

Experiences and Lessons Learned Worldwide to Increase Localization Ratios of Mobile Drilling Rig in Vietnam

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Abstract: Mobile rig manufacturing industry in the world is making significant changes in recent year with the trending of exploration and production drilling process in the deep waters and remote areas. The demand for operating mobile rigs is a quick increasing. In general, Asia Pacific countries thrive on the rig manufacturing industry are currently well supported policy for sustainable development by enterprise system and government, such as Singapore and South Korea. Rig manufacturing industry is Viet Nam's infant industry. Based on the platform design and manufacturing task, it can be divided into 2 product families: mobile and fixed platforms. Mobile platform is used to exploration, exploitation base on existed pattern design.

Tam Dao 3 jack-up rig (TD3) is made a success by Petrovietnam Shipyard, however, most equipment parts were imported from abroad. Localization portion of TD3 rig have been mainly for construction, detail design, construction design and the value of domestic goods account for only about 1.3% project cost. This fact demonstrates that the reality of supporting industries of Vietnam in rig fabrication is currently extremely weak and inadequate. The lessons learnt and experiences from Asia Pacific countries platform manufacturing shown that their success and faith, thereby orientation for development plan in Vietnam's young industry, especially maintaining and enhancing the localization ratio of mobile rig requires develop the design work, construction, installation, commissioning, mount up resources available of country. Paper suggest that some new policy to improve for developing mobile rig manufacturing, especially deepwater or remote areas.

Keywords: Shipbuilding, Mobile Rig, Transportation Infrastructure, Seaport, Offshore Industry

Introduction:

Rig manufacturing sector is a nascent industry and growing gradually in Vietnam. However, it only conduct in detail design, assembling and constructing processes. In reality, oil fields are being explored and exploited vigorously at Vietnamese continental shelves, however, most operated mobile rigs were installed and manufactured from abroad such as China, Korea and Singapore. Meanwhile, Korean rig manufacturing industry has developed rapidly as a typical lesson, now it is a leading in Asia.

Korea's shipbuilding industry has been established and developed since 1960s and it has become one of top ten best country. Nowadays, Korea's ranked on the seventh on the world, including a biggest shipbuilding companies, Hyundai Heavy Industry (HHI), Samsung, Daewoo (Bae Young, 2012).

Shipbuilding industry had developed robustly until 2000, Korea started diverting to offshore facilities manufacturing serving a petroleum industry, and then gaining a great achievements. Typically, localization rate of instruments assembly and constructing parts were the relatively high proportion of 10-40%, as well as good quality and reasonable price. Therefore, rig orders from abroad is increasing (Hyo Jae Jo, 2012). The success of Korea is a precious lesson to learn how to increase localization ratio of Vietnam's mobile rigs. This will solve the jobs, rise income and improve people's living standards and professional knowledge in fledgling industry. These are urgent requirements to increase the localization ratio of mobile rig in Vietnam's petroleum industry.

Transportation infrastructure system:

Korea's offshore industry history tied to the development of transport infrastructure system. So far, transportation network has completed and expanded throughout the country.

In 1970, Gyeongbu Expressway was built, which is the main northwest-southeast expressway from Seoul to Southeast ports of Busan, Ulsan (Hyo Jae Jo, 2012). After that, Korea has continued to build a series of deep-water ports in the Southern part. Besides, many highways for large tonnage container vehicles built to connect from big cities to commercial ports. In addition, railway and metro systems are expanded for connecting the heavy industrial areas to the seaports.

The development of transport infrastructure for three routes, such as road, railway and waterway, have promoted the rapid development of heavy industries, especially steel manufacturing, mechanical engineering. It creates the premise to facilitate a fabrication rig process. This has contributed to Korea from a poor country to become one of the world's leading countries in drilling rig manufacturing.

In Vietnam, only two routes running from North to South are National Highway 1A and Ho Chi Minh Highway. In addition, there are many small roads linking the provinces together, however, mostly narrow roads and low load, or damaged, speed limit. As a result, it takes longer time to deliver goods. Vietnam has been carried out to build the highways connecting the major cities only for travelling and transporting for passenger. However, offshore

industry requires a heavy facilities transportation on the expressway that it does not adapt enough. Currently, Cai Mep's deepwater port (Ba Ria – Vung Tau) and petroleum ports locate on the Thi Vai river. It is convenient to promote shipbuilding industry and petroleum industry. In addition, the National Route 51 plays a critical role in the transport of goods, machinery and fabricated from Ho Chi Minh City, Bien Hoa, Binh Duong and Vung Tau. Despite that, some parts on the National Route 51 limit speed and load weight from 15 to 20 tons. In addition, the highway separator between container trucks lane and motorcycles lane is unclear, its cause happening accidents. Therefore, an upgrade on the National Route 51 will create opportunities to lower transportation cost and more attracting for partners. Overall, the current transportation infrastructure of Vietnam is not as effective as Korea. It not eligible to develop an offshore industry. Government should plan to build highways for heavy freight transport from a key cities and industrial zones to seaports. From that, freight and equipment can be transported more easily and quickly.

Design localization process:

The design work of mobile rig manufacturing project can be divided into three phases: basic design, detailed design and construction design. These stages are closely linked. Basic design is considered as the frame. Detailed design will be based on the basic design and layout of specialized equipments, piping system, electrical system and others.

The United States and European countries have developed oil and gas industry since the 18th century, thus exploration techniques have been developing continuously until today. This is a solid foundation to create a world-leading basic design. Being aware of this, Korea has focused on research orientation for detailed design and construction design. The Korea Shipbuilders' Association (KOSHIPA), established in 1977, plays an important role in the application shipbuilding technology and development a rig design.

Moreover, Korea also concentrates on training high-quality human resources through the linking process between the universities and centres of research and development. In 2013, three universities educate a specialized in offshore engineering, offshore plant design. It is expected to rise to 6 universities in 2020. Furthermore, patents of the basic design are bought from developed countries to learn, thereby enhancing learning gradually competitiveness. Today, Vietnam Shipping Owners Association (VSA) and Vietnam Seaports Association are established to associate with shipping companies and freight-forwarding carriers. There is no association directly related to the rig offshore manufacturing.

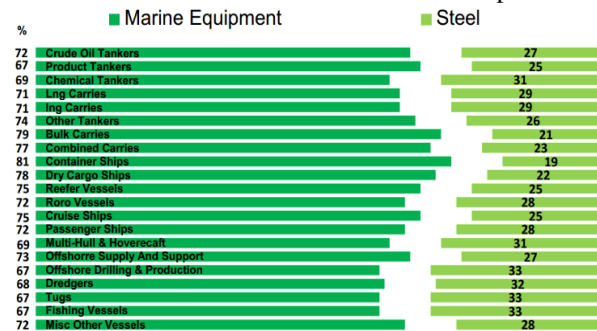
In R&D, some organizations worked on the rig design such as research and design institute of

Vietsovpetro, engineering design department of Petrovietnam Shipyard and Petrovietnam Drilling. However, R&D centers have not invested in modern equipments and facilities to make products instead of having to hire foreigners. Highly quality human resources are still limited. Some universities have been educated in shipbuilding and marine works for operating engineering, but still not focused on the rigs fabrication and design. Human resources are retrained or hiring an experts with high salary. A few engineers accumulated experience from rig operation work, and professional maturity from international works, or university graduation in abroad, learning in special training course at workshop and conference. Therefore, to develop a long-term and sustainable, rig offshore engineering should have educated and trained personal resource in engineering design and using software support tools.

Supporting industries system:

In the value chain of mobile drilling rigs, designing stage accounts for only 5%-10%, the construction engineering estimates from 20% to 30%, the rest of 60% to 70% is contributed by the material and equipment procurement. In mobile drilling rig, steel materials occupied as a core value (Table 1). Therefore, Korea had planned in developing steel industry since 1960s. Moreover, it ranked 5th in the world (2015).

Table 1. Ratio of steel value in maritimetime plant



Source: The Role of European Maritime Technology Manufacturers in the Offshore Industry, OECD, 2014

With the aim of increasing the localization rate, R&D centers have been established to improve offshore supporting industries. In addition, strengthens relationships between shipbuilding companies and equipment manufacturers to be closely. Not only supported in technical aspect, the companies also received a quality certificates from shipbuilding groups to develop the brand market and quality. The network connection in the supporting industries have been formed. Big companies would corporate with the smaller ones to make product outsourcing. It's a cost saving and opening business scale. Moreover, the establishment of professional associations also an significant role in share knowledge and experience. Accordingly, Korea machine tool manufacturer association (KOMMA) established in 1979 has

assisted greatly in securing and expanding a product sources, linked to investors from developed countries and provided marketing information.

Vietnamese steel industry has dominant advantages due to raw materials deposited in Northern Vietnam, while Korean must import most of the iron ore from abroad. Every year, a large quantity of steel products is used for civil sector. Lately, real estate crisis downturn a construction demand to cause a huge steel inventory. Despite of a great production, Vietnamese steel's quality ineligible to used for installation of offshore platforms. So the first step is focusing on raising the steel quality to guarantee step by step in localization roadmap.

In reality, supporting industries are extremely weak and inadequate, especially an engineering. Therefore, understanding to operate equipment specifications or technical system as requirements is necessary. However, domestic firms are facing prices due to shipbuilding and rig fabricating does not enough economic sources and technology. Therefore, it is necessary to establish connections between firms in order to improve supply quality, aggregate demand of shipbuilders as an important role. Currently, only Hanoi supporting industries business association (HASIBA) presented, therefore, it is urgent to form national network to connect from person to person and enterprises.

Localized parts of Tam Dao 3 rig mostly is a construction work, detailed design, construction design, the good value of domestic materials and equipments accounted for 1.3% of the shopping cost of the project. In order to increase localization ratio of Tam Dao 05 rig as well as other projects next future, enterprises need to attract investment capital from oversea for advancing knowledge and technology transfer.

Korean government policies:

The Korean government has been interested in developing the shipbuilding industry as well as localization rig since the 1960s. Shipbuilding Promotion Law enacted in 1958, is considered the first attempt by the government to promote the development of this field. In the 5-year plans, their policies was encouraged to clear objectives for the shipbuilding industry. Specifically, when the shipbuilding industry was still young and outdated, the government has launched financial policies to support shipbuilding companies such as Hyundai Heavy Industries (HHI), Samsung, with low-interest from state banks, debt guarantees in loans from abroad (Lars C. Bruno & Stig Tenold, 2013). Its aim to advanced conditions for enterprises to invest and develop in this activity. Vietnam was only interested in the field of shipbuilding, rig manufacturing in recent years and virtually no financial support policies for investors in the rig-manufacturing sector. Korea's government issued good principles for investing in R&D. In that, firms must have a certain

funding in R&D. In addition, they encourages opening institutes, centres and manufacturing disciplines on the rig at the university. Students have been received scholarships in this field.

However, Vietnam's condition has yet to focused on the research & development activities, easing of investment regulations for foreign as well. Investment law amended in 2014, article 75, prescribed that capital investment on the research & development must halved. This makes foreign corporations less emphasis on research and development, not rising in manufacturing industry and high technology.

In terms of infrastructure and equipment, Korean government invested heavily in the construction of supporting industries cluster in Ulsan, Okpo and Chukdo regions. This creates favourable conditions for the shipbuilder in developing activities, contributing to the supporting industries, especially the steel industry.

In Vietnam, the shipbuilding, rig manufacturing and supporting industries are not interested in investing. The government has no policy to encourage and support the financial and technical, which makes businesses that do not want to invest due to high capital and risk. The Vietnam's government has not enacted a specific law for shipbuilding industry, drilling rig manufacturing and encouraging the development of ancillary industries. Moreover, do not have any guarantee of output that investors are hesitant in investing and build factories.

It noticed that the current localization activities in Vietnam rigs conduct in the detailed design, construction design, construction, assembly, repairs due to their effort. The government has also set a target for the development of shipbuilding industry, namely Decision No. 2290 / QD - TTg on approving the master plan on development of Vietnam Shipbuilding Industry in 2020 , driven 2030 by the Prime Minister launched on 27-11-2013. Accordingly, by 2020, maintaining and developing the capabilities of the base building and repair of existing vessels; development of new base building and repair of ships to meet the needs of the domestic market, foreign; forming a centers of large-scale shipping linked to the seaports and key maritime routes of international; shipping repairing technology has advanced, environmentally friendly; quality assurance and competitive price; undertake repairs of vessels synchronous domestic and foreign tonnage of up to 300 thousand tons. By 2030, the long-term development of shipbuilding industry in line with the marketing needs, the financial capacity and management capabilities; forming a centers of building vessels with high-tech, large economic value, including container ships, tankers, bulk carriers, floating docks and floating oil storage warehouse to 100 thousand tons to meet international standards of quality, serving the needs of domestic market and exports.

In summary, Vietnam stands at supporting and encouraging, and no specific action and initiative in developing in this industry. Compared to Korea, immediately before the 1970s, the Korean government has embarked on the construction of the plant, build transportation infrastructure, major investments in this industry (Table 2). The Korean government has chosen to support stronger financial incentives for some of the largest corporations such

as Hyundai, Samsung. So they invested in the areas of the rig fabrication. Due to policies of financial support are vague, leading to the Vietnam enterprise also concerns in investing risks. In addition, Korea has invested in infrastructure (building bridges, heavy roads, deep-sea port...), while Vietnam transportation are mostly small road, low-load bearing, rare deep-sea port to support the activities of the shipbuilding industry and making large-scale rig.

Table 2: Comparing supportive policies between Korea and Vietnam

	Policy	Infrastructures	Supportive industries – Steel industry	Building research and developments
Korea	<ul style="list-style-type: none"> - In 1958, Korea enacted Shipbuilding Promotion Law. - Every 5-year plans, shipbuilding developments policies was changed and supplemented. - Financial support for the big shipbuilding corporations (tax reduction, low interest rates, risk sharing...). 	<ul style="list-style-type: none"> - Construction of highways connecting the major industrial areas to the seaports. - Building deep-water port, high-speed train, railway system. 	<ul style="list-style-type: none"> - Investment in steel factory to provide in shipbuilding and drilling rig manufacturing. 	<ul style="list-style-type: none"> - Open the subjects related to rig manufacture at universities. - Construction of the research centers. - Investing more money into R & D activities.
Viet Nam	<ul style="list-style-type: none"> - There is no policy to support the shipbuilding business. - There is no such a law for shipbuilding and rig manufacturing. - Only encouraging policies, no concrete action and not itself actively in the development of this industry 	<ul style="list-style-type: none"> Ongoing construction of the highway, but not pay attention to the road through the port, mostly small road, low load. - Obsolete rail system, not to transport the goods with large load and bulk. - a few deep water port, small ports 	<ul style="list-style-type: none"> - No support policies for enterprises producing specialized steel, mainly civil steel 	<ul style="list-style-type: none"> - No specialized rigs manufacturing in the universities. - No R & D centers for shipbuilding and rig manufacturing. - Low capital investment regulation in R&D

Experience lessons:

Most localization ratio of the drilling rig located in the procurement of equipment. Therefore, Korea government has driven an increasing the localization rate of the equipment in the supply chain via the following route:

- + Step 1: Select the target device
- + Step 2: Conduct research and development for such equipment
- +Step 3: Develop energy sources to support production, links with foreign companies to increase a production experience. Then performing at the market and looking for first orders
- +Step 4: Demonstrate the potential project to investors, and attracting capital to expand production
- +Step 5: Expand the application of the device, moving from the machining equipment to design
- +Step 6: Complete 100% localization from design to construction

In localization roadmap, first need to specialize a specific activity, then proceed to expand development into other activities. When selecting works for localization should be considered in line

with the existing resources conditions such as the factors of financial, economic and social order to identify products that may be produced or purchased from abroad, to avoid scattered investment without developing effective products.

The contribution of construction work accounted for about 20-30% of project value, the procurement of materials from 60-70%. Vietnam’s investing activities can learn on the construction and design of the rig (Table 3). For construction work, now Vietnam has achieved 100% tasks. In addition to Vietnam companies has been implementing the construction work for a rigs abroad. However with the commissioning of equipment and systems, this work depends dominant on suppliers, equipment manufacturers, therefor project work must still own hired experts of providers, equipment manufacturers from abroad. Thus, after having completely mastered technology, we continued development other segments of the value chain in the offshore equipment industry.

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Table 3: National competitiveness comparison in the supply chain of the offshore plant industry

	Feasibility studies & preliminary exploration	Drilling & appraisal	Design	Construction & fabrication	Transportation	Installation & commissioning	Operation & maintenance
Korea	Bottom	Bottom	Mid	Top	Mid	Mid/Top	Mid
USA	Top	Top	Top	Mid	Top	Top	Top
Japan	Mid	Mid	Top	Mid	Mid	Top	Mid
France	Top	Top	Top	Mid	Top	Top	Top
UK	Top	Top	Top	Mid	Top	Top	Top
Italy	Top	Top	Mid	Mid	Mid	Mid	Mid
Netherlands	Mid	Mid	Mid	Mid	Top	Mid	Mid
Switzerland	Mid	Mid	Mid	Bottom	Mid	Mid	Mid
China	Bottom	Bottom	Mid	Mid	Mid	Mid	Mid
Brazil	Mid	Mid	Mid	Mid	Mid	Mid	Mid
India	Mid	Mid	Mid	Bottom	Bottom	Mid	Mid
Singapore	Bottom	Bottom	Mid	Mid	Mid	Mid	Mid

Source: Ministry of Knowledge Economy, Competitive Analysis and Mid- and Long-term Development Plan for Offshore Plant Industry (2011)

Currently, most of the detailed design and construction work has done in Vietnam, but the basic design is still quite limited. It could be seen that Korean businesses invested more in research and development. Vietnam need to build mechanical industrial complex to concentrate on the production and fabrication of specialized equipment and assembly in drilling rig. Building centers of research and development adjacent to the plant to apply technology and engineering quickly, close to the practical demand. Human resource policy needed to attract highly qualified staffs to contribute an offshore industry.

Conclusions:

From the above analysis of localization rig manufacturing between Korea and Vietnam, it can draw some conclusions and recommendations as follows:

- The government should give economic policy to encourage and support the financial, tax and corporate law in investing and developing drilling rig equipment. The strategy and mission is clear and reasonable to develop this industry.
- To build a modern infrastructure as highway, deep-water port to facilitate transportation, assembly and construction of heavy equipment. In parallel, development of shipbuilding industry is to create output for auxiliary and mechanical industries. It facilitate to improve a local supply chain and accumulate experience for rig manufacturing operations.
- The research and development policies should be seriously noticed, such as building centers, research institutes for attracting scientists. Incentive policies require foreign corporations to increase investment funding in research and development. The goal is to share professional knowledge and experience in order to avoid

becoming a nation only machining without production value core yet.

- In terms of production and management, backward production process need to change by new methods based on more efficient modern manufactories as Lean, Six Sigma, Green Belt... to reduce time and optimize resources. Developing auxiliary industries and the supply of quality assurance are ready.
- For drilling rig manufacturing in current conditions, design basis is still a barrier to fully master the technology. To proactively entirely design work, rig manufacturer must continue to research on base design.

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