Determining Priority Export Sectors for the Philippines using Analytic Hierarchy Process (AHP)

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Abstract

Prioritization of export sectors enables export promotion agencies to allocate scarce resources to sectors and activities that need it most. This paper utilized Analytic Hierarchy Process (AHP) to determine the priority export sectors for the Philippines based on the following criteria: (i) export value added; (ii) export competitiveness; (iii) export demand; and (iv) supply capacity. To provide a more granular analysis, sub-criteria were also identified as follows: labor value added, domestic value added, and stable export revenue are used as sub-criteria for export value added; comparative advantage and market concentration for export competitiveness; growth of world imports, distance to importing countries, and tariff rate for export demand; and growth of Philippine exports per sector, logistics cost, and gross value added of each sector for supply capacity. Individual weights of each criteria and sub-criteria were computed and applied to relevant trade and export statistics to determine the priority ranking of each sector. Consistent with historical data, the result shows that the most important export sectors for the Philippines are machinery and electrical, agricultural, and food products.

Keywords
Analytic Hierarchy Process (AHP), export planning, export promotion

1. Introduction

The contribution of exports to economic growth has been extensively studied in economic literature (Emery, 1967; Michaely, 1977; Heller and Porter, 1978; Tyler, 1981; Kavoussi, 1984; Ram, 1985). The main argument is that exports help stimulate and concentrate investments in the more efficient sectors of the economy, thus raising productivity. Producing for the international market also creates economies of scale which drives down cost and increases efficiency. Exports also facilitates increased flow of technology, market innovations, as well as managerial skills. Given its important role to economic development, many countries have formulated export development plans to improve their export performance and assess their export potential.

Several methodologies have been developed to guide countries assess their export potential. Cuyvers et al (2012) developed the decision support model which analyzes the macroeconomic conditions of potential target markets and then, using a filtering approach, systematically screens possible product-market combinations until a shortlist of the most promising and realistic opportunities remain. The International Trade Center (ITC) also developed an export assessment methodology that determines the country's products or sectors with export potential in existing or new markets based on an assessment of the supply capacities and product space of the exporting country, demand conditions in the target market and market access conditions in the target market (Decreux and Spies, 2016).

Hausmann and Klinger (2007), Hausmann et al (2007), and Hidalgo et al (2007) also developed the product space framework which asserts that countries will find it easier to diversify into new products that are related to products that it already exports. The framework assumes that these new products require a set of capabilities similar to those that the country already possesses. Lall et al (2006) also introduced the concept of export sophistication – a combination of factors that include technology, ease of product fragmentation, natural resource availability, and marketing – to examine trade patterns and analyze export performance of individual economies.

In the Philippines, Dacuycuy (2012) utilized the concept of product space developed by Hidalgo et al (2007) and the index of product level sophistication to analyze the performance of the country's export basket. In a follow up study,

Dacuycuy and Serafica (2018) found that the average sophistication of products included in the country's export basket has barely improved from 1995 to 2014 and has remained lower than the average sophistication of exports in the world market. However, they also found that some of the products has potential forward linkages to goods with higher sophistication content, which in turn has potential linkages to even more sophisticated goods.

Increasing export sophistication requires thorough assessment of the existing export portfolio to determine viable and effective export diversification strategies. While the tools mentioned above are ideal, all of them requires rigorous econometric modeling and computation. As an initial step on export planning, a less rigorous approach to prioritization of export sectors is necessary. To this end, the Analytic Hierarchy Process (AHP) technique is introduced. The utility of AHP is that it can combine both quantitative and qualitative data in the analysis.

AHP has been widely used in selecting and prioritizing economic sectors for development planning. Baffoe (2019) utilized AHP in prioritizing livelihood activities to aid in effective and sustainable poverty reduction interventions in developing countries. Jovanovic et al (2015) used the methodology to prioritize manufacturing sectors in Serbia for energy management improvement. Go et al (2019) constructed a composite sector prioritization index that identifies the key sectors based on five criteria of sector significance, namely: degree of influence, structural significance, degree of interconnectedness, dependence on domestic economy, and contribution to risk of inoperability.

In export planning, AHP has been used extensively as well. Sener (2014) used AHP to determine new markets for porcelain products in Turkey. Joneghani and Joneghani (2018) identified and ranked the effective factors for export promotion in pharmaceutical companies in Iran. The methodology was also utilized to explore importance of indicators and drivers of industrial competitiveness (Sirikrai and Tang, 2006). AHP has also been used in combination with other selection and optimization techniques to enhance the methodology results. Ozturk and Girginer (2014) assessed the export efficiency of Turkish textile and apparel firms using Data Envelopment Analysis (DEA) and AHP. Sudjarmoko et al (2015) analyzed the challenges hindering production and exports of Indonesian pepper using Trade Performance Index and AHP. Saediman (2015) used a combination of AHP and Borda Count to determine the priority agricultural commodities in the province of Southeast Sulawesi in Indonesia.

This paper proposes an Analytic Hierarchy Processing (AHP) approach in determining priority export sectors that will be the basis for allocating resources for export planning and promotion. The rest of the paper proceeds as follows: Section 2 will discuss the methodology used for deriving the priority ranking; Section 3 will present the results of applying the AHP methodology on relevant Philippine trade and export statistics; Section 4 will discuss the results and provide recommendations; and Section 5 will provide a conclusion.

2. Methodology

2.1. Data Gathering

The data used in this study was obtained from market and trade statistics available online. Philippine exports statistics such as the export value, labor and domestic value added, share of each product to total Philippine exports, Revealed Comparative Advantage of each product, growth rate of world demand for each product, and growth rate of each export product were obtained from the World Integrated Trade Solution (WITS) website. WITS is an online tool developed by the World Bank in collaboration with other multilateral institutions such as the United Nations Conference on Trade and Development, International Trade Center, United Nations Statistical Division, and the World Trade Organization. The tool provides access to international trade and protection related data and offers built-in analytical tools for assessing the impact of tariff changes. It can also be used to assess the competitiveness of a country's overall basket of products as well as specific traded sectors.

Data on market concentration, distance to importing countries, and tariff rates were obtained from the Trade Map. facility of the International Trade Center. Trade Map provides indicators on export performance, international demand, alternative markets and competitive markets, as well as a directory of importing and exporting companies covering 220 countries and territories and 5300 products of the Harmonized System. Logistics cost per sales were sourced from Banomyong (2017) while the gross valued added for each export product were acquired from the Philippine Statistics Authority (PSA).

2.2. Analytical Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is a multi-criteria decision-making methodology developed by Thomas L. Saaty in the 1970s (Saaty, 1987). With AHP, decisions consist of a discrete set of alternatives that are evaluated based on a finite number of criteria. AHP ranks the alternatives by decomposing the decision problem into pairwise comparisons, wherein every alternative is compared with the others using the criteria with corresponding weights. Applications of AHP includes selection of alternative from a given set of alternatives, ranking alternatives (e.g., from most to least desirable), prioritization of alternatives (as opposed to selecting the single best alternative), resource allocation, benchmarking, quality management, and conflict resolution, among others.

The first step in the AHP methodology is to identify the problem or goal of the study. For this paper, the goal is to prioritize the different export sectors in terms of its export potential. Prioritizing export sectors that has the optimum impact to the country's economy is significant since government will be able to allocate its limited resources to the development and promotion of these identified priority sectors.

After determining the goal of the study, the next step is to identify the criteria that will be used in the decision-making process. For this study, the ranking of the export sectors will be based on the following main criteria: (i) export value added, (ii) export competitiveness, (iii) export demand, and (iv) supply capacity of the Philippines to export the product. To provide a more detailed analysis, sub-criteria were also identified. These criteria and their respective sub-criteria are described, as follows:

1) **Export Value Added.** Export value added measures the amount of domestic value added embodied in the exported product (Johnson and Noguera, 2012). Value added is further differentiated between direct value added and labor value added. Direct value added is the value added embodied in exports, measured as gross exports less domestic and foreign inputs (World Bank, 2020a). Labor value added, on the other hand, is the total domestic labor value added embodied in a sector's exports, including the wages paid directly for the production of the sector's exports and indirectly via the production of inputs for the sector's exports (World Bank, 2020b). The stability of export revenue is also considered since export products with strongly fluctuating prices will result in unpredictable export revenue thus can be a risky strategy for exporting countries (Decreux and Spies, 2016).

2) **Export Competitiveness.** Export competitiveness compares the exported product of a country with similar exports from other countries. One way of measuring the competitiveness of an export product is by its Revealed Comparative Advantage (RCA). The RCA, which calculates the relative advantage or disadvantage of a country in a certain class of goods or services, is the ratio between the share of the country's exports of a particular product to its total exports and the share of world exports for that product to the total world exports (Balasa, 1965). A country is said to have a comparative advantage in a product if its RCA for that product is greater than one. Market concentration, as measured by Herfindahl-Hirschman Index (HHI), is also considered to gauge the competitiveness of export products. HHI is a measure of the dispersion of trade value across an exporter's partners. A country with trade (export or import) that is concentrated in a very few markets will have an index value close to one. Similarly, a country with a perfectly diversified trade portfolio will have an index close to zero (World Bank, 2020c).

3) **Export Demand.** For this study, export demand will be measured by the growth rate of world demand for each export product. The growth in market demand shows which products have recently experienced a relative change in demand and allows for a projection of potential demand for that product. The distance of importing countries is also considered since products differ in their sensitivity to distance. For instance, fresh agricultural products are sensitive to distance and thus typically imported from neighboring countries. In general, countries situated close to each other trade more intensively than countries that are farther apart (Leamer and Levinsohn, 1995). Market access indicators are also used to model export demand. Market access refers to the ability of an exporting country to sell its goods and services to a given country (International Monetary Fund and The World Bank, 2002). For this study, the measure used to indicate market access is the average tariff rate applied to the products of the exporting country. If the tariffs applied to an exporting country are lower compared to other countries, then the exporting country has a tariff advantage that will translate into higher export potential. Conversely, if an exporting country faces a tariff disadvantage, its capacity to export to that market is also diminished.

4) **Supply Capacity.** Supply capacity describes the country's capacity to supply an export product. For this study, supply capacity is primarily measured by the country's productive capacity as measured by the gross value added

of each export product or sector. In addition, the average growth of Philippine exports of each product is also used to measure the country's recent export performance, which reflects the country's capacity to produce goods for export. Logistics cost is also considered since logistics performance has been found to be positively correlated with exports performance (Gani, 2017).

After defining the main criteria and sub-criteria, the next step is to identify the alternatives that will be used in the model. For this study, the alternatives are the nine export product groups namely: agriculture (AGR), chemicals, plastics, and rubber (CHE), food products (FDP), footwear (FWR), fuel (FUE), machinery and electrical products (MEP), metals and minerals (MTL), textiles and clothing (TEX), and transportation (TRN). The grouping was patterned on the sectoral grouping used in the WITS website. With the different components already identified, the AHP model can now be formulated (Figure 1).

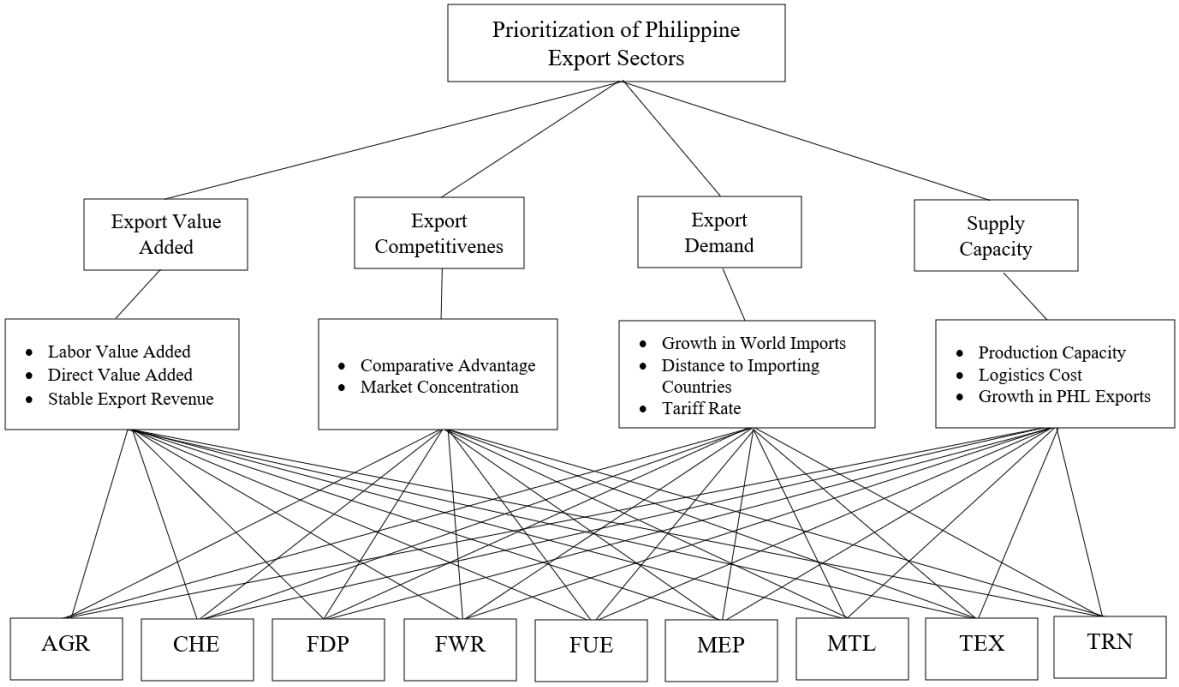

Figure 1. AHP Model

After constructing the AHP model, pairwise comparison matrices were constructed to determine the weights of each main criteria and sub-criteria. To construct the matrix, a questionnaire was prepared and distributed to five respondents to determine their perceived importance of each criteria in prioritizing the export sectors of the Philippines. The ratings range from 1 (equal preference for both criteria) to 9 (extremely strong preference of one criterion over another) as specified by Saaty (1987) (Table 1).

Table 1. Scale of Relative Importance

Rating	Preference	Explanation
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment moderately favor one element over the other
5	Strong importance	Experience and judgment strongly favor one element over the other
7	Very strong importance	One element is favored very strongly over another, its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible affirmation
2, 4, 6, 8	Intermediate values	Can be used to express intermediate levels of intensity

A pairwise comparison with n criteria can be summarized in an ($n \times n$) evaluation matrix A in which every element a_{ij} represents the importance of the criterion in the row i relative to the criterion in the column j. Conversely, the reciprocal of a_{ij} is computed as $a_{ji} = 1/a_{ij}$.

$$A = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & & a_{2n} \\ \vdots & & \ddots & \vdots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix}$$

Once the pairwise comparison matrices have been constructed, the priority level w_i of criterion i is computed using the formula:

$$Aw = \lambda_{max} w$$

where w is the vector of weights w_i and λ_{max} is the maximum Eigenvalue.

Then, the consistency ratio (CR) is computed to check whether the respondents provided a consistent preference rating from the survey results. The CR is the ratio between the consistency index (CI) of the pairwise comparison matrix and the consistency index of a randomly generated matrix (RI). If CR is less than 0.10, pairwise comparison matrix is consistent. Otherwise, the respondents were asked to reconsider their initial preference rating to improve their judgements. The consistency ratio is computed using the following formula:

$$Consistency\ Ratio\ (CR) = CI/RI$$

where $CI = (\lambda_{max} - n)/(n-1)$ and the RI value was derived from the values generated by Saaty (1987) for various sizes of matrices (Table 2).

Table 2. Consistency Indices for Random Matrices

Matrix size (n)	1	2	3	4	5	6	7	8	9	10
Random consistency index (RI)	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

3. Results

3.1. Descriptive Statistics

Trade and export statistics for each product group corresponding to each sub-criterion were obtained and summarized in Table 3. As shown in the table, machinery and electrical products has the largest labor value added among the nine product groups followed by agriculture. These two sectors combined, in fact, comprised 73 percent of total labor value added for all product groups. In terms of direct value added, food products posted the largest value followed by machinery and electrical, textiles and clothing, and agriculture. For export revenue, machinery and electrical products is still the highest revenue earning export sector for the Philippines. From 2015 to 2019, the sector posted an average annual export revenue of USD36.68 million, equivalent to 62 percent of total export revenue over that period. The

agriculture sector is the second highest revenue-earning export sector for the country but is a distant second with only USD6.87 million average earnings over the same period.

The Revealed Comparative Advantage (RCA) of each product group was also obtained to measure how competitive these products are compared with exports from other countries. Again, machinery and electrical products is the most competitive among the nine export sectors with an RCA value of 2.4. Agricultural products and metals and minerals both had an RCA value of 1.0, which indicates that the Philippines also has comparative advantages in these products. Food products is also competitive with an RCA value of 0.9. In terms of market concentration, the data shows that, Philippine export products are generally diversified in terms of destination country (i.e., sold to more countries (values closer to zero) as opposed to concentrated only on a few export markets (values closer to one)). Among the nine product groups, food products had the lowest Herfindahl- Hirschman Index (HHI) value of 0.2 while footwear had the highest HHI value at 0.48.

In terms of export demand, fuels had the highest average demand from 2015 to 2019 at 10 percent annual average growth rate over that period. It is followed by metals and minerals at 5.72 percent and chemicals, plastics, and rubber at 4.54 percent. Textiles and clothing and transportation equipment had the lowest growth rates at only 2.13 percent and 1.75 percent, respectively.

Table 3. Summary Statistics for Philippine Exports by Product Group

	Export Value Added			Export Competitiveness		Export Demand			Supply Capacity		
Product Group	Labor Value Added (USD)	Direct Value Added (USD)	Ave. Export Rev. (2015-2019) (USD M)	RCA	Market Concen-tration	Growth Rate of World Imports (2015-2019) (%)	Distance to Importing Countries (km)	Tariff Rate (%)	Growth Rate of PHL Exports (2015-2019) (%)	Logistics Cost/ Sales (%)[1]	Prod. Cap. (GVA in PHP M)
Agriculture	1,081.45	2,217.81	6.87	1.00	0.36	3.29	6,193.83	6.60	2.00	26.60	1.72
Chem., Pl., & Ru.	375.82	1,007.14	2.29	0.30	0.25	4.54	5,300.15	2.00	3.20	43.30	0.42
Food Products	339.05	17,017.78	2.09	0.90	0.20	3.78	7,087.11	8.00	0.90	32.72	1.72
Footwear	26.04	209.77	0.14	0.20	0.48	4.00	7,209.25	7.70	13.10	26.60	0.01
Fuels	29.06	208.79	1.11	0.20	0.30	10.00	2,417.00	0.70	1.70	26.60	0.04
Mach. & Elec.	3,375.10	11,254.65	36.68	2.40	0.28	4.14	7,263.25	1.40	3.60	13.57	0.49
Metals & Min.	392.76	808.65	5.20	1.00	0.37	5.72	4,072.11	3.10	0.60	26.60	0.10
Text. & Cloth.	342.35	2,363.01	1.51	0.60	0.28	2.13	7,706.69	7.60	-1.40	20.35	0.12
Transportation	159.37	833.24	3.42	0.20	0.30	1.75	5,652.50	6.90	2.20	23.08	0.07

Source: World Integrated Trade Solution, International Trade Center, Banomyong (2017), Philippine Statistics Authority

For supply capacity, the data shows that the footwear sector has the highest annual growth rate from 2015 to 2019 at 13.1 percent. The textiles and clothing sector, on the other hand, experienced negative growth over that period at -1.4 percent. Machinery and electrical products have the lowest logistics cost per sales at 13 percent, while chemicals, plastics, and rubber had the highest at 43.3 percent. In terms of gross value added, agriculture and food products (which are primarily consists of processed fruits, marine, and other agricultural products) had the highest gross value

[1] In the presentation where the data is gathered, only 5 of the 9 sectors have logistics cost per sales data. These are chemicals, food products, electronics, textiles, and transportation equipment. To compute the missing values in the other 4 sectors (i.e., agriculture, footwear, fuels, and metals and minerals), mean imputation was performed.

added. Footwear, given its small export share had the least gross value added hence production capacity among all product groups.

3.2. AHP Results

The criteria weights for the AHP model were obtained using the Excel template of the BPMSG AHP Priority Calculator (Goepel, 2013). Using the ratings provided by the five respondents, pairwise comparison matrices for the main criteria and sub-criteria were computed. Then, the local weights of each main criteria and sub-criteria were multiplied together to generate the global weights as shown in Table 4.

Table 4. Summary of AHP Weights for Main Criteria and Sub-Criteria

Main Criteria	Weight (W_M)	Sub-Criteria	Weight (W_S)	Global Weight ($W_M \times W_S$)	Rank
Export Value Added	0.1192	Labor value added	0.2727	**0.0325**	10
		Direct value added	0.2339	**0.0278**	11
		Stable export revenue	0.4934	**0.0587**	8
Export Competitiveness	0.1527	Comparative advantage	0.6045	**0.0924**	5
		Market concentration	0.3955	**0.0606**	6
Export Demand	0.3298	Growth in world imports	0.3760	**0.1241**	4
		Distance to importing countries	0.1694	**0.0558**	9
		Tariff rate	0.4546	**0.1502**	3
Supply Capacity	0.3983	Production capacity	0.4487	**0.1786**	1
		Logistics cost	0.1496	**0.0596**	7
		Growth in PHL exports	0.4016	**0.1599**	2

Table 4 shows that supply capacity and export demand are the two most important criteria in prioritizing export sectors with 0.3983 and 0.3298 priority weights, respectively. Consistent with these ratings, the sub-criteria for supply capacity and export demand were also rated higher compared with the other sub-criteria. Among the eleven sub-criteria used in the model, production capacity was ranked first with 0.1786 global weight followed by growth in Philippine exports at 0.1599. Tariff rate, which reflects market access conditions, and growth rate of world imports, which indicates demand for exported products, are the next two most important sub-criteria, with 0.1502 and 0.1241 weights, respectively. Interestingly, logistics cost and distance to importing countries were ranked significantly lower, indicating that shipping cost is not the main consideration for exporters.

The significance of supply and demand factors is reasonable since ultimately a country's export performance hinges on its capacity to produce export goods needed by the world market. Complementary with supply capacity is the existing demand for exports and the market access conditions in destination countries. Fugazza (2004) found that poor supply-side conditions are an important constraint to export performance, along with trade barriers. It should be noted that the said study referred to supply conditions as not only limited to production capacity but also the country's infrastructure, macroeconomic soundness, and good quality institutions.

Export competitiveness and export value added criteria were rated 0.1527 and 0.1192, respectively. Next to supply and demand indicators, export competitiveness factors such as comparative advantage and market concentration were ranked fifth and sixth, with global weights of 0.0924 and 0.0606, respectively. Export value added indicators were the least significant criteria based on the ratings provided by the respondents. Having a stable export revenue was only ranked eight, labor value added was ranked tenth, and direct value added was ranked last among the eleven sub-criteria.

3.3. Priority Ranking of Export Sectors

Using the global weights in Table 4, the performance score and the ranking of each product group was computed using the trade and export statistics summarized in Table 3. The data were first normalized using linear sum normalization method. The normalization was computed in two ways. Benefit criteria whose higher values are desirable (i.e., labor value added, domestic value added, export revenue, RCA, growth rates) used the standard formula of dividing each value with the sum of the values. On the other hand, cost criteria whose lower values are preferable (i.e., market

concentration, tariff rate, logistics cost), the reciprocal of each value was computed and the divided by the sum of the reciprocals. The normalized data values were then multiplied with the corresponding weights of each sub-criterion to generate the individual scores. Then the scores of the sub-criteria were added and ranked to determine priority for each main criterion. Finally, the main criteria scores were aggregated to obtain the overall score that is the basis for the final ranking of the export sectors (Table 5).

Table 5. Prioritization of Exports by Major Product Groups

	Main Criteria									
Product Group	**Export Value Added**	**Rank**	**Export Competi-tiveness**	**Rank**	**Export Demand**	**Rank**	**Supply Capacity**	**Rank**	**Overall Score**	**Overall Rank**
Agriculture	0.0143	3	0.0191	3	0.0231	7	0.0784	2	**0.1349**	**2**
Chem., Plastics & Rubber	0.0050	6	0.0121	6	0.0405	3	0.0401	5	**0.0977**	**6**
Food Products	0.0171	2	0.0223	2	0.0245	6	0.0695	3	**0.1333**	**3**
Footwear	0.0004	9	0.0069	9	0.0256	5	0.0969	1	**0.1298**	**4**
Fuels	0.0014	8	0.0093	8	0.0929	1	0.0190	7	**0.1227**	**5**
Machinery & Electrical	0.0629	1	0.0397	1	0.0501	2	0.0534	4	**0.2061**	**1**
Metals & Minerals	0.0079	4	0.0190	4	0.0356	4	0.0137	8	**0.0762**	**7**
Textiles & Clothing	0.0051	5	0.0152	5	0.0203	8	0.0025	9	**0.0431**	**9**
Transportation	0.0049	7	0.0094	7	0.0174	9	0.0245	6	**0.0562**	**8**

As shown in Table 5, machinery and electrical products is ranked first with an overall score of 0.2061. This sector was ranked first in both export competitiveness and export value added criteria, second in export demand, and fourth in supply capacity. Based on Table 3, this sector accounted for 62 percent of average export revenue from 2015 to 2019. It also contributed the highest share in labor value added since it is primarily composed of manufacturing plants which assembles electrical and electronics parts and components. These manufacturing and assembly plants require large manpower hence the large labor value added. The sector is also competitive as indicated by its high Revealed Comparative Advantage (RCA) of 2.4 and the low market concentration in the sector's target markets (0.28). Export demand statistics for this sector are also favorable based on its stable growth rate of world imports and low average tariff rates.

Agriculture sector is ranked second, and food products is close behind at third. The agriculture sector ranked third in export value added criteria and is also the second biggest export revenue earner for the Philippines (next only to machinery and electrical products) with an average export value of USD6.87 million (Table 2). Food products or processed foods contributed the largest domestic value added – even more than machinery and electrical products. This can be attributed to the fact that the raw materials used by the sector are largely domestically produced, unlike electronics where parts are mostly imported, and the value added created in the country is primarily on the assembly process. In terms of export competitiveness, food products sector is also again ranked second having an RCA of 0.90, which is slightly below agriculture's RCA of 1.00. In terms of market concentration, export markets for food products are more competitive (i.e., more open market competition) with an HHI of 0.20 compared with agriculture's HHI value of 0.36. It should also be emphasized that these two sectors have the highest gross value added among all product groups, denoting the importance of agriculture and its related sectors to the economy.

Interestingly, the footwear and fuels sectors were ranked fourth and fifth, respectively. These two sectors were buoyed by their high ranking in supply capacity and export demand. Footwear was ranked first in terms of supply capacity mainly because of its 13.1 percent average growth rate from 2015 to 2019 (Table 3). The fuel sector had the highest growth rate of world imports among all product groups at an average of 10 percent in the last five years. However, looking at the average distance to importing countries, we can see that fuel products has the smallest value with only 2,417 kilometers. This means that fuel exports from the Philippines are mainly destined for neighboring countries in

Southeast Asia. This also explains the almost negligible tariff rate imposed on fuel products (0.7 percent) since trade among Southeast Asian countries are now practically duty-free by virtue of the Association of Southeast Asian Nations (ASEAN) Economic Cooperation (AEC) agreement (ASEAN, 2008).

The bottom half of the ranking is comprised of chemicals, plastics, and rubber (sixth), metals and minerals (seventh), transportation equipment (eight), and textiles and clothing (ninth). Chemical, plastics, and rubber is ranked third in terms of export demand owing to its low tariff rate and relatively high growth rate of world imports for the product. However, it is a sector that we do not have a comparative advantage in (RCA value is only 0.30) and has the highest logistics cost per sales at 43.3 percent (Table 3). The metals and minerals sector, while only ranked seventh overall, is also an important export for the Philippines given its relatively high ranking in export value added and export competitiveness (ranked fourth in both criteria). The transportation sector was ranked near the bottom mainly due to the low growth rate of world imports for the product. It also has a very low comparative advantage rating at only 0.20. The textiles and clothing sector is the third largest sector in terms of direct value added. What contributed to it being ranked last among all the product groups is the negative growth rate of the sector over the last five years (2015 to 2019).

4. Discussion

Machinery and electrical products, specifically electronics products, have been the country's leading exports since the 1990s. However, since then, the country has not progressed much beyond assembly and testing which has the lowest value added in the production chain (Austria, 2006). Recognizing this concern, the PEDP intends to move the sector to higher value-added electronics products and services (e.g. wafer fabrication, integrated circuit design). With the advent of advanced technologies such as the internet of things (IoT), autonomous vehicles, smart factories, and others, the demand for electronics is seen to continue to rise in the future (PEDP, 2018). It is then critical for the Philippines to continue to upgrade the capacity of this sector to take advantage of this continuing increase in demand. Obviously, the government has a significant role to play for this upgrading to succeed. Among the recommendations are attracting talent and providing incentives to retain them in the country, increasing budget for research and development, development of local suppliers, and improving overall business environment (Awan et al, 2017).

The prospect for agriculture and food products is also promising. As noted in the PEDP, this is due to the continued urbanization around the world which drives the demand for all types of unprocessed and processed food. The Philippines is a major producer of tropical food products (both fresh and processed) and has a comparative advantage in this sector (PEDP, 2018). However, the sector is also plagued with challenges that have been hindering the growth of agricultural exports for the longest time. This include high and variable cost of production inputs, lack of mechanization to improve productivity, limited access to finance to scale operations, inadequate infrastructure particularly in irrigation, and inefficient logistics and limited connectivity exacerbating post-harvest losses (Arangkada Philippines, 2016). To resolve these challenges, the government has launched a roadmap initiative that seeks to generate higher value addition to the country's key agricultural products (DTI-BOI, 2017). This is coupled with the need to implement bold measures to open new export markets, make capital more accessible, improve infrastructure, among others (Arangkada Philippines, 2016).

Footwear could be a new addition to the country's export portfolio given its high export growth rate in the last five years. The PEDP, in fact, also noted the importance of this sector because of better prospects and expanding opportunities (PEDP, 2018). The sector has been on a decline since the 1990s but is experiencing a resurgence in the last several years due to the easing of market access restrictions in lucrative markets. For instance, the European Union (EU) has granted the Philippines the Generalized Scheme of Preferences (GSP)+ preferences in 2015 for many products which include footwear. The GSP+ status means that qualified products have zero percent import duties when exported to EU.

The fuel sector has also seen a steady increase in growth in the last few years starting with the first crude oil export in 2009. Presently, the bulk of Philippine fuel exports include condensate, fuel oil, gasoline, propylene, naphtha as well as crude oil from the Galoc oil field in Palawan. Although demand for fuel exports is high, the industry is still in its nascent stage thus would need continued investment in research and development to develop higher value products. There is also a need for more exploration to find new sources of oil deposits to ensure continuous supply moving forward.

The chemicals sector includes basic chemicals (e.g., resins, organic, inorganic, alcohols), chemical products (e.g., pharmaceutical, cosmetics, paints, fertilizers), plastic products (e.g., plastic articles, pipes and tubing, films, sheets), and rubber products (e.g., tires, industrial products, re-threading). Exports in this sector has dropped in recent years due to tightened regulation of controlled chemicals but the demand is still strong considering that chemicals is one of the largest tradable products in the world. Shift in consumer preferences for natural and environment-friendly products, particularly on health and wellness, is also seen to contribute to the better prospect in this sector. Moving up the value chain in these sectors would require investments in manufacturing process enhancement, new product development, materials and supplier assurance, as well as talent development and innovation.

The metals and minerals sectors are also one of the most important sectors of the Philippines considering that the country is gifted with vast amounts of mineral resources, both metallic and non-metallic such as gold, nickel, iron, copper, limestone, and marble. Among the metallic minerals, the largest reserve that the country has is copper, which is estimated at 4 billion metric tons, making the Philippines the fourth largest country in the world in terms of copper reserves (DTI-BOI, 2017). The country is also a major exporter of nickel. There is high demand for metals and minerals products since they are inputs to other industries such as electronics and automotive parts manufacturing. Presently, however, majority of Philippine metals and minerals exports are raw materials. To generate more export revenue, the sector needs to move up to higher value products, which entails huge investment in facilities and research and development.

The textiles and clothing or garment sector used to be a USD3 billion industry and one of the top performing export sectors of the country in the 1990s. The sector benefited from quota allocations for textiles and garments exported by developing countries such as the Philippines to developed countries. However, in 1995, the quota allocation was discontinued and, as a result, garments and textiles enterprises in the Philippines which relied on quotas underwent difficulties leading to closure of factories and downsizing. Since then, the sector has experienced a steady and continuous decline. Now, with the help of various government agencies, the sector is developing a roadmap to revive the country's textiles and garments industry. Among the strategies outlined is the provision of capital and land to increase clothing and textile production across the country, procurement of new equipment, as well as provision of fiscal incentives. Investing in research and development and marketing as well as strengthening the supply chains are also considered.

5. Conclusion

This paper proposes a new methodology for prioritizing export sectors using Analytic Hierarchy Process (AHP). Four main criteria were identified, namely: export value added, export competitiveness, export demand, and supply capacity. To provide a deeper evaluation of the different sectors, different sub-criteria were also determined. Export value added was further decomposed into labor value added, domestic value added, and export revenue. Export competitiveness was further elaborated using Revealed Comparative Advantage and market concentration indicators. Export demand was modeled based on the average growth rate of world demand for each export sector, the average distance of importing countries, and tariff rate as proxy for market access conditions. Finally, supply capacity was determined using the average growth of Philippine exports for each sector, the logistics cost, and the productive capacity which used the gross value added of each sector as proxy indicator.

Applying the weights of the criteria mentioned on relevant trade data obtained from various sources, performance scores were computed and were used as the basis for ranking the export sectors, as follows: (1) Machinery and Electronics; (2) Agriculture; (3) Food Products; (4) Footwear; (5) Fuels; (6) Chemicals, Plastics, and Rubber; (7) Metals and Minerals; (8) Transportation Equipment; and (9) Textiles and Clothing.

Prioritization of these export sectors can be an important input to export planning and promotion. Given the government's limited resources for export development, a prior analysis of which sectors to focus on will help ensure that resources are invested efficiently and effectively, for instance, in the selection of matching and market missions. Moreover, looking at the results and ranking for each criterion (and its sub-criteria) would also inform policy makers about the more specific challenges facing each sector and with further analysis would be able to formulate strategies to address those challenges.

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