ASSESSMENT OF SUSTAINABLE FORESTRY DEVELOPMENT CASE HA TINH PROVINCE

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SUMMARY

Sustainable development of forestry (SDF) is one of the goals in the general sustainable development of Vietnam. Measuring exactly the level of SDF is necessary, which will be a crucial basis to propose effective solutions for achieving SDF. Based on research results have been published and the possibility of calculation and collection data, the study proposed: i) The set for measuring the sustainable level of Forestry development including 30 indicators in three dimensions: economy (10 indicators), society (11 indicators), and environment (9 indicators); ii) The methods of calculation, normalization, aggregation, and assessment standards used for measuring the sustainable level of Forestry development. The hypothesis of the research was applied in Ha Tinh province in 2017. The application results of the proposition showed that Forestry development in Ha Tinh province was unsustainable and There was an imbalance among 3 pillar components; it also had imbalances among the particulars indicators in each dimension. This will be an important basis to propose a solution for sustainable development in Ha Tinh province. These were the important bases to propose solutions for achieving SDF in Ha Tinh province. The results showed that the given set and the synthetic method and assessment method can be able widely applied.

Keywords: Assessment indicators, assessment method, Ha Tinh province, sustainable development of forestry.

1. INTRODUCTION

The goal of sustainable development is not too stranger on the development of national-level or particular sectors. Sustainable development needs to be equal among three dimensions (economy, society, environment) (WECD, 1987). The viewpoint about "what sustainable development is" was clear and accepted. But measuring the level of sustainable development of forestry still have had many views and approaching ways.

The forestry sector plays an important role in national sustainable development. Forestry which is a distinct sector has clear functions in the economy, society, and environment. SDF is considered a necessary purpose. That is expressed by the Vietnamese government released the strategy of SDF in the period from 2016 to 2020 (Prime Minister, 2017).

Assessing the level of SDF is a basis to propose measures for SDF. On over the world, there were several studies that gave the indicators and process for assessment SDF, especially in China. Ma's research used the set including 27 indicators to measure the level of Heilongjiang's SDF (Ma, 2006). Yang (2003) conducted to assess Suzhou' SDF by using the set which has 39 indicators. 27 indicators were used to assess SDF in Hunan province in 2005 (Hexiuchun, 2005). In the research, namely "Strategy of sustainable development in China", the author gave the set which included 21 indicators to assess SDF (Lu Zhao-hua et al., 2002). While there are many similarities in the set of indicators measuring SDF, there are some differences among the methods of calculation and assessment.

There has not been any research in Vietnam now which gives the indicators for measuring SDF and the process to aggregate and assess the level of SDF. The research was conducted for building indicators, a process of assessing SDF. The study was also applied in one case, Ha Tinh province, to test the research hypothesis.

2. RESEARCH METHODOLOGY

- Building indicators of assessment

Base on theories relating to the research issues to build the set of indicators measuring the level of SDF. The construction of the set was considered the possibility of calculation and collection data. The set had 30 indicators, shown in the table 1.

Table 1. The set of indicators measuring Sustainable Development of Forestry in Vietnam

No.	Indicators	Unit	Formulas	Meanings	Classification	References
A	**Indicators of the economic dimension**					
A1	Change rate of exploitation	%	$\frac{\text{The amount of harvested timber this year}}{\text{The amount of harvested timber last year}} \times 100$	Showing how the changes in exploitation from forests between 2 years are	Positive indicator	(Ma, 2006) (Lu et al., 2002)
A2	Change rate of forestry gross output	%	$\frac{\text{The gross output of forestry this year}^{(a)}}{\text{The gross output of forestry last year}^{(a)}} \times 100$	Showing how the changes in forestry gross output between 2 years are	Positive indicator	(Ma, 2006) (Hexiuchun, 2005)
A3	Land use rate	%	$\frac{\text{The forest area}}{\text{The land area zoning for Forestry}^{(b)}} \times 100$	Showing how much the actual forest area is in the total land area planned for forestry.	Positive indicator	(Yang, 2003), (Hexiuchun, 2005)
A4	Rate of Business diversification	%	$\frac{\text{The gross output of non-timber forest product and service}}{\text{The total of forestry gross output}} \times 100$	Showing the contribution rate of the non-timber forest business	Positive indicator	(Ma, 2006) (Lu et al., 2002)
A5	Exporting value of forestry products	USD	The amount of Exporting value of forestry products	Illustrating the ability of the forestry industry to collect foreign currency	Positive indicator	Proposed by The author
A6	Per capita gross output of forestry	VND per person	$\frac{\text{The gross output of forestry}}{\text{The number of citizens}}$	Showing the efficiency of forestry business	Positive indicator	(Ma, 2006), (Yang, 2003), (Hexiuchun, 2005), (Lu et al., 2002), (UN, 2016)
A7	Gross output of forestry per hectare	VND per ha	$\frac{\text{The gross output of forestry}}{\text{The land area zoning for Forestry}^{(b)}}$	Showing the productivity of producing Forestry gross output per hectare.	Positive indicator	Proposed by The author
A8	Forestry self-financing rate	%	$\frac{\text{The forsetry capital funded by itself}^{(c)}}{\text{The total amount of forsetry capital}^{(d)}} \times 100$	Showing the financial autonomy of the forestry sector.	Positive indicator	(Lu et al., 2002)
A9	Processed wood rate	%	$\frac{\text{The amount of harvested timber producing into the final product}^{(e)}}{\text{The amount of harvested timber}} \times 100$	The indicator shows the percentage of harvested timber used to produce the final product.	Positive indicator	Proposed by The author
A10	Contribution rate to GRDP	%	$\frac{\text{The forestry gross output}^{(f)}}{\text{The gross regional domestic product}} \times 100$	Showing the contribution of the forestry sector to the district economy	Positive indicator	Proposed by The author

B	**Indicators of the social dimension**					
B1	Average of forestry worker income	VND per person	$\frac{\text{The wage fund for forestry worker}}{\text{The number of workers in Forestry sector}}$	Showing the amount of salary of workers who are working in the forestry sector.	Positive indicator	(Ma, 2006) (Lu et al., 2002)
B2	Contribution rate to household income	%	$\frac{\text{The household income from forestry activities}^{(g)}}{\text{The total income of household having forestry activities}^{(g)}} \times 100$	Showing the contribution of forestry activities to the income of households who have forestry activities	Positive indicator	Proposed by The author
B3	Number of employees	People	Number of people working in Forestry sector	Showing the forestry sector creates how many employments	Positive indicator	Proposed by The author
B4	Average of PFES per hectare	VND per ha	$\frac{\text{The amount of Payment for ecosystem services}}{\text{The land area zoning for Forestry}^{(b)}}$	Showing the forest benefits shared to communities	Positive indicator	(Ma, 2006)
B5	Forest volume per capita	m^3 per person	$\frac{\text{Forest volume}}{\text{The number of residents}}$	Showing the forestry sector contributes to improving the quality of living environment	Positive indicator	(Hexiuchun, 2005)
B6	Forest area per capita	Ha per person	$\frac{\text{The land area having forests}}{\text{The number of residents}}$	Shows the forestry sector contributes to improve the quality of living environment	Positive indicator	(Ma, 2006) (Lu et al., 2002)
B7	Budget allocation rate for forestry	%	$\frac{\text{The amount of forestry capital supported by local budget}^{(d)}}{\text{The total of regional budget}} \times 100$	Showing the extent to which local governments concern the forestry	Positive indicator	(Ma, 2006)
B8	Change rate of ecological tourists	%	$\frac{\text{The number of ecological tourists this year}}{\text{The number of ecological tourists last year}} \times 100$	Showing how much communities concern about the forestry sector, especially ecological tourism	Positive indicator	(Hexiuchun, 2005)
B9	Land use allocation right proportion	%	$\frac{\text{The forestry land area allocated the right of land use to owners}}{\text{The land area zoning for Forestry}} \times 100$	Showing the local government creates a favorable condition for communities approaching forest resources	Positive indicator	Proposed by The author
B10	Local owners rate	%	$\frac{\text{The number of forest owners being local}}{\text{The number of total forest owners}} \times 100$	Showing the local government prioritizes local citizens in approaching forest resources.	Positive indicator	Proposed by The author
B11	Forest area change rate	%	$\frac{\text{The forest area this year}}{\text{The area having forests last year}} \times 100$	The current generations concern the benefits of future generations seen through efforts to increase forest area	Positive indicator	(Yang, 2003) (Hexiuchun, 2005)

C	**Indicators of the environmental dimension**				
C1	Forest cover rate	%	$\frac{\text{The forest area}}{\text{The natural land area}} \times 100$	The higher the value is, the higher the level of ecological environment protection is.	Positive indicator	(Ma, 2006), (Yang, 2003), (Hexiuchun, 2005), (Lu et al., 2002), (UN, 2016)
C2	Mixed species plantation rate	%	$\frac{\text{The area of mixed species plantation}}{\text{The total area of plantations}} \times 100$	Showing the effort of maintaining biodiversity in plantations and restricting mono species plantations	Positive indicator	(Hexiuchun, 2005)
C3	Conservation area rate	%	$\frac{\text{The conserved forest area}}{\text{The forest area}} \times 100$	The percentage of forests preserved on existing forest areas	Positive indicator	(Lu et al., 2002), (UN, 2016), (Thủ trướng CP,2013)
C4	Forest volume per hectare	m^3 per ha	$\frac{\text{The forest volume}}{\text{The forest area}}$	Forest quality contributes to improving the ecological environment	Positive indicator	(Ma, 2006) (Yang, 2003)
C5	Degenerate land rate	%	$\frac{\text{The area of degenerated land}}{\text{The land area zoning for Forestry}^{(b)}} \times 100$	The proportion of forestry land area degenerated	Negative indicator	(Ma, 2006), (Yang, 2003), (Hexiuchun, 2005), (Lu et al., 2002), (UN, 2016)
C6	Wildfire and disease rate	%	$\frac{\text{The area of burnt forests and the area of damaged forests by pests}}{\text{The land area zoning for Forestry}^{(b)}} \times 100$	The proportion of forestry land area impacted by forest fires and pests. The result of efforts to protect forests.	Negative indicator	(Ma, 2006), (Yang, 2003), (Hexiuchun, 2005), (Lu et al., 2002)
C7	Infringing forestry law	VND per case	$\frac{\text{The proceeds from handling cases}}{\text{The number of cases}}$	Showing the extent of deforestation control both in number and severity	Negative indicator	(UN, 2016)
C8	Rate of allocation FSC	%	$\frac{\text{The forest area received FSC certification}}{\text{The land area zoning for Forestry}^{(b)}} \times 100$	The proportion of forestry land area received FSC certification	Positive indicator	(UN, 2016)
C9	Exploitation rate compared to area change rate	Times	$\frac{\text{Change rate of forest exploitation}^{(h)}}{\text{Forest area change rate}^{(j)}}$	To maintain the balance of ecological environment, the exploitation rate need to be smaller than the area change rate	Negative indicator	(Hexiuchun, 2005) (FSC, 2017)

[(a)] The gross output of forestry is the value of four forestry activities including planting and tending; harvesting timber and other forest products; gathering forest products are not wood and other forest products; forestry services. These data, collected by the Statistic Department, does not include the value of forest product processing and trade.

[(b)] The land area zoning for Forestry consists of natural forest land, planted forest land and non-forest land.

[(c)] The amount of forestry capital funding by itself, which collected from the Department of Forestry's Ha Tinh province, including the funding capital from The Payment for ecosystem services.

[(d)] The amount of forsetry capital collected from the Department of Forestry's Ha Tinh province, without investments from personal and company subjects.

[(e)] That consist of the wood using for the carpentry because of the final product in the studying area only being woodworks.

[(f)] The forestry value added is more suitable for calculating, in condition without the data of forestry value-added, using The forestry gross output as an alternative measure.

[((g)] The data collected through quesionnaires.

[(h)] Change rate of forest exploitation $= \frac{\text{The amount of harvested timber this year}}{\text{The amount of harvested timber last year}}$

[(j)] Forest area change rate $= \frac{\text{The area having forests this year}}{\text{The area having forests last year}}$

In this set of indicators, the concept of forestry is understood as an economic-technical sector including forest management and protection, development and use forests, forest product processing and trade. The concept of Forest given in this article is understood as forests consist of three types of forests, namely special-use forests, protection forests and production forests.

- The study time and study area

The secondary data collected from relevant offices included: Ha Tinh's Statistical Office; Ha Tinh's Department of Labor, Invalids and Social Affairs; Ha Tinh's New Rural Coordination Office; Ha Tinh's Department of Resources and Environment, Ha Tinh's Department of Agriculture and Rural Development... The data were collected from monthly, yearly reports in terms of three sides including the economy, society, and environment in the period from 2012 to 2017. These data were the basis to specify the minimum, maximum of each indicator in the process of normalizing data.

- The calculation and assessment methods

According to the proposed set of indicators and the collected data, the stages and the specific methods used in assessing SDF constructed 4 steps (Figure 1).

The actual data of indicators used to assess the level of SDF had the differences in the measurement unit, the size and the meaning in assessing. The study used the Min-Max method to transform from the disjointed value into a compatible scale between 0 and 1. Basing on the meaning of each indicator, the set of indicator was separated into 2 groups: The positive indicator, The negative indicator. The positive indicators were the indicators which had higher value it showed the higher level of sustainable development (ex: Forest cover rate, Average of forestry worker income, etc.). The negative indicator had the higher value it showed the lower level of sustainable development (ex: Degenerate land rate, Infringing forestry law...). The classification of indicators shown in table 1.

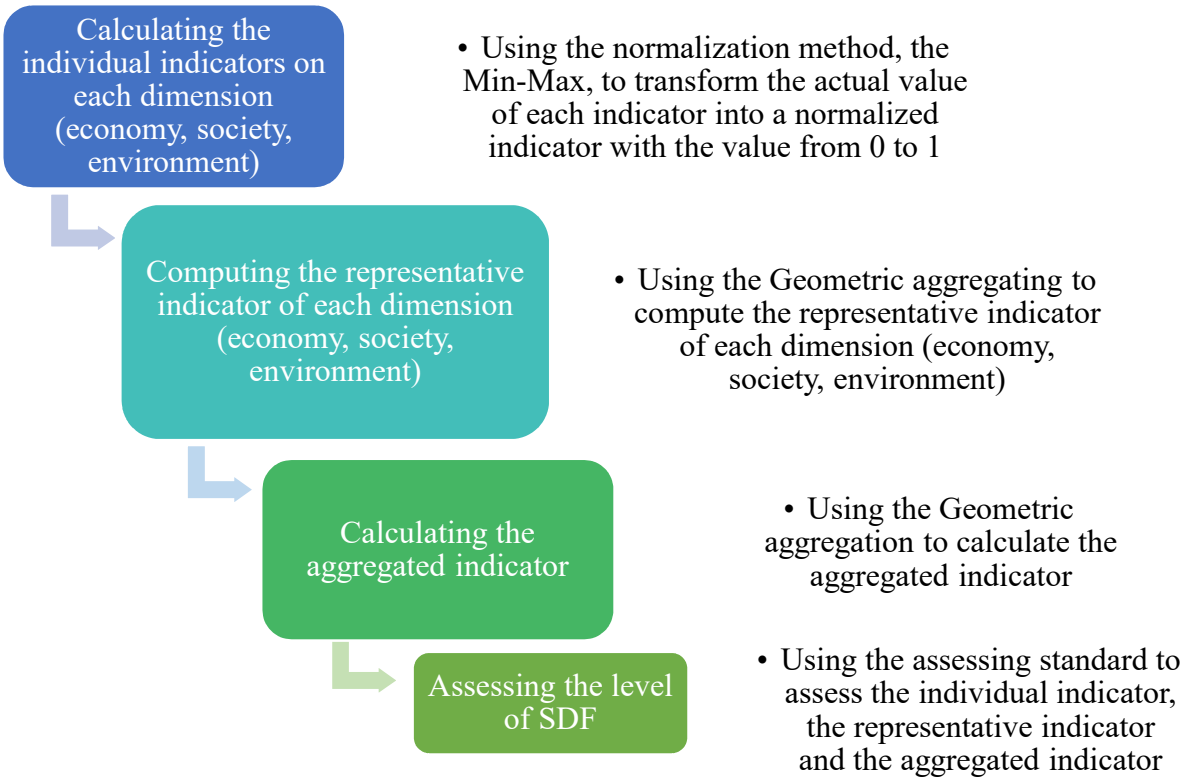

Figure 1. Stages in computing and assessing the level of SDF

Each group of indicators shown above uses the different formulas in normalizing by the Min-Max method. After normalizing, the higher the values are, the more sustainable the development they showed.

Positive indicator (x)

$$x = \frac{X - Min}{Max - Min}$$

Negative indicator(x')

$$x' = 1 - \frac{X - Min}{Max - Min}$$

Using the Geometric Aggregation to calculate the indicators in each group into an indicator for representing for these indicators, and to compute the Aggregating indicator.

$$I_{RI} = \sqrt[k]{\prod_{i=1}^{k} x_i}$$

I_{RI} Representative indicator of three dimensions

x_i - Normalized indicator

k – Number of indicators in each group.

$$I_{AI} = \sqrt[3]{\prod I_{RI}}$$

I_{AI} Aggregated indicator

The representative indicators of each group and the aggregated indicator had the value between 0 and 1. The higher they were, the more sustainable development they showed.

To assess the level of SDF the study used the scale having 5 levels: i) [0.0 - 0.2]: Forestry development is very unsustainable; ii) [0.2 - 0.4]: Forestry development is unsustainable; iii) [0.4 - 0.6]: Sustainable forestry development relatively; iv) [0.6 – 0.8]: Forestry development is quite sustainable; v) [0.8 - 1.0]: Forestry development is very sustainable.

3. RESULTS

The actual values of each indicator, The results of the normalized indicator, The representative indicator and the aggregated indicator in assessing the level of SFD Ha Tinh province in 2017 shown in table 2.

Table 2. The results of assessing the level of SDF in Ha Tinh province in 2017

Indicators	Actual value		Normalized Indicator(*)	Representative Indicator (*)	Aggregated Indicator
	Value	Unit			
A1	180.40	%	0.992	0.407	**0.329**
A2	10.58	%	0.329		
A3	86.90	%	0.869		
A4	5.89	%	0.149		
A5	48.84	Million USD	0.543		
A6	24.95	Million VND per person	0.695		
A7	3.46	Million VND/ha	0.977		
A8	7.32	%	0.073		
A9	12.05	%	0.275		
A10	2.47	%	0.395		
B1	2.231	Thousand VND/month	0.044	0.150	
B2	33.93	%	0.339		
B3	50.000	People	0.714		
B4	170.950	VND/ha	0.427		
B5	24.17	m^3/person	0.322		
B6	0.25	ha/person	0.139		
B7	26.57	%	0.886		
B8	1.24	%	0.007		
B9	90.75	%	0.908		
B10	100.00	%	1.000		
B11	0.005	%	0.001		
C1	52.32	%	0.934	0.580	
C2	19.55	%	0.391		
C3	1.00	%	1.000		
C4	101.67	m3/ha	0.635		
C5	0.00	%	1.000		
C6	0.00	%	0.999		
C7	7.34	Million NVD/case	0.541		
C8	5.54	%	0.554		
C9	1.80	Times	0.107		

(*) Using the Geometric Aggregation to aggregate, details shown in appendix

It is noticeable that there was an imbalance among the value of indicators on the economic dimension. There are half of the indicators which show that forestry development is sustainable relatively, the others are unsustainable and very unsustainable. The change rate of exploitation was 0.992 which was the highest value in the economic dimension. The lowest was Forestry self-financing rate been 0.073.

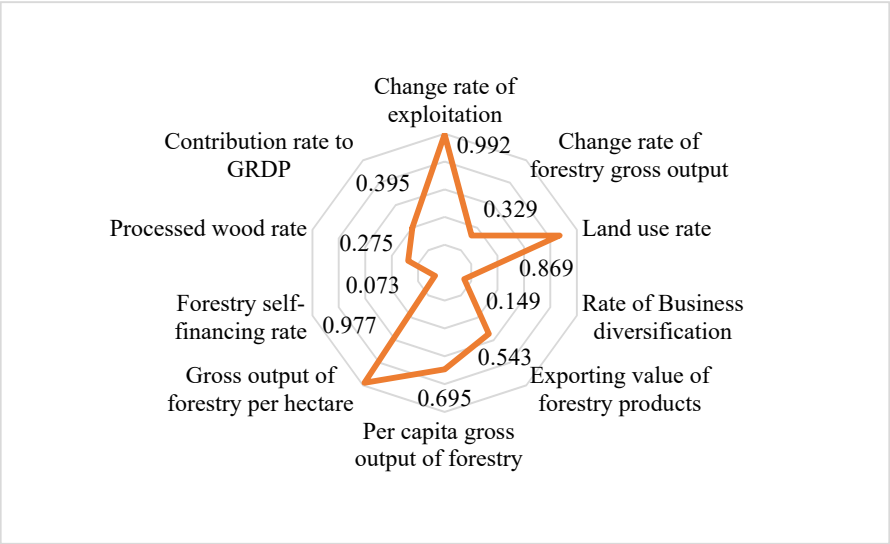

Figure 2. The indicators of economic dimension

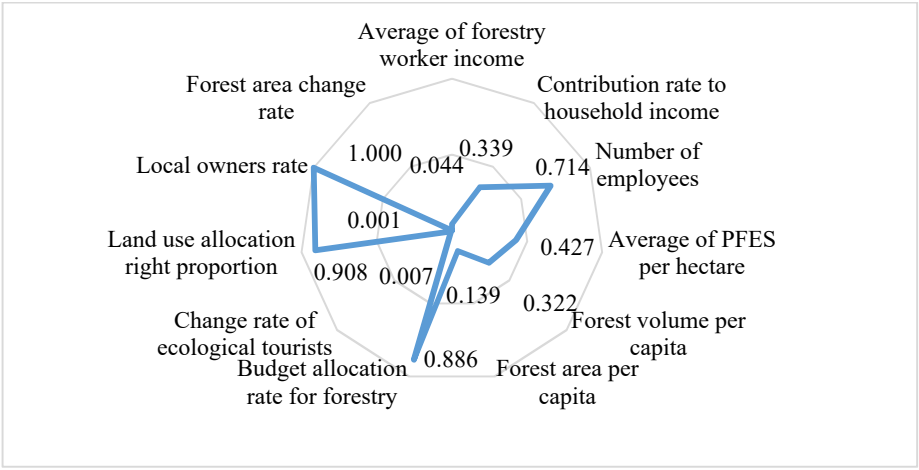

Figure 3. The indicators of social dimension

There are many differences among the indicators in the level of SDF on the social dimension shown in figure 3. There were 6 out of 11 showed the level of SDF was unsustainable. The typical indicators included average of forestry worker income, Increasing rate of the number of ecological tourists, rate of increasing forest area yearly, all of 3 indicators had low value, below 0,05, showing the level of SDF was very unsustainable. Whereas the indicators, namely budget allocation rate for forestry, land use allocation right proportion, local owners rate, expressed the inverse meaning being very sustainable.

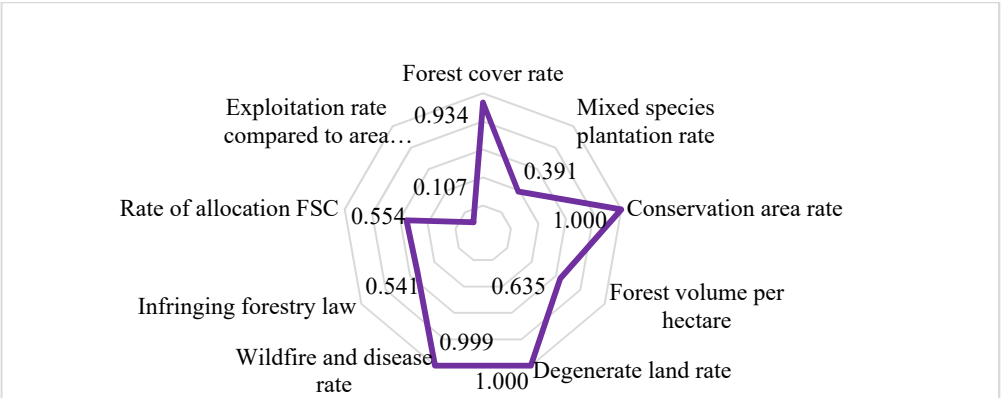

Figure 4. The indicators of environmental dimension

It can be seen in figure 4 that the indicators in the environmental dimension had not too many differences in its values. There were 7 out of 9 indicators showing they were sustainable relatively. It illustrated that there was a relative balance among the indicators in assessing the level of SDF on the environmental dimension.

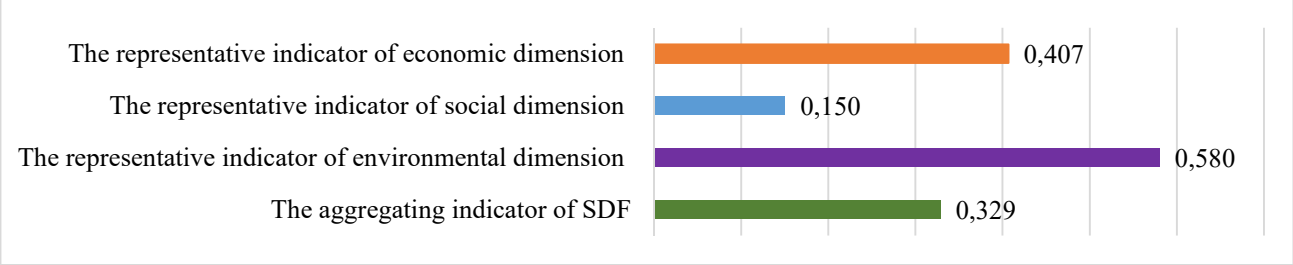

Figure 5. The representative indicator of dimensions and the aggregated indicator

As the given results above, the values of indicators in each dimension were dissimilar. The same phenomenon happened in comparing the representative indicator of each dimension (Figure 5). While the representative indicator of the environmental dimension was 0.580, that showed the level of SDF was sustainable relatively. The represented indicator of the social side was mere 0.15 showed the level of SDF was very unsustainable. The economic dimension was developing relatively at 0.407. There was an imbalance among the 3 pillar components, which was shown after assessing the level of SDF in Ha Tinh province, especially the social dimension. The aggregated indicator calculated by 3 representing indicators was 0.329. That belonged to the unsustainable level in measuring SDF.

3. CONCLUSION

The study proposed the set of assessing the level of SDF which included 30 distinct indicators in 3 dimensions, namely economy, society, and environment. The study also proposed the normalize, the aggregating method to transform the actual indicator to the represented indicator, the aggregated indicator and the standard in assessing the level of SDF. Applying the given proposes in case, Ha Tinh province, showed the hypothesis of research was feasible and can be applied in the fact. The results in assessing in Ha Tinh province showed: i) The level of SDF in 2017 was unsustainable; ii) There was an imbalance among 3 pillar components; it also had imbalances among the particulars indicators in each dimension.

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ĐÁNH GIÁ PHÁT TRIỂN LÂM NGHIỆP BỀN VỮNG – TRƯỜNG HỢP TỈNH HÀ TĨNH

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TÓM TẮT

Phát triển lâm nghiệp bền vững (PTLNBV) là một trong những mục tiêu phát triển bền vững chung của quốc gia. Việc đánh giá mức độ PTLNBV là thật sự cần thiết, đây sẽ là cở sở quan trọng để đề xuất những giải pháp hiệu quả. Trên cơ sở lược khảo lý thuyết, nghiên cứu đề xuất: i) Bộ chỉ tiêu đánh giá PTLNBV bao gồm 30 chỉ tiêu trên 3 thành phần: kinh tế (10 chỉ tiêu), xã hội (11 chỉ tiêu) và môi trường (9 chỉ tiêu); ii) phương pháp chuẩn hóa, tổng hợp và quy chuẩn đánh giá mức độ phát triển lâm nghiệp bền vững. Vận dụng đề xuất để đánh giá PTLNBV trên địa bàn tỉnh Hà Tĩnh năm 2017. Kết quả vận dụng đề xuất cho thấy phát triển lâm nghiệp tỉnh Hà Tĩnh ở mức không bền vững và Có sự mất cân đối giữa ba thành phần trụ cột và mất cân bằng giữa các chỉ số cụ thể theo từng nhóm thành phần. Đây sẽ là cơ sở quan trọng đề xuất giải phát nhằm PTLNBV trên địa bàn tỉnh Hà Tĩnh. Kết quả nghiên cứu cho thấy bộ chỉ tiêu và phương pháp tổng hợp, đánh giá có tính khả thi và có thể đưa vào áp dụng rộng rãi.

Từ khóa: Chỉ tiêu đánh giá, Hà Tĩnh, phát triển lâm nghiệp bền vững, phương pháp đánh giá.

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