exported by Australians to distributors in the United States alone requires 441.8–597.6 liters of water consumption, 28.1–46.4 MJ of fossil energy consumption, agricultural land-cultivation of 2.5–29.9 m2. The conversion efficiency of consumable proteins of 7.9–0.3 and GHG emissions reached 27.2 kg CO2-e (Wiedemann et al., 2015b). If there is no change in the way we produce and consume food, and given the need to increase food production by more than 60% by 2050 (FAO, 2006, 2015), the environmental impacts associated with food production systems will become even more severe and will increasingly exceed the limit.

The life cycle approach involves a cradle-to-grave assessment, in which the product followed from the production stage associated with the raw material until its final use (Von Blottnitz & Curran 2007). A system of life cycle can be started by extracting raw materials from the ground and generating energy. Materials and energy then become part of manufacturing, transportation, use, and ultimately recycling, reuse, or disposal. In the context of this standard, the term life cycle refers to successive and interrelated stages of a product system from the acquisition of raw materials to final disposal of life. The life cycle perspective means we recognize how our choices influence what happens at each of these points so that we can balance the trade-offs and have a positive impact on the economy, environment, and society. Life cycle studies become the method that used to generate data that reflect these ecological footprints. This research laid the foundation for the supply chain of beef within limits set. Identification is done concerning methods that experience specific environmental implications in the supply chain described in Figure 1.

This research focuses on the impact of water consumption because the water scarcity is spreading the world (Mekonnen & Hoekstra 2016). Agriculture which contributes 70% of world water consumption is one of the factors that causing the water scarcity (UN Water, 2014). Meanwhile, water has become the core of sustainable development (UN Water, 2015). With American beef consumption of 25.6 kg/capita/year and population of 324,304,407 people by the end of 2016, annual use of Americans reaches 8 billion kg of beef. Consumption of this size requires the availability of water resources reached 3.6–4.9 trillion liters. Industrialization of the livestock sector can reduce the water consumption. However, it raises new issues, such as increased greenhouse gas emissions (Gerbens-Leenes et al., 2013). The availability of water in quality, quantity, and continuity should ideally guarantee social justice, economic growth, and environmental protection efforts. Water as the primary necessity of living things needs to be managed with a long-term perspective concerning limitations and practices of unsustainable water use.

For that purpose, this research will analyze the impact of water consumption generated in the study of life cycle of beef exported from Australia to America. The analysis will be accompanied by a solution proposal to help solve the water scarcity problem, especially in the livestock sector. Solutions are proposed not only within the framework of production, but also consumption (Hoekstra, 2012). The level of water consumption can be reduced by limiting the consumption of animal products (Jalava et al., 2014).

2. Methods

The methods used is Study literature and review of several journals related to the case. Meanwhile, the collected data consisted of the impact of water consumption in functional units of one kilogram of beef exported by Australia to retail in America as well as data related to organic commodities and dietary changes in its contribution to the level of water consumption. Before the methods and the described data, the following description and constraints of meat supply chain need to be understood.

The livestock industry is one of Australia's main export commodities. All industrial activities of beef account for the gross production of $11 billion in 2014–2015 (ACCC, 2016). The high production of gross value is directly proportional to the large population of Australian cattle. An Angus or Wagyu cattle breed is a type of cattle whose meat is usually ordered by an American restaurant (Wiedemann et al., 2015b).

In meat supply chain, the breeding process becomes part of the livestock industry up to the fattening process. According to Oldenbroek & Waaij (2014), animal breeding involves selective breeding of domestic animals to improving desirable qualities and inheriting the next generation. One of the breeds of cattle grown in Austalia is Brahman Cross (BX) cattle (Zhang et al., 2014). Cattle that have been fattened and ready to cut then goes to the next stage of the semi-finished processing stage. In this process, livestock butchering to the carcass process was done. After that, beef is packaged and distributed until it goes into retail. Retail is a fast and important industrial part that employs residents and contributes significantly to the health and wealth of developed countries (Fernie et al., 2013). The Australian Meat Standard (MSA) is an asset to the Australian beef industry to provide a feasibility assessment on the resulting carcass (MLA, 2013).

2.1 Methods

The method for achieving research objectives is literature study. This method is done through theoretical studies on sources with high scientific level, such as Scopus indexed journals, other supporting journals, books and institutional reports that have been published. To carry out the literature study method, a systematic study was conducted. A systematic review is to gather relevant evidence according to eligibility criteria to respond to specific research objectives (Moher et al., 2015). As illustrated in Figure 2, this study covers five main steps: problem formulation, data collection, data evaluation, evidence deduction to an interpretation of results (Khan et al., 2003).

2.2 Data

The impact of water consumption is a major concern in this research. The consumption of water in the supply chain of one kilogram of meat is 441.8–597.6 liters (Wiedemann et al., 2015b). This interval is water consumption for beef and lamb. In research, water consumption focuses on beef. Based on the supply chain flow, cattle are divided into two types, namely conventional cattle and modern cattle. Conventional cattle consume only grass, while modern cattle consume grass and concentrate, both for medium-term (115 days) and for an extended period (330 days).

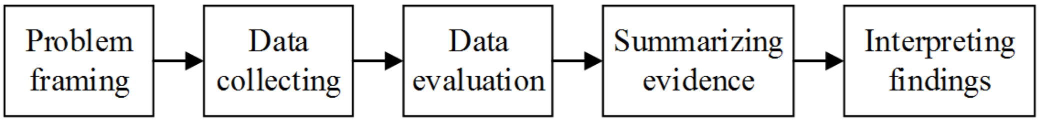

Fig. 2. Main steps of systematic review
(Khan et al., 2003)

The results of the impact assessment of beef water consumption can be seen in Table 1. These results describe the consumption of water in the process of drinking, irrigation, processing into beef, and other minor processes.

Table 1. Water consumption of beef

Processes	Water consumption (liter)		
	Conventional beef	Modern beef (medium)	Modern beef (long)
Other minor processes	11.2	19.5	28.9
Meat processing	10.1	10.1	10.1
Irrigation losses	15.1	42.2	25.4
Irrigation	63.4	165.8	97.8
Drinking losses	272.1	217.1	163.7
Drinking	168.6	142.9	115.9
Total	540.5	597.6	441.8

(Wiedemann et al., 2015b)

Past research only examines the distribution of beef to retail in America (Wiedemann et al., 2015a, 2015b, 2017). That is, the environmental impact, such as the consumption of water produced from the processing of semi-finished meat into food has not been included. For that, there is a requirement for further data that relates to the impact of water consumption on beef-based food products such as dairy products and burgers (Ercin et al., 2012).

As a basis for achieving sustainable development objectives and reduction of water scarcity risk (Owusu-Sekyere et al., 2017), water consumption calculations are carried out with water footprint studies, as applicable to the livestock sector (Badruzzaman et al., 2017). This study calculates not only the amount of water consumed but also the amount of polluted water (Hoekstra et al., 2011). Apparently, the use of organic systems can reduce water consumption due to evaporation from soil, and the amount of polluted water decreased (Ercin et al., 2012). This system is evident from the water footprint of food products in the form of soy milk (1-liter functional unit) and soy burgers (150-gram functional unit).

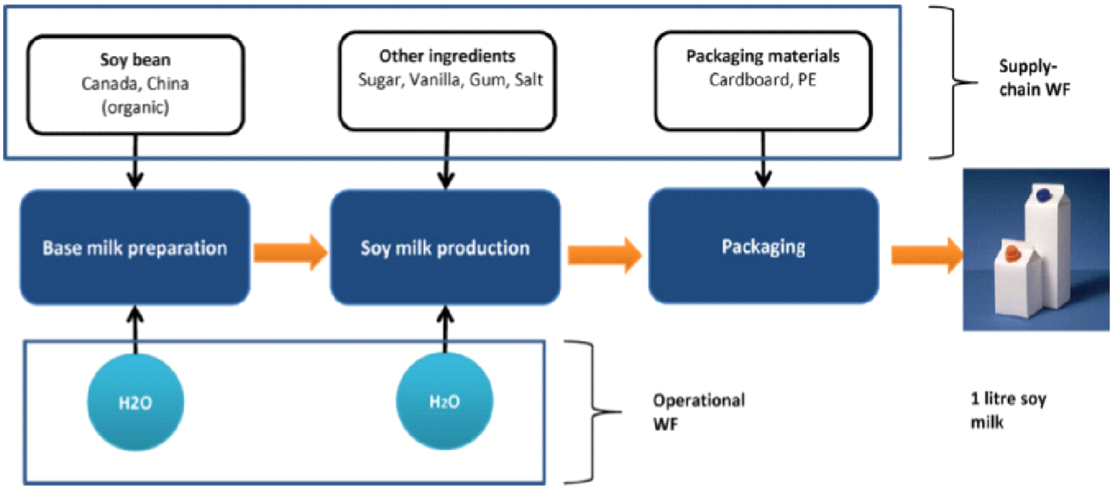

Fig. 3. Supply chain diagram of soy milk
(Ercin et al., 2012)

Stages of soy milk production and soy burgers are illustrated successively in Figure 3 and Figure 4. Most of the water footprint of this product contributed by the soybean farming process. The application of the organic system in soybean farm can reduce water pollution by 98%.

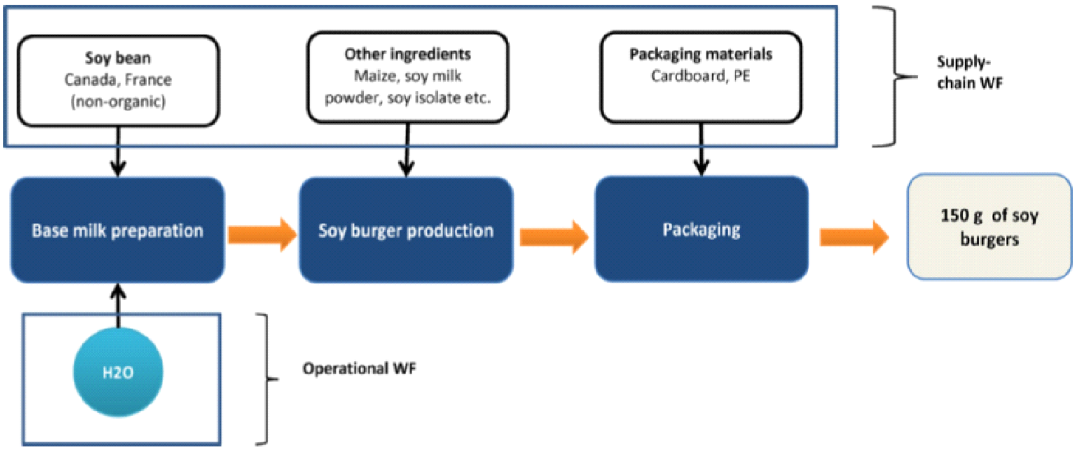

Fig. 4. Supply chain diagram of soy burger
(Ercin et al., 2012)

In addition to the organic system, reduction of the water footprint is also made efficiently with dietary changes. The use of vegetable base ingredients, such as soy (in dairy products and burgers) can reduce drastic water consumption. Can be seen in Table 2. The change of diet to vegetarian also proven to reduce the water consumption of agriculture especially in european countries (Vanham et al., 2013). A water footprint study is being used because it can evaluate the use of water in the production of some agricultural commodities on a global, regional, national or local scale (Shrestha et al., 2013). Water consumption is calculated by water footprint studies at consumption levels for European countries grouped into the West (such as Germany), North (such as Ireland), South (such as Portugal) and the East (such as Poland) with LCD units (liter per capita per day). Water consumption of agricultural products compared between non-diet and dietary conditions. Comparative examples can be seen in table 3 which contains a comparison of conditions without diet and dietary conditions in all four zones.

3. Results and Discussion

3.1 The explosion of water consumption

Water consumption to produce ready-to-sell beef at American retail is 441.8 – 597.6 liters. This consumption range is limited to the production process cycle, i.e. from livestock up to beef (Wiedemann et al., 2015b). In other words, water consumption only calculated for operational activities. Therefore, the calculation data has not adequately reflected the actual water consumption based on the concept of the water footprint.

Table 2. Reduction of total water consumption of soy milk and soy burger

Product	Soy milk	Cow milk	Soy burger	Beef burger
Functional unit	1 liter	1 liter	150 gram	150 gram
Water footprint	297 liter	1.050 liter	158 liter	2,350 liter
Reduction	753 liter (71.7%)		2,192 liter (93.3%)	

(Ercin et al., 2012)

The water footprint is a derivative of the ecological footprint concept. Both are complementary in the issue of sustainable development (Hoekstra, 2009). For example, the effect of food consumption contributes significantly to both the ecological footprint and the water footprint. What distinguishes is the scope of the study. Ecological footprints look at the whole process, including aspects of energy use that later correlated with carbon emissions. Meanwhile, water footprints only focus on the water aspect of the food life cycle. Water footprint studies not just concentrate on operational elements but also elements of the supply chain. That is, in the context of the livestock sector, the calculation of water consumption not only in the operational production of beef but also the supply chain of other materials used. For example, feed that also consumes water in the production process. Besides, the calculation of water consumption in water footprint studies is even more profound because it includes three types of water footprint such as green water footprint, blue water footprint and grey water footprint (Hoekstra et al., 2011).

Table 3. Compared water footprint of non-vegetarian diet and vegetarian diet

Zones of Europe	West	North	South	East
Water footprint of non-vegetarian diet (lcd)	3,761	3,197	5,875	4,053
Water footprint of vegetarian diet (lcd)	2,208	2,166	3,476	2,956
Reduction	41%	32%	41%	27%

(Vanham et al., 2013)

With water footprint studies, the consumption of water in the production of the livestock sector exploded in quantity. The average footprint of world beef reaches 15,415 liters/kg or equivalent to 4,056.6 gallons (Mekonnen & Hoekstra, 2010, 2012). This figure will peak when beef products processed into food products such as burgers and milk. Processing requires a process that can not separate from water consumption, such as industrial processes or processing food products in restaurants. For example, for the production of a standard beef burger (Tory, 2014) it takes one piece of beef (660 gallons), one slice of cheese (40 gallons), two pieces of tomato (1 gallon), one piece of lettuce (0.19 gallon) cut into bread (22 gallons). If totalled, the consumption reached 723.19 gallons (equivalent to 2,748.122 liters). The explosion of water consumption of livestock products requires a study not only on the production level but also the consumption level (Hoekstra, 2012). A radical change needs to be done to avoid the threat of water scarcity.

3.2 Livestock industrialization

Industrialization is mostly a process of transferring traditional production systems into industrial systems. Livestock sector production systems include grass, mixed and industrial systems. The grass system is a livestock system that releases livestock, in this case, cattle, on certain grasslands to live and grow. The industrial system is a system of cattle growth unnaturally, for example through fattening. Cattle are treated with certain conditions and fed with a particular mixture so that cattle grow and produce faster. Meanwhile, mixed systems are a combination of grass systems and industrial systems.

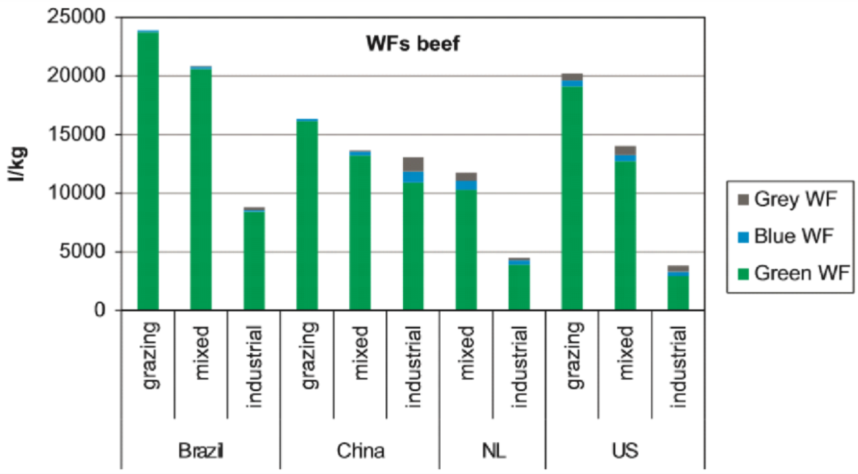

Fig. 5. Water footprint comparison of livestock production system (Gerbens-Leenes et al., 2013)

Apparently, the water footprint of beef products can be reduced by the industrialization of farms (Gerbens-Leenes et al., 2013) as shown in Figure 5. The reduction of water footprint from the grass system to the industrial system occurs consistently in the four countries studied, namely Brazil, China, the Netherlands and America. The most noticeable decline happened in Brazil and America, which became the leading actor of world beef consumption. Similar studies conducted in China, India, Netherlands, and America also showed similar results (Mekonnen & Hoekstra, 2012), as shown in Table 4. In total, the average water footprint decreased as changes to industrial systems.

Table 4. Average water footprint several beef production system

Product	Soy milk	Cow milk	Soy burger	Beef burger
Functional unit	1 liter	1 liter	150 gram	150 gram
Water footprint	297 liter	1.050 liter	158 liter	2,350 liter
Reduction	753 liter (71.7%)		2,192 liter (93.3%)	

(Mekonnen & Hoekstra., 2012)

Behind the advantages of the industrialization process, this solution certainly has the potential to cause new problems of land conversion and excess GHG emissions. Industrialization often sacrifices green land for the sake of the economy. GHG emissions are also potentially increase due to machines that assist production, such as cattle milk machines, grass enumerators, and feed mill machines. Based on Table 4, changes from the grass system to the industrial system do lower the total water footprint, but increase the grey water footprint value. That is, there are indications of the excessive use of chemicals in industrial systems that would otherwise have other negative effects. The increase also seen in Figure 5 for the Chinese. For that, this solution is less effective because it raises new environmental problems.

3.3 Combination of organic system and diet change

The decrease of water consumption through the organic system is mostly due to the decrease in the grey water footprint. This is because of organic systems, especially those that have officially been certified, do not use hazardous chemicals, so they do not require much water to neutralise the chemicals produced. This system can also be applied to the cattle breeding sector. Applications include treatment at one-third birth, outdoor access, organically certified land, 100% organic animal feed to antibiotic ban (USDA, 2013). However, the application of organic systems will be more effective when combined with dietary changes.

The vegetarian diet shifts the water consumption from the livestock sector to the agricultural sector. This diversion has been shown to reduce water footprint, as applied to soy burgers and soy milk products (Ercin et al., 2012). In fact, the decrease of water footprint on burger products reached 93.3%. This shows that water consumption in the agricultural sector is much lower than the livestock sector.

Changes in the vegetarian diet proved successful in reducing water footprint in parts of the world. In Europe, the vegetarian diet reduced the water footprint by 27–41% (Vanham et al., 2013). Meanwhile, with four scenarios of animal protein consumption ratio of 50%, 25%, 12.5% and 0%, obtained a decrease of green water footprint by 6%, 11%, 15%, and 21%, respectively, and a decrease of blue water footprint by 4%, 6%, 9%, and 14% respectively (Jalava et al., 2014). That is, the decline in the ratio of animal protein consumption causes a significant decrease in water consumption. In Latin America, Europe, Central Asia, East Asia and Sub-Saharan Africa, dietary changes lead to a decrease in green water footprint. In North America, Australia, and Oceania, dietary changes lead to a decrease in green and blue water footprints. Meanwhile, in South Asia and Southeast Asia, dietary changes do not have a significant impact on the decrease in water consumption. The combination of dietary changes and organic systems has become an alternative solution for sustainable livestock sectors, particularly to help mitigate the impact of the world's perceived water scarcity.

America and Australia as the two main actors of the global livestock sector need to conduct an assessment of this alternative immediately. Moreover, both countries have the potential to reduce the water footprint generated from the livestock sector, mainly through dietary changes. Their position as the livestock sector giant increases the urgency of this study. Radical change will contribute significantly to sustainable development missions.

3.4 Industrialization: A double-edged knife

Solving water consumption problems in the livestock sector through industrialization requires essential consideration. Sustainable solutions from an environmental issue should not cause new environmental issues. Changes in the production system from the grass system to the industrial system succeeded in decreasing the level of water consumption (Gerbens-Leenes et al., 2013; Mekonnen & Hoekstra, 2012). On the other hand, industrialization also causes environmental impacts such as land conversion, energy consumption from industrial processes, decreased beef product quality to the threat of cattle welfare.

The opening of the livestock industry indeed requires a new land allocation. Increased demand due to population explosion encourages the fulfilment of needs with the orientation of the result. Industrialization becomes an instant way of solving this problem. As a result, the industrial development also ignores the importance of green land as part of the continuity of the ecosystem. Green land that diverted into livestock industry, without proper management, creates environmental impacts such as the emergence of methane from cattle ranch.

Industrial processes also contribute relatively higher energy consumption. Industrialization aims to achieve great results with a more effective and efficient process. Thus, the orientation in the development of the livestock industry tends to be pragmatic so only focus on the final result. With the available resources, the results are demanded maximally, both in quantity and production time. For that, in the process of industry, there is a sacrifice of resources to achieve maximum results. These sacrifices are in the form of emissions produced. The emissions mainly produced from machines that often used in the modern livestock industry, according to the supply chain of beef products production. Beef products in question are cut meat from cattle and milk derived from dairy. Commonly used machines include chopper machines, mixers for concentrate feed, generators as backup power supplies, restraining boxes, milking machines and cattle cargo trucks. All of these machines require energy, both in the form of electricity and fuel with a certain level of consumption. This machine is not found on the grass system (grazing). Feeding machines and feed mixers are not necessary because cattle freely removed for food. The backup power supply from the generator is also not required. Transportation is usually done manually by breeders or using horses as shepherds. The only energy consumption is only on electric fence applications. The fence is used to ensure the cattle does not come out of the specified cage area. Thus, industrialization leads to higher energy consumption and emission output.

Industrial cattle products also lost in quality. The use of concentrate as a diet in modern times has caused various health effects, both for cattle and humans as consumers. Most concentrates consist of a mixture of some chemicals that cause abnormalities of cattle metabolism (Schroeder, 2017). In addition to concentrates, injections given to cattle also contribute. The use of recombinant bovine somatotropin and oxytocin as injections is still frequent despite prohibition (Ilyas, 2015).

Finally, the current practice of the cattle industry often lowers the welfare of cattle. One of the most common practices in the process of slaughtering cattle through torture. Cattle also involved in industrial processes also experience an unfair fattening. Cattle are required to grow faster (1.5-2 years) than the natural growth period (2.5 years). Peak, they will experience various health problems, such as acidosis. Acidosis is a disturbance in the form of a decrease in pH in the digestive system of farm animals (RAGFAR, 2007). The pH levels in question range from 5.5 to 5.0 (Krause & Oetzel, 2006). Acidosis is mainly due to excessive consumption of carbohydrate-containing feed. This disorder has some distressing clinical symptoms and consequences, such as laminitis (inflammation of the skin layer), depression, changes in faecal content, high extinction rates to rumenitis and swelling of the liver (Tajik & Nazifi, 2011). Overall, industrialization is like a double-edged knife, on the one hand contributing to the water scarcity problem, but on the other side generating a variety of new environmental impacts.

3.5 Dietary behaviour intervention

Culturally, diet, consciously or unconsciously, influences human decisions in choosing foods that enter their bodies. Patterns that often appear as a culture in the context of beef consumption are social prestige and suggestion during the meal process. Beef consumption for some communities has its social prestige (Bogueva et al., 2017). Beef becomes a luxury that may only be consumed by the middle to upper class. This view is also due to the classy processing of the chefs in the fancy restaurants. Processing also supported by the location and situation of a cosy restaurant that makes processed beef deserve high appreciation. These preparations have a prestige value that far exceeds agricultural products. In fact, both have similar nutritional content. Moreover, the proteins that people need can be obtained from both animal and vegetable. Conditioning as a classy process makes animal products far superior to vegetable products.

Besides, the decision on the selection of foods that enter the body also influenced by the suggestion generated by the human mind. The term "hungry eyes" became popular today that is often referred to as the cause of excessive consumption. This condition is due to the suggestion that comes to mind. For example, the people of Indonesia who make rice as staple food. It is common that Indonesian people often feel that they have not eaten unless they eat rice. This suggestion ignores the fact that carbohydrate content can also be obtained from other food sources besides rice, such as cassava, potatoes and maize. Whether we realise it or not, this suggestion also encourages increased consumption of beef. Meat considered as compulsory food containing energy to support daily needs. In fact, energy can also obtain from a variety of other foods.

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3.7 Adaptation of organic system and diet change

Organic systems and dietary changes are predicted to reduce the level of water consumption for the livestock sector. Until now the use of organic systems is still rare. Some organic systems that can be applied in the field of animal husbandry are the use of organic fertiliser in animal feed crops, the use of herbal based medicines for livestock and animal agriculture and the use of environmentally friendly facilities during the production process.

The use of organic fertiliser in animal feed plants is one form of efforts to implement the organic farming system. Application of organic farming system aims to replace chemical-based fertilisers containing toxic substances such as Hg (Tang et al., 2018). In addition to lowering the soil fertility rate, the use of high-dose chemical fertilisers can affect decreasing the level of biodiversity in the environment and increase the disturbance of weeds, pests and other diseases. Agricultural management with chemicals can have a negative impact, such as pollution of agricultural products by these chemicals, thus implicating health problems (Nasrabadi et al., 2017; Mantorova, 2017; Tang et al., 2018). There is a significant difference between the use of organic fertilisers and inorganic fertilisers (Afrida et al., 2015). It is seen in the production. The organic farming paradigm also becomes part of the intensification of sustainable agricultural production that produces products that reduce negative environmental impacts as well as restore the ecosystem nature (FAO, 2011b). Ease of gain and effectiveness in the process leads to the use of inorganic fertilisers still a choice of many farmers than organic fertilisers.

In addition to the use of organic fertiliser in animal feed crops, the attempt to apply the organic system is to utilise traditional medicines for livestock. Like humans, livestock also needs vitamins and medicines when needed. The drugs available on the market are divided into traditional medicine and chemical drugs. The use of appropriate traditional medicine provides a more effective and more efficient effect (WHO, 2013). In addition to impacting the increase in grey water footprint, the use of chemical drugs also raises the resistance of livestock to the given drug, if in its giving is done continuously. In addition to medication for livestock diseases, there is also the use of drugs for farm management needs, one of which is insect repellent or pest remedies. The usual insects on the farm are flies. Flies can suck blood either farm animals or cage workers and will carry various diseases. The insects that usually attack the farm are flies. Flies can suck blood either farm animals or cage workers and will carry multiple diseases. These insects can disrupt the health of livestock and will eventually disrupt the production of livestock. It can even lead to the death of livestock and cause losses to farms.Musca domestica or home fly is a pest found in many homes and farms that considered as a barrier to activity and disease carriers (Arroyo, 2011). Reducing the number of insects or pests in farms can be overcome by regular cleansing of the cage and if necessary using drugs then do not use chemical drugs but with herbal medicines that are environmentally friendly.

The embodiment of environmentally friendly organic agriculture is a difficult challenge because it has become a structured habit in the social relations of society (Dhar et al., 2018). All concepts for creating organic systems must be done gradually and require a process. Besides, it must be done sustainably. To reach the sustainable agriculture with a lot of people and small land is very difficult, but that does not mean still maintain the concept of chemical agriculture. Therefore, it is necessary for agricultural activities that combine the two systems, namely through the use of controlled inorganic materials along with the utilization of organic materials. In addition to applying organic systems in all production activities, another thing that can be done to reduce the amount of water consumption is to change the human diet. Changes in the diet are meant to increase the amount of consumption of agricultural products (vegetarian). The hope is to reduce the grey water footprint.

4. Conclusions

Based on the steps taken in a systematical review, it was found that the consumption of water for one kilogram of beef exported to American distributors was 441.8-597.6 liters or equal to 116.3-157.3 gallons with the majority of consumption to livestock. This figure even exploded when the calculation of water consumption using water footprint studies. The average water footprint of processed cattle products, namely burgers in the standard size reached 15,415 liters/kg or equivalent to 4056.6 gallons. Livestock industrialization solutions are proven to reduce water footprint but have environmental impacts such as land conversion and excessive emissions from industrial processes. Meanwhile, organic systems are also able to lower the water footprint better if it integrated with changes in consumption patterns toward vegetarianism. The change of consumption from animal products to vegetable products has been shown to decrease water footprint, especially in the countries like America, Australia, Oceania, Europe and parts of Asia and Africa. These changes need to adapt to the people's culture who give the impression of prestige and suggestion when the consumption of processed meat products cattle. Adaptation is also necessary to change the diet consistently. Thus, the solutions offered can result in reducing the water consumption, especially in the livestock sector as the leading actor in agriculture.

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