PERSPECTIVES ON BIODIVERSITY CONSERVATION

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ABSTRACT. *The objective of this paper is to expose some empirical evidence regarding the relationship between economic development and environmental degradation, as stated by the Environmental Kuznet Curve theory. The issue here concerns specifically one dimension of environmental problems, which is the endangered biodiversity in the context of heavily globalised phenomenon and economic development around the world. Particularly, several groups of endangered biodiversity including bird, fish, mammal, and plant species are focused to represent the biodiversity loss circumstance. The analysis involves the construction of one composite indicator of endangered biodiversity. Scatter plots and correlation tests are used to identify the current status of most countries in terms of biodiversity loss against the international trade. The analysis uses the recent data of 2012 of the biodiversity and four decades of trade data of 180 countries. The paper also suggests four possibilities in which successful conservation of the current global biodiversity ecosystem is possible, but under some challenging pressures.*

INTRODUCTION

Appreciating the environment is the fundamental responsibility of every individual. Moreover, we must take into consideration the value of biodiversity. Biodiversity have essential values of nature which are quantifiable, such as the use value and non-use value (Jones-Walters & Mulder, 2009). One crucial perspective underlying this important value of biodiversity is that the existence of conflicts between human economies and biological system where human economic system is subject to biological laws in which human created activities exceed the limits of sustainable natural resources (Gowdy & McDaniel, 1995). Furthermore, the conservation of biodiversity is not only important to protect wildlife, but also crucial for human beings as living laboratories in which we develop knowledge about the ecosystem (Edwards & Abivardy, 1998).

The issue regarding the impacts of international trade on the biodiversity degradation has been explained in both theories and further elaborated in empirical studies. Due the complication of the integration of two broad disciplines including economics and ecology, the detail of any causality investigation is very limited. The theoretical studies also show trade-off between the economic detail and ecological details (Eppink & van den Bergh, 2007). Furthermore, trade has been proved empirically to have both beneficial and destructive effects to the biodiversity. Trade effects can be both direct cause to biodiversity loss and also a motivation towards conserving biodiversity as a result of welfare concerns of human population (Dinda, 2004: Birdsall & Wheeler, 1993). The objective of this paper is to analyze the changing endangered biodiversity of most countries in the recent time through the analysis on a constructed composite indicator. Furthermore, it also investigates the relationship between endangered biodiversity and international trade of four decades in the context of different income levels of most countries using graph presentations and simple statistical tests.

Biodiversity and Sustainable Economic Development

It is self-evident that economic activities around the world are the main contribution to the deterioration of mega-biodiversity, especially for trading purpose. The enquiry here concerns, if economic development will correct the problems associated with environmental degradation after one point or level of income as shown by the environmental Kuznet Curve, how sustainable is the world economy now and the future. Antoci, *et al*. (2005) explain that human intervention may correct the further degradation problem of biodiversity if a fixed point is reached with sufficiently low level of biodiversity species. This leads to agents' concerns to alleviate the problem due to their awareness of infinite welfare loss as the result of the degradation of biodiversity species. The fixed point is their estimation of the attractor, repell or a saddle point in a linear ecological dynamic system. Clausen and York (2008) predict a more specific investigation on the loss of fishery biodiversity shows that economic modernization has negative impact to the fish species and therefore economic growth could ultimately be unsustainable. It is also shown in a theoretical framework that international trade can alter the biodiversity species when comparative advantage rule applied and specialization takes place. Specialization of each trading partner is likely to focus on particularly type of biodiversity species, it will cause the sustainability of trade that depends on this resource to decline as this specific type of resource decline due to production specialization (Polasky, *et al*. 2004). In other words, the concentrated ecosystem habitat destruction may lead to unsustainable specialization in production for trade purpose in the future.

As income level of a country increases, it causes economic agents to be more concerns about their welfare loss due to biodiversity degradation as a result of production and trade, which potentially leads to unsustainable economic welfare. Most studies explore the causality aspect for this issue over the decades, while the exploration to the current status of the relationship among trade, income and biodiversity is crucial to see the extent these causalities have happened until the recent days. A question is deemed essential to answer in response to these explanations that concerns about the sustainability of the world economy in the context of declining biodiversity. How are the import and the export of trade over the past decades associated with the loss of biodiversity across countries in the global ecosystem nowadays?

Data and methodology

The study concerns particularly to the appropriate measurement that reflects to the biodiversity aspect of environmental degradation. To achieve this objective, a composite indicator construction procedure is applied (OECD & JRC European Commission, 2008). Four endangered categories of biodiversity species are used to construct a composite indicator, including the endangered fish, bird, mammal, and plant species collected for the year 2012. The data used are obtained from World Development Indicator, the World Bank database. One of the steps in the procedure to emphasize here is that the sensitivity and uncertainty of the composite indicator is examined via repeating the construction process with different methods. For instance, the original data are reconstructed by min-max normalization and repeated by z-score standardization. Furthermore, the principal component method is used alternatively with the maximum likelihood method in determining the weight for aggregation, which is repeated with both ranking aggregation method and linear aggregation method. Basically, the construction process satisfies the rules and assumptions needed for a composite indicator (OECD & JRC European Commission, 2008).

This study focuses primarily on biodiversity taking into consideration the losses of species reported in the categories of fish, bird, mammal, and plant. Although this is not a

comprehensive measure of biodiversity, but this composite indicator is used due to its approximation to the impacts of human economic activities on land and water resources.

RESULT AND ANALYSIS

It seems unambiguous that countries with relatively rich biodiversity ecosystem will have bountiful habitats to sustain the living of various species. This is shown by the countries which are identified to have such natural endorsement, such as Indonesia, India, Brazil, Mexico and China. These countries are also ranked to be among the top ten countries with the richness of mammals, fish, and flowering plants (Paine, 1997) and also among the highest in terms of biodiversity loss shown in this paper. Nonetheless, in comparison with the Environmental Performance Index (EPI) in year 2012, India is categorized to have the weakest performance and China is found to have weaker performance, while Indonesia and Mexico are identified as moderate performers. These ranks by EPI are also associated with their current high biodiversity loss as shown in Figure 1. Nonetheless, further proof is needed to verifying the underlying factors. The EPI ranking shows Brazil as a stronger performer in the year 2012, while it has high ranking of biodiversity loss. This reflects the uncertainty associates with the measurement which requires details of both the economics and ecosystem. Table 1 shows the result of correlation test between the biodiversity and both import and export across 180 countries. Both export and import are found to have adverse relationship with the endangered biodiversity indicator, which is significant at 1 percent critical level. This is further illustrated using scatter plot, figure 2 and 3.

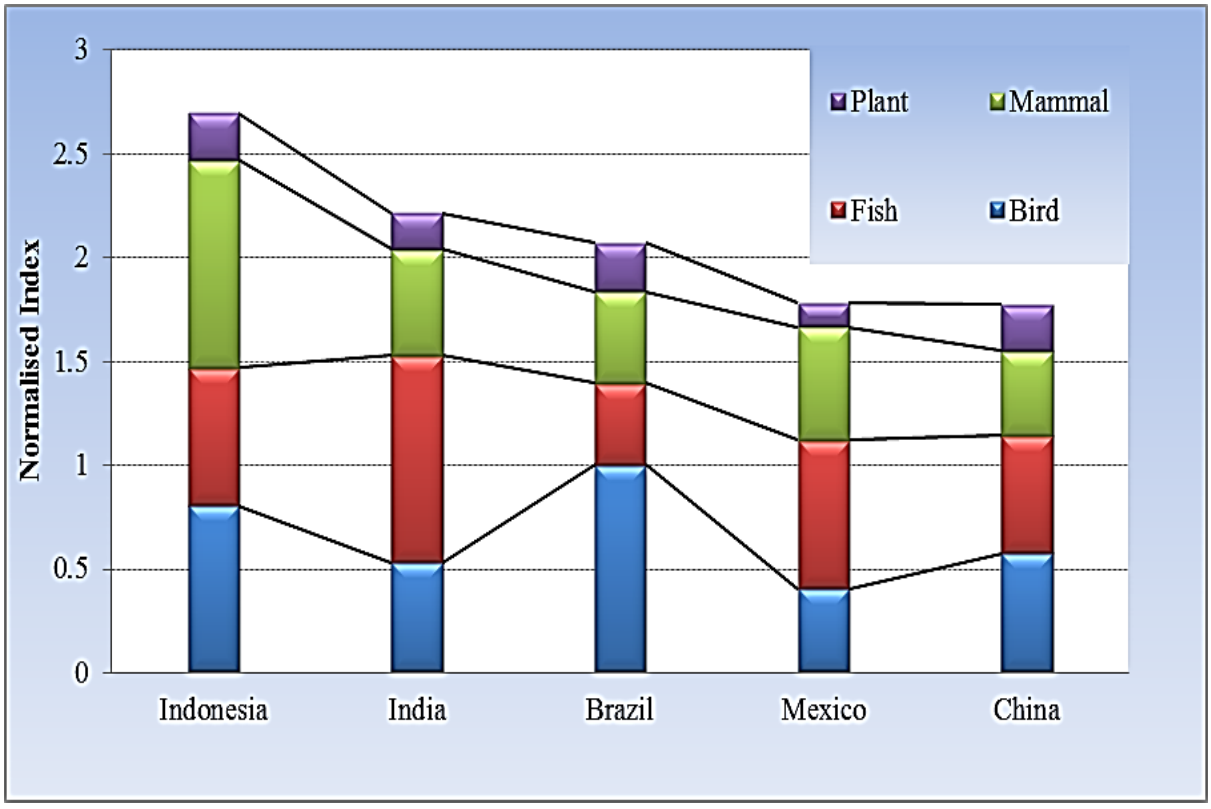


Figure 1: Mega-diversity Countries with High Biodiversity Loss

Table 1: Pair correlation results.

	Endangered Biodiversity CI & Import	***Endangered Biodiversity CI & Export***
Correlation value	-0.36	-0.29
t-stat.	-3.62	-2.86
p-value	0.0005	0.0000

Note: Data are obtained from World Bank database. Import and export data are mean value for the 1972-2011 periods. The constructed endangered biodiversity composite index is for year 2012. The result is based on 180 countries.

Figure 2 and 3 are the scatter plots built to identify the current status of the countries which are ranked according to the biodiversity loss against both export and import indicators. The lowest the rank number means the highest the countries in terms of each particular indicator. It is suggested that the current status of the countries in the figures are likely to have rigid improvement in the next few decades due to four possible reasons.

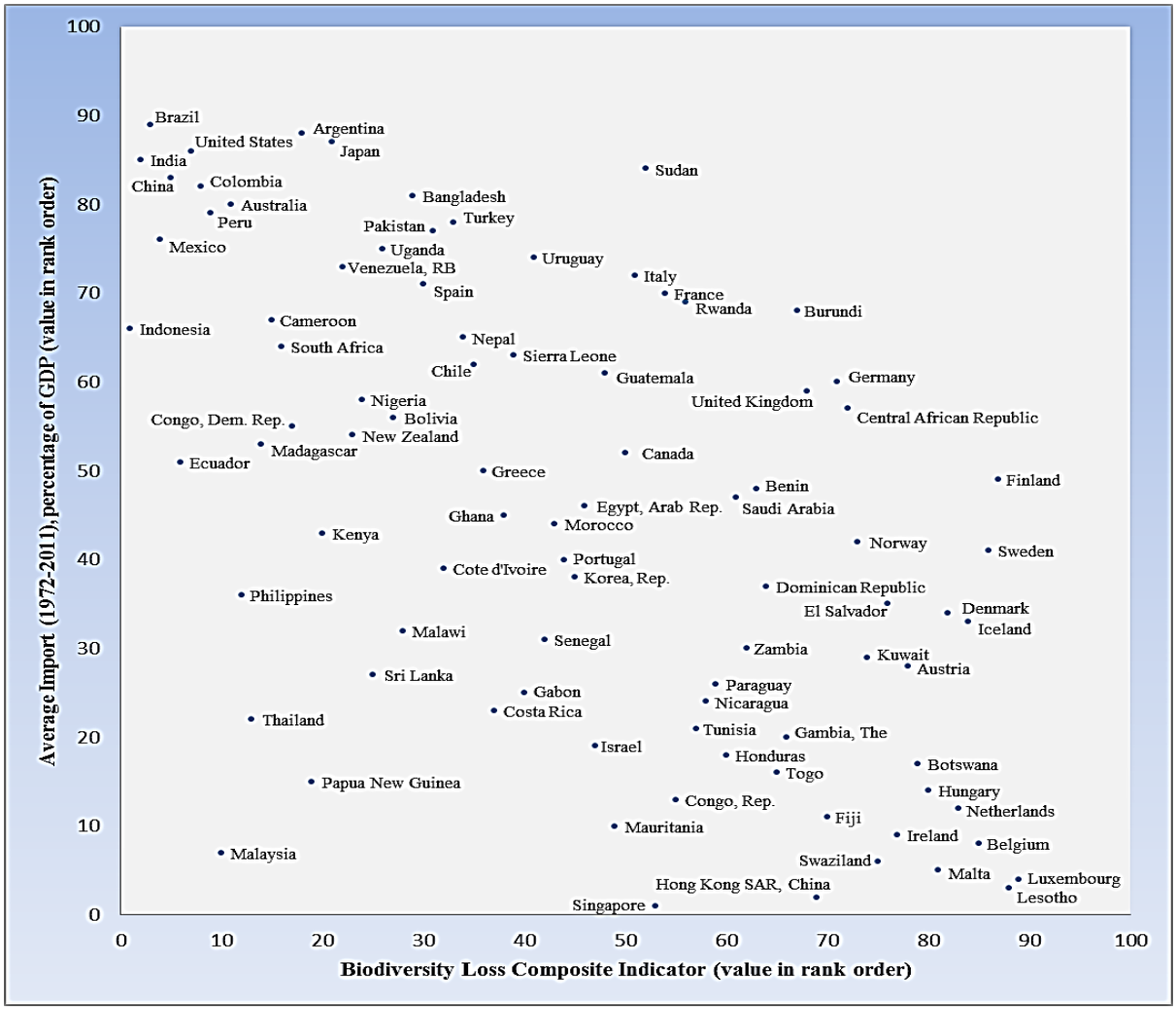
a. The evidence indicates that some countries which currently show high ranking of biodiversity loss have also relatively low average trade volume over the past forty years. However, the significantly negative correlation between trade and loss of biodiversity does not convey any meaning of causality. Indeed, it does not mean that high trade will improve biodiversity ecosystem and vice versa. Furthermore, the nexus of trade and biodiversity requires much more than simply some bivariate evidence because institutional factors can be crucial for cause and effect between trade and biodiversity, such as optimal market regulation and trade policy (Barbie & Bulte, 2004). According to the explanation by Ecchia and Mariotti (1998), effective international agreement regarding environmental issue can be formed via manipulation of institutional rules. Nevertheless, the aim towards international cooperation could be limited due to the currently aggressive development of world economy and population. As a result, it is expected that there will be a prolonging tendency of biodiversity degradation.

b. The current statuses of biodiversity situation as depicted in Figure 1 and 2 might change over time with some expected directions. For example, Singapore is relatively low in biodiversity loss but relatively high in trade ranking, it seems impossible to move to the position with high rank of biodiversity degradation and relatively lower trade simply because it has relatively low biodiversity intensity compared to Indonesia, Brazil, and China. Nonetheless, it is possible to move to the upper right area in the figures which has lower trade volume as a result of biodiversity pressure from both domestic and global development. However, due to the need to sustain economic development of most countries which also involve the binding effects of some international trade agreements, biodiversity loss is expected to increase continuously and international trade is likely to increase or maintain at the current stage. Verboom, *et al*. (2007) via four alternative scenarios of 25 EU countries also show that most countries will face biodiversity degradation in the next two decades as a result of urbanization and stress factors. Thus, the need for sustainable economy itself can become one constraint to biodiversity conservation.

c. The pressure of welfare loss due to biodiversity degradation will raise awareness and concern towards conserving biodiversity. Countries currently in the high ranking of

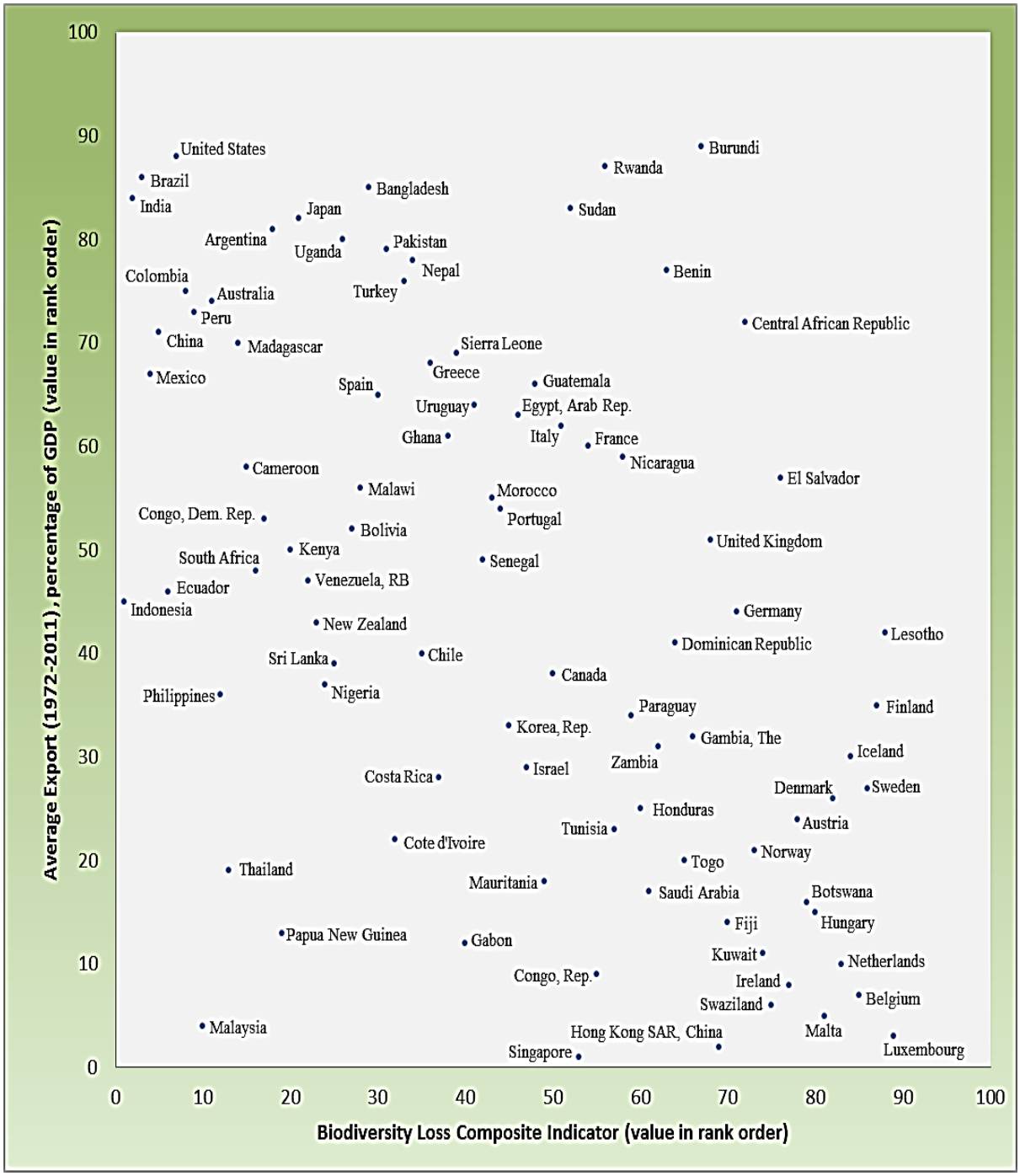
biodiversity loss might have been pursuing the conservation plans. However, while increasing biodiversity loss can be fast, the task for conserving the biodiversity ecosystem can be time consuming. This would involve altering and shifting production to more biodiversity friendly approach. Moreover, strategy of implementation must be wisely devised such as a well integration between biodiversity problems with policies (Spangenberg, 2007). Nonetheless, prior to these moves leading to a better biodiversity ecosystem is the need for a constructive measurement of the biodiversity ecosystem, which is crucial for effective policy and strategy with the lowest opportunity costs. Nevertheless, it is usually incomprehensive in the way of incorporating both the details of economics and ecosystem. Further digestion for both dimensions of economics and ecosystem can make improvement to the biodiversity measurement, but limited by the difficulty of integrating details without triggering any complication and conflicts.

It is unclear to what extent the specialization in production has contributed to the loss of biodiversity in the sense that it is a diverse matter in terms of the causal relationship production, trade, and biodiversity degradation across the countries. Production by one sector can give rise of profit opportunity to other industries and therefore it will cumulatively become a stressful factor to the natural biodiversity. Specialization for production and trade by various sectors might also associate with certain geographical areas and this would give double or triple degradation effects to biodiversity. For instance, the mining industry is often found near tourism destinations in one area in China and therefore magnifies the impact to the biodiversity hotspot in one area in China (Huang, *et al*. 2011). In short, the microeconomic aspect of development within a country can be a constraint to biodiversity conservation and should be further investigated.



Note: The highest ranking of import is 170.9% of GDP (Singapore), while the lowest is 9.7% of GDP (Brazil). The lowest ranking of endangered biodiversity indicator is 100.0029 (Luxembourg), while the highest ranking is 100.7496 (Indonesia).

Figure 2: Link between import and endangered biodiversity.



Note: The highest ranking of export is 179.9% of GDP (Singapore), while the lowest is 9.2% of GDP (Burundi). The lowest ranking of endangered biodiversity indicator is 100.0029 (Luxembourg), while the highest ranking is 100.7496 (Indonesia). Some countries are not shown in the figure to enhance vision effects.

Figure 3: Link between export and endangered biodiversity.

CONCLUSION

Biodiversity in the ecosystem is a matter of global concern and it is getting serious due to the upswing of human economic activities around the world. Global trades of goods and services are very diverse in the sense that it involves different countries, resources, cultures, people, currency, specialization, and institutional rules. Trades in the global economy have been claimed to be the reason for biodiversity degradation, while it has been defended as the motivating factor for correcting biodiversity loss. This paper has suggested that both ways are possible through revisiting the current status of most countries in terms of trade and biodiversity degradation as the literature have shown to have causality relationship. The causality is found notwithstanding in the literature, international trades over the past four decades are found to be opposite to biodiversity degradation of most countries. Indeed, countries with high ranking of biodiversity loss in the recent year have particular low in average trade over the past forty years. This finding consists of both developed and developing countries out of the 180 countries under observation, including some developing economies with aggressive production and trade in the decades, such as China, India, Brazil and Indonesia. Countries with both high trade volumes and biodiversity loss are seldom. It is suggested that the status where the countries are currently observed can be categorized diagonally in a XY plane in which the countries experience high trade but relatively low biodiversity degradation and vice versa. It is also shown that countries with high or low in both trade and biodiversity loss is seldom the case. Moreover, the countries which are currently high in biodiversity loss will have the difficulty to restore their biodiversity ecosystem against international trade. The major reason to this proposition is due to the upswing development of world economies and trade. Moreover, it has been a difficult task of integrating between policy and strategy in which this is subject to institutional rules which have to be manipulated to achieve international cooperation to correct the global ecosystem problem globally. The limitation in this study is the limited scope of the biodiversity degradation indicator constructed in this study, which it reflects more about species loss of birds, mammals, fish, and plant until the recent year 2012. The relative high or low in the ranking of the biodiversity loss composite indicator is subject to the richness of biodiversity that the countries have. For example, Indonesia rainforest is a mega-biodiversity habitats which reported loss can also be high for reasons that need further analysis, while Singapore is much less in biodiversity endorsement and therefore it is typical to show lower report of biodiversity loss. Further work is needed to explore both the detail of ecosystem and economic system related to this issue in order to develop a more comprehensive measure of biodiversity environment.

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