Nicaragua Canal: A New Corridor to Far East Asia

Mei Chi Wong and Tsz Leung Yip*

Department of Logistics and Maritime Studies,
The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

**Corresponding author*

Abstract

Connections between the Atlantic and Pacific Oceans are important for the international trade. Since 1914, the Panama Canal has provided ships a direct corridor to cross the Atlantic and Pacific Oceans. The geographical advantage of the Panama Canal enables it to enjoy an exclusive position in the international seaborne trade. The vessel tonnage passing through the Panama Canal represents approximately 5% of the world trade and the passage demand grows continuously. However, the Panama Canal's monopoly over inter-oceanic corridor may soon come to an end. In 2012, a memorandum of understanding was signed to construct the Nicaragua Canal which is close to the Panama Canal. It is expected that the canal should be operational by 2020. The proposed Nicaragua Canal as inter-oceanic corridor not only provides an alternative route for vessels to pass between the Atlantic and Pacific Oceans, but also triggers dynamic changes of seaborne trade pattern. To assess the long-term benefits of the proposed Canal, the scenario planning method will be used in this study to provide a framework for sketching several future scenarios in 2030, 10 years after the proposed Canal is built. The scenario planning enables us to explore novel insights about the future which demonstrate the causal relationships between factors. In this scenario planning, three forces, namely politics, economics and environment, will be taken into consideration. A pair of forces will be combined to generate a dominant scenario in order to foresee the roles of the Nicaragua Canal in the future international trade. The analysis of this study will benefit policy makers and other stakeholders to incorporate alternative mindsets into future strategy formulation and development.

Keywords: Nicaragua Canal; Panama Canal; Scenario planning

1. Introduction

On 8 October 2012, the Nicaraguan Government signed a memorandum of understanding for the construction of a new canal which is known as the Nicaragua Canal. The new canal will be an inter-oceanic waterway to connect the Caribbean and Pacific coasts of Nicaragua (Figure 1). It is expected that the canal should be operational by 2020. In this paper, we study what the proposed Nicaragua Canal will contribute to Far East Asia in 2030, 10 years after the proposed Canal is built. Shipping is a derived demand, and the shipping pattern is affected by many factors. The emergence of a new canal will provide an alternative option to ship navigation. The roles of the new canal depend on many factors as well as competing waterways. Moreover, a new canal will stimulate trade and shipping development. Therefore, we attempt to foresee the shipping pattern by using scenario planning under the uncertain situations of the future, especially in Far East Asia.

In this study, we attempt to develop possible dominant scenarios driven by forces, demonstrate possible interactions of the Nicaragua and Panama Canals (Figure 1), and predict the roles of the Nicaragua Canal. Shipping patterns are a result of route choices of ships. Route choices are determined by many factors, e.g. distance, cost, resources supply and demand, carriers' preference and route constants. This study will focus on analysing how the global factors (politics, environmental and economic) affect the role of new canal, in the presence of a competing canal, and how the two canals jointly affect the trade pattern. As the result, the policy makers and other stakeholders will benefit by incorporating alternative mindsets into future strategy formulation and development.

In Section 2, we review the literature related to canal and scenario planning. In Section 3, we develop scenarios for foreseeing the global development caused by forces. In Section 4, three scenarios will be formed by interacting between each pair of the 3 forces. Moreover, the possible roles of the new corridor will be generated. By demonstrating how the neighbouring canal, i.e. Panama Canal, will be affected by the new canal, the roles of the new canal will also be discussed in Section 4. Afterthat, the implications and corresponding strategies and the direction of future research will be incorporated in the conclusion.

2. Literature Review

In existing literature, there are many studies to compare competing canals or trade routes. Canals and trade routes maintain their competitive advantages by providing a shortcut to countries e.g. the Panama Canal, the Suez Canal, or deep channel for resources' accessibility, e.g. the Cape of Good Hope. In the 1970s and 1980s, few studies analysed the competitiveness and complementary nature of canals or trade routes. After the Suez Canal had been closed, Gradus (1977) investigated whether the Negev desert could be an alternative to the Suez Canal. The study compared cargo traffic in the period from the closure to re-opening of the Suez Canal. Gradus (1977) analysed the reasons for failure of this continental bridge.

New routes may be possible as ice melting is being caused by global warming. After the arctic route become more navigable, the distance between the Far Asia and Europe, and Asia and North America will be shortened. Previous studies illustrated cost advantages of new routes by comparing against existing the predominant routes of the Panama Canal or Suez Canal. Somanathan et al. (2009) simulated the shipping route between Asia and the East coast of North America via the Northwest Passage in northern Canada and the Panama Canal, respectively, in order to calculate the required freight rate. They concluded that the viable economic benefit may be achieved when arctic ice is further thinned in the possible future. Liu and Kronbak (2010) investigated the economic potential of the Northern Sea Routes (NSR) to be an alternative of liners to passage between Asia and Europe. The study was done from a users' prospective by conducting a case study, and a 4,000-TEU-containership was assumed. By adjusting main factors, e.g. bunker prices, the NSR navigable time and the ice-breaking fee, the economic feasibility of NSR in different scenarios were tested. It concluded that NSR is not competitive to the Suez Canal. Schøyen and Bråthen (2011) explored if there are potential benefits of energy saving from the shorter distance of Northern Sea Routes attracting the tramp shipping from the present predominant shipping routes of Suez Canal. It is found that the NSR may be profitable for minor bulk trades during the summer time. Many recent studies used a mathematical approach to estimate cost savings in order to determine the competitiveness of new arctic routes. The findings depend very much on the preset hypothesis and assumptions. In a different way from previous studies, we use the scenario planning to formulate the future strategies that enable the Nicaragua Canal to be an important asset of maritime transport.

Scenario planning is widely used to evaluate long term corporate strategies, and the most classic example is done by Shell Oil (Zentner, 1982). The recognition of future uncertainty and adaptive management allowed Shell Oil to outperform and move from being one of the smallest to being the second largest multinational oil companies (Wack, 1985). Moyer (1996) demonstrated the application of scenario planning with a case study of British Airways. The scenario planning study enabled British Airways to broaden the views on how the world would be changed in order to decide the corresponding corporate strategy to strive against the uncertain future. Moreover, scenario planning is applicable for forecasting the future in different scopes, and varies from being related to managing risk under dynamic changes for a new products (Ahn and Skudlark, 2002), industries (Stokke, et al., 1990), regional transport planning (Zegras, Sussman, and Conklin, 2004a), and national policy (Kahane, 1992).

Millett (1988) addressed how organisations are using scenario planning for strategic thinking and management. His paper illustrated the advantages of using scenario planning which offers alternative views of the future. This approach is the best to use for long term planning with complex situations especially when there is little or a lack of data is available for quantitative models. The business environment can be forecasted in order to evaluate and decide the corresponding strategies. Millett (1988) summarised the insights gained from scenario planning and concluded the study by citing the corporate examples that use scenario planning for strategic thinking. The 5th insight illustrates that the scenarios enable planners to deal with competition by considering rival companies with similar products and services and emerging threats in substitute products

and services into the scenario planning. Godet and Roubelat (1996) argued that the future cannot be simply built based on the continuation of the past. They cited the study of Gaston Berger (1964) that prospective attitude of forecast shall be (1) long term, (2) interactive, (3) risking taking (far horizons enable changing), (4) in depth (identify important factors and trend), and (5) interested in human consequences. The result of forecast should be simple enough to communicate between users and customers. Scenario planning can fit these criteria that stimulate imagination and build the offering visions of the normative future. The straightforward scenarios can be used as backgrounds behind strategic alternatives for solving "what-if" questions. Varum and Melo (2010) reviewed the literature that uses the scenario planning approach. They discussed the contributions of scenario planning which is a future analytical method and enables the planners to maintain the competitiveness of organisations by recognising uncertainty and applying adaptive management. While scenario planning creates a description of the future, it does not provide an accurate future.

The proposed Nicaragua Canal as inter-oceanic corridor will not only provide an alternative route for vessels to pass between the Atlantic and Pacific Oceans but also trigger dynamic changes of seaborne trade patterns. The future is highly uncertain, especially when little mathematical data is available for forecasting the accurate situation. Instead of mathematical forecasts, we would like to assess the long-term benefits of the proposed Nicaragua Canal by using the scenario planning method to provide a framework to sketch a few future scenarios. This study will enable us to explore novel insights about the future which demonstrates the causal relationships between factors. The micro and market changes of seaborne trade patterns will be analysed. These analyses will provide guidance for the future mathematical forecasts.

3. Scenario Development

In the literature, there are different approaches to develop scenarios. Ahn and Skudlark (2002) showed the steps for incorporating scenario planning in a new service development process: (1) generating issue, (2) developing scenario, (3) generating strategies, (4) analysing scenario corresponding strategies. To develop scenarios, a scenario delta chart is used. Key uncertainties and key nodes are listed. Distinct scenarios are explored based on effects of the *trigger event on uncertain environment and nodes.* Zegras (2004) summarised that there are different approaches to build scenarios, two are most commonly used: (*1) inductive (bottom-up) - builds based on data available that allows the structure to emerge by itself; and (2) deductive (top-down) - starts with building overview framework and fits data into it*. The study used a deductive approach. It first defines scope and identifies strategic options, and then outlines key local factors and driving forces. When combining driving forces, each force has two potential states, i.e. good/ bad binary possibilities. *16 combinations have been generated in a matrix, and the three most representative scenarios are selected.* After that, scenario implications and strategic options were analysed. Shell International Limited (2005) constructed a Trilemma Triangle to provide an overview on global trends, emerging challenges and corporate strategies. It first identifies a trigger issue and three driving forces. Instead of generating scenarios at each corner of the triangle, i.e. from one dominant force, the plausible scenarios are developed based on the interaction between two forces and the trade-off of the third force.

Following Shell (2005), our procedure of scenario planning is summarised as follows:

1. Decide the key questions – What is the role of the Nicaragua Canal?
2. Time of analysis – 10 years.
3. Identify key driving forces
4. Determine the dominant (extreme) scenarios
5. Assess the scenarios and associated implications.

In the absence of data, a critical step is to identify the key driving forces. We are making reference to previous related studies. Zentner (1982) classified methods for development scenarios into two methods: (1) "hard" method - mathematics models and computers; and (2) "soft" method - *intuitive and descriptive.* The most sophisticated "soft" technology is *cross-impact analysis* which *"identifies reinforcing and inhibiting events and trends, to recover relationships and to indicate the importance of specific events: application of multiple scenarios to corporate strategic planning"*. Godet and Roubelat (1996) categorised scenario planning into *two major types: (1) exploratory type - explore the likely future based on past and present*

trends; and (2) anticipatory or normative type - built different scenarios based on different versions, e.g. desired or feared. There are multiple methods to construct scenarios, a widely held consensus method includes numerous specific steps: systems analysis, retrospective, actors' strategies, and elaboration of scenarios. Stokke et al. (1990) did the scenario planning for the Norwegian Oil and Gas industry. They first established a "conceptual model" of the external environment which are: (1) micro forces - market and industry forces that determine future trends, e.g. product demand, price, market structure; (2) macro drivers - global and national economic, political, technological and social factors. *By using an "Impact/ Uncertainty Matrix" and scoring scheme, three alternative outcomes (energy market structure, national economy and technology) are summarised. Four descriptive scenarios are constructed and corresponding strategies are generated.*

Due to data limitation, an intuitive and descriptive approach is used for this study. Alternative scenarios will be built based on a cross-impact analysis that reinforces events and trends, to recover relationships by an anticipatory or normative method. Instead of using the approaches of two dimensional matrix or good/ bad binary possibilities, a Trilemma Triangle is constructed. Therefore, three distinctive scenarios are directly developed. Scenario planning is built based on the recognition of future uncertainty and adaptive management. In addition, driving forces are the areas having potential far-reaching changes to the environment responding to specific situations. Trends of economy, social, international, policy, and technology are forces commonly used in Shell's cases (Rene, 1982). Geopolitics, international economics and natural environment are driving forces (Kahane, 1992). Moyer (1996) applied technology, education, world trade and world finance as driving forces for the case study of British Airways. Zegras (2004) used economy, finance, technology and environment for building scenarios for Houston regional transportation planning. As we attempt to foresee the roles of the Nicaragua Canal in the future international trade, as suggested by previous studies, politics, economics, and environmental forces are selected as the three most significant factors affecting global trade pattern. We will discuss the three forces in the following sections.

3.1. First Force – Politics

The emergence of a new canal may create a new situation of seaborne trade. Marine traffic between countries implies political reasons. When the Suez Canal was blocked by the Egyptians from 1967 to 1975, the State of Israel built the Negev, a continental bridge, as an alternative to move freight between the Red Sea and the Mediterranean Sea. Gradus (1977) concluded that political force was one of major reasons for the failure to use the Negev. He showed that political force may deter some countries' preference on route choice. The security of global maritime trade is critical; and the threat to maritime trade route makes countries vulnerable to the threat on scarce natural resources (Nincic, 2002). Rodridue (2004) concluded that the fallout would be political and economic chaos, and a vulnerable and petroleum-dependent global economy could come to an end. In other words, canals and straits may be considered as national chokepoints to secure the supply of scarce resources, e.g. energy and food. They are critical to global economies. As China became a net importer of crude oil, Collins and Murray (2008) mentioned that the United States, India, and Japan are seen as potential blockaders of China. They examined the Chinese potential responses to energy blockade. Energy and scarce materials are mostly dependent on maritime transport, and canals and straits are considered as chokepoints. It is definitely a threat to a country when the energy insecurity is caused by a maritime blockade through canal or straits closures. Political force will alter the role of a canal.

3.2. Second Force – Economics

Trade pattern is interactive with economic development. Huebner (1915) mentioned there are two main functions of the Panama Canal. The first one is its political value as it enables the United States to transfer naval vessels between the Atlantic and Pacific Oceans, and the second one is its economic value as it offers a shortcut to transport freight between the Oceans. The shortened distance directly reduces travel time, fuel cost and access to profitable cargoes. Huebner (1915) summarised the economic value of the Panama Canal to America as one which stimulates traffic, changes trade flow, domestic and international economies and the growth of industries. In other words, economic development influences demand of trade routes and induces dynamic trade patterns. Mountjoy (1958) analysed the potential development of the Suez Canal, and he highlighted that development of the less-developed areas linked by the canal is speeded up. Fletcher (1958)

showed that the opening of the Suez Canal offered revolutionary changes to the shipping world and this canal shifted the trade pattern of East Asia and Australasia. All these studies showed trade affects the national and global economic development. On the reverse side, seaborne trade is a derived demand of commodity influenced by global economy (Stopford, 1997). In short, trade patterns interact with the national and global wealthy.

3.3. Third Force – Environment

International trade affects environmental sustainability in two folds: these are production and transportation. International trade is generated by demand and supply of a product between two countries, greenhouse gases are emitted during the manufacturing processes. International trade magnifies the products demand when manufacturers supply the product to fulfil global demand. International trade involves transportation, transportation generates greenhouse gases when fuel combust. In short, trade and environment are closely related. Yunfeng and Laike (2010) illustrated how international trade accelerates carbon-dioxide emissions in China. The study found that most of carbon-dioxide emissions in China are embodied in manufacturing goods for exporting to global. The high use of coal and low manufacturing efficiency intensified the situation in China. They suggested applying a consumption-based carbon-dioxide accounting system to ensure responsibility is fairly allocated. Cristea et al. (2013) quantified the emissions of international transport and highlighted the patterns across products and trade partners. Moreover, they further analysed the situation when global trade is affected by liberalisation. They found that full liberalisation encourages trading between distant countries and, as a result, emissions increased by 6% when land transport is replaced by air transport. In summary, international trade and emission of greenhouse gases are closely related in several aspects: energy consumption mix and manufacturing efficiency of export countries, transportation distance and mode, and system for allocating emission responsibility.

4. Discussion: Three Scenarios

It has been shown that politics, economic and environmental forces are significantly related to the international trade. These three driving forces are used to develop scenarios in 2030, so as to foresee the possible roles of the Nicaragua Canal in the future international trade.

After identifying the three driving forces, the Trilemma Triangle is developed by interacting and trading off between the different forces. Driving forces are represented by different colours: red represents economic, blue represents environment, and yellow represents politics. This Trilemma Triangle suggests three possible scenarios based on interaction/trade-off between the three driving forces. Purple represents the interaction between economics and environment and is named **Green Gold Scenario**; green represents the interaction between environment and politics and is named **Spilt Green Scenario**; orange represents the interaction between economics and politics and is named **Gold Spilt Scenario** (Figure 2). Table 1 summarises the characteristics of the three scenarios and the corresponding roles of the two canals.

4.1. First Scenario – Green Gold Scenario

In the first scenario, the "*Green Gold Scenario*", countries will emphasise the boosting of national economic development and fight against environment deterioration by global cooperation. The consideration of political security will be lightened. Globalisation will enable countries to magnify their comprehensive advantages by specialisation. Developed countries will maximise their national economic development by stimulating international trade. Developing countries will tend to manufacture at a large scale to enjoy benefits generated from economies of scale. The awareness of low carbon emissions will increase, and the carbon tax will be imposed in order to further share the emission responsibilities embodied in import products. Developed countries will further share responsibilities of carbon emissions by exporting their low carbon technologies to developing countries, both improving manufacturing efficiency and the energy consumption mix, e.g. advanced manufacturing equipment and biofuel technologies.

4.1.1. Implications to maritime and international trade

The emissions intensities of export countries will be reduced when low cost is no longer the sole consideration by import counties, while developing countries will maintain the comparative advantages by minimising carbon emissions of products in both the manufacturing process and transportation. Low carbon emissions will generate and maintain economic development in both developing and developed countries. By considering carbon emissions, distance between trading partners and transportation modes used are essential factors for international trade. Countries will tend to import products from proximate counties and use the most environmental friendly transport modes, e.g. railway and shipping.

Maritime transport will become more dominant in international trade by taking over from the air transport. To further take advantage of the low carbon opportunities, the shipping liners will use larger vessels and enjoy economies of scales for both economic and environmental benefits, while the hub and spoke system will be chosen to maximise the operation efficiency.

4.1.2. Possible roles of Nicaragua Canal

To survive, Canals will adapt to the global changes and fulfil the demands of Gold Green Scenario. Possible roles played by canals include:

- Green Corridor

To enable supply chain parties to assess energy consumption or supplier evaluation, a canal will implement an energy management system and impose green policies or launch a green program, e.g. Vessel Speed Reduction Program to request / encourage vessel sailing speeds within certain nautical miles of the canal in order to help lower vessel emission levels, and a Clean Fuels Vessel Incentive Program to encourage vessel to use clean fuel when passing through the Canal. The Canal will provide incentives by offering discounts on passage dues. An energy management system applied in the Canal can be considered as a comparative advantage when public awareness on low carbon increases.

- Large Vessel Corridor

As shipping liners will deploy larger vessels to enjoy scale economies and environmental benefits, a canal shall have water depth to accommodate both post-panama and very large vessels. To combine with shortened distance offered by the Canal, the economic and carbon-dioxide emissions will be lowered. The Nicaragua Canal can specialise in servicing very large vessels.

- Specialisation

Moreover, efficiency implies saving in cost, time and energy. Specialisation improves the operations efficiency of the Canal. The Canal will focus on handling specialised types of product, e.g. bulk specialised canal, tanker specialised canal or containerisation specialised canal. The speeding up of operation efficiency not only comes from equipment specialisation but also minimisation of errors. High operation efficiency further enables the canal to offer an unobstructed free-flow to vessels.

~ Containership:
  - Moving high-end electronics products from East Asia to North America
  - Moving agriculture products (e.g. sugarcane and soybean as food or energy supply) from Brazil to East Asia

~ Tanker:
  - Moving chemicals as raw materials for producing high-end electronics products from Venezuela to East Asia
  - Moving ecological products (e.g. biofuel as end products of biomass) from Brazil to East Asia for energy sources

~ Bulk carrier:
  - Moving coal as energy resources from Venezuela to East Asia

4.1.3. Reaction of Panama Canal

Instead of being in price competition, the Panama Canal and the Nicaragua Canal will be complementary

routes. The expansion project of the Panama Canal will allow the transit of vessels with 49 m width, 366 m length and 15 m draft which is equivalent to a container ship carrying around 12,000TEU. That means the Panama Canal is very likely to seize the opportunity to be "Large Vessel Canal" to attract liners to pass through the deepened channel with their Post-Panamax rather than passing through the Atlantic and the Pacific Oceans via South America. Therefore, the customer base of the Panama Canal widens to Post-Panamax. The Panama Canal specialises in handling containership. The specialisation and advanced equipment enables the Panama Canal to become the logistics hub of the North America.

4.1.4. Counter-reaction of Nicaragua Canal

The Nicaragua Canal will fulfil the market gap and offer green services to attract shipping liners which emphasise low emission of carbon-dioxide. The Nicaragua Canal will implement energy management system, impose green policies and launch a green program, e.g. Vessel Speed Reduction Program to attract low carbon liners passing through the Canal.

In addition, the Nicaragua Canal specialises in handling bulk vessels for moving coal from Venezuela to East Asia and tanker vessels for moving chemicals as raw materials from Venezuela to East Asia for producing high-end electronics products.

4.2. Second Scenario - Split Green Scenario

In the second scenario "*Split Green Scenario*", environmental issues will rise to the top of the political agenda, and countries will impose conservative environmental policies. Trade barriers will be built based on different opinions of combating global warming. There will be two major groups of judgment on product consumption: pro-green group and anti-green group. The pro-green group will share the emissions responsibility by bearing carbon tax on import products. The anti-green group will shift emissions responsibility to exporting countries, i.e. do nothing embodied on import products. International trade will only occur between the countries that have a similar belief on environmental tendency. In other words, two trade blocs will be formed. European Union, Australia and China will be the leaders of the pro-green group which will actively impose national regulations and support emissions responsibility by imposing a carbon tax and carbon trade. Japan, America, Russia and Canada will be the leaders of the anti-green group which will withdraw from the Kyoto Protocol. Developing countries will maintain their economic development by adapting to the different preferences of the two blocs.

4.2.1. Implications to maritime and international trade

Pro-green developing countries, e.g. China, will develop a market niche by manufacturing eco-products when trading with the European Union and Australia. The environmental dialogue will be opened between countries having similar directions to environmental protection. Pro-green developing countries will attract foreign direct investment from the European Union and Australia. The European Union and Australia will share their low carbon technologies with their partners, but they will import eco-products from their partners. Those developing countries will emphasise low carbon emission along the supply chain, e.g. using cleaner fuel and imposing an energy management system. China will switch to cleaner fuel from coal to natural gas and biomass with the supports of advanced technologies of the pro-green group. Furthermore, China will import biomass or biofuel to replace coal. Maritime transport will be boosted within the pro-green bloc. They will develop a green supply chain, especially in the shipping industry.

On the other hand, the anti-green developing countries, such as India, will maintain advantages on cost minimisation when trading with Japan, America, Russia and Canada. They will minimise costs by improving operation efficiency and enjoying economies of scales.

4.2.2. Possible roles of Nicaragua Canal

- National Chokepoint, or Energy and Food Corridor

Division of environmental protection approach will induce the political argument. The split of trade blocs with political consideration will induce traffic separation. Traffic separation will imply national chokepoints for communications which access scarce resources, e.g. energy and food.

- Green Corridor

Environmental consideration is one of the trigger points of traffic separation. To attract pro-green bloc to use the canal, it should implement an energy management system and impose green policies or launch a green program, e.g. Vessel Speed Reduction Program to request/ encourage vessel sailing speeds within certain nautical miles of the channel in order to help lower vessel emission levels and a Clean Fuels Vessel Incentive Program to encourage vessels to use clean fuel when passing through the Canal. The Canal provides incentives by offering discounts on passage dues. The Canal develops a market based on enabling countries to transport cargoes by minimising carbon emissions from transportation.

4.2.3. Reaction of Panama Canal

Political consideration alters the role of canals. The Panama Canal will continue to have a close relationship with the United States although it became independent in 1995; The Panama Canal will offer the United States a short cut between the Atlantic and Pacific Oceans, as well as being a military strategic point of the United States.

4.2.4. Counter-reaction of Nicaragua Canal

The United States, India, and Japan will be seen as potential blockaders of China, especially as they have different tendency on environmental protection. Energy and scarce materials will be mostly dependent on maritime transport, and canals and straits are considered as chokepoints. It is dangerous if a country faces the energy insecurity caused by a maritime blockade via the Panama Canal or Indian Straits closures. China will consider developing an alternative to prevent maritime blockade. China will invest in the construction of the Nicaragua Canal, and the Chinese government will maintain a good relationship with the Nicaragua government. Through the Nicaragua Canal, China will assess and extend its influence to South America via foreign direct investments. Therefore, South America will fight against the maritime blockade and will support the pro-green group by supplying energy and food to China. The Nicaragua Canal will move agriculture products, e.g. sugarcane and soybean, as food or energy supply from Brazil to China by containerships, while biofuel will be moved as an end product of biomass from Brazil to China as energy sources in tankers. In short, the Nicaragua Canal will act as green energy corridor for China.

4.3. Third Scenario - Gold Split Scenario

In the third scenario "Gold Split Scenario", countries will impose a conservative policy. The rapid rise of China will upset the peaceful environment. This will be worsened by the South China Sea Crisis. Countries will emphasise national economic development, countries of Far East Asia will be split. This will cause dynamic changes in trade patterns. To boost national economic development, countries will extend their political influence by foreign direct investment to the developing countries. Eco-political blocs will be formed. International trade will be conducted within eco-political blocs. China will strengthen its relationship with the European Union and expand into new markets with South America; the national economic development of China will be likely maintained. Japan will maintain its existing eco-political relationship with the United States to maintain its economic development.

4.3.1. Implications to maritime and international trade

Within the eco-political blocs, countries will specialise in manufacturing complementary products to maximise economic benefits. To further minimise the cost, specialised large vessels will be deployed for international trade. Shipping liners will decide the routing that maximise the capacity of vessels in every sailing; the trade routes that link complementary trading favour liners.

4.3.2. Roles of Nicaragua Canal

- National Chokepoint/ Energy and Food Corridor

National economic benefits will induce the political argument. The split into trade blocs with political consideration will induce traffic separation. Traffic separation will then imply national chokepoints for communications which access scarce resources, e.g. energy and food.

- Specialization

As shipping liners will deploy larger vessels to enjoy the economic benefits from economies of scale, the Canal will need to have water depth to accommodate post-panama and very large vessels. Combined with the shortened distance offered by the Canal, the transport cost will be lowered. The Canal will specialise in servicing very large vessels. Specialisation will improve the operations efficiency of the Canal. This efficiency will imply cost and time savings. The Canal will focus on handling specialised types of product, e.g. bulk specialised canal, tanker specialised canal or containerisation specialised canal. The speeding up of the operation efficiency not only comes from equipment specialisation but also minimisation of errors. High operation efficiency further enables the canal to offer an unobstructed free-flow to vessels.

4.3.3. Reaction of Panama Canal

The expansion project of the Panama Canal will allow the transit of containerships carrying around 12,000 TEU. That means the Panama Canal will be very likely able to seize the opportunity to be "Large Vessel Canal" to attract shipping liners to pass through deepened channel with their Post-Panamax rather than passing through the Atlantic and the Pacific Oceans via South America. Therefore, the customer base of Panama Canal will be increased to Post-Panamax. The Panama Canal will specialise in handling large containerships. The Panama Canal has close relationship with the United States although it was independent since 1995 and it is also a military strategic point of the United States. The specialisation and advanced equipment will enable the Panama Canal to become the logistics hub of the United States.

4.3.4. Counter-reaction of Nicaragua Canal

United States, India, and Japan will be seen as potential blockaders of China, especially when they have different tendencies regarding environmental protection. Energy and scarce materials will be mostly dependent on maritime transport, and canals and straits are considered as chokepoints. The maritime blockade via the Panama Canal or Indian Straits closures will pose significant threats to energy insecurity of some countries, e.g. China.

China will develop an alternative to prevent maritime blockades. China will invest in the construction of the Nicaragua Canal, and the Chinese government will maintain a good relationship with the Nicaragua government. Through the Nicaragua Canal, China will assess and extend its influence to South America by foreign direct investment. Therefore, South America will fight against the maritime blockade and support the pro-green group by supplying energy and food to China. This means that the Nicaragua Canal will be used to move agriculture products, e.g. sugarcane and soybean as food or energy supply from Brazil to China by containerships, while coal will be moved as energy resources from Venezuela to China.

Besides energy and food, South America will supply raw materials to China, e.g. agricultural products and energy, while China will export finished products to South America for consumption, e.g. textile and electronics. Therefore, specialised hub ports of containers or tankers will be developed in both South America and China to facilitate trade and maximise operation efficiency.

~ Containerships:
  - Moving high-end electronics products from East Asia to South America and Canada
  - Moving agriculture products (e.g. sugarcane and soybean as food or energy supply) from Brazil to East Asia

~ Tankers:
  - Moving Chemicals as raw materials for producing high-end electronics products from Venezuela to East Asia

- Moving ecological products (e.g. biofuel as end products of biomass) from Brazil to East Asia

5. Conclusion and Future Research

This study represents the first attempt to conceptually investigate the future possible roles of the new Nicaragua Canal in the presence of the competing Panama Canal. Generally speaking, the proposed Nicaragua Canal will make the world more integrated via the maritime transport network.

This paper uses scenario planning as a methodological approach to gain new insights into the roles of Nicaragua Canal in three different dominant scenarios. Scenario planning allows us to understand how driving forces will work and jointly develop different scenarios. From our analysis, the new Nicaragua Canal will complement the Panama Canal in the international maritime transport network. These two canals may separate the traffic of ship types so that the efficiency of canal transits will be enhanced. They may separate the traffic of cargo types so that the safety of canal transits will be improved. Currently, the presence of different ship types and ship sizes imposes navigational and pollution hazards in the Panama Canal that make it essential to reduce the speed for safety. If the Nicaragua Canal and Panama Canal separate the traffic, it will improve the maritime safety and reduce the collision risks and subsequent pollution. The traffic separation could be an effective way of managing the traffic flows in both canals, especially when the traffic becomes very congested.

It is found that the Nicaragua Canal will strengthen particularly the connection between the Far East and the East Coast of South America and will become an energy corridor for the Far East. South American countries export iron ore, crude oil and other resources, while China and other Far East Asian countries are exporting finished and semi-finished products. Although South American and Far East Asian countries have some competitive exports, export differentiation shows a high potential of mutual trade between the two regions. In addition, the new Nicaragua canal will reduce the trade barrier between the two regions.

The driving forces behind these scenarios are assumed to be political, economic, and environmental. For other objectives, a mix of different driving forces may be established for further investigation and analysis, which may enable the Nicaragua Canal to be more contributory to the world. Even under different scenarios, large net benefits are likely to occur from this new canal. This paper provides useful information in shaping policy regarding the canal's development and enhancement.

In this study, the intuitive and descriptive method is used to build up the scenario planning. Three forces, namely politics, economics and environment, are taken into consideration. It recovers micro and market changes of seaborne trade and indicates the importance of the emergency of Nicaragua Canal.

This study attempts to conceptually investigate the future possible roles of the new Nicaragua Canal in the presence of the competing Panama Canal. It enables us to explore novel insights about the future of inter-oceanic canals, which demonstrates the causal relationships between factors of canal market. The economic conflicts between the Nicaragua Canal and the Panama Canal can be further analysed by the game theory when more information is available. More specific results can then be obtained such as competition, substitution and cooperation among rival canals.

Acknowledgements

The research was financially supported by the Hong Kong Polytechnic University (number A-PL59).

References

Ahn, J., and Skudlark, A. (2002). Managing risk in a new telecommunications service development process through a scenario planning approach. *Journal of Information Technology*, 17(3), 103-118.

Collins, G. B. and Murray, W.S. (2008). No oil for the lamps of China? *Naval War College Review*, 61.2 (Spring): 79-95.

Cristea, A., Hummels, D., Puzzello, L., and Avetisyan, M. (2013). Trade and the greenhouse gas emissions from international freight transport. *Journal of Environmental Economics and Management*, 65(1), 153-173.

Donna J. Nincic (2002). Sea lane security and U.S. maritime trade: Chokepoints as scarce resources. In: (ed.) Tangredi, Sam J., *Globalization and Maritime Power*, Chapter 8, 1-26.

Fletcher, M. E. (1958). The Suez Canal and world shipping, 1869-1914. *The Journal of Economic History*, 18(4), 556-573.

Godet, M., and Roubelat, F. (1996). Creating the future: The use and misuse of scenarios. *Long Range Planning*, 29(2), 164-171.

Gradus, Y. (1977). Is the Israeli Negev a viable alternative to the Suez canal? *Geoforum*, 8(1), 29-32.

Huebner, G. G. (1915). Economic aspects of the Panama Canal. *The American Economic Review*, 5(4), 816-829.

Kahane, A. (1992). Scenarios for energy: Sustainable world vs global mercantilism. *Long Range Planning*, 25(4), 38-46.

Liu, M., and Kronbak, J. (2010). The potential economic viability of using the northern sea route (NSR) as an alternative route between Asia and Europe. *Journal of Transport Geography*, 18(3), 434-444.

Millett, S. M. (1988). How scenarios trigger strategic thinking. *Long Range Planning*, 21(5), 61-68.

Moyer, K. (1996). Scenario planning at British Airways — A case study. *Long Range Planning*, 29(2), 172-181.

Rodrigue, J.-P. (2004)..Straits, passages and chokepoints: A maritime geostrategy of petroleum distribution. *Geostrategy of Petroleum Distribution*, 48, 357-374.

Schøyen, H., and Bråthen, S. (2011). The northern sea route versus the Suez Canal: Cases from bulk shipping. *Journal of Transport Geography*, 19(4), 977-983.

Shell International Limited (2005). *Shell Global Scenarios to 2025*, The Eurospan Group.

Somanathan, S., Flynn, P., and Szymanski, J. (2009). The Northwest Passage: A simulation. *Transportation Research Part A: Policy and Practice*, 43(2), 127-135.

Stokke, P. R., Ralston, W. K., Boyce, T. A., and Wilson, I. H. (1990). Scenario planning for Norwegian oil and gas. *Long Range Planning*, 23(2), 17-26.

Stopford, M. (1997). *Maritime Economics* (2nd ed). New York: Routledge.

Varum, C. A., and Melo, C. (2010). Directions in scenario planning literature – A review of the past decades. *Futures*, 42(4), 355-369.

Wack, P. (1985). Scenarios: Uncharted waters ahead, *Harvard Business Review*, 85(5), 72-89.

Yunfeng, Y., and Laike, Y. (2010). China's foreign trade and climate change: A case study of CO2 emissions. *Energy Policy*, 38(1), 350-356.

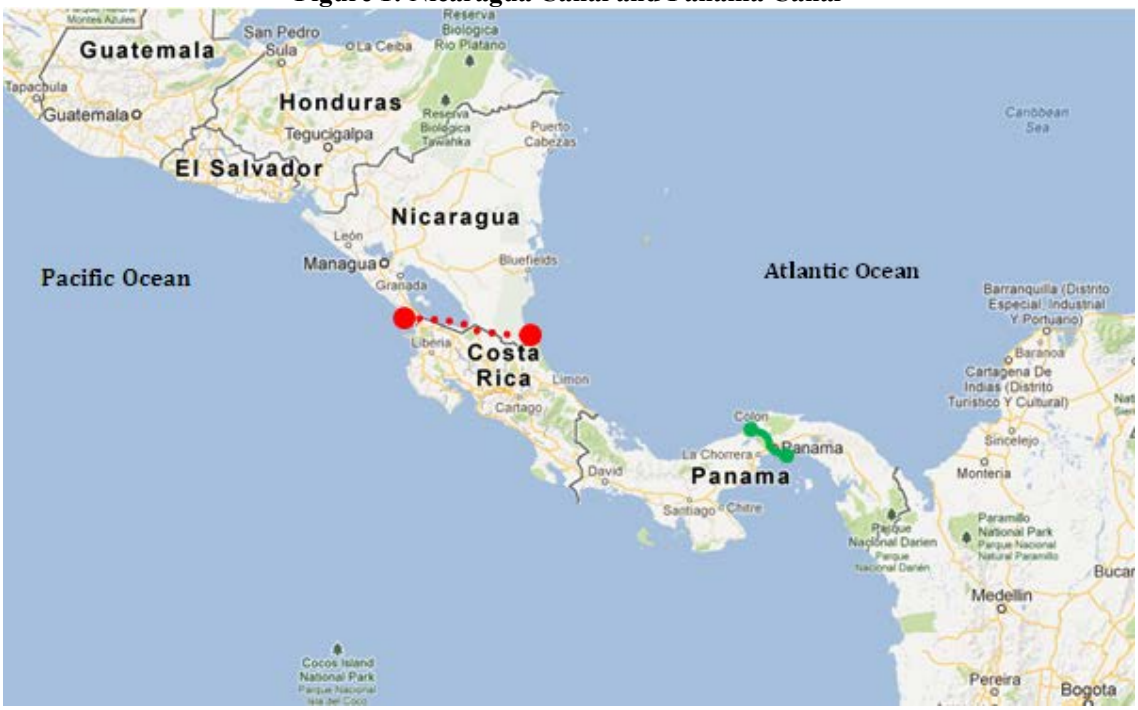
Zegras, C., Sussman, J., and Conklin, C. (2004a). Scenario planning for strategic regional transportation planning. *Journal of Urban Planning and Development*, 130(1), 2-13.

Zentner, R. (1982). Scenarios, past, present and future. *Long Range Planning*, 15(3), 12-20.

Table 1: Summary of Scenarios

Scenario	1	2	3
	Green Gold Scenario	Split Green Scenario	Gold Split Scenario
Politics	Political environment will be stable and globalised.	Political environment will be unstable.	Political environment will be unstable.
Economics	Economics will be focused.	Trade barriers will be set up.	Economics will be focused.
Environment	Environment will be focused.	Environment will be at the top of political agenda.	N/A
Descriptions	Countries will boost national economic development and fight against environment by globalisation.	Countries will be split into two trade blocs based on their environmental tendency, i.e. pro-green group and anti-green group.	Countries will be split into eco-political blocs. Countries will boost national economic development by extending political influence via foreign direct investment.
Possible Roles of Nicaragua Canal	* A green corridor * A large vessel corridor * A specialised corridor	* National chokepoint: Energy and food corridor * A green corridor	* National chokepoint: Energy and food corridor * A specialized corridor
Reaction of Panama Canal	* Specialised on handling Post-Panamax ships * Become a logistics hub of North America	* Become an military strategic point of the United States	* Specialized on handling Post-Panamax ships * a logistics hub of North America * Military strategic point of the United States
Counter-reaction of Nicaragua Canal	* Will fulfil the market gap by offering green services, e.g. launching green programme similar to Vessel Speed Reduction Program * Will specialise in handling bulk vessels, e.g. coal from Venezuela to East Asia and tanker, e.g. chemicals from Venezuela to East Asia.	* China chokepoint: Energy and food corridor green corridor	* China chokepoint: Energy and food corridor green corridor * Will specialise in handling containerships and tankers

Figure 1: Nicaragua Canal and Panama Canal



Source: Google Map

Figure 2: Trilemma Triangle of Driving Forces