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MAJOR CHALLENGES FACING SHIP MAINTENANCE OR REPAIR SERVICES IN THE TEMA DRYDOCK AND SHIPBUILDING YARD IN GHANA

Abstract
Generally, the ship maintenance and repair Industry is one of the core sectors that has been contributing substantially to the development of the maritime Industry and the world’s
economy. It does this by generating maximum revenue, creation of employments and transfer of technology through the rendering of effective and efficient ship repair services to its customers. Just like any other business entity, the ship repair Industry faces numerous global challenges that are threatening the development of this industry. It is no doubt, that the ship repair Industry is consistently experiencing upward growth rate of the economy and facilitation of other infrastructural development.

As a result, this article aims to carefully discuss three (3) of the major challenges facing the ship maintenance and repair services in the Tema Ship Yard, Ghana. It is to provide efficient and improved internationally acceptable practices pertaining to the ship maintenance Industry within the Tema Drydock, Ghana.

As already been captured and inexhautively discussed (i.e didn’t use Strengths, Weaknesses, Opportunities, Threats Analysis) in some previous publications (Nutsugah, 2018 and Yawson, 2017), however, this article has adopted a holistic approach and provided unattainable heights of insight into analysing and finding long-term permanent solutions to these major challenges facing the ship repair services in the Tema Shipyard, Ghana. It has also discussed a brief history of the Tema Shipyard in Ghana in the perspective of global scenario.

Overall, the article gives detail accounts of the prospects of the shipbuilding and ship repair industry in Ghana using the strengths, weaknesses, opportunities, threats (SWOT) Analysis of the Tema Shipyard. It then also, discussed the few major challenges facing ship maintenance services in the Tema Shipyard and provided suggested solutions to them, before drawing a final conclusion on the subject matter.

**Introduction**

Today’s shipbuilding and ship maintenance Industry is increasingly embedded with many challenges. A growing number of developed economies and emerging economies such as
Europe and Asia have been tackling these challenges to create a sustainable shipbuilding and ship repair industry so as to maintain growth of their economies and development.

Effective and efficient installation of the modern advanced technological shipbuilding and repair equipment, upgraded drydocks, properly trained skilled labour and available sufficient capital will provide permanent solutions to these challenges – inadequate governments funding; Inadequate skilled labour; lack of capacity; Technical problem (lack of Research and Department), Safety, Health and Environmental aspect (i.e., lack of governments’ ratification, implementation and enforcement of international environmental regulations on workers exposure to certain harmful substances and activities from shipbuilding and repairs, blasting, painting, welding) (Iqba S.K., Zakaria N. G., & Hossain Akhter. K.A, 2010). One example of such modern advanced technological shipbuilding and ship repair equipment is Dormac Dock 1 in Durban, South Africa with capacity of accommodating 155M Length Overall (LOA) and 24.5M beam (http://www.dormac.net/dormac-dock-1/).

Although in Ghana, an extensive academic research has explored these challenges (Nutsugah, 2018 and Yawson, 2017) but much less research has investigated the three major challenges facing the ship maintenance and repair services in the Tema Shipyard in Ghana.

This article intends to objectively discuss three of the major challenges, namely, lack of capacity, obsolete ship maintenance equipment and lack of skilled labour facing the ship maintenance services in the Tema Shipyard.

Despite these challenges, the ship maintenance market has inevitable growth prospects. Historically, the global ship repair market has been growing in connection with the growth of the international seaborne trade. Presently, the shipping industry carries 90% of the world’s 10.702 billion tonnes of international trade (Alhouli, 2011 and United Nations Conference on Trade and Development, 2018). Also, the world merchant fleet continues to grow drastically. In 2016, the world merchant fleet grew to 91,256 vessels (Kavussanos & Visvikis, 2016). In addition, it is only 240 shipyards which received orders out of the approximately 730 active shipyards in 2015 (G.T) (Frederick S. & Brun.L, 2017).
A 2007 also experienced equal growth opportunities for ship repairs and conversion (ECORYS Consulting and Research, 2009). The worldwide annual turnover in ship repairs estimate has risen to U.D $10 – 12 billion (ECORYS Consulting and Research, 2009).

The United Nations Conference on Trade and Development projects that global maritime trade is to grow at a compound annual growth rate of 3.8 percent between 2018 and 2023 (United Nations Conference on Trade and Development, 2018). Per this rate, the volumes are expected to double in two decades thereby increasing shipping activities (United Nations Conference on Trade and Development, 2018).

However, these increasing shipping activities are associated with a growing international shipping carbon emissions which may arise as a result of unsustainable maritime transport practices (United Nations Conference on Trade and Development, 2018). This greenhouse gas (GHG) emissions from the sector is expected to increase by a factor of five (5) between 2012 and 2050 if no mitigation measures are taken to reduce the emissions (United Nations Conference on Trade and Development, 2018). Paradoxically, these mitigated measures shall come with costs. Perhaps, some vessels will be required to undertake maintenance and repairs, retrofitting and conversion for compliance.

Ships are simply referred to as floating structures and are constructed at the Shipyards. They are usually self-propelled but some, for instance, dumb barges and some offshore structures rely on tugs to move them (Tupper, 2004).

The design and construction of ships are done by the Naval Architecture. Naval Architecture is an engineering discipline dealing with the design, construction, maintenance and operation of marine vessels and structures (Ölcer.A, T.Nakazawa & M. Baldauf, 2016).

Shipyards are industrial plants located in a suitable water area such as a harbour basin, a bay or a river for the building, repair and maintenance of ships (Jonkers, 2003). A shipyard can perform two major functions, namely, shipbuilding and ship repair services (Jonkers,
Shipbuilding yards need to invest heavily in major capital equipment whereas ship repair yards must have a wider range of tools (Danny, S., & Ozgur, U.S., 2008).

Basically, the International Maritime Organisation (IMO) is the United Nation’s specialised agency with its Headquarters located in the United Kingdom (http://www.un.org/depts/los/consultative_process/mar_sec_submissions/imo.pdf). It is exclusively devoted to maritime affairs, thereby providing a forum for the following: cooperation among Governments in the field of governmental regulations and practices relating to all kinds of shipping engaged in international trade; facilitating the adoption of comprehensive multilateral treaties for wide range of technical measures, in particularly highest practicable standards, design to enhance safety, security and efficiency in shipping engaged in international trade (http://www.un.org/depts/los/consultative_process/mar_sec_submissions/imo.pdf).

During a ship’s life span operations, certain institutions are also required to make, implement and enforce regulations to maintain its seaworthiness for the safety of the crew and cargo. The International Association of Classification Societies (IACS) are responsible for the implementation of published rules and regulations concerning the structural strength (and where necessary the watertight integrity) of all essential parts of the hull and its appendages and; the safety and reliability of the propulsion and steering systems (Jonkers, 2003). The International Association of Classification Societies (IACS) in collaboration with the IMO, ensure that all classification societies work in uniformity for improving ships’ safety (https://www.researchgate.net/publication/291158725_International_association_of_classification_societies). That is, Classification Societies ensure that the rules are being strictly followed, and their Surveyors are present during construction of a vessel in a shipyard and at associated production facilities that provide key components, such as, the engines, generators, cargo handling equipment, steering systems and other components (https://www.researchgate.net/publication/291158725_International_association_of_classification_societies).

The Surveyors verify that the vessel is constructed in accordance with the Classification rules, and satisfied all the conditions therein, assignment of a class is approved and a Certificate of Classification is issued.
Once the vessel is in service, the owner must submit it to a clearly specified programme of periodic class surveys to verify that the ship continues to meet the relevant conditions for remaining in class. These surveys in addition to other reports dealing with damaged and repair are carried onboard the vessel in order that they be available for inspections by Port State Control Authorities and other interested parties.

Discussion the three major challenges facing the ship maintenance services in the Tema Shipyard.

The Author made field visit and surveys to the Ghana’s only Drydock and Shipyard, the Tema Shipyard to gather data and information for effective and efficient discussions of the subject matter (Iqba S.K., Zakaria .N. G., & Hossain Akhter. K.A, 2010).

This provided an opportunity for the author to see the real physical conditions of the drydock’s ship repair equipment, how they operate and assess them accordingly. Consultations and meetings were also held on different days with Captain Francis Kwesi Micah, the Chief Executive Officer of the Tema Shipyard, Mr. Adams Imoro Aiayana, the Vice President of Shipowners and Agents Association of Ghana and Mr. Franck Nutsugah, the Editor of Maritime Courier Publications Limited to grasp the picture of the challenges facing the ship maintenance and repair services in the Tema Shipyard (Iqba S.K., Zakaria .N. G., & Hossain Akhter. K.A, 2010).

Both primary and secondary data were collected from Captain Francis Kwesi Micah, Mr.Adam Imoro Aiayana and Franck Nutsugah including, other reliable and authoritative sources as referenced here to authenticate the analysis of this article.

The Drivers and Trends in Ship Maintenance and Repair Industry

Most often, the introduction of new legislations, usually has a series of economic implications on the ship maintenance and repair industry. The United Nations specialised agency, the International Maritime Organisation’s adoption of the International Convention
for the Prevention of Pollution from Ships (MARPOL 1973, modified 1978 / 1997) were measures purposely meant to prevent pollution from marine and shipping operations (https://www.bp.com/content/dam/bp/trading/en/global/trading/Documents/7718 MARPOL Brochure_web.pdf). However, it directly and indirectly increases ship maintenance and repair services in the shipping industry. Presently, Maersk Line had developed an investment plan to install technological retrofit on its existing fleet (Song, 2017). This technological retrofit is called waste-heat recovery system (Song, 2017). This innovation is aimed at reducing the Line’s energy consumption and relative Carbon Dioxide (CO2) emissions in its operations (Song, 2017).

In January 2020, again, the IMO much-awaited modified International Convention for the Prevention of Pollution from Ships (MARPOL 1997 will finally take effect on the 1st January, 2020. Basically, it is being designed to address sulphur emissions from ships (https://www.bp.com/content/dam/bp/trading/en/global/trading/Documents/7718%20MARPOL%20Brochure_web.pdf). It is introducing a global cap on the sulphur content of marine fuel oil and an additional limit in specific waters, known as Emissions Control Areas (ECA) (https://www.bp.com/content/dam/bp/trading/en/global/trading/Documents/7718%20MARPOL%20Brochure_web.pdf). Since 2015, the IMO’s regulation requires vessels operating in certain coastal ECAs to burn fuel with a maximum sulphur content of 0.1 % (Kenneth, T. & Kjus. T, 2016). It also permits the use of 3.5 % sulphur fuel outside the ECA (Kenneth, T. & Kjus. T, 2016). This change is really focused on reducing the global cap on sulphur content for general shipping, from 3.50 % wt to 0.50 % wt from 1st January, 2020 (https://www.bp.com/content/dam/bp/trading/en/global/trading/Documents/7718%20MARPOL%20Brochure_web.pdf). This new legislation will certainly change the marine fuel landscape. Probably, there is going to be increasing demand in ships repair market, especially, the already existing ships and the
new builds just delivered before its implementation and enforcement. These categories of ships may be required to do repairs, installations of scrubbers and conversions for compliance.

According to Kenneth Tveter & Torbjarn Kjus, the new IMO 2020 Sulphur cap will have profound implications for the economies of shipping and refineries (Kenneth, T. & Kjus. T, 2016). It has been estimated that the additional fuel cost based on the current market prices will be close to $50 billion per year (Kenneth, T. & Kjus. T, 2016). This could even increase further (Kenneth, T. & Kjus. T, 2016).

Presently, the low sulphur distillates (Gasoil) is already priced close $300/mt higher than high sulphur bunker in 2020 and may rise further (Kenneth, T. & Kjus. T, 2016). Obviously, these have a major negative impact on the bottom-line for most shipping companies (Kenneth, T. & Kjus. T, 2016). It might, however, be the best option for older vessels with limited service life after 2020 and companies with financial constraints require substantial investments, particularly in scrubbers (Kenneth, T. & Kjus. T, 2016).

**Salvage**

Salvage, basically, involves in the processes of rescuing a vessel or her cargo from loss at sea (Jonkers, 2003). Impliedly, salvage work encompasses a variety of expertise who offer different types of services to the entire shipping industry, including ship maintenance and repair industry. The table 1 below illustrates the list of services offered by the Salvage Association (Jonkers, 2003).
Table 1: List of Service Expertise (Jonkers, 2003).

<table>
<thead>
<tr>
<th>CASUALTY MANAGEMENT</th>
<th>RISK MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hull</strong></td>
<td>Risk assessment</td>
</tr>
<tr>
<td>Damage Surveys</td>
<td>Cargo projects</td>
</tr>
<tr>
<td>- Speed and angle of blow surveys</td>
<td>Civil engineering projects</td>
</tr>
<tr>
<td>- Advice on repairs and costs</td>
<td>Survey and advice for:</td>
</tr>
<tr>
<td>- Preparation of repair specifications</td>
<td>- Voyage or towage</td>
</tr>
<tr>
<td>- Negotiation of repair accounts</td>
<td>- Vessel lay-up or reactivation</td>
</tr>
<tr>
<td><strong>Advising on salvage operations and wreck removal</strong></td>
<td></td>
</tr>
<tr>
<td>Casualty investigation</td>
<td>Mooring arrangements</td>
</tr>
<tr>
<td>- Casualty co-ordination</td>
<td>Cargo load-out, stowage and towage</td>
</tr>
<tr>
<td><strong>Damage Engineering</strong></td>
<td>Shipyard inspections</td>
</tr>
<tr>
<td>- Third party liability surveys</td>
<td>Condition surveys</td>
</tr>
<tr>
<td>- General average surveys</td>
<td>Feasibility studies</td>
</tr>
<tr>
<td><strong>Cargo</strong></td>
<td>Damage Surveys</td>
</tr>
<tr>
<td>Advice on underwater location and recovery</td>
<td>- Investigation of cause</td>
</tr>
<tr>
<td>- Hull or machinery surveys</td>
<td>- Casualty co-ordination</td>
</tr>
<tr>
<td>- Advice on damage limitation and mitigation of loss</td>
<td>- General average surveys</td>
</tr>
<tr>
<td>- Speed and angle of blow surveys</td>
<td>- Third party liability surveys</td>
</tr>
</tbody>
</table>
Source: http://www.wreckade.org/

Also, Lloyd’s defines salvage as ‘’rendering services to a causality vessel in order to prevent it becoming a loss (Herbert, 2013)’’.

Other Literature defines salvage as ‘’ Marine salvage may encompass the formal definition of salvage (i.e, rescuing something of value from peril) as well as wreck, obstruction and debris removal (Commander, 2014)’’. Each activity may have different authorities, funding sources, and levels of agency involvement (Commander, 2014).

Shipwrecks
Generally, ship maintenance and repair services do also involve in the removal of ship wreck. According to James Herbert, there are typically some 1,000 serious ships casualties globally each year (Herbert, 2013). Thus, a successful intervention means that the majority of these casualties are salvage cases and are towed to safety, refloated, repaired and returned to service (Herbert, 2013).

Ship wrecks are potential hazards to the health and safety of both the ocean-going vessels and crew. Ocean-going vessels can run aground and become ship wrecks in the ocean. Their removal processes do become extremely expensive to the shipowners, operators and the marine insurance companies (Herbert, 2013). For instance, the available statistics in the North Sea alone, indicates that there were more than 27, 000 shipwrecks (The North Sea Manifest,
This figure may increase further if no action is taken to carry out total removal, partial removal and repairs on these shipwrecks in order to prevent the marine environment from marine pollution and vessels operation accidents.

Recently, there were occurrences of a number of high profile marine wrecks worldwide (Herbert, 2013). It includes Mediterranean Shipping Company (MSC) Napoli in the English Channel, Rena which ran aground off New Zealand and the Costa Concordia also sank off Western Coast of Italy last year (Herbert, 2013).

The various regionals and Continents’ economic emergence are strongly related to the performance of the ship repair industry. The recent Asia’s economic dominance in the world, led by China is attributed to its huge investment drive and efficient coordinated programmes in shipbuilding and ship repair industry (Jonkers, 2003). The Chinese Government succeeded in implemented strategic development programmes to maintain its economic growth in the long run (Jonkers, 2003). They are as follows: financial support for the expansion and development (upgrading) of its ship repair industry; cheapest area to do steel work as price level quoted as low as $ 1 / kg compared to Singapore’s $ 2-25 / kg and; cheapest workforce boosts China’s dominant (Jonkers, 2003).

Suddenly, within the last ten (10) years, China overtook the European shipbuilding Century dominance with a market share of about 80 % (ECORYS Consulting and Research, 2009). China has been enjoying 8 -11% economic growth rates every year since the 1990s (DongWook, 2017). Current developments in the shipping Industry still indicate that China’s economic growth has been accompanied with the development of the nation’s maritime infrastructure and seaports (Dong-Wook, 2017). The table 2: below. Shows its first position in the Top 10 Shipbuilding Countries in the world (Frederick .S. & Brun .L, 2017). The Table 2: Top 10 Shipbuilding Countries (based on GT Completed), 2015.

Table 2: 10 Shipbuilding Countries (based on GT completed), 2015

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>No.</th>
<th>‘000 GT</th>
<th>No. Share (%)</th>
<th>GT Share (%)</th>
<th>No. Change</th>
<th>GT Change</th>
<th>GT (000)/Ship</th>
</tr>
</thead>
</table>

2017).
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>World Total</strong></td>
<td>2,870</td>
<td>67,566</td>
<td>-23%</td>
<td>-30%</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>1 China</td>
<td>949</td>
<td>25,160</td>
<td>33.1</td>
<td>37.2</td>
<td>-33%</td>
<td>-31%</td>
</tr>
<tr>
<td>2 S. Korea</td>
<td>358</td>
<td>23,272</td>
<td>12.5</td>
<td>34.4</td>
<td>-32%</td>
<td>-27%</td>
</tr>
<tr>
<td>3 Japan</td>
<td>520</td>
<td>13,005</td>
<td>18.1</td>
<td>19.2</td>
<td>-10%</td>
<td>-36%</td>
</tr>
<tr>
<td>4 Philippines</td>
<td>42</td>
<td>1,865</td>
<td>1.5</td>
<td>2.8</td>
<td>24%</td>
<td>61%</td>
</tr>
<tr>
<td>5 Taiwan</td>
<td>56</td>
<td>749</td>
<td>2.0</td>
<td>1.1</td>
<td>167%</td>
<td>29%</td>
</tr>
<tr>
<td>6 Vietnam</td>
<td>90</td>
<td>591</td>
<td>3.1</td>
<td>0.9</td>
<td>-32%</td>
<td>6%</td>
</tr>
<tr>
<td>7 Romania</td>
<td>39</td>
<td>485</td>
<td>1.4</td>
<td>0.7</td>
<td>-9%</td>
<td>-21%</td>
</tr>
<tr>
<td>8 USA</td>
<td>75</td>
<td>427</td>
<td>2.6</td>
<td>0.6</td>
<td>-1%</td>
<td>79%</td>
</tr>
<tr>
<td>9 Germany</td>
<td>10</td>
<td>384</td>
<td>0.3</td>
<td>0.6</td>
<td>-72%</td>
<td>-59%</td>
</tr>
<tr>
<td>10 Brazil</td>
<td>32</td>
<td>361</td>
<td>1.1</td>
<td>0.5</td>
<td>52%</td>
<td>668%</td>
</tr>
<tr>
<td><strong>Top 10 (based on GT) Share</strong></td>
<td></td>
<td></td>
<td></td>
<td>76</td>
<td>98</td>
<td></td>
</tr>
</tbody>
</table>

Source: IHS (2016); Note = No. Number

According to the table, the detail statistics indicate the percentage of vessels completed by the following Countries:

China 37 %, South Korea 34 % and Japan 19 % accounted for 91 % of the world’s approximately 68 million Gross Tonnage of ships completed in 2015. However, the Philippines also completed roughly 2.8 % of the world’s total tonnage (Frederick .S. & Brun .L, 2017).
Ship Scrapping

Generally, everything has a beginning and an end. So do the life of ships, when they are sailing on the oceans in the world and the local bay (Sundelin, 2008). Once ships start their commercial operations, they certainly get to the end of their useful lives due to legislations and other reasons. At certain times, ships can no longer continue to serve their original purpose, due to their over-aged and therefore, must be removed (Sundelin, 2008). The other few ships may end up at museums and are sunk in order to create artificial reefs as habitats for marine species, military and defence purposes (Sundelin, 2008 and Damien.D.A, Winterton. P., & Beilvert. B, 2016).

Whether ships live fully to or beyond their average life span of the 23 years in service, they are obliged to be retired, scrapped and recycled (Frederick S. & Brun L, 2017). These activities take place in an internationally recognised dry-dock facility to end the ship life span cycle. This is because, the breakdown rate of over-aged ships usually occurs frequently and increases costs of operation.

The safe methods and processes deploy to dispose of over-aged ships are to avoid marine pollution from their operations. Ship-scraping marks the last voyage of the ship, hence the ship is totally dismantled (Sundelin, 2008). The ship’s steels and other relevant materials are also reused in the steel industry (Sundelin, 2008).

Ships-scraping Industry is gaining a significant root in the five (5) leading ship-breaking Asia countries, namely: China, Bangladesh, India, Pakistan and Turkey in Europe (Frederick S. & Bruni L, 2017). The figure 1: below shows their positions.
From the figure 1: above, China is leading with the highest number of ships being scrapped among them (Frederick.S. & Bruni. L, 2017).

Particularly, the recent emergence of these Countries’ economic development is anchored by that. It creates a source of revenue and employments (http://dione.lib.unipi.gr/xmlui/bitstream/handle/unipi/4633/Gerostergiou.pdf?sequence=2 &isAllowed=y). As a result, these governments have effective support policies and financial investments in their ship- scrapping Industry.

Ship dismantlement has both economic benefits and a cost responsibility for the shipowners who want to dismantle their ships. Ship dismantlement is paid for by the shipowners in accordance with the international conventions (Devault.D.A., Winterton. P, & Beilvert. B, 2016).

On the other hand, shipowners make huge sums of money after selling the vessel out for scrapping. Ideally, shipowners make super profit when the demand for ship scrapping is higher than the supply including, high prices for steel and other related scrapped materials.

However, the ship- scrapping Industry also has a serious negative health effects on the people of such Countries and their environments. Ninety-five percent (95%) of scrapped vessels weight is steel, coated with tons of paint, containing lead, cadmium, organotins,
Considering the impacts embedded in the above, it has led the international community to generate and adopt regulations to promote the environmentally-sound, shipbreaking activities at the Drydocks. A two (2) maritime convention deserves mentioning here only. Hence, the scope of this article is limited to the major challenges facing the ship maintenance and repair Industry in the Tema Dry-dock in Ghana. They are: Basel Convention on the control of the transboundary movements of hazardous wastes and disposal, enforced in 1992 and the Hong Kong International Convention for the safe and environmentally-sound Recycling of Ships, 2009.

**African Continent**

On the African Continent, the ship repair industry seems to be confined within the Oil and Gas producing regions and geographically located advantage. That is, there is a high level of investment concentration in ship repair industry in regions with increased activities of offshore Oil and Gas exploration and production (Jonkers, 2003). The Ocean Shipping Consultant’s (OSC) research indicates that, the North and West Coast will capitalise on regional shipping movements and supplemented by offshore contracts (Jonkers, 2003).

On the geographically located advantage, Egyptian’s facilities are expected to attract vessels transiting the Suez Canal (Jonkers, 2003).

Since the 1990s to 2003, the number of drydocks in Africa, has increased from 5 drydocks to 10. Perhaps, this increase could be attributed to the huge benefits that other countries have derived from investing in ship repair industry. China, is a classic example (Jonkers, 2003). The table 3. Below, illustrates the number of Docks and Capacity operating in Africa since 1990 to 2003 (Jonkers, 2003).

**Table 3: Africa Ship Repair Capacity Development to 2003 – by Size Sector**
From table 3, it becomes apparent that Africa’s highest expected capacity development is found in the 10 / 25,000 ton-size Sector while just the reverse was forecast for the 25 / 50,000 ton –size Sector

Presently, a number of African seaports are also undergoing infrastructural developments to accommodate bigger size vessels. These seaports infrastructural developments are wholly relying on the actors of the Foreign Direct Investments (Smart Comp Research, 2013). For instance, China’s Merchant Holding (international) Co. Ltd is investing $10 billion in building a new port which may be the biggest port in Africa (Smart Comp Research, 2013). It is located at Bagamoyo, the northwest of Dar Salaam, Tanzania (Smart Comp Research, 2013). The Port is a trade gateway for the East’s landlocked countries, namely: the Democratic Republic of the Congo, Zambia, Rwanda, Malawi, Brundi and Uganda (Smart Comp Research, 2013).

Ghana’s two seaports are also undergoing expansions and dredging of additional deeper berths to be able to accommodate bigger vessels. The Ghana Ports and Harbours Authority (GPHA) is constructing a new dedicated 3.5 million Twenty Equivalent Units (TEUs) container terminal at the Tema Port. This container terminal has four (4) berths of 16 metres draught and forms the first phase of the port’s ongoing development plan.
For instance, the Meridian Port Services Limited (MPS) has just taken delivery of the state-of-the-art cargo handling equipment for installation (https://ghanaports.gov.gh/news/1670/Mps-Takes-Delivery-Of-4-Sts-And-8-Electric-RubberTyre-Gantries-To-Begin-Operations-At-The-Newly-Expanded-Tema-Port-). These cranes are expected to be installed at the new facility and commence full operations within this year June, 2019. (https://ghanaports.gov.gh/news/1670/Mps-Takes-Delivery-Of-4-Sts-And-8-Electric-RubberTyre-Gantries-To-Begin-Operations-At-The-Newly-Expanded-Tema-Port-).

This container terminal is expected to make the Port of Tema operating the biggest and most efficient container terminal in West and Central Africa (https://ghanaports.gov.gh/news/1670/Mps-Takes-Delivery-Of-4-Sts-And-8-Electric-RubberTyre-Gantries-To-Begin-Operations-At-The-Newly-Expanded-Tema-Port-). Meridian Ports Services Limited (MPS) is a consortium made up of 3 major organisations as shareholders, the Ghana Ports and Harbours Authority, A.P. Moller Terminals and Bolloré Transport & Logistics (https://ghanaports.gov.gh/news/1670/Mps-Takes-Delivery-Of-4-Sts-And-8-Electric-RubberTyre-Gantries-To-Begin-Operations-At-The-Newly-Expanded-Tema-Port-).

Thus, the Port of Tema has started taking the bull by the horns. It is now tackling the major challenges facing it straight forward. This will automatically aid the Tema drydock to directly and indirectly benefit significantly from the ongoing developments on the Tema seaports because of its geographical proximity to the seaports. The reasons for locating drydocks close to seaports are to make them accessible and minimise amount of vessel down-time experience by shipowners when towing a damaged vessel to the nearest drydock for repair services (ECORYS Consulting and Research, 2009).

**The Emerging Shipbuilding Nations**

The look ahead indicates that there are fast, growing and strong emerging shipbuilding nations threatening to overtake China in the long run (ECORYS Consulting and Research,
2009). These emerging shipbuilding nations consist of India, Vietnam, the Philippines and Brazil (ECORYS Consulting and Research, 2009). There is a serious competitiveness among the various players in the ship repair industry. As of August, 2007, Indian had the fourth largest order book of the world, representing 1.2% of the total world market (ECORYS Consulting and Research, 2009). This, therefore, made India larger than any of the European Shipbuilding Countries (ECORYS Consulting and Research, 2009).”

However, the Philippines and Brazil overtook India in 2008 after India’s economy had slowed down due to the post 2008 world economic meltdown and financial crisis (ECORYS Consulting and Research, 2009).

Brazil is likely to emerge the strongest dominant in the shipbuilding and ship repair Industry in the world. The country’s total order book rose from 0.3 to 1.0 million CGT between 2006 and 2007 (ECORYS Consulting and Research, 2009). However, the growth rate for the new orders, completions and order book decreased drastically in the post 2008 as a result of the world’s economic crisis. The figure 2: Below shows the growth rate in its shipbuilding sector within 2006 and 2007 (ECORYS Consulting and Research, 2009).
The country seems to have a comparative advantage in the construction of offshore vessels because it appears to be a niche player and particularly produces offshore vessels (ECORYS Consulting and Research, 2009).

**Brief explanations of the following:**

**Definitions of a Dry-dock**

Ship maintenance and repair services are considered to make the ship operate efficiently and safely. Ship maintenance and repair services are carried out at a designated place. Most often, the ship maintenance and repair services are done at the drydock, at berth and at sea depending on the scale of the damaged ship.

Anish Wankhede defines Drydock as “a structure area wherein constructions, repairs and maintenance of merchant vessels and boats are carried out. It is a special construction that allows the water to enter into an area called lock for easy manoeuvring of a vessel within and out of it. Usually, the vessel is shifted inside the dock and is rested on the blocks in a suitable safe position whilst the gates are closed after the water has been drained or removed for the maintenance services to begin

([https://www.marineisight.com/guidelines/dry-dock-types-of-drydock-requirements-for](https://www.marineisight.com/guidelines/dry-dock-types-of-drydock-requirements-for)/)
It is also a “major project that including upgrades, modification, maintenance and repair activities carried on Mobile Offshore Units (MOU) which is associated with an off hire of the unit (Mashouri 2013)”. It is normally the shipowners who are responsible for the payment of the repair services. However, the charterers do also pay for the repair services based on the terms and conditions (clauses and provisions) of the charterparty (Jansson, 2013).

Drydocks are classified into different types which are used for repairing and cleaning of the ship’s bottom. They are as follows:

1. Graving dock
2. Floating dock
3. Marine Rail Dock
4. Shiplifts and
5. Marine Mobile lifts

Again, the scope of this article will not permit an in-depth discussion of the above mentioned types of the drydocks. However, attempt is made to link the criteria that shipowners and operators use to select these drydocks. These criteria are depended on the following underlisted factors:

(https://www.marineisight.com/guidelines/dry-dock-types-of-drydock-requirements-for-dry-dock/)

- The size of the vessel: usually, graving docks are used to accommodate larger size ships such as oil tankers.
- The condition of the vessel: It is the floating docks which are used to repair vessels which immobilised due to breakdown of their propulsion plant and other major damages to the vessels’ sensitive areas, perhaps the engines (https://www.marineisight.com/guidelines/dry-dock-types-of-drydock-requirements-for-dry-dock/)
- **The type of repairs:** Of course vessels often suffer different degrees of damages as a result of their sailing and cargo operations time. The proximity of a type of drydock to a shipyard is also important. It is therefore incumbent on the shipowners and operators to determine the types of drydock to be used for repairs. For instance, if there are major retrofitting or massive parts / machine fitting is required, then the graving dock is the preferred one hence it is easy to move the material from land to dock as compared to the floating dock. [https://www.marineisight.com/guidelines/dry-dock-types-of-drydock-requirements-for-dry-dock/dry-dock/](https://www.marineisight.com/guidelines/dry-dock-types-of-drydock-requirements-for-dry-dock/dry-dock/)

- **Schedule of the Vessel:** in a haste to arrive at final decisions about the location and types of drydock for vessel’s repairs will be inefficient and costly if the vessel’s schedule is not taken into account. That is, the location and the type of drydock should be decided as per the current schedule of the vessel so as to reduce unnecessary operation costs. Again, the criterion in selecting the type of drydock should be based on the vessel’s ability to reach the nearest available drydock after discharging all the cargo at the last port of call for the safety and moderate operation costs. [https://www.marineisight.com/guidelines/dry-dock-types-of-drydock-requirements-for-dry-dock/dry-dock/](https://www.marineisight.com/guidelines/dry-dock-types-of-drydock-requirements-for-dry-dock/dry-dock/)

- **Budget:** It is widely acknowledged that selecting a wrong type of dock, for instance a floating dock instead graving dock for ship repairs may affect the already allotted budget of the shipping company. It is no doubt, that the amount of money required to spend on the ship repairs at the floating dock will be more than the graving dock’s expenses. This is because using already allotted graving dock’s budget to carry out ship repairs at the floating dock which is not near to any shipyard will automatically affect the entire shipping company’s finance. The shipping company will be compelled to spend extra finance out of the already budgeted one to cover the transportation of the materials to far of drydock to complete the repair services. Therefore, the most important factor to select the type of drydock is the budget allotted to the ship.
These activities are aimed at fulfilling one of the SOLAS requirements that states that all merchant vessels are required to be dry docked twice within 5 years period for inspection and maintenance of their hulls and immersed parts in the water.

Ship Maintenance and Repairs

Basically, maintenance is an essential element that contributes to the development of many nations’ economies. As such, industrialised nations have been allocating large amounts of money each year to take care of maintenance (Alhouli, 2011). This is because the negative consequences of failure to manage maintenance can bring high penalty costs in the form of operation downtime (Alhouli, 2011). Thus, conducting either mandatory or other maintenance on ships is indispensable since it saves lives and property in the marine industry. It also provides system reliability, prevention of occurrence of system failures and reducing maintenance cost of deteriorating systems (Alhouli, 2011).

Although the brief discussions of the importance of maintenance have been stated in the above immediate paragraph, the definitions of its two main types in relation to ship building and repair cannot be ignored. To summarise them, Yousef Ahouli defines unscheduled (Unplanned) type of maintenance as “breakdown maintenance” or “run to failure maintenance” (Alhouli, 2011). Its standard approach is “fix it when it breaks” or “if it ain’t broke don’t fix it” (Alhouli, 2011). It is the most expensive type of maintenance because of its overall negative effects on the machine and other variables. It usually brings about a high overtime costs of labour, high machine downtime, low production and high inventory costs of spare parts (Alhouli, 2011).
Scheduled (Planned) Maintenance” embraces all activities necessary to plan, control, and record all work done in connection with keeping an installation at acceptable standard (Alhouli, 2011). Arguably, this type of maintenance attracts less cost due to the advance preventive measures being put in place to totally forestall and mitigate its occurrence. There are four basic tasks needed to be performed in the scheduled maintenance to protect the reliability and safety of a system (Alhouli, 2011). They are as follows: (1) inspection of a component to detect failure; (2) failure detection; (3) reworking and discarding of a component before its maximum age; and (4) inspecting an item to assess unseen failures (Alhouli, 2011). In addition, the scheduled maintenance consists of the various aspects of maintenance. They are: preventive maintenance, predictive maintenance, corrective maintenance, planned overhaul, planned replacement and spares provisioning (Alhouli, 2011).

Thus, connecting these types of maintenance to the shipbuilding and ship repair industry automatically gives the deepest understanding on the major challenges facing the Tema Shipyard and the adoption of long-term permanent solutions to them is now. Understandably, the shipping industry is one of the most sophisticated industry in the world, which has a tremendous impacts on the economic, social and environmental aspects. So, it is logical and prudence to always consider the right mix of the various maintenance approaches to achieve the optimum maintenance results (Alhouli, 2011).

According to Yousef Alhouli, ship maintenance is normally considered in the early stages of ship design (Alhouli, 2011). It is also the responsibility of the designers and shipowners to review the plans for preventive maintenance with the classification society to confirm that the plans are acceptable in accordance with the classification society’s requirements for surveys after construction (Alhouli, 2011).

Generally, ship construction includes ship repair (and conversion) and is directed at the larger commercial sea-going vessels, as represented by the Community of European Shipyards Association (ECORYS Consulting and Research, 2009). Ship maintenance and repair services are divided into two (2) major aspects, namely, breakdown maintenance and Preventive maintenance (Alhouli, 2011). The breakdown maintenance is usually carried out during the occasioned of unexpected damage to the ship. That is they are usually conducted without
any preventive maintenance, except for essential lubrication and making minor adjustments (Alhouli, 2011).

On the other hand, the preventive maintenance involves maintenance to reduce the number of breakdowns, and it can be time-based or condition-based maintenance (Alhouli, 2011).

The preventive maintenance are more mandatory in nature because the ships are required to be dry-docked at the ship repair yards for the major ship maintenance services to be conducted on the underwater parts of the vessels. According to Yousef Alhouli, ships are usually scheduled to go to the shipyard every two and half years for an intermediate classification survey and every five years for a major classification survey (Alhouli, 2011). This is the time, an overhaul of most of the ship’s machinery takes place to maintain the ship and restore it to its original condition (Alhouli, 2011).

Ship maintenance and repair can be completed in two different ways; (1). When maintenance is done in the ship repair at the time she (the ship) is due for drydocking to survey the underwater parts and undergo classification survey (Ahouli, 2011). (2). When maintenance are conducted during the ship’s day-to-day operations. The figure 3: below illustrates it (Ahouli, 2011).
Basically, ship conversion services have both direct and indirect substantial impacts on the shipowners and the environment. Arguably, Ship conversion services are currently increasing and are driven by a variety of factors, such as economic, social and environmental.

Undoubtedly, shipowners are trying very hard and fervently to overcome the high newbuild prices and long delivery times associating with the acquisition of newbuilds in the shipbuilding Industry (Danny,S, & Özgur,U.S, 2008). It is also more economically feasible to adapt the existing vessels for different roles, as a relatively short time required for conversion a bulk carrier as compared to its newbuilding lead time of up to four years (Danny,S, & Özgur,U.S, 2008).

Socially, under the “normal” times shipowners may elect to undertake a conversion in order to facilitate the entry of the vessels in a different market niche. That is, the prime objective is to lengthening a tanker so as to increase its capacity. Such decisions are generally opportunistic and impossible to predict (Danny,S, & Özgur,U.S, 2008).

Ships are also obliged to undertake conversion on their physical structure when in service to comply with the changing environmental regulations and business requirements. Ship conversion makes them to continue to be useful in the long run in their transportation trade than their intended purpose they were built for. For example, the conversion of single hull tankers (which are largely due to be forced out of service in 2010 by International Maritime Organisation regulation) enable them to operate in the dry bulk trades, where there are fewer environmental concerns with their cargoes, including their enjoyment of high freight rates (Danny,S, & Özgur,U.S, 2008).

Shipowners may convert vessels currently active in lean segments to become usable in other trades that are less affected by the crisis (ECORYS Consulting and Research, 2009). Practically, ship conversion differ significantly from routine ship repair and maintenance because of the complex and high value work that is associated with those conversions (with the commensurate need for higher order facilities and skills) (Danny,S, & Özgur,U.S, 2008).
Ship Maintenance and Repair Cost

Certainly, ship maintenance and repair costs are also a major expense to the shipowners and operators. This is because it is one of the most important factors that shipowners and operators must consider in their choice of the drydock, based on the efficiency of such drydock.

Ship maintenance and repair cost is been defined as “those costs incurred in the organisation, execution, and control of work undertaken for safe operations of the ship (Alhouli, 2011). It is classified into two, namely directly measurable maintenance costs implies work done directly towards the maintenance such as drydocking repair, voyage maintenance repair, irrecoverable damage and spare parts (Alhouli, 2011). Indirectly measurable maintenance costs embrace the maintenance which the crew always use the operator’s time to perform maintenance whilst on board the ship and are considered to be part of the maintenance function (Alhouli, 2011).

The chosen and preferred dry-dock, might have the capacity to render quality ship maintenance and repair services to a given ship within a reasonable period. This, certainly, enhances the ship seaworthiness status and reduces her down-time at the drydock.

Economically, the longer the ship stays at the drydock for repair services the higher are her operational costs. This is because the ship is no longer engaged in any income-earning ventures. Besides, it is the shipowner’s responsibility to fulfil his contractual obligations by paying the crew for still managing the asset.

The operating costs are also classified into five types of directly measurable costs, namely:

Personnel: the costs that are spent on crew are divided between wages and leave, overtime, pensions, crew travel manning expenses, and miscellaneous;

Storing: costs divided into provisions general stores, lubricating oil, and cabin stores;

Maintenance: the costs that cover drydocking repair, voyage repair and other repair, spare gear, and irrecoverable damage;

Insurance

General (Alhouli, 2011).
The figure 4 below shows the percentages of each of the above mentioned various types of maintenance costs (Alhouli, 2011).

Overall, maintenance costs are the largest item in the operating costs and the majority of this cost is controllable.

From the figure 4:
Maintenance has the largest percentage of 40% follow by Personnel, which has 30% as the second larger whereas General has the least percentage of 10% (Alhouli, 2011). Impliededly, effective ship maintenance and repair services guarantee the ship safety, crew and the cargo. It also ensures the ship’s compliance with the Classification Societies’ requirements and available for transportation of cargo from one node to the other node in order to earn freight.

It therefore constitutes the third (3rd ) major expense in the Capital Expenditures (CAPEX ) components due to its accumulative repair costs in the long run effects as the ship is ageing (Boris, 2014 ).

Basically, Capital Expenditures (CAPEX) are long lived investments in goods and real estates, which are normally being depreciated in the financial statements over several years (http://www.mevico.org/D61.pdf). As the ships grow older, the frequency of breakdown automatically increases. This is because they are constantly subjected to the bad weather (storms, high currents and waves) of the oceans and cargo stress during their operations (Alhouli, 2011). Thus ship repair expenses do fluctuate upwards in accordance with its growing age.

Initially, the ship repair expenses are very low, just about 5 – 7 % of the total cost, when a new ship enters into operations (Boris, 2014). But these expenses quickly go up to 15 – 20% and continue to rise up to 25 – 30% or even more as the ageing further deteriorates its physical condition (Boris, 2014).

As a result, shipowners and operators often begin to spend more on maintaining their ships when they (the ships) pass their fourth or fifth special survey (Alhouli, 2011). That is, the ships maintenance and repair costs are usually reasonable during the first year, perhaps run-in the period of the ships (Alhouli, 2011). They (maintenance costs) subsequently decline and start to increase again significantly at mid-life, but show a very sharp increase after 20 years continuously (Alhouli, 2011). Unless an effective extension programme is undertaken (Alhouli, 2011).
There is, therefore, an urgent need to carry out efficient repair services on the ships to minimise these costs before sending them for scrapping.

While modern, computer-based maintenance system saves a lot of labour and material resources (Boris, 2014). The ancient wisdom dictates to the chief engineer to have as many spares as possible onboard (Boris, 2014). But, this is expensive because the economic consideration calls for the minimisation of inventory (Boris, 2014).

Undoubtedly, the impacts of ship maintenance on the economy, safety, social and environment cannot be overemphasised. The table 4: Below summarises the impact of maintenance on the economics of ships operations (Boris, 2014)
ship maintenance and repair, and their impact on ship operations, especially when the M&R management is insufficient.

Table 1. Impact of M&R on economics of ship operations

<table>
<thead>
<tr>
<th>No</th>
<th>M&amp;R Factors</th>
<th>Impact on Economic Results of Ship Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M&amp;R Cost</td>
<td>- actual cost of M&amp;R, that causes reduction of operational profit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- cost of deviation required to deliver a ship to a shipyard outside of the normal area of operation</td>
</tr>
<tr>
<td>2</td>
<td>M&amp;R Duration</td>
<td>- down time as a result of failure or voyage repairs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- non-operational time while in a shipyard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- deviation time for bringing a ship to a remote shipyard</td>
</tr>
<tr>
<td>3</td>
<td>M&amp;R Quality</td>
<td>- ship’s down time due to failures and emergency repairs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- reduced ship’s equipment performance and associated increased operating costs and reduced revenues</td>
</tr>
<tr>
<td>4</td>
<td>Safety</td>
<td>- crew casualties and associated down time and costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- serious occupational injuries and corresponding law suites, legal costs and substantial reward payments</td>
</tr>
<tr>
<td>5</td>
<td>Environmental</td>
<td>- fines and penalties for sea and air pollution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- crew productivity reduction as a result of health problems and job dissatisfaction</td>
</tr>
<tr>
<td>6</td>
<td>Marketing</td>
<td>- possible cargo damages due to ship failures and down time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- late cargo delivery for the same reason and the corresponding penalties and even loss of a customer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- failure down time causing lost opportunity and possibly a loss of a customer</td>
</tr>
</tbody>
</table>
Marine Equipment

Marine Equipment is another sector that plays a crucial role in the ship repair industry. It serves as a source of supply of equipment in the process of shipbuilding, ship repair and conversion. It comprises of so many different actors who distribute a variety of products and perform various services to the ship repair industry (ECORYS Consulting and Research, 2009).

The European Marine Equipment Council (EMEC) defines marine equipment as “all products and services supplied for the building, conversion and maintenance of ships (sea going and inland) (ECORYS Consulting and Research, 2009).” This includes technical services in the field of engineering, installations and commissioning, and ship maintenance (ECORYS Consulting and Research, 2009).

History of the Tema Shipyard

Ghana is located off the West African Coast with a landmass of 238,535 m² and 2,093 kilometres of international land borders (Khadi, 2015). The country is bordered on the North by Burkina Faso, closed off on its Eastern and Western borders by Togo and Ivory Coast respectively (Khadi, 2015).

Historically, Ghana is endowed with a substantial deposit of variety of natural resources. They include Gold, Manganese ore, Bauxite and Diamond (Amponsah-Tawiah & Dartey-Baah, 2011). As a result, Ghana’s economy has been growing steadily as well as its infrastructural development. This is because Ghana’s mineral production generates substantial income and foreign exchange through the exportation of these primary products to the industrialised countries to aid their economic development (Amponsah-Tawiah & Dartey-Baah, 2011).

In 2012, the Country’s economy was ranked 85th in the world (Williams, A.E-B, 2016). In the Economic Community of West African States (ECOWAS)—Sub-Sahara, Ghana is the second largest economy behind Nigeria by attaining 10% of the total GDP of the Sub-region (Williams, A.E-B, 2016).

Interestingly, the year 2007 marks the milestone in the history of the country’s offshore Oil and Gas discovery. Kosmos Energy Limited and Tullow Oil Ghana Limited discovered offshore Oil and Gas in commercial quantities in 2007 at the Western Region of Ghana (Sarpong, 2015). Subsequently, many oil discovery in commercial quantities were made at the same
offshore from the 2007 and expected to continue. These automatically have significant economic implications on the Country’s economic growth following the successful oil production of some of the oilfields in 2010. For instance, the average contribution of oil and gas to the GDP (2010 to 2016) is approximately 5.2% including revenue accruing from the sector over the same period amounted to about US $ 3.45 billion (file:///H:/Imani-Report-Ghana-2.pdf).

However, these growth rates of the Ghana economy are also entirely depending on certain key factors such political stability, demand and supply of oil and gas by the industrialised countries for manufacturing and transportation purposes. Unfortunately, these key factors cannot be discussed here because of the limited scope of this article.

According to the Ghana Statistical Service, Ghana has a population of 24,658,823 people when the 2010 Population and Housing Census was conducted (Ghana Statistical Service, 2012). The figure represents an increase of 30.4 percent over the 2000 census population of 18,912,079 (Ghana Statistical Service, 2012).

Ghana has one main drydock, called the Tema Drydock and Shipbuilding Yard. It also has two principal deep-seaports, namely, Tema port and Takoradi port (SAL Consulting Limited, 2015).

The Port of Takoradi
The Port of Takoradi is located at a cape on the Gulf of Guinea in the present harbour city of about 228km west of Accra, the capital city of Ghana (SAL Consult Limited, 2015). It is the oldest of the two (2) seaports. It was built in 1928 as a commercial port capable of handling all types of cargo, including containerised cargo (SAL Consult Limited, 2015).

The Port of Takoradi has the following existing facilities (SAL Consult Limited, 2015).

Equipment; has both stock of container and general cargo handling equipment, ranging from Top lifters, Forklift Trucks, Cranes, Roll on and Roll off Trailers, Tugboats, Water Barges, Patrol Boat (SAL Consult Limited, 2015).

Berthing Facilities, has many berthing facilities (SAL Consult Limited, 2015).
Storage Facilities; has a total storage capacity of about 129m², consists of both opened and covered storage, including sheds (SAL Consult Limited, 2015).

Vessels Repairs, has a slipway for vessels and crafts up to 300 tonne dead weight and a drydock for vessels up to 30m long with 7.2m breadth (SAL Consult Limited, 2015).

Reefer Point, has (40 reefer points for storing refrigerated containers) and;

Equipment repair workshops and Offices (SAL Consult Limited, 2015).

It is now a hub port for the offshore Oil and Gas platforms, offshore supply vessels and other drilling equipment (SAL Consult Limited, 2015). This is because of the port’s proximity to Ghana ongoing exploration and production of offshore Oil and Gas (SAL Consult Limited, 2015). The port handles about 500 vessels yearly and with a total of 4.3 million tonnes of cargo in 2001 out of the static capacity of 5 million tonnes (SAL Consult Limited, 2015).

The Port of Tema

The Port of Tema is the biggest of the two (2) seaports in Ghana (Khadi, 2015). It was established in 1962 (Khadi, 2015). It lies along the Gulf of Guinea with 18 miles from Accra, the capital of Ghana (Khadi, 2015). The Port of Tema handles 80% of Ghana’s national exports and imports (Khadi, 2015). It serves as a major transit point for goods from and to the three (3) West African landlocked countries (Burkina Faso, Niger and Mali) to the north.

Currently, the Port of Tema is undergoing major dredging and expansion activities to strengthen its capacity to accommodate much bigger vessels when the dredging is completed in 2019 (https://ghanaports.gov.gh/page/15/Our-History-And-Future). Figure 5: below shows the performance of the Tema Port from 2008 to 2017 (https://www.ghanaports.gov.gh/Files/TEMA%20PORT%20PERFORMANCE%2020082017.pdf).
<table>
<thead>
<tr>
<th>YEAR</th>
<th>VESSEL CALL (UNITS)</th>
<th>TOTAL CARGO TRAFFIC</th>
<th>EXPORT</th>
<th>IMPORT</th>
<th>TRANSIT</th>
<th>TRANSHIPMENT</th>
<th>CONTAINER TRAFFIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TONNES</td>
<td>TEUS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>1,568</td>
<td>8,727,049</td>
<td>1,305,451</td>
<td>6,259,412</td>
<td>864,307</td>
<td>195,326</td>
<td>555,009</td>
</tr>
<tr>
<td>2009</td>
<td>1,634</td>
<td>7,406,490</td>
<td>981,075</td>
<td>5,694,280</td>
<td>509,124</td>
<td>192,565</td>
<td>525,694</td>
</tr>
<tr>
<td>2010</td>
<td>1,787</td>
<td>8,696,951</td>
<td>1,154,826</td>
<td>6,823,488</td>
<td>447,071</td>
<td>236,615</td>
<td>590,147</td>
</tr>
<tr>
<td>2011</td>
<td>1667</td>
<td>10,748,943</td>
<td>1,532,139</td>
<td>8,431,531</td>
<td>614,078</td>
<td>171,195</td>
<td>756,899</td>
</tr>
<tr>
<td>2012</td>
<td>1,521</td>
<td>11,468,962</td>
<td>1,477,390</td>
<td>9,383,462</td>
<td>530,457</td>
<td>50,403</td>
<td>824,238</td>
</tr>
<tr>
<td>2013</td>
<td>1,553</td>
<td>12,180,615</td>
<td>1,493,956</td>
<td>10,014,243</td>
<td>620,668</td>
<td>51,748</td>
<td>841,989</td>
</tr>
<tr>
<td>2014</td>
<td>1,504</td>
<td>11,126,355</td>
<td>1,463,273</td>
<td>8,922,550</td>
<td>577,227</td>
<td>163,305</td>
<td>732,382</td>
</tr>
<tr>
<td>2015</td>
<td>1,514</td>
<td>12,145,496</td>
<td>1,303,090</td>
<td>10,043,146</td>
<td>722,508</td>
<td>76,752</td>
<td>782,502</td>
</tr>
<tr>
<td>2016</td>
<td>1,521</td>
<td>13,414,784</td>
<td>1,633,036</td>
<td>10,890,084</td>
<td>862,377</td>
<td>29,287</td>
<td>893,841</td>
</tr>
<tr>
<td>2017</td>
<td>1,557</td>
<td>14,045,787</td>
<td>1,646,253</td>
<td>11,327,502</td>
<td>1,043,771</td>
<td>28,261</td>
<td>956,374</td>
</tr>
</tbody>
</table>

According to the figure 5, the number of vessels call in 2008 increased from 1,568 to 1,787 in 2010. Of all the years, the Tema Port recorded the highest number of vessels call in 2010. Impliedly, there were many Offshore Supply Vessels and merchant fleet calling at the port to do discharging and loading operations. It was mainly attributed to the commencement of Ghana’s first offshore Oil production in the same year (Sarpong, 2015).
These two (2) seaports are managed by Ghana Ports and Harbours Authority (GPHA), which is a statutory Government corporation set up by the Provisional National Defence Council Law 160 or GPHA Act 1986 (SAL Consult Limited, 2015).

The GPHA is responsible for planning, building, managing, maintenance, operating and controlling ports (Authority, G.P Act, 1986). The GPHA, particularly, provides in the ports, the facilities that are necessary for the efficient and proper operation of the ports and among other provisions (Authority, G.P Act, 1986).

**The Tema Drydock and Shipbuilding Yard**

The Tema Drydock and Shipbuilding Yard is located on 48.45 acres of land in the centre of the West Africa sub-region (PSC-Tema-Shipyard-Brochure-Back.pdf-PDF Complete). It is also situated adjacent to the Port of Tema ([https://www.temashipyard.com/about-us](https://www.temashipyard.com/about-us)).

Ghana Government’s main objective of establishing this national asset is to facilitate the development of its maritime industrialisation programme ([http://www.temashipyard.com/about-us/](http://www.temashipyard.com/about-us)). One way of achieving this, is rendering of an improved ship maintenance and repair services and other related functions such as heavy engineering, steel fabrication and shipbuilding ([http://www.temashipyard.com/services/](http://www.temashipyard.com/services/)).

This is to enhance its competitiveness and sustainability among the top three (3) Dry-docks and Shipbuilding Yards in Africa. However, the Tema Shipyard’s maintenance and repair services are facing major challenges, namely unexpanded capacity, obsolete ship repair equipment and inadequate skilled labour.

The Tema Drydock and Shipyard was established in 1965 and is the largest existing Drydock on the African Continent ([https://www.temashipyard.com/about-us](https://www.temashipyard.com/about-us)). It is strategically located between the Cape of Good Hope (i.e South Africa) and the Southern tip of Europe ([https://www.temashipyard.com/about-us](https://www.temashipyard.com/about-us)).

The Tema Shipyard has two (2) graving docks namely, the main Dock 1 and Dock 2 (PSC-Tema-Shipyard-Brochure-Back.pdf-PDF Complete). The main Dock 1 has a dead weight capacity of 100,000 tonnes and total length of 277.4m by 45.7m breadth (PSC-TemaShipyard-Brochure-Back.pdf-PDF Complete).

The Dock 2 has a 10,000 dwt capacity and a length of 106.7m by 13.7m (PSC-Tema-ShipyardBrochure-Back.pdf-PDF Complete).
The Tema Drydock and Shipyard also has a 233m lay berth (PSC-Tema-Shipyard-BrochureBack.pdf-PDF Complete). This lay berth is capable of servicing different types of vessels and other Offshore installations such as Oilrigs and Jack ups, Oil tankers and Barges operating within the Gulf of Guinea including those trading on the Atlantic, Africa - Europe route (PSC-Tema-Shipyard-Brochure-Back.pdf-PDF Complete).

**The Layout of the Tema Shipyard**

Below is the layout of the Tema Shipyard showing the graving docks, workshops and other important service areas.

![Yard Layout](image)

Source: The Chief Executive Officer, Tema Drydock and Shipbuilding Yard

**The Structure of the Tema Drydock and Shipbuilding Yard**

The Tema Shipyard adopted the Vertical Organisational Chart. That is, the hierarchy of the company starts from the highest top to the least bottom of the Shipyard. Therefore, all decision making and communications within the company must follow the same pattern. In other words, all information and communication within the Yard flows from the highest authority to the bottom and vice visa.
The Tema Shipyard is under the jurisdiction of Ministry of Transport. Usually, it is the Chairman, who is the Head of the Governing Board. He is accountable to the President of the Republic of Ghana through the Minister of Transport. According to the Ghana Ports and Harbours Authority Act, 1986, the members of Board shall be appointed by the President in accordance with Article 70 of the Constitution (Authority, G.P. Act, 1986). Following directly under the Chairman, is the Chief Executive Officer, including his nine (9) Departmental heads and heads of the various divisions (http://www.temashipyard.com/about-us/executive-team/). By the end of 2016, the Tema Shipyard had staff strength of 282 (Ministry of Finance, Ghana, 2016).

Below, is the Shipyard’s Organisational Structure.
From the above mentioned, one can identify the three levels of management permeating the Tema Shipyard’s hierarchy of authority.

Top Management of the company consists of owners /shareholders, Board of Directors, its Chairman, Managing Director and the Chief Executive, (http://www.ddegjust.ac.in/studymaterial/mcom/mc-101.pdf). It is the ultimate source of authority and lays down goals, policies and plans for the organisation. It also commits more time to planning and coordinating functions and accountable to the owners of the business of the overall management (http://www.ddegjust.ac.in/studymaterial/mcom/mc-101.pdf).

The Middle Management comprises of heads of functional departments, namely: Purchase Manager, Production Manager, and Financial Controller, divisional and sectional heads working under these Functional Heads (http://www.ddegjust.ac.in/studymaterial/mcom/mc101.pdf).

The Middle Management’s duties are to implement the policies and plans formulated by the top management. It serves as an essential link between the top management and the lower level or operative management. It is responsible to the top management and devotes more time to the organisation and motivation functions of management (http://www.ddegjust.ac.in/studymaterial/mcom/mc-101.pdf).

Last but not the least, the lower level or operative management composes of Superintendents, Foremen, and Supervisors. They are placed at the bottom of the hierarchy of the management (http://www.ddegjust.ac.in/studymaterial/mcom/mc-101.pdf). They perform the actual day-to-day operations and are in direct touch with the rank and file of the workers. They pass on the instructions of the middle management to the workers. However, their authority and responsibility is limited (http://www.ddegjust.ac.in/studymaterial/mcom/mc-101.pdf).

The Process

Basically, Dry docks contain certain types of procedures once they are selected by the ship manager. These processes must be adhered strictly to avoid another damage to the vessel during the preparations of positioning it at the drydock.
The procedures are as follows:

First, ensure that the ship is prepared to enter the drydock without having ballast and cargo carried on board (https://www.marineinsight.com/guideline/dry-dock-types-of-dry-docks-requirements-forhttps://www.marineinsight.com/guideline/dry-dock-types-of-dry-docks-requirements-for-dry-dock/dry-dock/).

Secondly, the movement of the vessel that is entering the floating dock is subjected to the requirements of the docking master and condition of the vessel. The floating dock should be able to move towards immobilised vessels due accident (https://www.marineinsight.com/guideline/dry-dock-types-of-dry-docks-requirements-forhttps://www.marineinsight.com/guideline/dry-dock-types-of-dry-docks-requirements-for-dry-dock/dry-dock/).

Thirdly, when the vessel enters the drydock, it must be moored to the dock to prevent it from total destruction due to the occurrence of an act of God (https://www.marineinsight.com/guideline/dry-dock-types-of-dry-docks-requirements-forhttps://www.marineinsight.com/guideline/dry-dock-types-of-dry-docks-requirements-for-dry-dock/dry-dock/).

Fourthly, the vessel’s crew will be notified beforehand about the trim requirements of the dock they need to maintain by the dock master (https://www.marineinsight.com/guideline/dry-dock-types-of-dry-docks-requirements-forhttps://www.marineinsight.com/guideline/dry-dock-types-of-dry-docks-requirements-for-dry-dock/dry-dock/).

Fifthly, it is the responsibility of the dock master to authorise the pumping out of the water from the dock to slowly let the vessel to sit on the keels block (https://www.marineinsight.com/guideline/dry-dock-types-of-dry-docks-requirements-forhttps://www.marineinsight.com/guideline/dry-dock-types-of-dry-docks-requirements-for-dry-dock/dry-dock/).
Once, the vessel is properly sits on the dock, the cleaning and repair process stars (https://www.marineinsight.com/guideline/dry-dock-types-öf-dry-docks-requirements-forhttps://www.marineinsight.com/guideline/dry-dock-types-öf-dry-docks-requirements-for-dry-dock/dry-dock/).

The table 5: below illustrates the Main Ship Dock Systems.

It clearly shows the basic specifications of dock systems, including their operation possibilities in both repair and new construction (Danny, S. & Ozgur, U.S, 2008).

<table>
<thead>
<tr>
<th>Operational possibilities</th>
<th>Slipway System</th>
<th>Shiplift/Lift Dock System</th>
<th>Floating Dock</th>
<th>Graving (Dry) Dock</th>
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</thead>
<tbody>
<tr>
<td>Docking times</td>
<td>Approx. 1 hour</td>
<td>Approx. 30-45 min.</td>
<td>Approx. 1.5-2 hrs</td>
<td>Standard 6-10 hrs</td>
</tr>
<tr>
<td>Operation</td>
<td>Skilled personnel needed</td>
<td>Skilled personnel needed</td>
<td>Skilled personnel needed</td>
<td>Simple operation</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Significant Breakdown of rails after long period of corrosion. Servicing of winches</td>
<td>Minor Limited corrosion of platform as submerged only during docking</td>
<td>Considerable Protection of the steel structure against corrosion is necessary</td>
<td>Minor Locking gates, pumps etc.</td>
</tr>
<tr>
<td>Service Life</td>
<td>10-15 years</td>
<td>25 years</td>
<td>15-20 years (if well serviced)</td>
<td>30 years</td>
</tr>
</tbody>
</table>
The Services of the Tema Drydock and Shipyard

Generally, the Tema Shipyards renders a variety of services to different types of ships which require maintenance or repair services. It also renders other relevant services to vessels at the dry-dock. These services are carried out by a combined team of professionals, namely, yard engineers, welders, painters, technicians, electricians, firefighting personnel, etc. They use the various types of ship repair equipment to perform ship repairs (PSC-Tema-Shipyard-Brochure-Back.pdf-PDF Complete). The services are as follows:

Ship repairs, Shipbuilding, Dry-docking to heavy steel fabrication;


The Tema Shipyards’ Facilities

The following are the facilities:

1. Preservation ship

Blasting facilities

High Pressure water jet cleaning Equipment

Preservation equipment

Airless spraying Equipment

2. Production Ship

Flanging machinery

Rolling machinery

Mild steel plate cutting machinery

500 tonnes Gap Press

10 tonnes COT- Crane- 29

300 tonnes Hydraulic ship Frame Bending Machine, etc.

3. Assembling Shop

2 bags with 30 and 20 tonnes EOT- Crane
Radial Drilling Machine

Facilities for Prefabrication of all types of section

4. General Engineering

Lathes

Shipping machine

Drilling Machine

Universal Milling Machine
The SWOT Analysis of the Tema Drydock and Shipbuilding Yard

The Strengths, Weaknesses, Opportunities and Threats – SWOT Analysis of the Tema Shipyard

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<th>Opportunities</th>
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The ongoing exploration and production of Ghana’s Offshore Oil and Gas Potential in influencing the development of the other local and international steel industries

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Africans’ expectant economic emergence after Asia

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**Proximity to Shipbuilding Countries and Shipping Routes**

As the largest Drydock on the African Continent, it has a comparative advantage in terms of availability of copious space for further expansion and upgrading to accommodate many bigger ships in the future.

The Tema Drydock and Shipyard is strategically located between the Cape Good Hope (South Africa) and Southern tip of Europe (https://www.temashipyard.com/about-us). Over the past years, there have been shipbuilding and ship repair activities taking place in these countries (ECORYS Consulting and Research, 2009). The figure 8: below shows the top four (4) Europe countries (Malta, Greece, United Kingdom and Portugal) with relatively more turnover from ship repair than the new building (ECORYS Consulting and Research, 2009). Figure 7: the top four ship repair European Countries
They have a geographical location advantage. They are located along major shipping routes (ECORYS Consulting and Research, 2009) As a result, their ship repair industry is efficiently accessible by their customers (ECORYS Consulting and Research, 2009).

So, the Tema Drydock and Shipbuilding Yard strategic location makes it a hub to service the Offshore Oil and Gas installations, namely, Oilrigs and jack ups, Oil tankers and Barges operating within the Gulf of Guinea. It also enables it to receive and render ship repair services to other vessels trading on Atlantic, Africa – Europe route (PSC-Tema-ShipyardBrochure-Back.pdf-PDF Complete).

Availability of workforce

Overall, a country that focuses on the development of human resources determines the pace at which its economy also develops. Human resource is the third factor of production (Bellefontaine, 2017). It encompasses knowledge base, the acquired skills, productive capacity (productivity) and quality of service (Bellefontaine, 2017). Thus, human resource and their effective management will determine the ability of a company to adapt to meet the changing demands (Bellefontaine, 2017).

Arguably, the ability of the Tema Shipyard to focus on well-trained and developed human resources will be an asset to it. Hence, these properly- educated and trained professionals would have the capability to identify and analyse developmental issues efficiently in their fields of work. Therefore, they will be able to contribute selfishlessly and immensely to make
the ship repair industry in the Tema Drydock competitive. That is, developing the human resource will enhance the reputation and marketability of the people employed (Bellefontaine, 2017).

A case in point is China’s growing number of lower cost skilled workforce that it employed to facilitate the development of its shipbuilding and ship repair industry as compared to Europe’s higher cost of skilled labour (Jonkers, 2003). Comparatively, China has the cheapest skilled labour in Asia and Europe in shipbuilding and ship repair Industry (ECORYS Consulting and Research, 2009).

**Government’s tax incentives and conducive investment environment**

Basically, tax incentives are deliberate special tools and a package of developmental strategies design by a country to attract foreign direct investment of a specific firm into that country. Such a firm will be given a tax holiday or tax exemption in a particular sector within a period of time (Chai & Goyal, 2008).

Jingqing Chai and Rishi Goyal define tax incentives as “preferential treatment for certain types of firms or entities – are common place in developed as well as developing countries (Chai & Goyal, 2008)”. Usually, these concessions are granted to promote investment and may be termed “tax incentives or investment incentives”, or to achieve defined social objectives (Chai & Goyal, 2008). For instance, corporate income tax (CIT) for five to ten years may be granted to firms that export goods and services or that locate in a designated area or region (Chai & Goyal, 2008).

The granting of tax concessions has its own demerits and merits in achieving the defined objectives. It becomes a disadvantage, if a country is granted increasingly generous concessions, by extending the duration of the tax holidays (Chai & Goyal, 2008). In this case, it becomes a very costly tool to promote investment (Chai & Goyal, 2008). Impliedly, the firm will no longer pay anything in the form of revenue to the host country in the extended time period.

It also becomes evidently merit, when a country attracts investment by building genuine economic advantages and a conducive investment environment (Chai & Goyal, 2008). This includes, a stable, low, and transparent tax policy rather than by simply offering incentives
(Chai & Goyal, 2008). Thus, the aforementioned issues constitute the strengths of the Tema Shipyard.

**Weaknesses:**

**Access to Skilled Labour**

The Tema Shipyard is continually grappling with inadequate availability of skilled labour. Especially, it faces an unsurmountable challenge of how to retain the few ones to make it competitive in the ship repair industry. The inaccessibility to the properly educated skilled labour is characterised with a limited or non-attractiveness to the manufacturing professions. This actually poses a serious threat to the entire Shipyard’s development (ECORYS Consulting and Research, 2009). These make it difficult for the Tema Shipyard to obtain its shipbuilding and ship repair capability (ECORYS Consulting and Research, 2009).

Therefore, the shipyard lacks a reasonable number of skilled and specialised labour to help carry out efficient ship repair services. This increases the downtime of ships undertaking maintenance services at the drydock with its high costs of operation. It simply makes the Tema Drydock somehow not attractive to ships which require repair services.

**Access to finance**

The second weakness is the extreme difficulty in accessing financing schemes in the post 2008 economic and financial crisis (ECORYS Consulting and Research, 2009). This is because, the balance portfolio of some banks are negatively affected. So, most of the banks are reluctant in issuing loans to even the reputable (i.e shipping companies with strong financial statement) shipping companies in the maritime industry due to fear of bankruptcy (ECORYS Consulting and Research, 2009).

Although Government of Ghana has already taken measures to alleviate this, by taking over the 100% share of the Drydock (Yawson, 2017). One, however, cannot predict whether the Government’s unilateral intervention is sustainable for the Drydock on the long term effect basis or not. The shipyard needs a heavy financial investment to bring it up to a certain acceptable standard whilst it continues looking for a committed credible investor to partner with (Ministry of Finance Ghana, 2016).
Presently, other Asian competing countries are doing the same in a more aggressive manner (ECORYS Consulting and Research, 2009). They tend to have more financial reserves and ‘longer breadth’ to survive the crisis (ECORYS Consulting and Research, 2009). For instance, China has a sustainable financial support and a strategic policy aims at integrating its ship repair industry, marine equipment, shipping companies to enhance competitiveness in the maritime Industry (ECORYS Consulting and Research, 2009).

**Threats**

**Competitors moving up the Ladder**

Undoubtedly, there is stiffest competition among the various players (ship repair centre) in the ship repair Industry. This can be attributed to the constant increases in the estimated annual turnover and costs of skill labour. Of all the emerging countries (i.e Dubai, Bahrain and Sri Lanka), Singapore has gained a share of approximately 20% of the global market (ECORYS Consulting and Research, 2009). Overall, Singapore benefits most from its geographic position along the major east-west routes (ECORYS Consulting and Research, 2009).

However, the position of Europe in the ship repair Industry is relatively strong (ECORYS Consulting and Research, 2009). In 2007, Europe made a total turnover of £3.5 billion in the ship repair industry (ECORYS Consulting and Research, 2009). “Compared to the estimated size of the world repair market, this represents a share of some 35% (ECORYS Consulting and Research, 2009)” But, Europe could not hold on to this position for a longer time and permanently. It subsequently lost it to China and Vietnam due to labour intensity of the repair industry (ECORYS Consulting and Research, 2009). This occurred, as a result of a shift to lower cost labour counties like China and Vietnam (ECORYS Consulting and Research, 2009).

**Loss of welding and engineering talents to other Countries**

Another threat to the Tema Shipyard in the ship repair industry is the loss of welding and engineering talents to other countries. Most often, the highly skilled labour preferred migrating from their own countries to work in other countries. This is because there is an improved condition of service in such countries. For instance, in 2005 and 2007, Romania lost about 2,000 skilled workforce per year due to the need for skilled workforce in West-Europe Countries and United States of America (ECORYS Consulting and Research, 2009).
The main reason was centred on higher wages in Western Europe and United States of America (ECORYS Consulting and Research, 2009). An average labour cost in the shipbuilding sector is Euro 30,000 per employee in 2006 for the European 27 Countries (EU-27) (ECORYS Consulting and Research, 2009). The development of the average labour costs between 2000 to 2004 for the EU-25 and EU-27 (as from 2004) is shown in the figure below (ECORYS Consulting and Research, 2009).

The figure 8: shows the development in labour costs per employee in EU-25 (2000 – 2004) and EU-27 (2004 – 2006)

From the figure 8: it has become clear that labour costs in the EU-27 have been risen in this period but remain substantially lower in the new EU members Romania and Bulgaria (ECORYS Consulting and Research, 2009).

Asia has many strong differences in wage costs between its main shipbuilding countries (ECORYS Consulting and Research, 2009). For instance, the Chinese labour cost is US$ 2 / day which is substantially lower than the labour cost in South Korea at US $ 19 / day or Japan US $ 25 / day (ECORYS Consulting and Research, 2009).

Figure 9: illustrates the labour cost development 2000 – 2006 in South-Korea in Euro and South-Korean Won (Labour cost per employee per year) (ECORYS Consulting and Research, 2009).
According to the figure 9: it becomes apparent that the highest labour cost in South-Korea is about Euro 27,000, far lower than the labour cost in Europe (ECORYS Consulting and Research, 2009).

Admittedly, the figures of Europe and Asia do accurately differ from each other that is, they do not have the same data source. They evidently aim at giving a good approximation of the differences between Europe and Asia (ECORYS Consulting and Research, 2009).

Also, the three main Asia’s shipbuilding and ship repair countries, with the exception of China (Japan, South Korea and China) are gradually shifting to high wage segment. The Japan and South Korea’s wage levels are close to the European’s wage level (ECORYS Consulting and Research, 2009).

The Tema Drydock and Shipyard has not even taken any significant capacity expansion, procurement of state-of-the-art ship repair equipment and comprehensive labour costs policies as compared to the above mentioned Countries. These situations make the Tema Drydock not competitive in the ship repair Industry.

It is arguably that the growth of the African economy, particularly, the Ghanaian economy, is unstable. It has always been characterised by somehow substantial unsustainable economic growth rates and severe recessions. This development has huge negative trickle-down effects on the education and employment of skilled labour. This is because, there is going to be
insufficient finance to invest in educating the skilled labour as well as creating a gainful employment for the available inadequate skilled labour.

As a result, the high level of informal employment in Ghana and many African countries could be traced to the low level of education (Alagidede, et al, 2013). Available data indicates that 28.5% of the 15.2 million working age population in 2010 had formal education (Alagidede, et al, 2013). While 48% had basic education, only 3% have had university education (Alagidede, et al, 2013). Since many decades, Ghana’s economy has been undergoing economic structural transformations for stable economic growth (Williams, A.E-B, 2016).

The economic growth bounced back to hit a peak of 15 percent growth rate in 2011 (Williams, A.E-B, 2016). It is largely due to commercial oil production and export growth for the first time in the country’s history (Williams, A.E-B, 2016). However, it took a nose-dive, subsequently to 7.6%, recording the lowest annual growth in four years in 2013 (Williams, A.E-B, 2016). On average, the Ghanaian economy grew annually by 5.8 percent compared to 3.7 percent in Sub-Saharan Africa (SSA) in 13 of the years between 1991 and 2013 (Williams, A.E-B, 2016). The performance of Ghana’s economy in terms of growth has been quite strong and robust (Williams, A.E-B, 2016). However, the major concern is that the growth has been largely driven by the extractive sub-sector with limited job creation impact (Williams, A.E-B, 2016). The agriculture and manufacturing sectors continue to record slower growth (Williams, A. E-B, 2016).

In summary, these developments usually create low wage levels in the ship maintenance and repair industry in the Tema Shipyard. Thus, the few skilled labour are being compelled to migrate to the stable developed economies (i.e, United States of America, Europe and Asia) to seek work with better wage.

Opportunities

Ongoing exploration and production of Ghana’s Offshore Oil and Gas

On the other hand, there exist the opportunities that can turn around the fortunes of the Tema Drydock. This will enable it (Tema Drydock) to contribute properly and efficiently to the country’s economic developmental agenda. The discovery of Ghana’s offshore oil and gas is one of the opportunities.
In 2007, Kosmos Energy Limited and Tullow Ghana Limited discovered oil in commercial quantities at the offshore waters, Western Region, Ghana (Sarpong, 2015). In 2010, Ghana’s first oil production commenced from the biggest offshore oil reserved field, known as the Jubilee Field (http://openoil.net/wp/wp-content/uploads/2012/08/Ghaha-Almanac-PDF.pdf). The field is estimated to hold up to 1.8 billion barrels of light, sweet crude oil (Sarpong, 2015). It followed a successful completion of installation / mooring of Floating Production Storage Offload (FPSO) and other relevant offshore platforms. These ongoing oil discoveries and production led to cargoes merchant vessels calling at the country’s two (2) seaports for discharging and loading operations. The figure 10: below, shows an increased number of vessel calls at the Takoradi Port (Tema and Takoradi PORT PERFORMANCE 2003 2016-1.pdf – PDF Complete).

According to the figure 10; above, the two ports recorded the highest total vessel traffic in 2011. This could be attributed to the commencement of the Ghana’s first oil production in the Western Region, Ghana. In 2007, Kosmos Energy Limited and Tullow Oil Ghana Limited discovered offshore oil in commercial quantities in the Western Region, Ghana (Sarpong, 2015). In 2010, the country started its first offshore oil production in one of the oilfields, known as the Jubilee Field (Sarpong, 2015).
Overall, there is steady increase in the total vessel traffic in the two (2) seaports, starting from 2003 to 2016. This is likely to increase the number of vessels that may need to undergo repair services at the Tema Drydock. This is because, most of these vessels and other merchant vessels involved in the ongoing offshore oil production campaign in Ghana, are required to undergo their mandatory inspections as stated in the requirements of the International Association of Classification Societies. In the long run, both seaports will probably not have enough berthing space to accommodate the increasing number of vessel traffic in decades to come as the current energy system is largely dependent on fossil fuels (https://www.oecd.org/greengrowth/greening-energy/49157219.pdf). Presently, the world economy is projected to use 80% more energy than it previously used (https://www.oecd.org/greengrowth/greening-energy/49157219.pdf).

As a result, more oil discovery is expected following continue increase in exploration and drilling activities by the Oil drilling companies in Ghana. For instance, the Offshore Cape Three Points joint venture is made up of Eni Ghana Exploration and Production Limited, operator of the block holding 47.222% participating interest, Vitol Upstream Ghana Limited, holding 37.77% participating interest and Ghana National Petroleum Corporation, holding 15% participating interest made three non-associated gas discoveries. They are as follows: Sankofa main in 2009, Gye Nyamy in 2011 and Sankofa East in 2012 (Eni, 2015).

In addition, the increased in maritime activities (i.e. shipbuilding, ship repair, shipping, export and import cargo and commodities) are also anticipated due to population and economic growth (https://www.oecd.org/greengrowth/greening-energy/49157219.pdf). This is because the world faces twin challenges: expanding the economic opportunities for a growing global population; and addressing environmental pressures that, if left unaddressed could undermine our ability to seize these opportunities (https://www.oecd.org/greengrowth/greening-energy/49157219.pdf).

In connection with these developments, a proposal has been made to construct a third port, dedicated to Oil and Gas service. The Environmental Study Impact Assessment (ESIA) has been conducted and approved of the construction of the alternative Port in the near future (SAL Consult Limited, 2015). It will receive all the Oil and Gas platforms and vessels. This
option is considered appropriate for the medium to long term development beyond ten (10) years as the port requirements expand (SAL Consult Limited, 2015).

These trends of developments automatically create high demand for ship repair market on the African Continent, especially Ghana. Certainly, the country is expected to host an increased number of vessels and offshore oil and gas platforms due to the ongoing oil production. Economically, majority of these vessels and platforms will prefer to do their repair services at the nearest drydock, the Tema Drydock provided it is efficient and capable of minimising operational costs. Arguably, it will be very expensive spending huge sums of money in bunker to tow a fixed drilling rig too far off Asia for the same quality of repair services.

With the backing up of a domestic input, the Tema Shipyard has been carrying out ship repair services on few number of vessels, including offshore oil and gas platforms. The Government quickly enacted and implemented the legal legislative instrument, known as the Local Content (The LI 2204) to regulate the oil and gas Sector in Ghana (Sarpong, 2015). This obviously has short, medium and long run impacts on the Tema Shipyard’s operations. Hence, the LI2204 primarily aims at revenue mobilisation for the Ghana Government, share of indigenous participation and transfer of technology within the Ghana’s offshore oil and gas industry (Sarpong, 2015).

**Potential in influencing the development of the other local and international steel industries**

The Tema Shipyard has the potential of contributing to the development of the national and international steel industries through the provision of steel from ship breaking. It has been estimated that ninety-five percent (95%) of the scrapped vessels weight is steel (http://dione.lib.unipi.gr/xmlui/bitstream/handle/unipi/4633/Gerostergiou.pdf?sequence=2). However, Ghana has not yet ratified some of the International Maritime Organisation’s Conventions for the establishment of ship recycling facility to handle ship scrapping (Durak, 2014). For instance, The 2009 Hong Kong International Convention mandates member states to make their own National Laws for the establishment of ship recycling facility to handle ship scrapping (Durak, 2014). It is this facility which will have the power and authority to undertake the demolition of over aged ships in Ghana (Durak, 2014).
Africans’ expectant economic emergence after Asia visa-vis the shipbuilding and ship maintenance & repair industry

Africans’ economic growth is just underway. The Continent has abundant natural resources, namely: Coal, oil and gas (Smart Comp Research, 2013). It also has one of the fastest growing human resources in the world. According to the United Nations, the world’s population numbered nearly 7.6 billion people as of mid-2017, implying that the world has added approximately one billion inhabitants over the last twelve (12) years (United Nations, 2017). Out of this number, Asia has the largest percentage of sixty per cent (4.5 billion) people whereas Africa has the second largest of seventeen per cent (1.3 billion) people (United Nations, 2017). It has also been estimated that more than half of the anticipated growth in global population, between now and 2050 is expected to occur in Africa (United Nations, 2017). Thus, looking beyond 2050, Africa will be the main contributor to global population growth (United Nations, 2017).

Impliedly, Africa needs to take certain pragmatic measures that will improve on its socioeconomic policies to facilitate its economic emergence and be able to minimise some of the insecurities associated with high population growth. That is, the continent ought to invest significant resources in expanding its drydock capacity, state-of-the-art ship repair equipment and skilled labour in order to maximise revenue and create employment for the growing number of unemployed youth.

It also needs advanced technology, effective legislations and political stability devoid of civil wars to ensure a conducive environment for development to take off. Certainly, Africa will also develop and overtake Asia, just as Asia did to Europe (ECORYS Consulting and Research, 2009).

However, the advanced technology, effective legislations and political instability will be analysed in my next articles in the near future.

The African continent is not totally immuned from the depression and growth of the world economy. Its economy has direct and indirect correlation with the behaviour of the world economy. If the world economy faces growing difficulties, it automatically slows down the economic growth of the African Continent.
For instance, the regional and global shocks in 2016 slowed the pace of growth in Africa, the signs of recovery were already manifest in 2017 (Group, A.D, 2018). The real output growth estimated to have increased to 3.6 percent in 2017, up from 2.2 percent in 2016 (Group, A.D, 2018). This real output growth is expected to accelerate to 4.1 percent in 2018 and 2019 (Group, A, D, 2018). Indicatively, this is a form of steady growth which is expected to attain its momentum at the right time.

Obviously, there is a significant difference in growth rate across African countries economies (Group, A. D, 2018). There are some African countries whose economies are doing remarkably well whereas others encounter tepid growth (Group, A.D, 2018). Especially, the non-resource-intensive economies are showing Africa’s resilience economy, whilst the structural reforms, sound macroeconomic conditions and buoyant domestic demand are sustaining the growth momentum in resource-intensive economies (Group, A.D, 2018).

These will make Africa competitive and attractive to much high foreign direct investment in its industrialised economy. Particularly, shipbuilding and ship repair industry may begin to attract most foreign direct investment. Just as today, we are witnessing unprecedented increased activities in the ports capacity expansion and infrastructural upgrading in Ghana’s two seaports (SAL Consult Limited, 2015). Already, some African countries domestic resource mobilisation now exceeds that of some Asia and Latin American countries at similar levels of development (Group, A.D, 2018). This is due to introduction of economic fundamentals and resilience to shocks improved measures in a number of African countries’ economies (Group, A.D, 2018). However, it is not sufficient to meet the high level of financing to scale up infrastructure and human capital (Group, A.D, 2018).

Despite, the Tema shipyard stands the chance of benefiting immensely from these huge opportunities because, there is an evident systematic demand shift for shipping operations and management from Asia to Africa. There are huge investments in ongoing expansion projects on some of Africans’ existing ports infrastructures including, construction of new ports in Africa (Smart Comp Research, 2013).

For the past years, the world witnessed a demand shift for shipping operations and management from Europe to Asia due to economic growth (ECORYS Consulting and Research, 2009). For instance, Europe’s market share in shipbuilding in terms of volume has declined over the years
Europe only succeeded in retaining a position by building more complex ships with a relatively higher value added, whilst the production of mass standard ships moved to other lower labour cost countries especially in Asia (ECORYS Consulting and Research, 2009). As a result, China is enjoying steady economic growth and now a leading dominance in the shipbuilding and ship repair industry (ECORYS Consulting and Research, 2009).

The major challenges:

Lack of capacity of the Tema Dry-dock and Shipyard

The Tema Drydock and Shipyard has not undertaken any expansion and dredging projects to be able to accommodate bigger vessels so as to service these ships. Given that, there is a growing demand for bigger ships due to the economies of scale (Kavussanos and Visvikis, 2016).

Both Shipowners and Operators prefer to acquire and deploy bigger vessels to carry a high volume of goods with a less operation unit cost over long distance – from one node to the other node within the world. This trend (i.e demand for bigger size ships) is directly and indirectly affecting the capacity of the Tema Drydock. This is because such vessels cannot access and undertake any ship repair services at the Tema Drydock, especially, when the Ghana Maritime Authority (Port State Control) authorises such vessels to do so after its mandatory inspection during their (vessels) port call for cargo operations. Specifically, the International Convention for the Safety of Life at Sea 1974 as amended (SOLA 1974 as amended), mandates Contracting Governments to inspect ships of other Contracting States if there are clear grounds for believing that the ships and their equipment do not substantially comply with the requirements of the Convention (https://maredu.gunet.gr/modules/document/file.php/MAK265/Dissertations%20in%20English/IMO%20CONVENTIONS%2020%26%20CODES.pdf).

Admittedly, the application of modern technological developments to ships construction is game changer. The technological advancement has impacted a drastic increment in vessels sizes whilst reducing transportation cost (United Nations Conference on Trade and Development, 2018). For instance, ore transportation costs between Brazil and China are estimated to have reduced by 20 to 25 percent as compared to “traditional” Capesize vessels
Today, the maximum ship sizes in the containerships have increased to about 21,000 Twenty Equivalent Units (TEUs) (United Nations Conference on Trade and Development, 2018). Such vessel is currently employed in the Far East to Europe trade (United Nations Conference on Trade and Development, 2018).

The Tema Dry-dock is the largest Shipyard and Dry-dock on the African Continent (https://www.temashipyard.com/about-us). However, it has not experienced any kind of significant infrastructural development projects such as widening, deepening and increasing the number of the graving docks and lay berth respectively. This unable it to accommodate the equally fast-changing generation ships sizes, with high draughts, including a growing number of the world merchant fleet. In the long run, these vessels may need its services in the near future.

In 2017, the total of the world merchant fleet stood at 93,100 ships with a 1.86 billion dwt (United Nations Conference on Trade and Development, 2018). This compares to a fleet of 1.28 billion dwt in 2010, 800million dwt in 2000, 680 million dwt in 1980 and 320 million dwt in 1970 (United Nations Conference on Trade and Development, 2018). Explicitly, the 1970s and the two (2) new millennium (i.e the 2010 and 2017) were the decades with the highest fleet (United Nations Conference on Trade and Development, 2018). It was characterised by overcapacity with its consequences of downward pressure on the freight rates (United Nations Conference on Trade and Development, 2018).

**Obsolete Ship Maintenance Equipment**

Today’s technological advancement in ships construction in relation to their sizes, shapes, engines, deadweight-tonnes, have significantly affected the 1970s made ships maintenance equipment. As a result, various Dry-docks around the world have tried to install the state-of-the-art- (advanced technology) ship maintenance equipment to efficiently handle the shipbuilding, repair services and others.

The Dormac Pty Limited, the major player in the ship repair industry in Durban, South Africa, has successfully introduced a unique Cofferdam System to perform any underwater repair
works involving damage of the ship’s thrusters, rudders and any part of the hull (file:///H:/Cofferdam%20Repairs%20_%20Dormac%20Marine%20Engineering.html). The Cofferdam System can repair a ship without it entering a drydock and floating dock (file:///H:/Cofferdam%20Repairs%20_%20Dormac%20Marine%20Engineering.html). It has become one of the best ship repair technological equipment in the ship repair Industry. Presently, shipowners and operators preferred the use of the cofferdam system to do the repairs of their ships due to its cost saving effects which permit simultaneous ongoing loading and discharging operations of their ships’ cargo whilst repairs are carried out (file:///H:/Cofferdam%20Repairs%20_%20Dormac%20Marine%20Engineering.html).

However, the ship maintenance equipment in the Tema Shipyard seems to be obsolete. These equipment, which were installed in the Shipyard for the past four decades, had not yet been replaced with the modern types of advanced technological equipment. They are simply absolutely obsolete and inefficient. They are unable to carry out ship repair services effectively. To buttress this point, the current Chief Executive Officer (CEO) Captain Francis Kwesi Micah said that, “the facility has since its inception in 1965 not seen any appreciable development and / or maintenance and is saddled with obsolete equipment, both at the docks and the workshops.”

It still, relies wholly on the outdated technological equipment to repair today’s modern ships as captured in its facilities list (PSC-Tema-Shipyard Brochure-Back pdf-PDF Complete), comparatively, the Dormac Pty Limited have acquired the latest, 2016 built 8500 tonnes advanced technological floating dock with capacity to accommodate 155M Length Overall (LOA) and 24.5M Beam (http://www.dormac.net/dormac-dock-1/). It is equipped with the latest energy-efficient technology and a computerised levelling system, including two brand new 16m 7.5-tonnes cranes as compared to the typical 5-tonne cranes (http://www.dormac.net/dormac-dock-1/). This Dormac Dock 1 will be able to accommodate a greater volume of clients’ vessels and at the same time uses the existing Panamax docking facilities in the Durban Port, South Africa (http://www.dormac.net/dormac-dock-1/).

These obsolete ship maintenance equipment rather turn out to make the vessels downtime at the Drydock longer and costly. The delay in completing repair services of a given ship within suitable time period, does affect the shipowner. Shipowners and operators whose ships delay
during repair services do end up losing new contracts from other customers. As a result, the drydock does not generate the necessary maximum revenue for the country’s developmental agenda. It is simply underutilised and not competitive in the ship maintenance or repair industry.

In 2016, the Tema Drydock only managed to repair very few vessels (Ministry of Finance Ghana, 2016). The details of the vessel types are as follows: Tugboat 5; Offshore Supply Vessels 3; Oil tanker 6; Barge 2; Cargo 2; Dredger 1; and Jack up 2 (Ministry of Finance Ghana, 2016).

Undoubtedly, the aforementioned statistics of the repaired vessels really reflected the obsolete and inefficient nature of the ship maintenance equipment in the drydock. Especially, the number of Offshore Supply Vessels (OSV) and Jack up repaired within the year was too small. According to the Chief Executive Officer, Captain Francis Kwesi Micah, between 2000 and 2015, there were one hundred and twenty (120) offshore Oil and Gas rigs towed annually from West Africa Oilfields to external serviced facilities, particularly in Singapore and East Asia.

**Lack of Trained Professionals / Manpower Resource**

The Tema Drydock is also grappling with inadequate supply of skilled labour. This is largely attributed to availability of insufficient finance to invest in skill development and training of a few qualified professionals. In short, the drydock has been suffering from financial crisis and cannot meet all the training expenses of its personnel. It seems to be in a serious debt and its sustainability is in doubt. The Drydock’s skill labour is not efficient and unable to generate enough revenue from its ship repair services.

There is lack of properly-educated skilled labour in the ship repair Industry because globally, the Ship maintenance Industry is facing absolute shortage of Master of Science degree and Bachelor of Science degree students in the ship repair industry (ECORYS Consulting and Research, 2009). This is because, the national education system does not provide sufficient qualified people (ECORYS Consulting and Research, 2009).

Besides, the ship repair industry is highly competitive and prevailing market scenarios are connected to factors, namely, the time charter and freight earnings.
This is because these factors (the time charter and freight earnings) are being used to set the lay-up time for repairs completion.

In 2016, the Tema Deydock and Shipyard made a net profit of fifty-five million Ghana Cedis (GHS 55m) after recovering from a net loss position in 2014 and 2015 (Ministry of Finance, Ghana, 2016). However, the company is facing the growing levels of debt and gearing ratios issues (Ministry of Finance, Ghana, 2016). Thus, the equity finance seems to be inadequate to sustain it in the industry (Ministry of Finance, Ghana, 2016).

Again, factors such as, labour legislation, conditions of service and skill development in the country (Ghana) also have a substantial negative impact on the Tema Drydock. A case in point is the recent incidence that led to the termination of the contract between the Government of Ghana and the Malaysian investors (Yawson, 2017).

This incidence occurred when the Malaysian investors failed to inject the required working capital to revamp the drydock in accordance with the (provisions) terms and conditions of the contract (Yawson, 2017). The Malaysian investors fragrantly breached the Sales and Purchases Agreement (S.P.A.) and Joint Venture Agreement with the Government of Ghana (Yawson, 2017). The Malaysian investors disposed of some shares to a third party, the Boustead Heavy Industries Corporation in 2007 without a reference to the Government of Ghana (GoG) (Yawson, 2017). This led to workers agitation against the Malaysian administration on allegations of corruption and violation of labour rights (Yawson, 2017). It resulted in GoG, finally terminated the contract and took over 100% share and management of the facility (Yawson, 2017).

**Opportunities in Ship Maintenance and Repair Services in Ghana**

The sustainable growing market of the ship repair industry is directly and indirectly tied up to the prospects of the African offshore oil and gas industry. Africa is said to have considerable prospects of the world’s deep water hydrocarbons. It has a share of 13% of the world’s daily production as stated by the Tema Shipyards’s Chief Executive Officer (CEO) Captain Francis
Kwesi Micah. The Tema Shipyard’s CEO, statistically, Africa requires the employment of about 12% of the world’s fleet due to the recent growth in exploration and production of Oil and Gas off the Coast of West African.

Recently, few of African countries have made series of offshore oil and gas discoveries at their Exclusive Economic Zones (EEZs). These developments have led to the high level of activity off the Coast of West Africa with one of the largest Oil proven reserves found off the Coast of Angola (Jonkers, 2003).

In 2007, Kosmos Energy Limited and Tullow Oil Ghana Limited discovered oil in commercial quantities in the Western Region of Ghana (Sarpong 2015). These African oil producing countries have now continuously experiencing an unprecedented increased call of offshore oil and gas platforms and other vessels at their offshore and ports to do business. These oil and gas platforms continue to undertake production and further exploration activities for more Oil and Gas discovery. In Ghana, the development resulted in an increased number of vessel calls, especially the Offshore Supply vessels at the country’s two (2) seaports. Coincidently, the two (2) Seaports are faced with a lack of deep berths, low working rate of cargo handling equipment, physical and functional decrepitude of port facilities have made it difficult for these ports to efficiently handle the rapidly increasing volume of cargoes (SAL Consult Limited, 2015).

Presently, the increase activities of the oil services vessels are also exacerbating the pressure on the two seaports. As a result, Ghana Ports and Harbours Authority (GPHA) has estimated that the oil services vessels will increase tremendously in the future, thereby prompting the need for a port facility that offers the vessels buoys (SAL Consult Limited, 2015).

Overall, these aforementioned indicators form the basis for informed decisions and justification for the upgrading of the Tema Shipyard. This will enable it to render effective and efficient ship repair services, shipbuilding and ship recycling activities from now and beyond the fourth industrial revolution.
Tema Shipyard’s Gains

Oil exploitation in Ghana began in 1896 by West African Oil and Fuel Company (Sarpong, 2015). So, Ghana’s discovery of offshore Oil and Gas in commercial quantities has both negative and positive impacts on the socio-economic situation of the country. The Oil find created euphoria among the populace (Sarpong, 2015). Many people’s perceptions were mainly focused on the short and medium term benefits. It could not increase the much-needed resources for the nation’s economic advancement in the short term (Sarpong, 2015). It somehow, also failed to involve many people so as to reap the benefits that accrue from petroleum exploitation (Sarpong, 2015).

However, it systematically placed the country’s economy on a sound development track because the Country is now hosting few offshore Oil and Gas platforms namely: the Floating Production Storage Offloads (FPSOs), Oil drilling rigs, Offshore Supply Vessels and other merchant ships. In 2011, Ghana commenced production of Oil (Alagidede.P, et al, 2013). This contributed 5.4% (Oil-GDP) to the 15.0% real GDP growth in that year (Alagidede.P, et al, 2013). As a result, the country took an enviable position as one of the six fastest growing economies in the world that year (Alagidede.P, et al, 2013). They (FPSOs, Oil drilling rigs, Offshore Supply Vessels and other merchant ships) shall require ship repair services during their operations, perhaps, at the Tema Shipyard in accordance with the 1974 SOLAS and other IMO’s Conventions.

The Tema Shipyard has already benefited significantly from the repair services of these vessels. The Ghanaian indigenes took part in the heavy engineering and fabrication work at the Shipyard (Sarpong, 2015). It happened during the construction of the country’s second FPSO with the backing of the local content (Sarpong, 2015). This facilitated the transfer of technology from the foreign Oil experts to the Ghanaians working on that part of the project at the Tema Shipyard (Sarpong, 2015).

Local Content has been defined as the “quantum or percentage of locally produced materials, personnel, financing, goods and services rendered in the petroleum industry value chain and which can be measured in monetary terms (Sarpong, 2015)”. In short, it gives the level of involvement of local actors both natural and artificial of the Oil and Gas industry (Sarpong, 2015).
The Tema Shipyard had already repaired few of the Offshore Supply Vessels, Oil tankers and jack up rigs, including other commercial merchant vessels (Ministry of Finance Ghana, 2016). Certainly, this is just the beginning of the learning processes to enable the Tema Shipyard’s personnel to develop their capabilities in the ship repair industry. This will make the Tema Drydock competitive in the ship repair industry as compared to the Asia countries (Frederick S. & Brun L., 2017).

Suggested Solutions to the Major Challenges

In this Article the suggested solutions have been categorised into three sub-topics, namely: Government’s commitment, installation of improved ship maintenance equipment and institutional training. These three categories allow or permit in-depth analysis on each of them. This will enable readers to understand and appreciate the connection to the major challenges raised here. It has also led to the discussion of the fallout of pertinent issues in the article.

Government’s Commitment to finding solutions to the challenges

Over the past century, shipbuilding and ship repair Industry had contributed immensely to economic development of Europe, and now the Asian region (ECORYS Consulting and Research, 2009). Therefore, it is very imperative for the Government of Ghana (GoG) to make long-term comprehensive policies and financial support to sustain the drydock. These long policies should consist of creation of conducive environment, aim at attracting foreign direct investment into the Tema Shipyard. It is high time the government re-exams and pursues tax concession reforms targeting more transparency procurement measures and reasonable low import tariffs on the ship repair cranes and marine equipment. The Government of Ghana should continue to show strong commitment in supporting the yard with adequate financing. This will enable the Tema Drydock and Shipyard to undertake the expansion of infrastructure (i.e widening, deepening, increase the graving docks and lay berth) to accommodate the modern bigger vessels with higher draughts. For instance, China’s financial stimulus and policies have sustained the development of its ship repair industry (Jonkers, 2003).

The Ghana Ports and Harbours Authority (GPHA) must play a coordinated role here between the GoG and Tema Shipyard. Also, to be included, are the other key stakeholders in Ghana’s
Maritime Industry, namely, Ghana Maritime Authority (GMA), Ghana Shippers’ Authority (GSA), Shipowners and Agent Association of Ghana (SOAG), Ghana Institute of Freight Forwarders (GIFF) and Customs Brokers Association of Ghana (CUBAG). All of these must be brought onboard to establish a common fund in order to render effective and efficient services to all type of ships calling at the Tema Drydock for its sustainability.

Ideally, the Ghana Ports and Harbours Authority is a statutory Government corporation set up in 1986 by the Provisional National Defence Council Law 160 (P.N.D.C.L. 160) with the legitimate responsibility to manage the Port of Tema, Takoradi and fishing harbour in Ghana (SAL Consulting Limited, 2015). It is the Ghana Ports and Harbours Authority’s Act 1986, which summarises some of the functions as follows: the Authority shall plan, build, develop, manage, maintain, operate and control ports (Authority, G.P, Act, 1986).

The GPHA should lead the above mentioned institutions and agencies to develop a policy document concerning the establishment of a common fund. This common fund will augment and sustain the Government’s funding initiatives of the ship repair industry in Ghana. That is, the agencies should collect monthly or annually contributions from their customers based on consensus. These contributions should be deposited into a special account in a creditable bank in the country. It will also help to salvage the Tema Drydock from its indebtedness burden as the Annual Aggregate Report, 2016 confirmed (Ministry of Finance, Ghana, 2016).

Installation of improved ship maintenance equipment

Although the Tema Shipyard’s repair equipment were installed to work to their fullest utilisation capacity in those years, their present effective utilisation capacity is severely limited. Their performance have now been increasingly inefficient. This is due to excessive wear and tear and general deterioration of installation. Their long term in operation without replacement makes them obsolete.

These out of date ship repair equipment perform extremely inefficient when they are used to do repair services on the modern technological advanced ships. They can cause injury to the personnel or loss of lives during usage. This is because they are highly depreciated (worn out) and can easily break down during repair services. They also come with a high cost of operations because the ship downtime at the drydock will be longer. That is, there will be a
delay in (longer days) finishing repairing a ship. These make the shipyard unattractive to vessels which may want to undertake ship repair services.

Therefore concerted efforts should be made to procure and install the advanced technological ship repair equipment. This will enable the Tema Shipyard to render efficient ship repair services to make it competitive in the shipbuilding and ship repair industry. These advanced ship repair equipment prevent marine pollution. For instance, the Dormac Pty Limited developed advanced technology that prevents marine pollution during ship repairs (Jonkers, 2003).

Institutional Training

Basically, any organisation consistently adheres to the implementation of training and development of its employees in accordance with the Human Resource Planning, seeks to provide a solid foundation for its survival. This is because people need training and development to continue to perform efficiently on their field of work. A training is a highly useful tool that can bring an employee into a position where they can do their job, correctly, effectively and conscientiously (file:///C:/Users/kambasenicholasawe/Desktop/Training_%20Meaning,%20Definition%20and%20Types%20of%20Training.html).

It is the Human Resource Planning which performs the core duties in training and development of the most capable personnel to occupy certain key position within the organisation (Leonard, 2017). Especially, it is the Human Resource Planning that identifies the skill development requirements for various levels of jobs (Leonard, 2017). It is also responsible for organizing the various training and development activities to impart the required skill and ability in employees to perform the task effectively and efficiently (Leonard, 2017). Of course, it is widely understandable and accepted that training and development enhances the skill and knowledge of employees. Thus, it is appropriate and logical for the Tema Shipyard to vigorously embark on training and development of its personnel so as to improve their capacity and capability for optimum competitiveness in the ship repair Industry.

The Tema Shipyards personnel need this effective training and development to meet the ship repair Industry’s needs. For, this will make them specialists with integrated knowledge of
specific engineering (i.e marine engineering, welding), and operational disciplines (i.e crane operators, steel cutters) (Boris, 2014).

The Tema Drydock should also consider all regulations and safety issues concerning the shipbuilding and ship repair industry (Fredercik.S. & Brun.L, 2017). That is, all personnel in the ship repair Industry must demonstrate their ability to perform to standard operating procedures for a specific task (i.e welding, etc) (Fredercik.S. & Brun.L, 2017). Likewise, all employers are also required to maintain documents proving the capabilities of these employees in accordance with the international regulations and safety requirements pertaining to the shipbuilding and ship repair Industry (Fredercik.S. & Brun.L, 2017).

Therefore, it is prudent for the Tema Drydock to invest in infrastructure and resource inhouse to ensure that workers are trained and reskilled continuously (Fredercik.S. & Brun.L, 2017). This is to keep them up with the changing requirements to enable them execute work safely just as the major shipyards and marine companies have done (Fredercik.S. & Brun.L, 2017).

In addition, some selected staff should be given adequate training in the relevant shipbuilding and ship repair institutions abroad. These privileged individuals or group of staff will be able to learn from the advanced technologies in the shipbuilding and ship repair industry (Frederick. S. & Brun. L, 2017). Especially, they should learn from the emerging shipbuilding and ship repair nations’ strategies (like China, Singapore, etc) that they have adopted to facilitate the development of their economies (Frederick. S. & Brun. L, 2017).

Conclusion

Despite the above mentioned major challenges continue plaguing the ship repair industry worldwide, it is one of the essential elements that facilitate economic growth and development. It consistently contributes significantly to the development of the world economy. It has both direct and indirect relationship with the development of the world economy vis-a-vis the international seaborne trade. When the world economy is growing, the demand for shipping increases. The prices of the new build will also increase. Therefore, ship owners and operators have no option but to embark on maintenance and repairs of their old ships in order to benefit from possible and spontaneous increase in freight rates. For, more
ships will be needed to carry a high volume of goods from one place to the other by sea. This eventually brings about overcapacity in the world merchant fleet because many ships will be ordered and added to the existing ones as cited in the United Nations Conference on Trade and development, 2018 which has been captured in this article.

This automatically exacts pressure on the drydocks because they (drydocks) lack the capacity to receive the increasing number of the world merchant fleet which may need their services.

On the other hand, if the world economy is in a depression state, the demand for ship scrapping increases. That is, the price of the new build will automatically decrease drastically. Hence, only few ships may be needed from the already-overcapacity ships to move goods from one node to the other node.

Furthermore, an introduction of a new legislation in the maritime community does increase the demand in the ship repair industry. This usually aims at preventing pollution from marine and shipping operations. These globally-ratified regulations do affect ship designs, shipbuilding and shipping operations. Most often, the vessels are mandated to undertake retrofitting, repairs and conversions in order to comply with the regulation requirements while other vessels must be scrapped off totally due to their non-compliance status to continue engagement in the commercial operations. This is normally done to ensure the safety of the vessels, the cargo and the crew during their entire life-span operations.

As a result, the shipbuilding and repair industry is growing globally. It is been seen as a major platform that creates huge employments, transfer of technology and a source of revenue for the development of other infrastructures.

Certainly, many European shipbuilding and repair countries have experienced significant economic development whilst the other Asian countries like (China, Vietnam, Philippines and India) are now emerging economies. Presently, China’s economic growth has overtaken Europe in the shipbuilding and repair industry. It is currently enjoying economic boom and has become the dominant leader in the shipbuilding and repair industry. This is because China has invested enough resources particularly in training its skilled labour and upgrading the infrastructure within the sector.
Overall, Ghana’s economic growth continues to remain resilient and robust in the face of the world economy crisis. Thus, the contributions of shipbuilding and ship repair industry to Ghana’s developmental agenda cannot be underscored. Specifically, the establishment of the Tema Shipyard is to facilitate the Ghana’s industrialised growth. Since its inception, the Tema Shipyard has made substantial gains in the ship repair industry. It has been rendering a various repair services to different types of vessels including offshore Oil and Gas platforms.

However, the ship repair services in the Tema Shipyard in Ghana, is faced with major challenges. The Tema Drydock and Shipyard lacks the capacity to accommodate the constant growing sizes of the world merchant fleet. Particularly, the two main drydocks and the lay berth, where repair services are carried out on ships have not been expanded. The Tema Shipyard requires dredging and expansion exercises to increase the number of its docks and lay berth to receive bigger vessels.

This is because, the recent application of high technology to ships construction has made them complex. Arguably, today’s modern ships have in-built technological systems which make them highly sophisticated. Thus, using the 1970s ship maintenance and repair equipment to service them is extremely difficult and increased cost. This is because, the Shipyard’s maintenance and repair equipment are absolutely obsolete and inefficient. Most of them were installed in the 1965 and had not been upgraded nor replaced with the modern type of ship repair equipment. These equipment need to be replaced with the modern ship repair equipment so as to carry out efficient repair services.

The Tema Shipyard does not also have sufficient skilled labour. It lacks a highly and properly-educated skilled labour due to poor conditions of service, labour legislations and human development. Thus, investing in improved conditions of service, training, skill development and retention of human resource should be the way forward. That is, the Tema Shipyard should increase the salaries and other benefits of its few skilled labour in order to motivate them to stay in the company and attract other skilled labour to it. The Tema Drydock and Shipyard should also continue to sponsor its inadequate skilled labour to undergo training and skill development abroad (for example, Europe and Asia) whose institutions are specialised in shipbuilding and repair services so as to equip them with the pre –requisite technology and skills to perform effectively and efficiently. In the medium to long-term run, these will
improve productivity and maximise revenue for the expansion of the company and the country’s developmental agenda.

Overall, the authority of the Tema Shipyard should endeavour to source for a credible investor to revamp the drydock. That investor should have enough finance to carry out both human resource and infrastructural development of the Tema Drydock and Shipyard. This approach will enable the Yard to find the long and permanent solutions to the major challenges facing the ship maintenance and repair services in the Tema Drydock and Shipbuilding Yard in Ghana. So, the Government of Ghana can realise the maximum revenue from it for its developmental agenda. This will enable it to become effective and efficient fully fledged Drydock and Shipbuilding Yard, capable of handling all types of ship repairs, shipbuilding, ship conversion and ship scrapping services in Ghana. Clearly, it requires a continuation of extensive research to achieve and sustain these objectives so as to aid the development of the other industries such as the steel industry and prevention of the early depletion of the Ghana’s iron ore deposits.

Certainly, this will really help the Tema Shipyard to achieve its vision of becoming the Top three Drydock and Shipbuilding Yards in Africa by the year 2030.
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