The new trend of maritime transport and job opportunities

Abstract:

Maritime transport for over decades now has demonstrated to be the world's largest mode of transport, transporting about 90% of global trade volume and providing the cheapest freight option to shippers. The maritime industry has long been acknowledged as one of the greatest pillars of the world's economy that contribute significantly towards economic growth and social development by linking businesses and market centers globally. Maritime transport over the years has been undergoing series of transitional changes and stages which are believed to be driven by the objective of International Maritime Organization and port users. Technological advancement in the maritime industry has caused tremendous improvement in maritime transport helping to improve issues of environmental, social and economic concern that has been a bottom neck to the industry and authorities. The current trend of maritime transport has caused a significant change in port operational settings with a resultant effect on port logistics and supply chain system. These changes are said to be accompanied by new business and job opportunities. Recent literature suggest that very few studies have been conducted focusing on the new trend of maritime transport and it associated job opportunities. The research gap makes it needful for this study to be conducted to examine the new trend of maritime transport and the available job opportunities for maritime professionals. This study adopt the use Partial Least Square Structural Equation Modeling (PLS-SEM) in examining the model and to establish a positive relationship between new trend of maritime transport and job opportunities. The exogenous variables (including green maritime transport, new capacity, formation of alliance, and green port practices) and the exo-endogenous variable (thus, emergence of technology) were used to examine their predictive relevance on job opportunities (endogenous variable). The rationale behind the use of the PLS-SEM model is it great ability to handle relatively small data. It is also said to be suitable for theory development. Again, the software is robust in nature and has high predictive relevance. The model of the study was assessed by examining the measurement and the structural model. Consequently, the findings of the study highlight on the current trend of maritime transport and it associated job opportunities. It also provide a hint to maritime authorities and investors on the new direction of maritime transport and key areas that can be invested in for business and profitable gains. Again, it serves as a guideline for maritime professionals on how to organize themselves to embrace these new developments for a brighter opportunity and career development.

Key word: Green maritime transport, new capacity, formation of shipping alliances, green port operations, emergence of technology, and job opportunities.

1. Introduction

As mariners always say “sea never dry”, the maritime industry has always been the focal point and the prime sector on which most industries and individuals dwell and secure their source of livelihood and existence. Maritime transport for over decades has strived to maintain its supremacy and dominance over the stiff competition given to her by other modes of transport including air, rail, and road transport. According to UNCTAD (2020), maritime transport transported 11.08 billion tons of world’s freight in 2019 but recorded 4.1% drop down in 2020 due the Covid-19 pandemic. The rise in demand for maritime transport is due to it resilient ability to offer the cheapest and cleanest mode of transport (by cargo volume) and providing an agile, safe, and reliable transportation network that promotes economic growth and development (Sanchez-Gonzalez et al., 2019). Despite the industry’s impressive support to international economic status, most of its associated operations depredate sustainable development which calls for strategic measures and plans to be deployed. In response to this, the International Maritime Organization (IMO) has mandated all maritime stakeholders to adopt and deploy sustainable measures in their operations. In support, various forms of conventions, treaties, and protocols have been enacted and adopted by IMO to help with these enforcements. Also, the implementation of the 17 sustainable development goals (SDGs) by the United Nations serves as a useful guide to these institutions. The intent by IMO as a keynote objective to enhance economic, social and environmental performance within the maritime industry has gradually given maritime transport a new focal lens. Excessive competition and the zeal by shipping lines to achieve competitive advantage (thus, being is a pole position to capture a larger market share) has as well contributed significantly towards the current new trends of maritime transport. For the purpose of this study, the current trends of maritime transport include; green maritime transport (GMT), emergence of technology (ET), new capacity (NC), formation of Shipping alliances (FSA), and green port operations (GPO).

Green maritime transport (GMT) parenthesis the adoption of environmental friendly measures by water vehicles in cargo transport. Statistics reveal that, maritime transport is the greatest contributor of environmental pollutant among the various modes of transport. Carbon component emitted into the atmosphere by a single vessel is equivalent to emission by 12000 road vehicles (Graham, 2007). Other forms of marine pollutant include oil spillage, discharging of ballast water, untreated sewage, garbage, etc. These marine pollutants when been introduce into the environment have it adverse effect on humans. In this regard, the need for sustainable maritime transport measures becomes very crucial for adaptation. To enhance this, IMO and other parties including the Clean Cargo Working Group (CCWG) and environmental NGO's have worked solidly towards the institution of certain fundamental green shipping policies (Coady et al., 2013). GMT policies include the use of energy-efficient fuel, green ship design, container transport, eco-generators, and other forms of enveironmental friendly means (Maringa, 2015; Psaraftis, 2016). The adaptation of these measures is believed to have gotten significant social, economic and environmental impact on stakeholders operations and businesses.

Advent of technology (artificial intelligence) has emerged so strongly in recent days maritime operations. Artificial intelligence is gradually replacing manpower activities within the maritime industry in key areas such as onboard the vessel, shipyards, seaports and port logistics systems. The ET in maritime transport has helped to cause a tremendous improvement on vessel design, work rate, safety and security, and efficiency. The introduction of technology in contemporary seaport operations has helped to enhance the competitiveness and the quality of services offered by seaports. For instance, digital information sharing and automation of certain aspect of port operations has made Tuas port of Singapore very competitive (Heilig et al., 2017). On the other hand, the introduction of technology in the maritime sector has resulted in a serious issue of redundancy as most operations are now fully automated. The use of robotics and other forms of artificial intelligence (AI) are generally considered to be more efficient and feasible compared to human hence maritime operation much more efficient and convenient (hence the future trend for maritime transport)

Maritime transport has experienced a rapid growth in capacity of marine transport vehicles over the past three decades. The size of merchant vessels continues to increase drastically as trade volume increases. Linear shipping has witnessed a steady growth from 8000TEUs in late 1990s to 24000TEUs in 2020. The desire to achieve economies of scale has made it possible for the latest container vessel to transport four times same cargo transported by the biggest container vessels in the late 1990's hence given linear shipping more hope for future prosperity (Parola et al., 2016). According to Notteboom et al. (2017), increase in capacity of marine vessels has contributed substantially towards the control of greenhouse gas effect and the minimization of maritime transport cost. Subsequently, the introduction of mega fleets into the active supply vessels has caused drastic change in port operational settings where mega vessels only calls at very few and limited major seaports across the globe to undertake cargo operations whereas feeder vessels connect to smaller ports. This has actually intensified port logistics system hence calling for the integration of port centric logistics system where wide range of value-added services are provided.

Again, maritime transport has evolved so strongly in recent times that the formation of shipping alliance (FSA) has become a common practice in linear shipping. Shipping alliance is defined as a group of shippers (carriers) with a common interest who come together under one management to have a full control over their shipment in terms of rate, sailing route, and transit time. There are various types of shipping alliance but the most predominant types include the 2M, Ocean Alliance, and THE Alliance. The main objective for the FSA is to provide members to the group a competitive advantage over their competitors (Fusillo, 2006) and enhancing capacity sharing, marketing, cost minimization and profit maximization, and vessel management of the group (Hirata, 2017; Panayides and Wiedmer, 2011). A report by Alphaliner's ranking suggest that the formation of these three shipping alliances has coincidently influenced about 80% of the global container market share in 2017 (thus, 2M- 2.1million TEUs, Ocean Alliance- 3.8 million TEUs and THE Alliance- 3.5 million TEUs). Such alliances are usually formed to secure global cooperation on main and major trading routes across the globe (Europe– the Far East, Transpacific, Transatlantic).

Lastly, green port operation (GPO) is discovered as one of the current trends ongoing in the maritime industry. A seaport is a very important node in maritime settings which connects both on-shore and off-shore operations. Most often than not, most seaports operate with less regards to environmental concern. Emission from ships, trucks and pollution from cargo operations exposes the marine environment to harmful substances which are very detrimental to human health and safety. The IMO has therefore charged authorities of seaports to adopt green port practices in their daily operations. In support, various forms of green port practices including emission minimization, waste management, and energy management measures etc. have been implemented by most seaport to help minimize the emission of harmful substance into the marine environment whenever vessels calls at port (Teerawattana & Yang, 2019).

These new trends are strongly supported by sustainable policies implemented by maritime authorities at regional, national and institutional level within the maritime industry. It is also believed that these new trends have gotten significant influence on current jobs and business opportunities. More sustainable jobs and business portfolios are been created which has an improved social, economic and environmental impact. On the contrary, it is discovered that the emergence of these new trends has gotten negative impact on certain old jobs and business avenues. As certain businesses are gradually fading out of the industry, others may have to modify and rebrand themselves to embrace these new developments. More so, maritime professionals are been advised to enhance their technical know-how to meet the current trends and likewise maritime training institutions. In effect, this study examines the current trends of maritime transport and job opportunities (JO) associated with it. The study therefore seeks to address the research question "what are the current trends of maritime transport and job opportunities"? The conceptual framework of the study proposes a research model which examines the direct and mediation impact of the new trends of maritime transport on job opportunities (JO). Given this, the findings of the study will serve as a useful guide for policymakers, investors, business developers and all maritime stakeholders on current developments ongoing in the maritime sector and its impact on social and economic development.

2. Conceptual model

The conceptual model of the study examines the current trends of maritime transport and job opportunities as represented in figure 1 below. From figure 1, green maritime transport (energy efficient fuel, green ship design, container transport, and eco-generators), emergence of technology (big data, automation, and digitalization), new capacity (economies of scale, emission reduction, and freight reduction), formation of Shipping alliance (capacity sharing, marketing, cost minimization, profit maximization, and vessel management) and green port operations (emission minimization, waste management, and energy management) are identified are the current trends of maritime transport and their respective measurement items. GMT, NC, FSA, and GPO are modeled as exogenous variables that have predictive influence on ET and JO. The exogenous variables are external to the model whose values highly determines the output of the endogenous variable. ET is modeled as an exo-endogenous variable mediating the relationship between the exogenous variables and the endogenous variable. Finally, JO is modeled as an endogenous variable that is highly influenced by the existence and performance of the exogenous and exo-endogenous variables. Besides, the model only examines the positive influence of the exogenous and the exo-endogenous variables on JO (thus, the endogenous variable). The conceptual framework of the study is supported by the Natural Resource-Based View (NRBV) theory implemented by Hart in 1995. The model of the study parenthesis the direct and indirect contribution of the variables towards the achievement of sustainable development in the maritime industry.

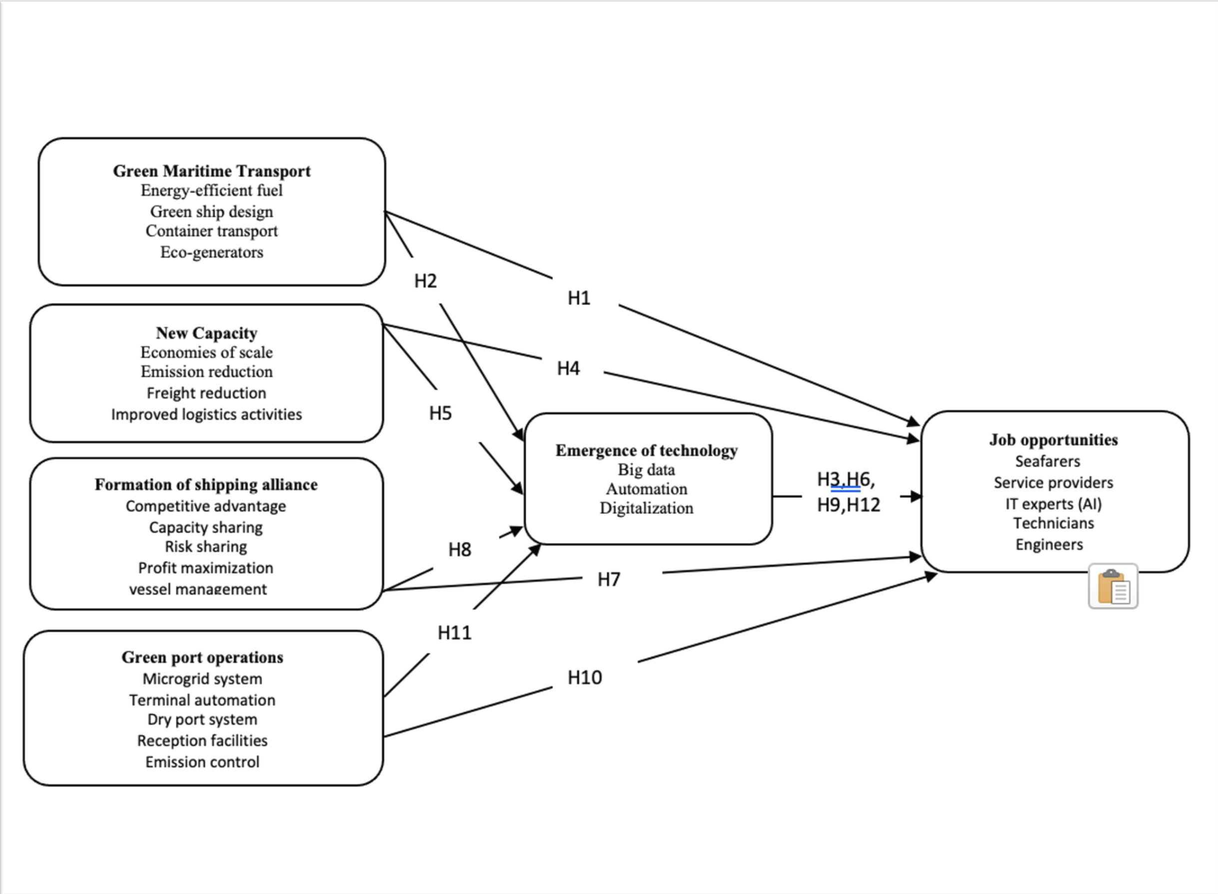

Figure 1: Conceptual Framework

3.0.Hypotheses Development

3.1.Green maritime transport on emergence of technology and job opportunities.

The need to achieve sustainable development within the maritime industry has made it needful for GMT policies to be adopted by authorities (Viana et al., 2014). Vessel operation exposes to the marine environment various forms marine pollutants which are very detrimental to human health and aquatic lives. The implementation of GMT policies as a countermeasure to these adverse effects has subsequently changed the focal lens of maritime transport (Song and Woo, 2013). More green operations are now been required which directly and indirectly provide green business and job opportunities. According to Alves et al. (2015), the implementation of carbon emission policy has increased the demand and supply of low-Sulphur fuel. More jobs and business avenues are been created for logistics service providers in such fields. Lai et al. (2011) also added that, increase in demand for container transport has enhanced container trading and value-added services activities on containers. Technological advancement within the maritime industry has helped to improve GMT (Sanchez-Gonzalez et al. 2019) hence the introduction of green ship design (Song and Woo, 2013), even though it is said to be accompanied with setbacks (Schaeffer, 2017). Green ship design has helped to boost the business prospect in the ship building industry and shipyards (Reni et al., 2020). More shipping companies ae now buying into the concept of unmanned ships (Rødseth, 2017). The demand for the installation of treatment plants and systems onboards vessels continue to be looming (Rivas-Hermann et al., 2015). These therefore gives the indication that the maritime industry has more prospect for green jobs and business opportunities. With the adaptation of NRBV theory, more GMT policies can be implemented that has substantial economic, social and environmental impact on job and business opportunities. In regards to the above literature, we hypothesize as;

H1: Green maritime transport is positively related to job opportunities.

H2: Green maritime transport is positively related to emergence of technology.

H3: Emergence of Technology plays a mediating role between green maritime transport and job opportunities.

3.2. New capacity on emergence of technology and job opportunities.

Maritime transport has experienced a rapid growth in capacity of maritime transport vehicles over the past few decades (Bennett, 2014). The emergence of technology in the maritime industry coupled with the need to achieve economic of scale by shippers has made it needful for mega vessels to be introduced. The introduction of NC into active supply has called for the demand for extra crew onboard these vessels. More crewing and ship management companies have been setup in providing ship agency services (Poulsen and Sornn-Friese, 2015). Apparently, the introduction of these fleets has caused a great change in vessels port call system (structure). Mega vessels only calls at major seaports to perform cargo works whereas feeder vessels connect to feeder ports hence creating business opportunity for both mega and feeder vessels (Lian et al., 2019). Port logistics system have been intensified which calls for the integration of port centric logistics system where all forms of value-added services within the port supply chain system are provided. This provide numerous business opportunities for logistics services providers and third-party suppliers within the port operational settings (Song and Panayides, 2015). The introduction of NC of vessels have gotten significant influence on job creation opportunities on-shore more than off-shore. With the implementation of the NRBV theory, more new capacity of vessels can be introduced as a strategic measure to reduce carbon emission and sustainable job opportunities for seafarers. From the above literature discussed, we hypothesize as;

H4: New capacity is positively related to job opportunities

H5: New capacity is positively related to the emergence of technology

H6: Emergence of technology plays a significant mediating role between new capacity and job opportunities.

3.3. Formation of shipping alliance on emergence of technology and job opportunities.

Excessive competition among shipping lines particularly linear shipping has led to the FSA. The basic objective for the FSA is to provide members of the group competitive advantage over their competitors (Fusillo, 2006; Song and Panayides, 2002). According to Jansson (2012), linear shipping does not only compete among themselves in terms of cargo transport but also marketing and advertising duties. The FSA helps to expand the capacity of the members and providing sustainable job opportunities for seafarers. More businesses and job opportunities are been opened as members to the alliance share capacity, facilities and resources. For instance, such operation calls onboard vessel and port agents, shipping management companies and other forms logistics services providers along the trade routes. The collective effort by these bodies ensures that the intended objectives to the formation of the alliance is achieved. Also, the emergence of technology in the shipping industry has helped to provide a single platform where informations is been shared among these bodies. The integration of technology in maritime transport has helped to create new job portfolios for artificial intelligent experts in programming, cargo planning and tracking, monitoring, cyber security, network developing, blockchain, etc. (Orji et al. 2020) which provide maximum security to the cargoes, containers and vessels (Ding et al., 2021). Port operations and businesses are equally boosted. The formation of shipping alliance contributes substantially towards social, economic, and environmental performance. Based on this, we hypothesized as;

H7: Formation of shipping alliance is positively related to job opportunities

H8: Formation of shipping alliance is positively related to the emergence of technology

H9: Emergence of technology plays a key mediating role between the formation of shipping alliances and job opportunities.

3.4. Green port operations on emergence of technology and job opportunities.

Seaport is a very important node in maritime operational settings that connect on-shore and off-shore maritime operations. It is discovered in recent times that; most seaports operate with less regard to environmental concern. Seaport environment most often than not are polluted with various forms of marine pollutants which calls for the adoption of environmental management policies. Port authorities are therefore mandated to deploy green port practices and measures capable of minimizing emission and managing waste and energy. This concept however support the NRBV theory introduced by Hart in 1995. The adoption of these measures on gradual basis is virtually changing the status quo for seaport operations hence the introduction of GPO, green businesses and job opportunities. According to Fang et al. (2019), the adaptation of the energy management policies by seaports has provided new business opportunities for most seaports (Midilli et al., 2006). Microgrid system enable seaport to supply electricity to visiting vessels when in port with the help of "cold-ironing technology". Other seaports are into the supply of low emission fuels as bunkers to vessels. The mandate by IMO to seaports in providing reception facilities for visiting vessels as a means of managing waste has provided new business opportunity for seaports (Svaetichin and Inkinen, 2017). Jeevan et al. (2018), also emphasis that the integration of dry port system into seaport operations as a strategic pollution control measure has provided the gateway for numerous supply chain related businesses and jobs. Green logistics and supply chain activities is taken oven port logistics system (Kaur and Awasthi, 2018). The automation of certain key aspect of port operations is gradually paving way and creating opportunity for computer and AI experts within the maritime industry (Heilig et al., 2017). From the literature review, we hypothesize as;

H10: Green port operations are positively related to job opportunities

H11: Green port operations is positively related to emergence of technology

H12: Emergence of technology plays a significant mediating role between green port operations and job opportunities.

4.0. Methodology and Data analysis.

The objective of the study is to assess the new trends of maritime transport and job opportunities accompanied. The population of the study involves the 656 registered key maritime stakeholders under Ghana Ports and Harbours Authority (GPHA) operating in either Tema or Takoradi port and or both seaports. It also include academic professionals from the Regional Maritime University of Ghana. The population of the study was purposively categorized into 13 groups including Ghana Maritime Authority (GMA), Ghana Ports and Harbours Authority (GPHA), Ghana Shippers Authority (GSA), Regional Maritime University (RMU), Customs, Shipping lines, Shippers, Freight forwarders, Haulage companies, Terminal operators, Shipping agents, Warehouse operators, and Service providers. A total of 1312 questionnaires which forms the sample size of the study was administered to the targeted population via electronic mail system. The sample size is deemed satisfactory enough to conduct this study as it meet the minimum threshold suggested by Hair et al., (2017). Before the questionnaires were disseminated, an introductory letter detailing the purpose of the study was first mailed to the various institutions seeking for their mutual support and participation in this study. The feedback was positive as all the population acknowledged their invitation. A pilot testing was first made using 50 respondents from the population with satisfactory responses. The validity and reliability of the measurement variables were tested using twenty-six (26) measurement items. The questionnaires were semi-structured in a close-ended format with a five-Likert scale ranging from strongly disagreed to strongly agreed to choose from. The questionnaires were made up of two parts. Part one contains the demographical details of the respondents whereas part two explains how the individual variables correspond to job opportunities. A total 1176 valid responses were received and analyzed using partial least square structural equation modeling (SEM-PLS). The rationale to the use of this model is it robust ability to handle relatively small data. It is also good for model development and have high predictive relevance (Hair et al., 2017). Common method bias of the study was tested using exploratory actor analysis (EFA). Also, the model was equally examined by assessing the measurement model and structural model. PLS-SEM algorithm and bootstrapping of the model were measured to the limited values of 300 and 5000 respectively and blindfolding to the limit of D7 (Hair et al., 2017). The goodness fit (GoF) of the model estimated within the range of 0 to 1. The details to the demographic data of the respondents are in appendix A below.

4.1. Assessment of the measurement model

Assessment of the measurement model as illustrated in **table 2** in the appendix section examines the relationship between the latent variables and their measurement items. It assesses the reliability and validity of the model. It is estimated by examining the internal consistency reliability, convergent validity, and discriminant validity of the model. In regards to the model, internal consistency reliability is estimated by examining Cronbach's alpha (CA), and composite reliability (CR). Convergent validity is examined by average variance extracted (AVE) and discriminant validity also examined by Fornnel-Larcker criterion and Heterotrait-monotrait ratio (HTMT). From table 3 and 4, the values obtained for Larcker criterion and HTMT were within the ranges of (0.467-0.824) and (0.462-0.732) respectively hence meeting the minimum threshold suggested by Henseler, (2017). From **table 2,** the values of AVE were within the range of (0.563-0.681) as suggested Hair et al., (2013). The values for Cronbach's alpha and composite reliability which examines internal consistency reliability of the model values were within the range of (0.78-0.81) and (0.79-084) respectively hence meeting the >0.70 minimum threshold suggested Henseler, (2017).

4.2. Assessment of the structural model

Assessment of the structural model attempt to measure the relationship between the latent variables. Assessment of the structural model is estimated by examining the variance explained (R^2), effect size (f^2), and predictive relevance (Q^2) of the model. From **table 5** below, the model predicted Q^2 values of ET (0.502) and JO (0.647). From the 0.00 minimum threshold suggested by Henseler (2017), the model is said to have achieved perfect predictive values. The values for variance explained (R^2) for the model were ET (0.460) and (0.572) hence considered moderate by Henseler (2017). The effect size values for ET and JO were (0.263) and (0.346) respectively. Again, according to Hair et al. (2013), the model said to have achieved moderate and substantial effect size. Goodness fit (GoF) measures the geometric mean of the average mean of the outer model and the average R-square of the inner model was estimated at a value of 0.682.

5.0. Results and discussion.

The model of the study examines the direct and mediation effect existing between the variables of the study. With reference to the hypotheses of the study been tested at statistical significance of <0.05, all the twelve (12) hypotheses support the model of the study. From the results in **table 6**, the findings suggest that, GMT have a significant impact on JO which is supported by hypothesis H1($\beta = 0.622$, $t = 7.648$, $p = 0.000$). The findings of the study explains that the implementation GMT in the maritime industry have a significant influence on creating environmental friendly jobs and business opportunities for maritime professionals. Again, the findings reveal that GMT have a positive relationship with ET hence in support of hypothesis H2 ($\beta = 0.408$, $t = 6.337$, $p = 0.001$) as represented in **table 6**. The findings depict that the introduction of technology in the maritime industry is gradually changing maritime transport into the digital. The introduction of technology in maritime transport is making maritime transport become more efficient, convenient and safer (environmental friendly). The above findings are supported by the literature by Lai et al. (2011) and Alves et al. (2015). Also, from **table 7,** the results suggest that ET plays a very significant mediation role between GMT and JO and in support of hypothesis H3 ($\beta = 0.352$, $t = 4.652$, $p = 0.000$). According to the findings, technology is now the “sine qua non” of maritime transport. For instance, all the new developments in maritime transport are based on technology. Numerous jobs portfolios have been created for artificial intelligence experts within the maritime industry in areas such as shipyards, ports, onboard vessels and etc. On the other hand, the study conducted by Schaeffer, (2017) established a negative relationship between these variables. According to him, the introduction of technology is rather causing redundancy to most maritime professionals.

Furthermore, the findings in **table 6** establish a positive relationship between NC and JO which is supported by hypothesis H4 (β = 0.336, t = 4.826, p = 0.003) of the model. According to the findings, increase in capacity of maritime fleets does not only provide job opportunities for navigators but also on-shore maritime players in the port logistics system as supply chain activities are boosted. This affirm the findings of the study conducted by Lian et al., (2019). More so, the findings suggest a positive relationship between NC and ET. This relationship support hypothesis H5 (β = 0.482, t = 6.473, p = 0.000) of the model in **table 6**. The findings parenthesis that the advent of technology in the maritime industry has influence the recent size of maritime transport vehicles. The newly discovered designs and sizes of vessels for certain type of trade and operations are highly influenced by technological advancement in the maritime industry. This finding is however supported by the study of Song and Woo, (2013). The findings again reveal that, ET play a significant mediation role between NC and JO hence support hypothesis H6 (β = 0.428, t = 6.211, p = 0.021) as illustrated in **table 7.** The findings suggest that the emergence of technology in the maritime industry have been the backbone behind the success story of the introduction of NC of maritime transport vehicles. The introduction of these NCs calls extra hands been needed onboard in terms of vessel management, cargo mobilization and transport. More supply chain personnel are demanded to undertake service providing duties. This is however supported by the literature of Song and Panayides, (2015).

In addition, the results of the findings indicate that the FSA is positively related to JO as shown in **table 6** hence in support of hypothesis H7 (β = 0.318, t = 5.025, p = 0.010) of the model. According to the findings, the FSA helps to enhance the capacity of the shipping lines. The vessel size, number, market share, and scope of the members to the alliance are been expanded which calls for additional personnel's to be deployed. More management (thus, both crew and ashore ship management personnel's) team are called onboard to help with the vessels management. It also serves as an extended gateway for boosting businesses for geographic cargo forecasters, shipping agents and logistics service providers. This finding therefore falls in line with the study conducted by Jansson, (2012). Again, the findings suggest that, FSA is positively related to ET and hence in support of hypothesis H8 (β = 0.429, t = 6.237, p = 0.006) as shown in **table 6**. The findings explain that the introduction of technology in shipping alliance enables the members to the alliance enjoy competitive advantage over their competitors. Members to the alliance share some risk and cost together including marketing, advertisement, information, and other forms of publications due to technology. This affirm the literature by Panayides and Wiedmer, (2011). Also, the findings suggest that ET plays a significant mediating role between FSA and JO hence in support of hypothesis H9 (β = 0.328, t = 4.320, p = 0.000) in **table 7**. According to the findings, the FSA and linear shipping business involves multiple players which requires the exchange of series of information and data. The introduction of technology in the maritime industry provide to the members of the alliance a common interface whereby all these are met exchange. It also provides a common user platform where vessels, cargoes and containers are been monitored and managed by experts. The usage of AI becomes very paramount in linear shipping and FSA hence creating various job opportunities for computer experts in vessel management and port centric logistics system. This finding is supported by the findings of the study conducted by Orji et al. (2020).

Lastly on GPO suggest that, GPO is positively related to JO and in support of hypothesis H10 (β = 0.381, t = 4.980, p = 0.000) in **table 6**. The findings depict that, GPO within the seaport area enables and provide green job opportunities for maritime services providers including the supply of green energy to vessels and other green logistics related activities. The findings again suggest that, GPO is positive related to ET hence in support of hypothesis H11 (β = 0.246, t = 3.018, p = 0.000) in **table 6**. The findings explain that the introduction of technology in maritime operations has help to improve seaport operations. Most seaport are diverting into the concept of automating their operations which does not only enhance efficiency but also reducing cost and protecting the maritime environment from excessive pollution from marine operations. Also, the findings suggest that the ET play a positive mediation role between GPO and JO. This connection support hypothesis H12 (β = 0.302, t = 4.123, p = 0.000) in **table 7** of the model. The findings emphasis that, technology has helped to replace man power with automation of operation in most terminal. Digitalization is now taking over seaport terminals creating opportunities for computer experts. Cargos can now be moved and transported with easy from a service station. Also, most seaports are now developing green energy means of supplying energy services to vessels when in port. For instance, the use of renewable energy has become very come in maritime seaports and terminals. Port logistics system and service provider are all also moving into green logistics system with the advent of technology hence paving way for green logistics jobs. The above findings affirm the findings of the study by Kaur and Awasthi, (2018).

6.0. Conclusion

Maritime transport is gradually taking a new shape with new developments. Gradually, old businesses and job portfolios are fading out of the system as new ones takes over. The objective of this study was to examine the new trends of maritime transport and job opportunities. The model of the study assesses the direct relationship between green maritime transport, new capacity, formation of Shipping alliance, and green port operations on job opportunities. In support, the study examines the mediation role that the emergence of technology play between the exogenous and endogenous variables od the model. The conceptual framework of this study is supported by the natural resource-based view (NRBV) theory implemented by Hart in 1995. According to the theory, the implementation of these new trends has a significant influence on environmental, economic, and social development or performance. The findings of the study reveal that, maritime transport is currently undergoing changes and development which has significant impact on current job opportunities for maritime professionals. Even though these changes negatively are causing other forms of redundancies to mariners and land base professionals, yet, it is discovered to be creating sustainable job employment to maritime base professionals. The world is gradually moving towards the sustainable era and that, it is advisable to all maritime base personnel to enhance their technical know-how and expertise to embrace the incoming green concept in order to take advantage of it associated businesses and job opportunities.

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Appendix A:

Table 1: Demographic information of respondents

Sociodemographic features	Frequency	Percentage (%)
Age range of respondents		
Below 30 years	326	27.7
30 – 40 years	420	35.7
41 – 50 years	364	31
51 and above	64	5.6
Total	***1176***	***100***
Gender		
Male	797	67.8
Female	379	32.2
Total	***1176***	***100***
Marital status		
Single	218	18.5
Married	875	74.4
Divorced	83	7.1
Total	***1176***	***100***
Academic level		
Ph.D.	69	5.9
Master's	347	29.5
Bachelor's	611	51.9
High National Diploma	149	12.7
Total	***1176***	***100***

Name of institution		
GPHA	70	6.0
GMA	25	2.1
GSA	25	2.1
Customs	50	4.2
Shipping lines	54	4.6
Shippers	450	38.3
Freight forwarders	157	13.3
Haulage companies	110	9.3
Terminal operators	12	1.0
Services providers	163	13.9
Shipping agents	20	1.7
RMU	10	0.9
Warehouse operators	30	2.6
Total	***1176***	***100***
Location of institution		
Tema	820	69.7
Takoradi	356	30.3
Total	***1176***	***100***
Position		
Directors and managers	172	14.6
Supervisors	448	38.1
Officers	546	46.4
Professors	10	0.9
Total	***1176***	***100***
Years of working		
1 – 10years	223	19
11 – 20years	499	42.4
21 – 30years	370	31.5
Above 30years	84	7.1
Total	***1176***	***100***
Employment status		
Permanent	760	64.6
Contract	416	35.4
Total	***1176***	***100***

Table 2: Cronbach's alpha, composite reliability and average variance extracted

Constructs	Measurement items	Loadings	Items	CA	CR	AVE	Source
GMT	Energy-efficient fuel	0.77	GMT1	0.78	0.80	0.571	Maringa, (2015); Psaraftis, (2016)
	Green ship design	0.81	GMT2				
	Container transport	0.74	GMT3				
	Eco-generators	0.79	GMT4				
ET	Automation	0.82	ET1	0.77	0.79	0.563	Heilig et al., (2017)
	Big data	0.75	ET2				
	Digitalization	0.79	ET3				
NC	Economies of scale	0.80	NC1	0.80	0.81	0.583	Bennett, (2014)
	Emission reduction	0.78	NC2				
	Freight reduction	0.84	NC3				
	Improved logistics activities	0.81	NC4				
FSA	Competitive advantage	0.79	FSA1	0.80	0.80	0.579	Panayides and Wiedmer, (2011).
	Capacity sharing	0.81	FSA2				
	Risk sharing	0.77	FSA3				
	Profit maximization	0.85	FSA4				
	vessel management	0.81	FSA5				
GPO	Microgrid system	0.84	GPO1	0.79	0.83	0.663	Fang et al. (2019), Jeevan et. al., (2018).
	Terminal automation	0.79	GPO2				
	Dry port system	0.84	GPO3				
	Reception facilities	0.77	GPO4				
	Emission control	0.80	GPO5				
JO	Seafarers	0.81	JO1	0.81	0.84	0.681	
	Service providers	0.78	JO2				

	IT experts (AI)	0.84	JO3
	Technicians	0.89	JO4
	Engineers	0.78	JO5

Table 3: Fornel-Larker criterion.

Constructs	GMT	ET	NC	FSA	GPO	JO
GMT	0.824					
ET	0.697	0.798				
NC	0.812	0.742	0.810			
FSA	0.667	0.545	0.773	0.752		
GPO	0.598	0.613	0.541	0.646	0.633	
JO	0.631	0.554	0.489	0.603	0.467	0.741

Table 4: Heterotrait-monotrait ratio (HTMT).

Constructs	GMT	ET	NC	FSA	GPO	JO
GMT						
ET	0.691					
NC	0.732	0.728				
FSA	0.630	0.539	0.669			
GPO	0.711	0.462	0.722	0.652		
JO	0.584	0.619	0.477	0.511	0.622	

Table 5: variance explained (R^2), effect size (f^2) and VIF.

Constructs	f^2	VIF	Q^2	R^2	R^2adj
ET.	0.263	2.526	0.338	0.460	0.451
JO.	0.346	3.162	0.447	0.572	0.601

Table 6: Direct effect

Path	Hypotheses	Beta Coefficient	T-statistics	P-values	Supported
GMT→JO	H1	0.622	7.648	0.000	Supported
GMT→ET	H2	0.408	6.337	0.001	Supported
NC→JO	H4	0.336	4.826	0.003	Supported
NC→ET	H5	0.482	6.473	0.000	Supported
FSA→JO	H7	0.318	5.025	0.010	Supported
FSA→ET	H8	0.429	6.237	0.006	Supported
GPO→JO	H10	0.381	4.980	0.000	Supported
GPO→ET	H11	0.246	3.018	0.000	Supported

Table 7: Mediation (indirect) effect

Path	Hypotheses	Beta Coefficient	T-statistics	P-values	Supported
GMT→ET→JO	H3	0.352	4.652	0.000	Supported
NC→ET→JO	H6	0.428	6.211	0.021	Supported
FSA→ET→JO	H9	0.328	4.320	0.000	Supported
GPO→ET→JO	H12	0.302	4.123	0.000	Supported