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Business Environment-Based Risk Model for the Container Liner Shipping Industry

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Abstract
Container liner shipping is a risky industry. There are many unexpected risks and uncertainties in extended journey around the world which can be the result of external events such as political actions, economic situation and natural disasters. The impact of these external risks can be devastating. In this paper, a new business environment-based risk (BEBR) model for prioritising and assessing the external risk criteria in the CLSI, is developed. The term BEBR can be defined as a wider scope of external risks including political risks, economic risks, social risks and natural hazards that directly or indirectly influence the business performances in the CLSI. An analytic hierarchy process (AHP) approach is employed to prioritise the importance of risk criteria and is adapted into a deterministic weight factor in the context of risk impact level. So far, no study has been found that developed this model for the CLSI which highlights a significant research gap to be fulfilled. Based on the test case, the result has shown that economic risks are the most significant main criteria in the BEBR model, followed by political risks, natural hazards and social risks. For future research, this paper recommends a quantitative risk analysis for assessing the targeted or whole risk criteria in the BEBR model.
Keywords: business environment-based risk (BEBR), container liner shipping industry (CLSI), analytic hierarchy process (AHP), prioritisation.

1. Introduction
The container liner shipping system is the most efficient way of transporting goods globally. This shipping system, which transports goods using metal shipping containers, was invented by Malcolm P. McLean in 1955 (World Shipping Council 2012). It makes the logistics process simpler and quicker, as one container can be lifted from a truck directly onto a vessel without its contents first being unloaded. This idea is a system of "intermodalism", designed based on efficiency theory in which the same containerised goods can be transported with minimum disturbance on their shipping journey (World Shipping Council 2012).

It is worth mentioning that global operations of the liner shipping system significantly bring obvious benefits to the global economy. However, there are many unexpected risks in extended journeys around the world (CLSCM 2003; Hoti & McAleer 2004; Gurning 2011; UNCTAD 2011; Riahi *et al*. 2014). These risks arise from unexpected events that might disrupt the flow of materials on their journey from initial suppliers to final customers (Waters 2007). Some of the unexpected events which arise from external events are beyond a manager's control. These risks include earthquakes, tsunamis, hurricanes, extreme weather conditions, wars, terrorist attacks, outbreaks of disease, financial risks, crime, financial irregularities, industrial action, diversity of languages, different cultures and a whole host of others (Waters 2007). Since a containership operates from one port to another across the globe, a disruption by these unexpected events can cause delay, deviation, stoppage or loss of service platform (Gurning 2011). Although these external risks are beyond a manager's control, it needs to be proactively analysed and assessed, so further mitigation strategies can be implemented. However, before quantitative risk analysis and assessment can be conducted, it is useful if these external risks are prioritised to target the most significant risk factor in the BEBR model. Therefore, a new BEBR model for prioritising the external risk criteria in the CLSI has been proposed in this paper.

2. Literature Review
Recently, supply chain risk management (SCRM) has gained significant attention from practitioners and researchers (Blome & Schoenherr 2011; Colicchia & Strozzi 2012). In the CLSI, SCRM has also become a major concern for liner shipping operators (LSOs) to manage risk and uncertainty in their supply chain. In the literature, there are plenty of ways of categorizing sources of risk. These sources of risk can be classified into three categories which are environmental, organizational and network-related (CLSCM 2003; Jüttner *et al*. 2003). Yet, the current trend exposes the fact that, in the CLSI, there is a lack of understanding of how external or

environmental risks can influence the CLSI in the context of business performances. CLSCM (2003) defined these external risks such as natural hazards, technology risks, economic risks, political risks and social risks that affect an organisation's operations, asset and infrastructures and supply chain. Trkman & McCormack (2009) elucidated that exogenous uncertainty is a source of risk from outside of the supply chain. This exogenous uncertainty can be due to the discrete risks (e.g. terrorist attacks) or continuous risks (e.g. inflation rate) (Trkman & McCormack 2009).

The global operation of container liner shipping in different countries has necessitated the need for LSOs understand the riskiness of the business environment in a country under consideration (Mohd Salleh *et al*. 2015). In this paper, the proposed model of the BEBR in a country is developed by combining four main criteria which are political risks, economic risks, social risks, and natural hazards (CLSCM 2003; Hoti & McAleer 2004; UNCTAD 2011; Riahi *et al*. 2014). Although these risk criteria are originated from different sources, it is necessary to combine them into a single model to obtain the risk value of the BEBR in a country. As a result, the proposed BEBR model from a liner shipping perspective is capable of prioritising and synthesising these four main risk criteria. Moreover, the decision makers are provided with a single model that is capable of dealing with multi-complex elements.

Since the BEBR criteria are originated from multiple disciplines (i.e. political, economic, social and natural), prioritising them is a challenging task. When such risks are considered from a wider viewpoint, the procedures for data collection, measurement and quantification will be exceptionally complicated. These problems not only resulted from the extension of the searching scope but also originated from the incompleteness of data. For prioritising the BEBR criteria, four key aspects (i.e. political risks, economic risks, social risks, and natural hazards) are considered.

2.1 Political Risks

Political risks can be defined as any change in political aspects that may alter the probability of achieving business objectives. The political risks can cause financial losses or disruptions to an organisation due to non-market factors (e.g. policy, restrictions, *etc.*), and events related to the political instability (e.g. terrorism and civil war) (Kennedy 1991). Several maritime studies for the assessment of political risks are available in literature (Banomyong 2005; Tsai & Su 2005; Maachi & Sequeira 2009; Magee & Massoud 2011; Gurning 2011). In this paper, political risks are categorised into two groups which are macro and micro political risks. Government instability, domestic conflict, foreign conflict, restriction in foreign enterprise policy, corruption, and lawlessness are macro political risks that adversely affect the overall sustainability of an industry (Clark *et al*. 2004; Awosuke & Gempesaw 2005; Jones *et al*. 2005; Tsai & Su 2005; Magee & Massoud 2011; UNCTAD 2011). Micro political risks such as customs-related risk, exchange control rules and excessive bureaucracy are undesirably affect the LSOs' performances, which lead to cargo delay, cargo rerouting and excessive control on capital transactions (Sawhney & Sumukadas 2005; Wei & Zhang 2007; Ng *et al*. 2013).

2.2 Economic Risks

Economic risks of a country refer to the national economic situations that affect the outcomes of financial transaction and international trade served by the CLSI. A fall in economic development will adversely affect the performance of the CLSI. As a result, The CLSI performances and economic development are directly proportional and they have always been intractably linked. In this paper, economic risks are classified into two categories (i.e. macroeconomic and microeconomic risks) (Bouchet *et al*. 2003). GDP per employed person, current account to GDP, exchange rate fluctuation, inflation rate, and industrial production are the significant indicators that signify the macroeconomic performance of a particular country from a liner shipping perspective (Alizadeh & Nomikos 2009; Stopford 2009; Riahi *et al*. 2014). A fall of the values of these indicators in a country will show a reduction of a country's productivity, export and import performances and currency exchange value that can eventually daunt the container services demand. Freight rate fluctuation, bunker price fluctuation, and labour cost are the significant indicators that signify the microeconomic performance of a particular country and they will impact the operational cost of LSOs (Alizadeh & Nomikos 2009; Rodrigue *et al*. 2011). As a result, these risks are to be assessed for the financial strategy by LSOs.

2.3 Social Risks

Liner shipping operates across the globe and connects many countries. As a result, the CLSI is potentially exposed to a high-risk level as it has to deal with social risks in different countries. Numerous studies have attempted to evaluate social risks in the maritime industry. For example, Celik *et al*. (2009) investigated the degree of control, labour quality and safety standards as the elements of social risks for the evaluation of preferable flagging choice for shipping operators. Extending from this study, Kandakoglu *et al.* (2009) evaluated ship registry choice by considering the reputation of the ship-owners, NGOs' pressure and environmental concerns as the external assessment criteria. Based on the literature review, labour quality and availability in the market, working cultures, reputational risk, and religious/ethnic tensions are four crucial criteria that affect the sustainability of the CLSI (Bekefi *et al*. 2006; Lu & Tsai 2010; Zhang 2011; Riahi *et al*. 2012).

2.4 Natural Hazards

The CLSI offers an advantage in terms of the environmental transport problem by reducing pollution, traffic congestion and accidents; natural hazards, however, threaten the smooth operation of the liner shipping operation. Events such as earthquakes, tsunamis, and severe storms can cause delay in operations, destruction of ports, operation stoppage or even loss of service platforms (Gurning 2011; UNCTAD 2011). In this paper, natural hazards are classified into five categories (i.e. geophysical, meteorological, hydrological, climatological and biological disasters) (EM-DAT 2009). Earthquakes, tsunamis, and ash from volcanic eruptions are classed as geophysical disasters; severe storms and tornadoes are important examples of meteorological disasters; sea surges and coastal floods are categorised as hydrological disasters; extreme temperature, climate change and haze are grouped as climatological disasters; and insect infestation and epidemic/pandemic diseases are characterised as biological disasters.

The following Table 1 summarises the BEBR classifications discussed in the preceding sections.

Table 1. The Summary of Identified Risk Criteria for Assessing the BEBR in the CLSI

Main Criteria	Sub-criteria	Sub-sub-criteria	References
Political Risks	Macro Political Risks	Government Instability, Domestic Conflict, Foreign Conflict, Restriction in Foreign Enterprise Policy, Corruption, and Lawlessness.	Clark *et al.* (2004); Awosuke & Gempesaw (2005); Jones *et al.* (2005); Tsai & Su (2005); Magee & Massoud (2011); UNCTAD (2011).
	Micro Political Risks	Customs-Related Risk, Exchange Control Rules, Excessive Bureaucracy in Trade.	Sawhney & Sumukadas (2005); Wei & Zhang (2007); Ng *et al.* (2013).
Economic Risks	Macroeconomic Risks	GDP per Employed Person, Current Account to GDP, Exchange Rate Fluctuation, Inflation Rate, Industrial Production.	Alizadeh & Nomikos (2009); Stopford (2009); Riahi *et al.* (2014).
	Microeconomic Risks	Labour Cost, Freight Rate Fluctuation, Bunker Price Fluctuation.	Alizadeh & Nomikos (2009); Rodrigue *et al*. (2011).
Social Risks	Labour Quality and Availability	Labour Quality, Labour Availability.	Celik *et al*. (2009); Kandakoglu *et al*. (2009).
	Working Culture Reputational Risks Religious/Ethnic Tensions		Bekefi *et al.* (2006); Lu & Tsai (2010); Zhang (2011); Riahi *et al.* (2012).
Natural Hazards	Geophysical Disasters	Earthquakes, Tsunamis, Ash from Volcanic Eruption.	Chang (2000); EM-DAT (2009); Gurning (2011).
	Meteorological Disasters	Severe Storms, Tornadoes.	NOAA (2007); EM-DAT (2009); Gurning (2011).
	Hydrological Disasters	Sea Surges, Floods.	Goodwin (2003); Nicholls *et al.* (2007); Gurning (2011).
	Climatological Disasters	Extreme Temperatures, Climate Change, Haze.	Peterson *et al*. (2006); Rowland *et al.* (2007); National Research Council, (2008); Rauhala *et al.* (2009).
	Biological Disasters	Insect Infestations, Epidemic/Pandemic Diseases	EM-DAT (2009); WHO (2009).

In this paper, an AHP approach is employed to perform the prioritisation process. The AHP approach is a theory of measurement through pair-wise comparisons and relies on the judgements of experts to derive priority scales (Saaty 2008). In the AHP approach, comparisons are made using a set of scales of absolute judgements that represents the relative importance of one element to another element in a given attribute. The fundamental scale has been shown to be one that captures individual preferences with respect to quantitative and qualitative attributes as well as, or better than, other scales (Saaty 1980). In addition, the AHP is a well-structured approach for organising and analysing complex decisions (i.e. multiple attributes or multilevel criteria). It has been developed based on precise mathematical structures of consistent matrices and their associated right-eigenvector's ability to generate weights (Merkin 1979; Saaty 1980). Furthermore, if the judgements are inconsistent due to different perceptions and beliefs with regard to criteria or alternatives, the AHP approach is capable of measuring inconsistencies and improving judgements (Saaty 2008).

The main objective of the AHP approach is to provide judgements on the relative importance of given attributes. The AHP approach also ensures that the judgements are quantified to the extent that permits their quantitative interpretation with respect to given attributes (Pillay & Wang 2003; Riahi *et al.* 2012). There are several advantages of using the AHP approach, which can be listed as follows (Pam 2010):

- It is capable of analysing both qualitative and quantitative criteria.
- It is capable of taking a large quantity of criteria into consideration.
- It is capable of facilitating the construction of a flexible hierarchy to address decision-making problems.

3. Methodology

In this paper, in order to prioritise the BEBR criteria from a liner shipping perspective, a generic model is constructed. An AHP approach is employed to quantify the importance of attributes and is adapted into a deterministic weight vector (i.e. in the context of impact level) (Saaty 1980). To develop the calculation process for prioritising risk criteria in the BEBR model, a flow chart of proposed methodology in sequential order is illustrated in Figure 1.

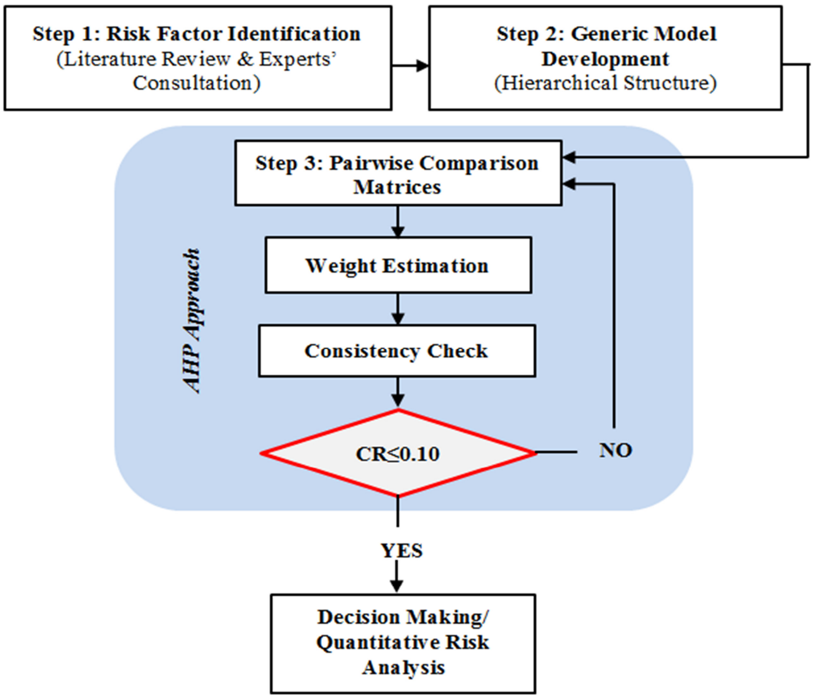

Figure 1. Methodological Framework for Prioritising the BEBR Criteria

3.1 Identification of the BEBR Criteria (Step 1)

The risk factor identification step forms visualisation of the potential risk factors and builds the foundations for the ensuing risk prioritisation process (Blome & Schoenherr 2011). The process requires an overall understanding of the CLSI and the specific political, economic, social and natural criteria which affect the LSO's business. In this paper, the process of identifying the BEBR criteria in the CLSI involves the listing of risk factors, and then classifying them into appropriate criteria in the categorisation system. With the focus on the BEBR, every significant external risk factor in the CLSI is carefully reviewed. A literature review was used as the main technique for the risk factor identification process in this study. Through the extensive literature review, firstly, the 39 assessment criteria (i.e. lowest level criteria in the model) that adversely affect the CLSI's performances are identified. Secondly, these criteria are further revised by the domain experts. Finally, as shown in Table 1, 34 assessment criteria are selected.

3.2 Development of a Generic Model for the BEBR (Step 2)

The kernel of developing a generic model is that it can be modified or adjusted to be used for a particular firm or industry. The risk factors, as shown in Table 1 are used for developing a generic model in a hierarchical structure form. As shown in Figure 2, the BEBR (i.e. Goal) are assessed by four main criteria (i.e. political risks, economic risks, social risks and natural hazards). Sub-criteria of political risks consist of macro and micro political risks. Macro political risks indicate the government instability, domestic conflict, foreign conflict, restriction in foreign enterprise policy, corruption and lawlessness; whereas micro political risks include customs-related risk, exchange control rules and excessive bureaucracy. Sub-criteria of economic risks are divided into macroeconomic and microeconomic risks. The indicators for macroeconomic risks are the GDP per employed person, current account to GDP, exchange rate fluctuation, inflation rate and industrial production. The indicators for microeconomic risks are labour cost, freight rate fluctuation and bunker price fluctuation. Sub-criteria of social risks consist of labour quality and availability, working cultures, reputational risks and religious/ethnic tensions. Sub-criteria of natural hazards consist of geophysical, meteorological, hydrological, climatological and biological disasters. Earthquakes, tsunamis and ash from volcanic eruptions are classified as geophysical disasters; severe storms and tornadoes are classified as meteorological disasters; sea surges and coastal floods are categorised as hydrological disasters; extreme temperature, climate change and haze are classified as climatological disasters; and insect infestation and epidemic/pandemic diseases are categorised as biological disasters.

3.3 Establishment of Criteria Weights (Step3)

A weight can be assigned to each criterion using established methods such as simple rating methods or more elaborate methods based on pair-wise comparisons (i.e. AHP). To compare the criteria or alternatives in a nature of pair-wise comparison mode, a fundamental scale of absolute numbers is used. Table 2 shows an example of the ratio scale of pair-wise comparison which consists of linguistic meaning and numerical assessment. In this table, the comparison scale is described as “1 i.e. equally important”, “3 i.e. weakly important”, “5 i.e. strongly important”, “7 i.e. very strongly important”, “9 i.e. extremely important” and “2, 4, 6 and 8 are intermediate values of important”. Each expert should understand the ratio scale of the pair-wise comparison before the assessment has been taken in order to avoid misjudgement.

Table 2. Comparison Scale

Numerical Assessment (Scale)	**Linguistic Meaning**
1	Equally Important (EQ)
3	Weakly Important (WE)
5	Strongly Important (ST)
7	Very Strongly Important (VS)
9	Extremely Important (EX)
2, 4, 6, 8	Intermediate values between the two adjacent judgements

The judgements on pairs of attributes A_i and A_j are presented by an $n \times n$ matrix D. The entries a_{ij} are defined by entry rules as follows (Saaty 1980):

- Rule 1: If $a_{ij} = \alpha$, then $a_{ji} = 1/\alpha$, $\alpha \neq 0$.
- Rule 2: If A_i is judged to be of equal relative importance as A_j, then $a_{ij} = a_{ji} = 1$.

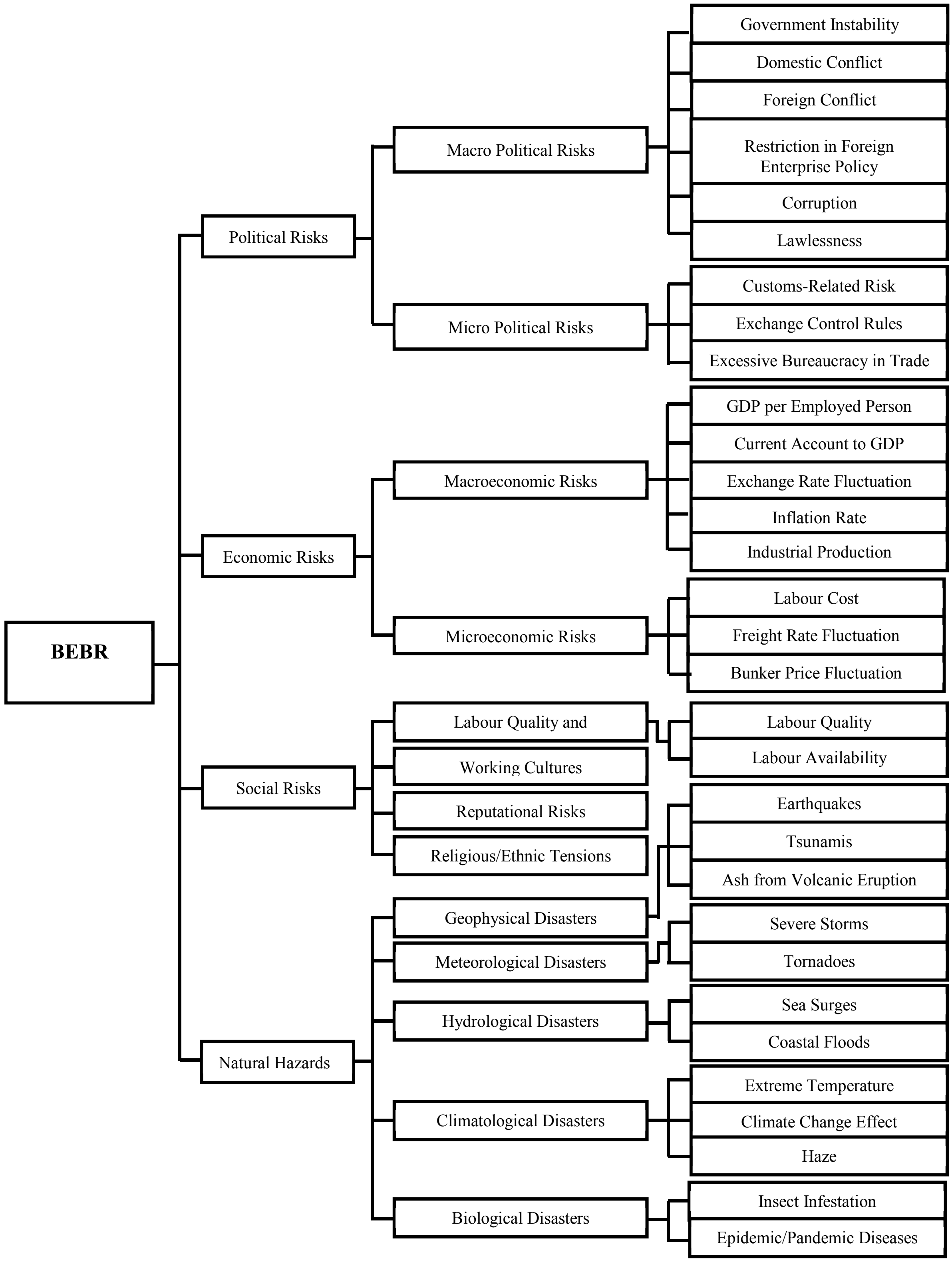

Figure 2. The Generic BEBR Model

According to above rules the matrix D is shown as follows:

$$D = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & \cdots & a_{2n} \\ . & . & \cdots & . \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix} \tag{1}$$

where $i, j = 1, 2, 3, \ldots, n$ and each a_{ij} is the relative importance of attribute A_i to attribute A_j.
The quantified judgement of comparison on pair (A_i, A_j) is noted as a_{ij} in the matrix D; a further step is to allocate the weight vector for each criterion or alternative, as it indicates the prioritisation of the criteria or alternatives (Riahi *et al.* 2012). A weight value w_k can be calculated as follows:

$$\mathrm{w}_{\mathrm{k}} = \frac{1}{n}\sum_{j=1}^{n}\left(\frac{a_{kj}}{\sum_{i=1}^{n} a_{ij}}\right)(k = 1,2,3,\ldots n) \tag{2}$$

where a_{ij} stands for the entry of row i and column j in a comparison matrix of order n.
The judgements may be inconsistent due to different perceptions and belief with regard to criteria or alternatives. By using a Consistency Ratio (CR), inconsistency of the pair-wise comparisons can be measured. If CR value is 0.10 or less, the consistency of the pair-wise comparison is considered reasonable, and the AHP can continue with the computations of weight vectors (Andersen *et al.* 2008; Riahi *et al.* 2012). In contrast, a CR with a greater value than 0.10 indicates an inconsistency in the pair-wise judgements. To check the consistency of the judgements, a CR is computed by using Equations 3-5 (Andersen *et al.* 2008):

$$\mathrm{CR} = \frac{CI}{RI} \tag{3}$$

$$\mathrm{CI} = \frac{\lambda_{\max} - n}{n-1} \tag{4}$$

$$\lambda_{\max} = \frac{\sum_{j=1}^{n}\left[\frac{\left(\sum_{k=1}^{n} w_k a_{jk}\right)}{w_j}\right]}{n} \tag{5}$$

where CI is the consistency index, RI is the average random index (Table 3), n is the number of items being compared, and $\lambda_{\max}$ is the maximum weight value of the $n \times n$ comparison matrix D.

Table 3. Value of Average Random Index versus Matrix Order

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

4. Test Case

In order to demonstrate the prioritisation process by using the AHP approach, the CLSI in Malaysia is selected as a case study. For prioritising the risk criteria in the BEBR model from Malaysian CLSI's perspectives, in step one all assessment criteria as shown in Table 1, are considered. In step two, the generic BEBR model as illustrated in Figure 2 is used for this test case.

Five domain experts from the CLSI are approached to perform the pair-wise comparison for the BEBR criteria. The selection of domain experts for subjective judgements was based on their experiences and qualifications. In this study, the domain experts have at least 15 years' experience in the CLSI (Mokhtari *et al.* 2012). Due to difficulties in assigning weights for experts and to avoid prejudgement, they are assigned with equal weight (Riahi *et al.* 2012; Mokhtari *et al.* 2012). For the four main criteria, a 4×4 pair-wise comparison matrix needs to be developed for obtaining the weight for each criterion. For example, *D(PESN)* is a matrix for comparing the relative priority of the political risks, economic risks, social risks and natural hazards. To obtain the aggregated comparison matrices, geometric mean (GM) is used in this study to aggregate judgements of individuals within a group. As an example, for evaluating the priority of the criterion "*P*" to the criterion "*S*", expert one (e_1) ticked number 1, expert two (e_2) ticked number 2, expert three (e_3) ticked number 1, expert four (e_4) ticked number 5 and expert five (e_5) ticked number 3. The GM of the importance of the criterion "*P*" to the "*S*" can be calculated as follows (Aull-Hyde *et al.* 2006):

$$\mathrm{GM}_{\mathrm{ij}} = \left[e_{ij}^{1} \cdot e_{ij}^{2} \cdot e_{ij}^{3} \cdots e_{ij}^{k}\right]^{\frac{1}{k}} \tag{6}$$

where k is the number of experts and e_{ij}^{k} stands for the k^{th} expert opinion for relative importance of the i^{th} criterion to the j^{th} criterion. As a result, the importance of P (i.e. first element) to S (i.e. third element) is calculated as follows:

$$\mathrm{GM}_{13} = a_{13} = (1\times2\times1\times5\times3)^{1/5} = 1.97, \text{ then } a_{31} = 1/1.97 = 0.51$$

The same calculation technique is applied to all pair-wise comparisons for the aggregation processes. Based on Equations 1-5, the a_{ij} values can be evaluated as follows:

The matrix *D(PESN)* for the main criteria (i.e. political risks, economic risks, social risks and natural hazards) is obtained as follows:

$$\text{PESN} = \begin{bmatrix} 1 & 0.80 & 1.97 & 1.11 \\ 1.25 & 1 & 1.82 & 1.40 \\ 0.51 & 0.55 & 1 & 0.44 \\ 0.90 & 0.71 & 2.27 & 1 \end{bmatrix}$$

Based on Equation 2, weight calculation for each main criterion is demonstrated as follows:

$$w_P = \frac{1}{4}\left(\frac{1}{1+1.25+0.51+0.90}\right) + \left(\frac{0.80}{0.80+1+0.55+0.71}\right) + \left(\frac{1.97}{1.97+1.82+1+2.27}\right) + \left(\frac{1.11}{1.11+1.40+0.44+1}\right) = 0.2737$$

$$w_E = \frac{1}{4}\left(\frac{1.25}{1+1.25+0.51+0.90}\right) + \left(\frac{1}{0.80+1+0.55+0.71}\right) + \left(\frac{1.82}{1.97+1.82+1+2.27}\right) + \left(\frac{1.40}{1.11+1.40+0.44+1}\right) = 0.3201$$

$$w_S = \frac{1}{4}\left(\frac{0.51}{1+1.25+0.51+0.90}\right) + \left(\frac{0.55}{0.80+1+0.55+0.71}\right) + \left(\frac{1}{1.97+1.82+1+2.27}\right) + \left(\frac{0.44}{1.11+1.40+0.44+1}\right) = 0.1430$$

$$w_N = \frac{1}{4}\left(\frac{0.90}{1+1.25+0.51+0.90}\right) + \left(\frac{0.71}{0.80+1+0.55+0.71}\right) + \left(\frac{2.27}{1.97+1.82+1+2.27}\right) + \left(\frac{1}{1.11+1.40+0.44+1}\right) = 0.2632$$

As a result, w_P, w_E, w_S and w_N are evaluated as 0.2737, 0.3201, 0.1430 and 0.2632. A further step is to calculate and check the consistency ratio of the pair-wise comparison. Firstly, $\lambda_{\max}$ is calculated as to lead to the consistency index (*CI*) and consistency ratio (*CR*).

$$P = (1 \times 0.2737) + (0.80 \times 0.3201) + (1.97 \times 0.1430) + (1.11 \times 0.2632) = 1.1037$$

$$E = (1.25 \times 0.2737) + (1 \times 0.3201) + (1.82 \times 0.1430) + (1.40 \times 0.2632) = 1.2910$$

$$S = (0.51 \times 0.2737) + (0.55 \times 0.3201) + (1 \times 0.1430) + (0.44 \times 0.2632) = 0.5745$$

$$N = (0.90 \times 0.2737) + (0.71 \times 0.3201) + (2.27 \times 0.1430) + (1 \times 0.2632) = 1.0614$$

$$\lambda_{max} = \frac{\left(\frac{1.1037}{0.2737}\right) + \left(\frac{1.2910}{0.3201}\right) + \left(\frac{0.5745}{0.1430}\right) + \left(\frac{1.0614}{0.2632}\right)}{4} = 4.029$$

$$CI = \frac{\lambda_{max} - n}{n-1} = \frac{4.029 - 4}{4-1} = 0.0097$$

Based on Table 3, the random index (*RI*) for the four criteria is 0.90. As a result, the *CR* is calculated as follows:

$$CR = \frac{CI}{RI} = \frac{0.0097}{0.90} = 0.0108$$

The *CR* value for the main criteria is 0.0108. Saaty (1980) stated that a $CR \leq 0.1$ indicates that the judgements are acceptable. As a result, the consistency of the pair-wise comparison for the main criteria is acceptable. The same calculation technique is applied to rank the sub- and sub-sub-criteria in the BEBR model. The weight values and consistency ratio values for the sub- and sub-sub-criteria are shown in Table 4.

The above calculation is for the local weights of the criteria, which is compared with each other in a same group (e.g. a group of main criteria consists of political risks, economic risks, social risk and natural hazards). To find the most important risk factor (i.e. lowest level criterion) in the BEBR model, a global weight needs to be calculated through multiplying a local weight of such lowest level criterion and the local weights of its upper level criterion or criteria. For example, the global weight of the "government stability" can be calculated as GW_{GI} = 0.2109 × 0.5000 × 0.2737 = 0.0289. By using the same technique, all global weights are calculated and shown in Table 4.

5. Result and Discussion

Based on Table 4, it is worth mentioning that economic risks are the main criteria that contribute a highest impact level in the BEBR model. Based on the AHP calculation, the weight for economic risks is calculated as 0.3201 followed by political risks (0.2737), natural hazards (0.2632) and social risks (0.1430). It can be seen that the weight value of economic risks was closely associated with the perspective of experts' judgement. This is because they believed that CLSI performances and economic development are directly proportional and they have always been inextricably linked. Moreover, economic risks highly influence trade performance as it is very sensitive to economic stability, as has been proven by the 2008 financial crisis (Rodrigue *et al*. 2011).

Based on the global weights as shown in Table 4, the most significant lowest level criteria was found to be exchange control rules (0.0604), followed by the GDP per employed person (0.0518) and bunker price fluctuation (0.0507). The ranking orders of other lowest level criteria are shown in Table 5.

Table 4. Result of Weight Values and Consistency Ratios for all Main, Sub- and Sub-Sub-Criteria in the BEBR Model

Goal	**Main Criteria**	**Weights**	**Sub-criteria**	**Local Weights**	**Global Weights**	**Sub-sub-criteria**	**Local Weights**	**Global Weights**
BEBR	Political Risks	0.2737	Macro Political Risks	0.5000	0.1369	Government Instability	0.2109	0.0289
						Domestic Conflict	0.1781	0.0244
						Foreign Conflict	0.2055	0.0281
						Restriction in Foreign Enterprise Policy	0.1442	0.0197
						Corruption	0.1373	0.0188
						Lawlessness	0.1240	0.0170
						CR =	0.0253	
			Micro Political Risks	0.5000	0.1369	Customs-Related Risk	0.2757	0.0377
			CR =	0.0000		Exchange Control Rules	0.4411	0.0604
						Excessive Bureaucracy in Trade	0.2832	0.0388
						CR =	0.0237	
	Economic Risks	0.3201	Macroeconomic Risks	0.6260	0.2004	GDP per Employed Person	0.2584	0.0518
						Current Account to GDP	0.2342	0.0469
						Exchange Rate Fluctuation	0.1819	0.0365
						Inflation Rate	0.1480	0.0297
						Industrial Production	0.1775	0.0356
						CR =	0.0102	
			Microeconomic Risks	0.3740	0.1197	Labour Cost	0.2667	0.0319
			CR =	0.0000		Freight Rate Fluctuation	0.3099	0.0371
						Bunker Price Fluctuation	0.4234	0.0507
						CR =	0.0018	
	Social Risks	0.1430	Labour Quality and Availability in the Market	0.3862	0.0552	Labour Quality	0.6538	0.0361
						Labour Availability	0.3462	0.0191
			Working Cultures	0.2022	0.0289	***CR =***	0.0000	
			Reputational Risk	0.2097	0.0300			
			Religion and Ethnic Tension	0.2019	0.0289			
			CR =	0.0178				
	Natural Hazards	0.2632	Geophysical Disasters	0.3336	0.0878	Earthquake	0.4438	0.0390
	CR =	0.0108				Tsunami	0.4438	0.0390
						Ash from Volcanic Eruption	0.1124	0.0099
						CR =	0.0000	
			Meteorological Disasters	0.1985	0.0523	Severe Storms	0.6137	0.0321
						Tornadoes	0.3863	0.0202
						CR =	0.0000	
			Hydrological Disasters	0.1286	0.0339	Sea Surges	0.5000	0.0170
						Coastal Flood	0.5000	0.0170
						CR =	0.0000	
			Climatological Disasters	0.1990	0.0524	Extreme Temperatures	0.3684	0.0193
						Climate Change	0.3858	0.0202
						Haze	0.2458	0.0129
						CR =	0.0018	
			Biological Disasters	0.1403	0.0369	Insect Infestation	0.3462	0.0128
			CR =	0.0095		Epidemic/Pandemic Diseases	0.6538	0.0241
						CR =	0.0000	

Table 5. Ranking Orders of the Lowest-Level Criteria

Lowest-Level Criteria	Global Weights	Ranks
Exchange Control Rules	0.0604	1
GDP per Employed Person	0.0518	2
Bunker Price Fluctuation	0.0507	3
Current Account to GDP	0.0469	4
Earthquake	0.0390	5
Tsunami	0.0390	5
Excessive Bureaucracy in Trade	0.0388	6
The Customs-Related Risk	0.0377	7
Freight Rate Fluctuation	0.0371	8
Exchange Rate Fluctuation	0.0365	9
Labour Quality	0.0361	10
Industrial Production	0.0356	11
Severe Storms	0.0321	12
Labour Cost	0.0319	13
Inflation Rate	0.0297	14
Government Instability	0.0289	15
Foreign Conflict	0.0281	16
Domestic Conflict	0.0244	17
Epidemic/Pandemic Diseases	0.0241	18
Tornadoes	0.0202	19
Climate Change	0.0202	19
Restriction in Foreign Enterprise Policy	0.0197	20
Extreme Temperatures	0.0193	21
Labour Availability	0.0191	22
Corruption	0.0188	23
Lawlessness	0.0170	24
Sea Surges	0.0170	24
Coastal Flood	0.0170	24
Haze	0.0129	25
Insect Infestation	0.0128	26
Ash from Volcanic Eruption	0.0099	27

In many countries, in order to protect the local economy, the government has enforced specific exchange control rules as a political tool to protect its national interests. This type of government policy is commonly used in most countries, especially in developing countries and transition countries. Wei & Zhang (2007) argued that there is economically and statistically significant evidence of the negative effects of exchange control rules on trade. Although the Free Trade Agreement (FTA) has been established in response to the globalisation trend and economic liberalisation, some countries still impose exchange control rules such as controls on payments for imports and exports (i.e. documentation and financing requirement), capital and foreign exchange transactions (i.e. derivatives, credit operations, real estates, ban on currency derivative trading and control on bank accounts) (Wei & Zhang 2007).

The aforementioned CLSI performance and economic development are directly proportional and they have always been inextricably linked. One of the most important economic indicators is GDP per employed person. GDP per employed person can provides a general picture of a country's productivity (US Department of Labour 2009). Riahi (2010) measured the reliability of a country from an economic point of view by using GDP per employed person as a general indicator of productivity. Reductions in GDP per employed person may reduce the country's productivity and finally discourage the demand for export and import performances.

One of the major costs in shipping operations is fuel cost. As fuel is the main energy source for moving ships, volatility in bunker prices is an important factor in the expenditure of the CLSI (Rodrigue *et al.* 2011). Alizadeh & Nomikos (2009) argued that the most important source of risk on the costs side of the shipping operation is fluctuations in bunker prices. From the middle of 2008, many LSOs suffered with regard to their vessels' operation due to the global economic recession as well as the sharp increase in bunker prices (Rahman *et al.* 2012). These events led to a dramatic fall in trade demand on all major routes and ultimately caused a surplus of containership services. Consequently, sharp and unanticipated changes in bunker prices may have a major impact on the operational costs of LSOs and can lead to reduced marginal profits or even losses. As a result, it is of the utmost importance for LSOs to assess their risk exposure to bunker price fluctuation in order to secure their operating profit (Alizadeh & Nomikos 2009).

6. Conclusion and Future Research

Today, the CLSI faces a variety of external risks which are beyond a managers' control. However, these external risks (i.e. called BEBR) need to be proactively analysed and assessed by using an appropriate approach, thus enabling informed decisions to be made regarding mitigation strategies. In this paper, the BEBR model and decision support framework for prioritising the BEBR criteria are proposed. Four main criteria, namely political risks, economic risks, social risks, and natural hazards, are investigated. For the prioritisation process, firstly, various risk criteria affecting the CLSI's business performance are identified. Secondly, a generic model is developed in a hierarchical structure. Finally, the AHP approach is used to prioritise the BEBR criteria by establishing the weight to each of them. Based on the AHP calculation, the result shown that the economic risks are the most important main criteria in the BEBR model, followed by the political risks, natural hazards and social risks. For future research, a quantitative risk analysis for assessing the targeted or whole criteria in the BEBR model can be implemented. Several mathematical methods such as fuzzy set theory (FST) and evidential reasoning (ER) for the assessment, can be employed (Zadeh 1965; Yang & Xu 2002). An FST can be used by exploiting a membership function for assessing the BEBR criteria (Mohd Salleh *et al.* 2014). Furthermore, an ER algorithm can used to synthesise the belief degrees of linguistic variables of BEBR criteria (Mohd Salleh *et al.* 2014). This BEBR model can provide a useful model for LSOs to assess the BEBR value in a particular country before making a decision about investments and operations. Furthermore, it can be used for the assessment of the overall existing situation in a host country.

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