Assessment of the Factors Affecting the Development of Abidjan Port in Ivory Coast

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Abstract

Located in Ivory Coast, the Abidjan Port is a port that seeks to get developed but that is affected by some internal and external factors that hinder its development. In this article, the Analytic Hierarchy Process (AHP) is applied with the SWOT model in order to give a concrete rank of the main factors affecting the development of the port under study. After applying these techniques, the results found show that the Abidjan port has more strengths than weaknesses and more opportunities than threats. Based on the findings, a Mini-Maxi development strategy is proposed. This article can be used by Abidjan Port Authorities and the Ivory Coast Authorities as a reference for decision-making in planning the development of Abidjan port.

Keywords: Analytic Hierarchy Process, internal factors, external factors, SWOT analysis, development strategy, Abidjan port

1. Introduction

Abidjan port is a port that plays an important role in the economic development of Ivory Coast. In order to meet the high demand for foreign goods from its hinterland population, the authorities of the country and of the port have decided to develop this port. However, like other ports in the West African region, it is a port that is slowed down by numerous internal and external factors that affect its development. Port as a node of the waterway transport, is not only as a logistics center, a transportation hub, but also becomes a way of foreign trade, the driving force of the regional economic development (Rongtai Lin, Jian Tan, 2013). The Analytic Hierarchy process (AHP) and the SWOT analysis have been identified by many researchers, as the two best models that can be used for the assessment of the development of a port in the world. Indeed, SWOT has been used by countless practitioners, marketing researchers, and is a frequent and popular tool for business marketing and strategy students (Marilyn M. Helms, Judy Nixon, 2010). It is essential to use the Analytic Hierarchy Process (AHP), as its outcome is a priority vector, which gives us an insight into the best option for the decision makers (Giang Huong Nguyen, 2014). Assessing the factors that affect the development of a given port, contributes to clearly identify why the given port is slowly developing compared to other ports in the world. By doing this, solutions can be proposed and can be applied in order to avoid the different factors that greatly affect the development of the given port. For this research work that was conducted from February 2017 to August 2017, it was important to meet representatives of the different institutions or organizations that have important roles in the development process of the Abidjan port in Ivory Coast. This article uses the SWOT-AHP hybrid model to analyze and assess the current factors affecting the development of Abidjan port in Ivory Coast.

2. Literature Review

Africa is considered by many as a continent of opportunities, thus investing in Africa is a very good choice for experienced investors. Regarding the investment strategy in Africa, ports have an important role, because they show how goods enter and exit a country or region. Developing the African ports in general is therefore essential for the countries they belong to. Thus, topics related to the many difficulties that ports in developing countries currently face when developing, nowadays attract many researchers' interest and attention. Hence many of them have written on related topics, mainly using the SWOT method or the Analytic Hierarchy Process technique (AHP). For those that used both models, they in majority noted that the SWOT-AHP techniques help to prioritize the SWOT groups and the sub-factors in order to determine exactly which factors belonging to the SWOT must be given attention firstly, without of course neglecting the other factors. This article is the first ever to use the SWOT-AHP hybrid model to assess the factors affecting the development of a port in Africa.

Some researchers have used the Analytic Hierarchy Process (AHP) in their research, this being the case of José Fabiano da Serra Costa (2011) who presented in his research work a proposition to solve the problem of inconsistency in Analytic Hierarchy Process matrices using genetic algorithms. He noticed a good performance of the algorithm model requiring no user intervention and having no variations in the mutation and reproduction rates. Neda Jalaliyoon, Nooh Abu Bakar and Hamed Taherdoost (2012) used the AHP technique in an

automobile company in order to propose an appropriate methodology for designing and implementing strategy and critical success factors in the organization. Based on the findings, they concluded that critical success factors play critical roles for an organization to achieve its mission, thus they are vital factors required for ensuring success of a company. Marko Krybovokov (2005) applied at the same time the AHP and the direct questionnaire methods to estimate the weighs of the most important location attributes influencing apartment prices in Donetsk, Ukraine. By comparing the results found using the two methods, he noted that the AHP is characterized by a smoothing effect, as it generates lower maximum weights and higher minimum weights compared to the direct questionnaire. Izak Johannes Roux (2015) in his research paper used the AHP to rank a total of 33 compliance risks and 12 mitigation strategy criteria. The results found showed that the regulatory compliance, company reputation, environmental compliance, and economics ranked the highest and that a multicriteria mitigation strategy for environmental compliance ranked the highest. Han Jiang (2014) applied documents literature, mathematical statistics, logical reasoning and the AHP, to analyze Chinese men's basketball team current status, to do research on Chinese competitive basketball declined phenomenon causes and to put forward Chinese men's basketball strategic countermeasures. The results found showed that develop Chinese men's basketball team overall advantages and its coaches guiding and training capacity to Chinese men's basketball team as well as improve CBA league training ability to Chinese new generation players are the key to Chinese men's basketball team development.

Other researchers used the SWOT model, that being the case of Vlado Mezak, Ana Peric and Alen Jugovic (2006) who, in their article, initiated the building of the SWOT matrix after having analyzed the Rijeka port competition and environment in order to spotlight the importance and significance of the long-term port development strategy planning. Based on the findings, they suggested that the SO-Maxi-Maxi, the WO-Mini-Maxi, the ST-Maxi-Mini and the WT Mini-Mini strategies be used for the development of Rijeka port. Agrawal V (2016) used the SWOT analysis to analyze the problems being faced by the inbound tourism industry and the vast potential in India. He concluded that there are various factors which could contribute as key drivers of inbound tourism such as new product offerings, price competitiveness, etc. Ahmad Reza Ommani (2011) used the SWOT analysis to indentify strategies for agricultural development, especially in farming systems in Shadervan district, Shouahtar Township, Iran. Based on the results found, strategies for farming system management were prioritized and they include: development of poor local market opportunities and infrastructure, planning of crops with high economic values, etc.

There is also a certain number of researchers that decided to combine both the AHP and the SWOT models, as it is done in this article. F. Rashidinejad and Bahareh Asi (2012) in their paper used the SWOT analysis in combination with analytic hierarchy (AHP), to create a quick overview of the Iranian copper industry's strategic situation. It resulted that steps should be taken to leverage the current production status and future development by utilizing the advantages of strengths, transiting potential threats to opportunities, and enhancing weaknesses. Baiq Fitria Rahmiati, Dodik Briawan and Siti Madanijah (2017) analyzed the internal and external factors affecting iron supplementation program by using cross sectional study, with in depth interviews to IFA's stakeholders in Tasikmalaya district. Analysis of Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) were used to identify the program positions internally and externally. The results showed that the total score of IFE was 2.14, indicating that internally, the program does not optimize strengths and does not avoid weaknesses. EFE score was 2.10, indicating that externally, the program does not optimize the opportunities and does not avoid threats. Bahadır Çağrı BAYRAM and Tutku ÜÇÜNCÜ(2016) used a hybrid method which is composed of SWOT analysis and Analytic Hierarchy Process (AHP), to try to identify the condition of the forest products industry in Taşköprü. Based on the findings, it is possible to say that Taşköprü has a potential for being an important part of the Kastamonu's forest product industry. Wenchang Li and Yunfan Zuo (2017) used the SWOT, factor quantization and weight with AHP, through the analysis of the existing problems of the traditional budget of the enterprise and the budget under the information technology environment and the analysis of the internal and external influencing factors of the budget management of the large and medium sized enterprises under the current environment, to develop a strategic program according to the priority of weight. They concluded that, the budget management work can be more strategic and forward-looking through the combination of AHP with SWOT analysis. Sayyid Ali Banihashemi and Zahra Rejaei (2016) used the Analytic Hierarchy Process (AHP) technique with SWOT, to rank external and internal factors affecting universities environment in Iran. They concluded that university should make use of its current opportunities more and more relying on its internal power.

3. SWOT-AHP Model Methodology

The AHP is a theory of measurement through pairwise comparisons and relies on the judgments of experts to derive priority scales (Thomas L. Saaty, 2008). In the Analytic Hierarchy Process (AHP), it is assumed that the relevant importance of an attribute influencing a goal over other attributes can be determined via a pair-wise comparison. This pairwise comparison is matrix A. In this article, the AHP is used to determine the weight of

each factor. As the main goal of this article is to assess the factors affecting the development of Abidjan port, it is firstly important to determine a hierarchy, thus the criteria layer will be the Strengths, the Weaknesses, the Opportunities and the Threats of Abidjan port, and the project hierarchy will be based on the key factors that have been identified. Secondly, a judgment matrix should be set up, by analyzing and judging the relative importance of a factor to another factor, and the judgment result will be expressed in the judgment matrix. The relative importance between two criteria is measured and scored by experts according to a numerical scale from 1 to 9, as shown below in Table 1. Scaling means comparing factor i to factor j by estimating their relative importance and the estimated value found is denoted as aij. The values of aij are presented in Table 1 below. If aij's main objective is to determine the difference value between the factor i and the factor j, and the weight i and the weight j, thus it will give the ratio Wi/Wj. Hence, in decision making, the pairwise comparison of n objectives can be expressed by the judgment matrix A, as shown below:

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \cdots & \cdots & \cdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix} = \begin{bmatrix} w_1/w_1 & \cdots & w_1/w_n \\ \cdots & \cdots & \cdots \\ w_n/w_1 & \cdots & w_n/w_n \end{bmatrix} \quad (1)$$

Table 1. Relative Importance Scale of Judgment Matrix

Value of a_{ij}	Definition	Explanation
1	Equally important	The i and j factors are of equal importance in comparison
3	Slightly important	Comparing i and j factors, i is a little more important than j
5	More important	Comparing i and j factors, i is more important than j
7	Of great importance	Comparing i and j factors, i is much more important than j
9	Extremely important	Comparing i and j factors, i is extremely more important than j
2,4,6,8	——	An intermediate value that is intermediate to the above
Reciprocal		If the factor i is compared to the factor j, it gives a_{ij}, hence the judgment of the factor j compared to factor i will be $1/a_{ij}$.

The Table 1 above gives a concrete idea on the judgment table that experts used for providing correct relative importance scale for this research work. Thirdly, in what concerns the ranking of judgment matrices, in the AHP the importance weight between the factors relative to their criteria is computed by a single judgment matrix. When the decision maker obtains the matrix A by pairwise comparison, the matrix can compute the value of the weight vector. The common methods of computing weight vector include the sum method, the root method, the characteristic root method and the least square method. In this article, the root method is used to calculate the weight vector, thus:

$$w_i = \frac{\left(\prod_{i=1}^{n} a_{ij}\right)^{1/n}}{\sum_{k=1}^{n}\left(\prod_{j=1}^{n} a_{kj}\right)^{1/n}}, i = 1,2,\cdots,n \quad (2)$$

The Strength-Weakness-Opportunity-Threat (SWOT) Matrix is an analytical tool that is utilized for underlying internal and external factors to generate strategies that would be feasible to consider. Basically the SWOT Matrix matches key external and internal factors as a basis for generating feasible strategies (Meredith E. David, Forest R. David, Fred R. David, 2009). There are four steps involved in conducting a combined SWOT and AHP analysis which are: to perform SWOT analysis, to carry out pair-wise comparisons between the SWOT factors within every SWOT group, to perform pair-wise comparisons between the four SWOT groups and to utilize the results in the strategy formulation and evaluation process (M. Kurttila, M., Pesonen, J., Kangas, M. Kajanus , 2000).

Table 2. Matrix of the Abidjan Port Internal and the External Factors Evaluation

External Factors	Internal Factors
Opportunities: B3	**Strengths: B1**
E1 Constant increase of the demand level for foreign goods from hinterland population	C1 Geographical position
E2 Financial support available from China	C2 Large land available for future port expansion plan
E3 Port hinterland is full of natural resources	C3 Benefits from financial support of private investors and Ivory Coast's government
E4 Constant growth of hinterland countries' economy	C4 Encouraging Container throughput volume growth
E5 Worldwide growth in container shipping business	C5 Port has most of the certificates such as International Ship and Port Facility Security (ISPS) code, ISO 14001 and ISO 9001.
Threats: B4	**Weaknesses: B2**
F1 High risk of political instability in Ivory Coast	D1 Not well trained employees
F2 Absence of Ivory Coast Maritime Authority	D2 High level of corruption in the port
F3 Poor Port connectivity to its hinterland	D3 Lack of modern information and communication technologies
F4 Competition of neighboring ports proposing better tariffs and better service quality	D4 High port costs
F5 Low level of education in Ivory Coast	D5 Container port congestion

The SWOT factors presented in Table 2 above were derived from the use of the Delphi method and interviews with not only Universities professors in Ivory Coast, mainly from Alassane Ouattara University, Félix Houphouët-Boigny University, the University of Science and Technology of Ivory Coast, the University of Abidjan and the Catholic University of West Africa; but also with some regular customers of Abidjan port, some representatives of the Abidjan port authorities, some representatives of the Directorate General of Maritime and Port affairs of Ivory Coast, some representatives of the Ministry of Transport of Ivory Coast, some representatives of the Ministry of Economy, Finance and Budget of Ivory Coast and some representatives of the SETV company, which is the company that obtained the concession of the Abidjan port unique terminal in 2003. Indeed 150 questionnaires in which were gathered many factors affecting a port development that were found from collated literature were sent or given to the above mentioned experts and 127 completely filled questionnaires were collected back. This demonstrates that about 85% of the people contacted, responded positively. These factors are the five main Strengths, five main Weaknesses, five main Opportunities and five main Threats that can be noticed in the current development process of the Abidjan port in Ivory Coast.

4. Analysis of the Results Found

After the experts identified the main internal and external factors affecting the development of Abidjan port in Ivory Coast using questionnaires, a paired comparison was done between those factors using a second set of questionnaires, which were sent to the same experts that previously responded positively. For this step, the Analytical Hierarchy Process was used. The experts were also asked to give a rank to each factor. The results of the pair-wise comparison matrices among the SWOT groups are presented in Tables 3 to 12 below.

Table 3. Strengths and Weaknesses Judgment Matrix

A	B1	B2	W
B1	1	2	0.58
B2	1	1	0.42

Table 4. Strengths Weight Judgment Matrix

B1	C1	C2	C3	C4	C5	W
C1	1	2	1/3	5	3	0.22
C2	1/2	1	1/5	4	3	0.15
C3	3	5	1	6	5	0.50
C4	1/5	1/4	1/6	1	1/2	0.05
C5	1/3	1/3	1/5	2	1	0.08

Table 5. Weaknesses Weight Judgment Matrix

B2	D1	D2	D3	D4	D5	W
D1	1	1/6	1/2	1/5	1/3	0.05
D2	6	1	5	2	3	0.43
D3	2	1/5	1	1/4	2	0.12
D4	5	1/2	4	1	2	0.28
D5	3	1/3	1/2	1/2	1	0.12

Based on the above findings, the weight found of each small factor is multiplied by the weight found of the big factor (B1, B2) it belongs to, in order to get the final score vector of Internal Factors affecting the development of Abidjan port in Ivory Coast.

Table 6. Score Vector of Internal Factors

Internal Factor	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5
Weight	0.13	0.09	0.29	0.03	0.04	0.02	0.18	0.05	0.12	0.05

From the Table 6 above, it can be noticed that in terms of strengths factors, the factor C3 Benefits from financial support of private investors and Ivory Coast's government is the most important strength of Abidjan port as it has got the biggest weight, followed by the factor C1 Geographical position, the factor C2 Large land available for future port expansion plan, the factor C5 Port has most of the certificates such as International Ship and Port Facility Security (ISPS) code, ISO 14001 and ISO 9001and finally the factor C4 Encouraging Container throughput volume growth. While on the other hand, in what concerns Weaknesses factors, the factor D2 High level of corruption in the port has been found to be the biggest weakness of Abidjan port, followed by the factor D4 High port costs, the factor D3 Lack of modern information and communication technologies, the factor D5 Container port congestion and the factor D1 Not well trained employees.

Table 7. Opportunities and Threats Judgment Matrix

A	B3	B4	W
B3	1	2	0.67
B4	1/2	1	0.33

Table 8. Opportunities Weight Judgment Matrix

B3	E1	E2	E3	E4	E5	w
E1	1	1/6	1/5	1/6	1/4	0.04
E2	6	1	4	3	4	0.45
E3	5	1/4	1	1/3	2	0.14
E4	6	1/3	3	1	5	0.28
E5	4	1/4	1/2	1/5	1	0.09

Table 9. Threats Weight Judgment Matrix

B4	F1	F2	F3	F4	F5	W
F1	1	6	5	3	7	0.51
F2	1/6	1	1/3	1/4	2	0.07
F3	1/5	3	1	1/2	4	0.14
F4	1/3	4	2	1	5	0.23
F5	1/7	1/2	1/4	1/5	1	0.05

Based on the above findings, the weight found of each small factor is multiplied by the weight found of the big factor (B3, B4) it belongs to, in order to get the final score vector of External Factors affecting the development of Abidjan port in Ivory Coast.

Table 10. Score Vector of External Factors

External Factor	E1	E2	E3	E4	E5	F1	F2	F3	F4	F5
Weight	0.03	0.30	0.09	0.19	0.06	0.17	0.02	0.05	0.07	0.02

From the Table 10 above, it can be noticed that in terms of Opportunities factors, the factor E2 Financial support available from China is the biggest opportunity that Abidjan port has, as it has got the biggest weight, followed by the factor E4 Constant growth of hinterland countries' economy, the factor E3 Port hinterland is full of natural resources, the factor E5 Worldwide growth in container shipping business and finally the factor E1 Constant increase of the demand level for foreign goods from hinterland population. In what concerns Threats factors, the factor F1 High risk of political instability in Ivory Coast is the biggest threat threatening the development of Abidjan port, followed by the factor F4 Competition of neighbouring ports proposing better tariffs and better service quality, the factor F3 Poor Port connectivity to its hinterland, the factor F2 Absence of Ivory Coast Maritime Authority and the factor F5 Low level of education in Ivory Coast. In order to get the weighted score of each factor, its score vector weight is multiplied by its rank, given by the experts. Indeed, a rating was given to each internal factor by the experts based on the Likert scale from 1 to 4. The rating demonstrates how effective Abidjan port current strategy responds to the factor. Rating 1 means that the response is not good, rating 2 means that the response is below average, rating 3 means that the response is above average and rating 4 means that the response is superior. The total of rating given by each expert was added together and then divided by the number of experts in order to get the average rating rank given by experts for each internal factor.

Table 11. Internal Factor affecting the Abidjan Port Development Evaluation Matrix

Internal Factor	Weight	Rank	Weighted Score
Strengths			
C1. Geographical position	0.13	4	0.52
C2. Large land available for future port expansion plan	0.09	3	0.27
C3. Benefits from financial support of private investors and Ivory Coast's government	0.29	3	0.87
C4. Encouraging Container throughput volume growth	0.03	3	0.09
C5. Port has most of the certificates such as International Ship and Port Facility Security (ISPS) code, ISO 14001 and ISO 9001 and finally the factor	0.04	3	0.12
Weaknesses			
D1. Not well trained employees	0.02	2	0.04
D2. High level of corruption in the port	0.18	2	0.36
D3. Lack of modern information and communication technologies	0.05	2	0.1
D4. High port costs	0.12	1	0.12
D5. Container port congestion	0.05	2	0.1
Sum	1		2.59

In the Table 11 above, if the total weighted score found was less than 2.5, this would have meant that the Abidjan port does really suffer a lot from its weaknesses, however if the result found exceeded 2.5, this would have meant that the Abidjan port does really have a lot of strengths. The same method of calculation was used to get the results for the External Factor affecting the Abidjan Port Development Evaluation Matrix, presented in Table 12. A rating was given to each external factor by the experts based on the Likert scale from 1 to 4. The total of rating given by each expert was added together and then divided by the number of experts in order to get the average rating rank given by experts for each external factor.

Table 12. External Factor affecting the Abidjan Port Development Evaluation Matrix

External Factor	Weight	Rank	Weighted Score
Opportunities			
E1. Constant increase of the demand level for foreign goods from hinterland population	0.03	2	0.06
E2. Financial support available from China	0.30	3	0.90
E3. Port hinterland is full of natural resources	0.09	2	0.18
E4. Constant growth of hinterland countries' economy	0.19	3	0.57
E5. Worldwide growth in container shipping business	0.06	2	0.12
Threats			
F1. High risk of political instability in Ivory Coast	0.17	2	0.34
F2. Absence of Ivory Coast Maritime Authority	0.02	2	0.04
F3. Poor Port connectivity to its hinterland	0.05	3	0.15
F4. Competition of neighboring ports proposing better tariffs and better service quality	0.07	2	0.14
F5. Low level of education in Ivory Coast	0.02	2	0.04
Sum	1		2.54

In the above table, if the total weighted score found was less than 2.5, this would have meant that the Abidjan port's current strategy does not respond very well to the external factors that it faces, however if the result found exceeded 2.5, this would have meant that the Abidjan port has very bright opportunities that may help it to avoid the threats.

5. Suggested Strategy

Based on the results found above through the use of the SWOT-AHP method, it is now possible to choose a development strategy for the Abidjan port in Ivory Coast from the four types of strategies proposed by the SWOT matrix. Indeed, this matrix is used to determine a strategy that an organization should use, based on the findings provided by the SWOT analysis of that organization. The four types are in fact a combination of the Strengths, Weaknesses, Opportunities and Threats of an organization. The coordination and synchronization between internal and external elements to formulate an adoptable strategy is a challenging task. Thus the SWOT matrix can simplify this task by producing different alternative options or strategies by making different combination of SWOT elements as shown in the table 13 below (I. A. HALEPOTO, A. A. SAHITO, G. M. SHORO, 2015) :

Table 13. SWOT matrix

	Strengths	Weaknesses
Opportunities	SO	WO
Threats	ST	WT

In the Table 13 above, the SO strategies are strategies that consist of using the strengths of an organization to maximize its opportunities. The ST strategies are strategies that consist of using the strengths of an organization in order to reduce its threats. The WO strategies are strategies that consist of reducing the weaknesses by exploiting the opportunities. The WT strategies are strategies that consist of reducing the weaknesses and preventing the threats. Based on this, the Figure 1 below shows the SWOT matrix of the Abidjan port in Ivory Coast.
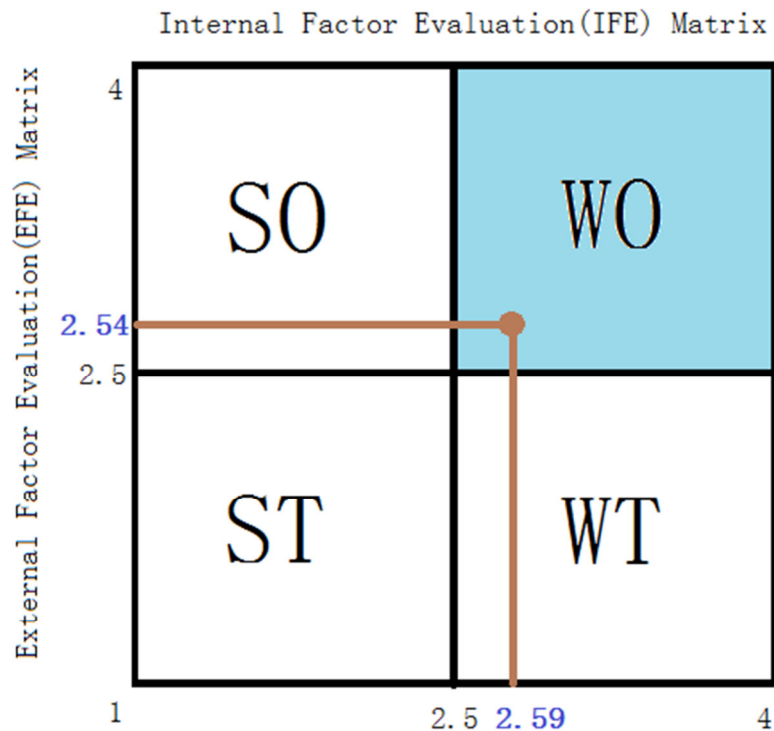
Figure 1. SWOT matrix made with IFE-EFE Matrix results

Source: Research findings

The above figure 1 demonstrates that the Abidjan port authorities should apply the Mini-Maxi strategy, also known as the WO strategy, by taking advantage of the external opportunities, to reduce the weaknesses. This concretely means that the Abidjan port authorities through the partnerships that they have with some Chinese ports and based on the friendship and business partnership that China has with Ivory Coast, can send some of Abidjan port's employees to China regularly for some training. It also means that the port authorities can ask for the help of China in order to acquire modern information and communication technologies tools or working instruments. As corruption can be found everywhere in the World, Abidjan port authorities can learn from the Chinese experience in what concerns reducing the level of corruption in ports, and obviously adapt their findings to the Ivory Coast's realities. The Abidjan port can count on the constant growth of hinterland countries' economy and on the worldwide growth in container shipping business in order to reduce its port service costs. By doing so, they will attract more customers of the hinterland and surely gain more money on a long term perspective.

6. Conclusion

Through developing the Abidjan port, Ivory Coast will confirm that it is an indispensable country in the West African region. It will at the same time help the Abidjan port to become the leading port among all the African ports of the Atlantic Ocean. Above, the main internal and external factors affecting the development of the Abidjan port have been deeply analyzed. After the application of the Analytic Hierarchy Process and the SWOT model, it can be concluded that the biggest strength of Abidjan port is to benefit from the financial support of private investors and of the Ivory Coast's government, its biggest weakness is the high level of corruption in the port, its biggest opportunity is the financial support available from China and its biggest threat is the high risk of political instability in Ivory Coast. Therefore, serious measures should be taken to reduce the corruption level within the port, and political authorities should work harder and faster to reunite the Ivoirians and bring back a total and constant peace in this beautiful country. In the coming studies, research can be done on how can potential investors face the different risks that are present when investing in Ivory Coast and especially in Abidjan port.

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