A survey on the features of the existing motorized wooden dhows and the proposed replacement for these vessels

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Abstract

There has been lengthy discussion at national level for many years in connection with a replacement for the motorized dhow called "lanj" by another type of vessel. In order to formulate an answer to the question of whether to preserve the said dhows with the existing conditions, or to replace them, a comprehensive feasibility study will need to be carried out in which all the determining parameters in the present dhows and their replacement are fully considered from all aspects. For the realization of this replacement the authors have carried out a survey from economic, social, and technical aspects of dhow building in the Hormozgan region, and this paper is the summary of the preliminary feasibility study in regard to the potentials and prospects in this marine industry. In the first section, the gathered statistical data for the existing motorized dhows, their types, maintenance, repair work shop, and the information in connection with the useful working life plus the finished costs of the wooden vessels and national regulations regarding insurance and bank facilities have been explained. In addition to that the cultural, economical, and social conditions of lanj keepers and boatmen have also been reviewed. The technical specification of the lanj (powered wooden dhow) including dimensions, weight, form of the hull, deck, and engine room layouts plus hydrostatic and hydrodynamic features as well as shaft, propeller and all other equipment have been examined. In the third section the features of the proposed substitute vessel have been presented.
Keywords: wooden dhow, dhow build, dhow replacing vessel, dhow design, motorized dhow.

1 General overview

Dhows are the traditional vessels of the Persian Gulf, and Oman Sea, made mostly of teak wood (Saj), which is used for planking, keel, stem, stern, and

masts. Very simple tools are used in dhow building: hammer, handsaw, chisel, adz, electric and hand drills, plane, band saw and caulking iron. In the past wood having the necessary property to be used in salty water and its availability, which is easily joined and shaped into form constitute the principal raw material used to build this vessel. Era, country, region, and capacity evidently determine the shape of the hull of the vessel. Tonnage establishes the dimensions of the dhow, which is in itself dependent on the funds that the lanj owner wishes to invest. Therefore these varieties in shape of the hull and carrying capacity are the basis for the different names such boom, Sambuk, Pakistani etc given for various dhows, while some types of the wooden boats are no longer built. The building of a large dhow can take up to a year, while a smaller one can be finished in one to four months. Pakistani type motor lanj plying in the Persian Gulf calling a dhow wharf for discharging cargo and awaits the merchant's cargo to carry back home. Unfortunately, there is almost no pictorial evidence of early dhows. Most of our knowledge of the dhow's early construction comes to us from the records of Greek and early Roman historians. Added to this, we can compare some similar hull constructions used in the later Roman period, after they had opportunity to learn from the Arab sailors. Along with this we can examine early shipwrecks, and lastly we can learn from modern day construction of dhows. It seems that dhow making is considered an art, and this art has been passed down from one generation to another, preserving, at least in part, the dhow's basic design and use. Some modern dhow makers now nail their hulls together, and many are now making a square stern rather than a double-ended vessel. By taking all of these into consideration, we can get an excellent idea of how the ancient dhow was constructed and what its sailing abilities were [1-3].

2 General features of the dhows trading in Iran

In the past all the vessels with lateen sail were called jihaaz. But today most of the dhows are powered and are called lanj. The word " lanj " in Persian language (Farsi) means stroll slowly, and this is probably deduced because of the dhow behaviour movement in the sea. This word in English is called "launch " derived from Spanish or Portuguese, of Malay origin which means boat. The word lanj could also be the allonym of the word launch transliterated in Farsi. The generic word for dhow in Arabic is markab and safiinah. The word daw is a Swahili name, and not used by the people of this region although it was popularized by English writers in the incorrect form of dhow. In general these traditional types of vessels are built from wood with length of 5 to 24 meters and with the carrying capacity of 5 to 800 tons. The dhow was known for two distinctive features. First of all, it's triangular or lateen sail, and secondly, for its stitched construction Stitched boats were made by sewing the hull boards together with fibers, cords or thongs. The idea of a boat made up of planks sewn together seems strange. A Greek sea captain or merchant who wrote in the first century AD reports the use of small sewn boats off Zanzibar and off the southern coast of Arabia. Marco Polo saw sewn boats at Hormoz at the entrance to the Persian Gulf. He took a dim view of them: "they were twine and with it stitch the planks

of the ship together. It keeps well and is not corroded by seawater but it will not stand well in a storm [4].

2.1 Types of dhow

Master craftsmen of dhow building craft in Hormozgan Province, the region under study, generation from generation have preserved this art and job and had different names for their creations. These names probably have existed from hundreds of years ago. Despite numbers of these dhow types are not made any more, but their indigenous names has remained. These dhows have identical and some case similar names in the language of People in southern part of Iran and the language spoken by the people living in the littoral states of the Persian Gulf. Table 1 reflects the most known dhows and wooden boats of the region and table 2 names the vessels which are currently in wide use [5].

Table 1: Most known dhows and wooden boats of the hormozgan province.

Name	Features
Sam- mach	Small fishing boats
Huri	An early oar driven narrow dhow, often dugout and made of Mango- wood
Zarookeh	A long oar driven wooden fishing boat
Manshowa	A wooden boat used to take boatmen to shore
Baghlah	A square-stern, lateen rigged 200-300 ton vessel used mainly for cargo transport. It is now rare as it is being replaced by the curved stern Boom
Breik	A variation of the Boom is the Breik, which has a tapered stern
Batil	A long fast dhow used for fishing
Mangea	Small fishing boat
Bagar	Small fishing boat
Katar	Small fishing boat
Teshala	Small fishing boat
Shooaea	Small fishing boat
Kouchy	Small fishing boat
Shasha	Smallest and oldest traditional boat, a small oar-driven fishing boat made entirely of date palm sticks

Table 2: Wooden dhows which are currently in wide use.

Boom	A curved-stern, 200-800 ton vessel used mainly for cargo transport, which is commonly seen at the wharves in the regions
Sambuk (Jalbot)	Usually around 40-60 feet in length. It was originally used for pearling and now mostly for fishing
Pakistani	Cargo transport vessel influenced by Pakistani craftsman

2.2 Statistical data of the vessel in Hormozgan province

Data in connection to the number of different vessels and the fabrication workshops for dhow building has been obtained from various sources such as lanj owner & fishers' cooperatives, port and shipping organization, Governors general office etc. The data gathered for the number of wooden dhow in hormozgan province is about 860 and total number of wooden dhows in Iran is about 5934 including fishing and cargo powered dhows. It also worth mentioning that 23 active workshops with around 937 employees are involved in manufacturing wooden dhows in hormozgan province [6].

2.3 Social, economic, and cultural conditions of dhow owners and dhow keeping in the province

The word dhow owner is applied to individuals or group of people who own fishing, passenger and cargo transport vessels. Dhow owners are member of their respective cooperatives so that they can benefit from services and facilities that these cooperative provide in the different grounds. They pay an annual membership of 50000 Rials (60USD). In addition to that the dhow owner pays 1.5 % of the each freight charge for the bill of landing which is issued by the cooperative of the dhow owners. At present the carriage rate to destination of United Arab Emirates for fruits and green grocery and other consignments is about 85000 Rials (about $ 10) per ton, depending on the nature of the cargo, and from Emirate ports to the ports in Hormozgan province is about 120000 Rials (about $ 14) / ton. Number of the voyage of dhows is about 10-15 times per annum depending on the economic situation of the region.

2.4 Finished cost of a wooden boat

A cost break down calculated for fabrication of a 50 feet (15.24 m) cargo transport or trawler, Pakistani model with 190 ton capacity, which was launched March 2003, amounted up to 955 million Rials (about $ 110,000) and the cost for purchasing a 630 HP engine for such length is about 650 million Rials (about $ 75000). The speed for the motorized built dhows ranges from 7 to 13 nautical miles, depending on the horsepower of their engine. The finished costs estimated for the building a 16.76 meter long and 250 ton fishing vessel, excluding the cost of purchasing engine is about 1375 million Rials (about $158000). The period taken to build a 200 ton wooden vessel normally is about 200 days, of course this can be reduced by employment of more craftsman [6-7].

2.5 Educational conditions and the level of the education of dhow keeping personnel

Dhow keeping is a trade which is particular to people living in the coastal region. Majority of workers involved in this profession, do not possess the minimum level of education. But this literacy level does not apply to the dhow owners. We can conclude from the level income of the said workers, that generally the level of the education of this class is less than the average level of the country.

3 Technical specification of motorized dhow

In this part the following matters has been dealt with, and to avoid the lengthiness of this paper, only one drawing, one figure and one table has been attached (Figure 1, Figure 2 & Table 3).

Main dimensions of the vessel, Bodylines, Hydrostatics, Hydrodynamics and propulsion, Materials specifications, Machinery and equipments, The Vessel behaviour in the waves.

Table 3: Table of offset for a selected wooden dhow (width is in mm).

sec/w.l	w.l1	w.l2	w.l3	w.l4	w.l5	w.l6	w.l7	w.l8	w.l9	w.l10	w.l11	
0	0	0	0	0	0	0	598	796	1131	1747	1793	AP
1	0	0	0	153	166	502	1195	1592	1.94	2435	2470	
2	0	127	171	300	339	1133	1945	2299	2.55	2949	2983	
3	0	239	474	959	1058	2012	2582	2837	3.05	3325	3348	
4	229	578	1371	2063	2150	2665	3027	3212	3.34	3543	3556	
5	405	1269	2047	2572	2631	2914	3146	3347	3.51	3644	3656	
6	481	1514	2296	2736	2786	3021	3218	3396	3.53	3660	3671	
7	557	1758	2545	2900	2940	3128	3289	3445	3.56	3675	3685	
8	678	2082	2905	3119	3146	3316	3440	3521	3.58	3670	3677	
9	700	2149	2974	3176	3202	3368	3477	3538	3.6	3674	3680	
10	702	2156	2980	3182	3209	3374	3481	3539	3.61	3675	3680	
11	702	2156	2980	3182	3209	3374	3481	3539	3.61	3675	3680	
12	634	1934	2829	3092	3124	3316	3438	3503	3,569	3630	3634	
13	486	1444	2491	2893	2936	3187	3341	3419	3.49	3530	3532	
14	375	1049	1942	2401	2463	2881	3136	3252	3.35	3429	3434	
15	282	699	1293	1771	1856	2493	2880	3045	3,184	3329	3338	
16	193	361	665	1148	1252	2087	2605	2822	3	3220	3235	
17	154	211	372	634	693	1395	2024	2333	2.56	2983	3026	
18	86	95	162	272	298	793	1346	1708	2.01	2633	2687	
19	0	0	0	0	0	244	685	1002	1385	2217	2270	
20	0	0	0	0	0	0	0	350	705	1411	1475	FP
Z W.L(M)	0	0.45	0.9	1.35	1.8	2.25	2.7	3.15	3.6	4.05	4.5	

LOA	B	D	T	L.B.P	KG	DIS
25.11	7.4	4.5	2.71	19.3	2.24	179

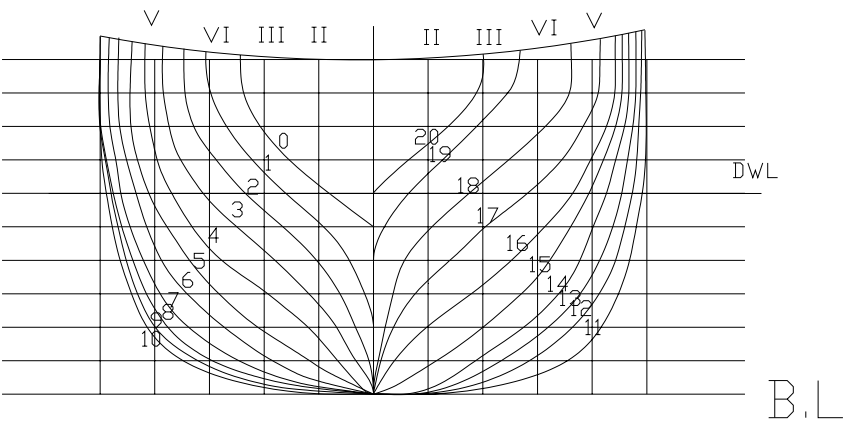

Figure 1: A bodyline of a wooden dhow.

Figure 2: Interior section of a wooden dhow.

3.1 Advantages and disadvantages of wooden dhows

In this section, major advantages and disadvantages of dhows are dealt with. In the meantime, Ports and Shipping Organization, the authority for the implementation of maritime rules and regulations in Iran, has recently decided not to issue any authorization and building permit for the fabrication of the wooden dhows.

3.2 Qualitative and economical features

Generally speaking, the survival and sustainable conditions of the dhows can be accidental, therefore, definitely must be due to the qualitative features of the dhows that dhow owners are so eager to preserve this industry. Dhows come in different lengths and their cost varies from 1000 million Rials to several thousands. Their cost of upkeep and maintenance is as low as 5000000 Rials ($ 580) per year and their five year overhaul costs amounts up to 50 to 60 million Rials ($5800 to $6900). The average income of a motorized dhow owner is about 150 to 200 million Rials ($17000- $23000).

3.3 Social and cultural status

Dhow or in other words “lanj" has gradually become a part culture and tradition of the people in the region and, the crafts and professions related to dhow keeping have found its social position within the society. The people of the region have tried to preserve this craft empirically, on the board from boatman to of one generation to the next generation. On the other hand there sufficient

numbers of dhow building workshops in the region in which, some have tried utilize simple sawing machines and automatic planes. Craftsmen and carpenters are trained locally.

3.4 Technological issues and man power

Dhow keeping does not require a complicated technology, therefore there is no need for a new technology to be purchased or imported. Thus this by itself is considered as an important advantage. The labour force chain from construction period to sailing and maintenance and repair crew with good quality is available in the region.

3.5 Flexibility and environmental aspects

Wooden dhow is small vessel with low draught seaworthy of plying in the coastal waters, enables it to berth at any small wharf, jetty or berthing place. Dhow can be used as a multipurpose means. It can be utilized as a fishing, ferry, or cargo transport vessel. Additionally its low carrying capacity makes it very versatile since it does have lay for several days for cargo to fill its capacity. Raw materials used in dhow building, the mechanism of its construction, and its maintenance do not pose any threat to the ecosystem and the environment. The only environmental impact it my have is cutting the tree, since the old industrial trees have be one day as they grow old, therefore, dhow building is a useful utilization of the log of the trees.

4 Disadvantages and difficulties of dhows

The major issue in connection with dhow building is the out-datedness of the technique used in the construction of dhow. One such technique is the time taken for the design of hull form. This used to take months, but at present with CAD/ CAM it takes less than a week with great accuracy. If, wood was the best raw material for this purpose at older times, now with availability of highly reliable raw materials such as different metals, alloys, and composite materials, which their utilization in the ship building industries brings about safety, reliability, while observing the principle of engineering and standards. In view of the above matter, the negative aspects of the wooden dhow are classified as below:

4.1 High finished costs

The finished cost for a 200 ton cargo transport wooden motorized vessel, sums up to 1600 to 1800 million Rials (about $185000-$209000). Wood as the main raw material take 650 to 720 million Rials (about $ 75000-$83000) out of the said amount therefore the bare vessels without engine and accessories will come up to 1000 to 1200 million Rials (about $ 115000 - to $138000) which all these prices depends on the type and quality of wood used in the construction of the vessel.

4.2 Useful working life, wreckage of motorized dhows

If you happen to ask a dhow master the useful working life of his vessel, the answer will be, 15 to 25 years providing that the vessel not being foundered or wrecked. The reason behind his statement lies in the fact that, dhow is very vulnerable in storm and easily is wrecked or foundered. There is not accurate statistics about the number for such incident, but an approximate number is wrecked vessels is about 50 out of the wooden dhow fleet per year.

4.3 Rule observance and dhow design

Despite, imposition of maritime national rules for dhows, which are obligatory regulation for dhow operation, the least safety measures have not been take in connection to said rules for dhow trading. There are also various IMO rules, that dhow traders are not obliged to observe. Therefore the incidents and wreckages can be an unusual accident. The dhow is a vessel which is very eye-catching from appearance point of view. The interior space of the dhow cannot fully utilized, which during loading remains unused. All of this can be modified by small alternation.

4.4 Restriction in loading and unloading

The unsuitable form and the shape of the holds of the wooden dhows make it difficult for loading and off-loading the cargo from the vessel. Since these are all done manually, it is cost bearing and time consuming.

4.5 Dhow building tools

The tools utilized in dhow building are very simple and this will increase the labour costs and reduces the quality of the work. This method of building belongs to 100 to 200 years ago when the procurement of tools was difficult and costly, whereas, wages at that time was low. But at present time it is just the opposite.

4.6 Equipment and machinery used in the dhow

In general in merchant vessels the costs of the equipment and installations is between 50 to 85 per cent of the total cost of the vessel, while the equipment costs in dhows is maximum 35% of the overall costs of the vessel.

5 Main features of replaced vessel

We have concluded from our study that, better replacement for the existing motor wooden dhow is not feasible only with application minor changes, but also it needs to undergo fundamental changes and introduction of totally new suitable vessel. The proposed vessel to replace motor lanj (dhow) must have the following features:

a. The material for the construction should be steel, and vessel will be a cargo transport type, not passenger or fishing vessels. Cargo holds, with different hatches, and the capable of carrying cars, trucks must be foreseen in their design.
b. The vessel must have different carrying capacity, so that could cater to the customer's tastes, in other words their dead weight tonnage as well as their draught should be almost the same as the existing vessels and should be built in three class 200, 500, and 1000 DWT.
c. The maximum proposed draught should range from 2.5 to 4.5 meters.
d. The speed of the new vessels should range between 12 to 15 nautical miles.
e. Their propulsion system should be single screw fixed pitch and single shaft powered by diesel type engine without gearbox. Due care must taken in the design of pitch of the propeller.
f. The steering system is simple rudder at lower part of the stern.
g. Electricity is supplied by small diesel generator.
h. Vessel should be equipped with small crane of 500 to 1000 kg lifting capacity, which is fed by the generator that supplies the Vessel's electricity.
i. The superstructure should look impressive to lanj buyers and skippers, therefore with slight modification to the wooden cabin and the steering wheel room, keeping the previous design of the dhows of the make the vessel more appealing to the people with traditional tendencies. This navigation bridge and crew accommodation will be situated aft.
j. The vessel shall be classed under domestic classification society or other international classifications.
k. The production of the new vessel is recommended to be of series type, therefore in this type of production the vessels are identical in shape, as the result the construction costs are considerably reduced and the design costs is omitted, consequently the vessel costs is kept at minimum.
l. From design point of view the vessel, it is necessary to be designed in such a way that, it meets the hydrodynamic and sea keeping requirements. Operability and survivability of model tests for the betterment of hull shape must be determined in moderate waves conditions. Its radius of operation should be about 200 miles.
m. From construction point of, the design and the form of the hull should not be so complicated in order to keep the finished costs as low as possible.

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The references given below are examples of the following: [1], [2], [3], [4] and [7] are books and [5] is journal and [6] is research report.

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