

Global trends in maritime cruise fleet development

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Key words: maritime tourism, cruise shipping, shipping, cruisers, cruise fleet, trends

Abstract

The exercise of the economic and social functions of maritime tourism has undergone significant changes in recent years. A case in point is the development of the maritime cruise fleet, in both quantitative and qualitative terms, across various regions. This is a result of, among other things, the changing needs of international tourists in particular regions. The worldwide expansion of globalization has also marked a turnaround in preferences, with customers now willing to visit regions formerly unattractive or rarely considered by tourists. These changes are also visible in the variety of transport modalities available to passengers for both domestic and international voyages. To a large extent, these changes stem from technological developments. New possibilities for quick and efficient passenger transport have contributed to transforming maritime tourism in many countries. This, in turn, has led to increasing volumes of tourist traffic, generating economic growth for such nations. This article discusses contemporary trends in the world's cruise ship fleets in the context of the technical parameters of global cruise shipping. The authors have attempted to determine the basic quantitative parameters and metrics expected for characterizing the global cruise ship fleet. To accomplish this, the method of linear regression has been used, with the input data being the sizes of cruise ship fleets and some other characteristic parameters, during particular time periods, carrying capacities, registered tonnages, numbers of passenger cabins, main and auxiliary engine powers, and levels of fuel consumption. The econometric model of linear regression has allowed calculating the projected values for the nearest future.

Introduction

The development of the global economy at the beginning of the 21st century was dominated by new trends inextricably connected with the growing importance of the service sector within the global economic system. A special place there is held by tourist services, whose development is driven mainly by growing social mobility and wealth. The growth of tourism has been accompanied by new trends pushing entities who provide tourist services to create new products.

Tourism is a sector of national economies which has developed rapidly worldwide of late. Within the last 10 years, the number of passengers serviced annually by the CLIA (Cruise Lines International Association Inc.) fleet alone rose from 17.8 to

30 million (CLIA, 2019). In some regions, tourism is the primary sector of business, even sustaining some local economies (mainly in the Caribbean area (CLIA, 2019)). It also represents a most important sphere of both economic and social activity for nations in general. Indeed, the volume of tourism is a yardstick of the living standard and civilizational development of a society. According to the World Travel & Tourism Council (WTTC), the tourist economy across the world accounts for more than a 10.4% slice of the gross global product (WTTC, 2019). This indicator shows the economic position of tourism in today's world while also highlighting the strong connections between what is happening in the tourist sector, in other sectors of the economy, and in the world economy as a whole.

Factors in the development of world maritime tourism

The literature defines maritime tourism as tourism comprised of travel along fixed sea routes, cruises to attractive destinations, and individual yachting trips over maritime or inland waterways, as well as many other recreational activities pursued on or by the water. Cruises are self-contained tourist products featuring short-distance (local) and long-distance (domestic and international) voyages by sail- or motor-powered vessels, maritime and inland passenger shipping, canoeing, and rafting (Kaup, Łozowicka & Chmielewska-Przybysz, 2013). Miotke-Dzięgiel emphasizes that “The contemporary market for maritime tourism includes a wide range of voyages by different means of maritime transport” (Miotke-Dzięgiel, 2002). Therefore, the concept of maritime tourism covers all its multiple forms, such as cruising, maritime sailing, passenger coastal shipping (‘the white fleet’), ferry services, canoeing, underwater tourism, and travel services operated by cargo and passenger-and-cargo vessels. In a narrow understanding of maritime tourism, it is assumed that spending time in or on the water is the main reason for undertaking this form of travel. A broader understanding of the term takes into account water-related tourism as a possible, though not usually the main, motivation for tourists to choose a specific cruise / travel destination (Mańkowska & Mańkowski, 2010).

The conditions of maritime tourism and its developmental trends are shaped largely by changes in the world economy, such as (Urbanyi-Popiołek, 2013, p. 84; Program of development, 2015):

- financial factors related to the increasing wealth of societies;
- political factors related to the security and stability of regions where maritime tourism is present and also from growing international integration as exemplified by, among other things, conveniences related to the freedom of travel, e.g. the opening of internal state borders within the European Union, visa-free entry, and convenience in cross-border traffic. It should be remembered that local and regional conflicts in many areas adversely affect the amounts and routes of maritime tourism;
- economic factors: economic crises in many developed economies will reduce tourist traffic from and to these countries and divert the same traffic to quickly-developing countries;
- social factors: economic growth, improved education levels, and generally greater access to

wealth in a country influences the supply of and demand for tourist services which become more attentive to the needs of tourists with exacting requirements; these factors are related to the motivations for travel by sea and a direct result of growing social and economic mobility in Europe, the USA, Canada, and Asia, as well as increasing leisure time, urban fatigue, occupational burnout, and longer life expectancies; sea travel is seen as a remedy to tiredness and psychological strain;

- environmental factors: growing social awareness of environmental protection and climate change will spur tourist services towards compliance with the highest standards of environmental protection, including cruise services;
- technological factors: advances in information and communication technology have enormous impacts on providing methods of access to tourist services, including the adjustment of methods and services to diverse customers’ needs.

These factors contribute to new trends in world tourism whereby trips are becoming shorter but more frequent, with travelers increasingly expecting services tailored to their needs and offering a more ‘genuine’ travel experience. In addition to these demands, supply factors play a large role in creating demand as maritime tourism services, carriers, and tour operators offer diverse choices of vessels and itineraries. These changes are also driven by developments in tourist infrastructure, such as hotels and land-based transport infrastructure (Urbanyi-Popiołek, 2013). World trends in demand for tourist services include more customers with discerning tastes who are vocal about their needs, rising levels of education, lifestyle changes in Western societies characterized by the increasing importance of individual needs, superior awareness with respect to environmental protection and sustainable development, and growing interest in and use of new IT technologies, including the internet (Markiewicz, 2013).

The factors discussed above have led to the rise of luxury passenger cruises as increasingly popular options for tourists from Western Europe and the USA. Luxury tourism is designed for customers willing to pay a premium for experiences that satisfy their high expectations. A particular example of luxury tourism is cruising, understood as touring the world on board a passenger ship travelling between destinations hosting tourist attractions (Taraszkiewicz, 2008). According to Swoboda-Rydz, a passenger ship is designed for pleasure cruising, in which the voyage itself, the associated modern

conveniences, and the destination all contribute to the desired positive travelling experience (Swoboda-Rydz, 2012). Transport is not the main goal here because cruises usually end at the point of departure. According to the federal US register, a cruise ship is defined as a passenger ship with capacity to carry over 400 passengers and more than 200 feet (60.96 metres) in length. This definition also covers ferries conforming to these rules and regulations (Rules and regulations, 2011). Certainly, this represents a form of tourism that does not place any demands on the tourist. The passenger may spend the entire voyage on the ship, taking advantage of a wide range of recreational activities. This means that he/she may be unlikely to visit the port cities, but this does not detract from the role of cruising in the development of modern tourism (Mańkowski, 2008). The most famous passenger carriers include the “Queen Mary 2,” “Queen Elizabeth II,” and “Queen Victoria,” while the “Symphony of the Seas” operated by the Royal Caribbean International, was commissioned into service in April 2018 and is now the largest and most expensive such vessel (EUR 1.3 billion).

Selected classification criteria in the world cruise fleet

Cruise Lines International Association (CLIA) is an umbrella body with a worldwide membership of over 30 shipping associations operating more than 300 cruise ships. The increasing size of newly built vessels is one of the characteristic developments in

maritime tourism nowadays. The tendency is most prominent in the North American maritime cruising market, especially in the Caribbean. The enlargement of passenger ships has economic motives. In the face of growing competition, many shipping associations believe that long-term survival on the market is impossible without a reduction in operating costs (Gaworecki, 2000, pp. 42–43). This means that a ship able to accommodate more passengers at a time makes better business sense. According to Kizielewicz, the long-time hotbeds for cruising are in the Americas, in particular the Caribbean Sea area, and in Europe, led by the Mediterranean area (Kizielewicz, 2015). Other regions command a much smaller share of the market. One can see there is a strong demand in these regions, as they are home to the largest maritime cruising corporations, such as the Carnival Cruise Line, Royal Caribbean International, Norwegian Cruise Line, and Costa Crociere (Table 1). Also, these regions contain leading destinations such as Miami and the Everglades in Florida, and Barcelona and Rome in (Civitavecchia) in the Mediterranean area. The largest cruise ships are operated by Royal Caribbean International, a Norwegian-American company headquartered in Miami and responsible for a 25% market share of luxury cruises. All of this company’s ships have, since 1991, had the words “of the Seas” added to their names. Their largest ship is Symphony of the Seas, a 1.4 billion-dollar project built, like most of these ships, by Finnish shipyards (Rettinger & Urbańska, 2012).

Table 1. The 15 top-ranking cruise shipping companies (end of 2016) (ISL, 2018)

Owner/operator	Country	No.	1000gt	Berths	Average 1000gt	gt-% share	Average age
Carnival	USA	102	8 754	224 115	86	44.3	12.9
RCCL	USA	40	4 480	109 615	112	22.7	13.6
NCL Group	USA	24	1 909	46 592	80	9.7	11.0
MSC	Switzerland	12	1 189	31 756	99	6.0	9.1
TUI Group	Germany	15	784	19 930	52	4.0	19.1
Genting Group	Malaysia	8	530	13 075	66	2.7	19.0
Disney Cruise Line	USA	4	426	8 520	107	2.2	11.3
Silversea Cruises	Italy	8	142	2 268	18	0.7	20.1
Fred Olsen Cruise Lines	Norway	4	125	3 785	31	0.6	34.5
Phoenix Reisen	Germany	4	124	3 154	31	0.6	29.5
Louis Group	Cyprus	4	98	3 940	25	0.5	32.5
Viking Ocean Cruises	Norway	2	96	1 874	48	0.5	0.5
Cruise & Maritime Voyage	UK	3	84	2 650	28	0.4	50.0
SkySea Cruise Line	China	1	72	1 778	72	0.4	21.0
Windstar Cruises	UK	6	56	1 234	9	0.3	27.2
Others		64	889	24 766	14	4.5	26.3
TOTAL		301	19 759	499 052	66	100.0	17.5

Maritime tourism, due to the number of participants, can be divided into (Ward, 2006):

- Individual cruises (1–9 passengers), which are organized on the smallest crafts;
- Group cruises (10–500 passengers), on small ships;
- Mass cruises (501–2000 passengers), on medium size vessels;
- Large resort ship cruising, (2001–4000 passengers), on the largest ships.

Considering tourism in terms of purpose travel, the following classification can be described: (Kizielewicz, 2012):

- cultural tourism: sightseeing excursions to coastal towns and cities, national parks, fishing villages, natural reserves, and places of worship;
- adventure tourism: fishing and diving cruises (e.g., SCUBA, cave diving, and snorkelling);
- topical tourism: Valentine's Day cruises, Christmas cruises, golfing cruises, gambling cruises, cruises for seniors, photographers, women, singles and others;
- educational tourism: cooking cruises, dance cruises, and language cruises;
- business tourism: company cruises, motivational cruises, business meetings, seminars, conferences, symposiums, and congresses;
- entertainment tourism: dance events on the sea;
- health tourism: SPA & Wellness cruises, surgery cruises, and fitness cruises;
- eco-tourism: cruises to ecologically intact areas.

In closing, it should be emphasized that the development of new generations of cruise craft will increasingly rely on economies of scale (i.e. the mass tourism market), at the cutting edge of design

and technical innovation and offer a multifaceted recreational shipboard experience (Johnson, 2002).

An analysis of quantitative and qualitative aspects of the world cruise fleet – the authors' own research

As of August 31, 2019, the database at maritime.lhs.com put the number of cruise ships at 585 worldwide, of which only 7 are ice-classed and therefore fit to provide services associated with arctic tourism. The combined register tonnage within that group stands at 23,162,737 and net capacity at 14,207,466. The total carrying capacity was 2,293,761 dwt with a total of 705,740 berths. The changes in the basic parameters of the fleet from 2010–2018 are illustrated in Table 2.

The average weighted per-ship register tonnage within the cruise group was 39,574 gross and 24,286 net. The average values for linear parameters are as follows:

- LOA (length over all) – 154.1 m,
- Width – 21.06 m,
- Water line – 9.7 m.

With these figures, the average number of decks on a cruise ship is 7, each of which houses on average of 507 cabins with 1221 berths. The average size of ship crews is 478. The total number of berths available to passengers within that fleet is 693,748.

The above data refer to the entire existing fleet. For ships commissioned into service between the years 2010–2018, the average values of the fleet's main parameters have been shown in Table 2 in order to illustrate how the calculations have changed in both quantitative and qualitative terms. These

Table 2. Basic quantitative and qualitative parameters of world cruiser fleet (based on (HIS, 2019))

Year	No. of ships	Average main engine power	Total fleet engine power	Average LOA	Average No. of cabins	Average No. of decks	Average No. of pax. places	Total fleet No. of pax. places
[unit]	[pcs]	[kW]	[kW]	[m]	[pcs]	[pcs]	[pcs]	[pcs]
till 2009	451	20 660	9 069 709	142.0	438	6	1 069	482 090
2010	17	42 063	715 068	221.5	579	9	1 520	25 837
2011	12	26 373	316 474	154.0	664	7	1 483	17 794
2012	9	49 322	443 894	248.3	796	9	1 880	16 916
2013	7	37 254	260 780	234.5	1 244	14	2 584	18 086
2014	7	43 956	307 692	246.9	757	9	1 688	11 813
2015	9	31 632	284 684	205.2	1 161	12	2 587	23 283
2016	12	41 789	501 462	249.2	1 053	13	2 596	31 150
2017	17	29 341	498 800	195.9	1 500	14	3 513	59 724
2018*	24	23 479	563 490	163.0	119	3	24	6 793
2010–2018	117	34 382	4 022 664	206.5	774	9	1 809	211 658

* only a single large vessel was delivered in that year; the other 23 vessels were very small units, of which 8 with space to accommodate 36 passengers and 4–16 passengers.

additional figures are much higher than the averages for all ships, which means that the following have taken place in the last 9 years:

- the world cruise fleet has increased its size by over 25.9%;
- average power of a cruise ship has grown by over 66.4%;
- total engine power in the cruise fleet has grown by 44.4%;
- the average length of new ships is over 45% greater than the average overall figure for the world fleet;
- the average number of passenger cabins on new ships is higher by 76.7% than the overall figure;
- the average number of berths on new ships has grown by close to 70%;
- the combined number of berths on new ships equals 43.9% of the overall available number of berths pre-2010, amounting to an almost two-fold increase in that figure.

As for engine power, a total figure of 13,272,894 kW was recorded for main engines and 797,884 kW for generators. On average, each ship is powered by three engines with the combined output of 23,547 kW and three generators with 4030 kW each. The average daily fuel consumption hovers at 103 tons, of which 93.6 tons are used for propulsion and the other 9.4 tons for utility purposes. The stated figures refer to HFO and MGO drives and do not include the seven ships powered by LPG/NPG.

Prospects for development of the world cruise fleet

The growth values stated above for the period between 2010 and 2018 with reference to the basic

quantitative and qualitative parameters of the world cruise fleet provided the inspiration to survey the prospects for these parameters up to the year 2030.

This has been done using linear regression with the input data being the size of the world cruise fleet and its associated parameters such as average craft length, average main engine power, and combined engine power of all fleet members. Also consideration has been given to other parameters impacting the fleet's capacity, such as the average number of cabins per ship, the average number of passenger berths and the combined number of berths offered to passengers in all ships in the fleet. Thanks to the econometric linear regression model, it has been possible to determine the parameter values for the period from 2019 to 2030. Regression means that when the value of an independent variable changes by a unit, the dependent variable rises or drops (depending on the sign) by a parameter value b . The angular coefficients of straight lines $b(y)$ and $b(x)$ are referred to as regression coefficients (Aczel, 2000; Kleinbaum et al., 1998).

These methods yielded some interesting values for the parameters under discussion, as presented in Table 3.

The linear regression model is somewhat inadequate for extremely long strings of input data, as seen in the above calculations, particularly where the forecast number of berths is concerned. The figure forecast for the years 2019–2020 proved to be lower than the actual figure for 2018, calling for a cautious treatment of values calculated for subsequent years, especially because the estimated percentages of growth for other parameters are inconsistent with the calculated growth of the overall number of berths.

Table 3. Estimation of chosen parameters of world cruiser fleet

Year	No. of ships	Average LOA	Average main engine power	Total fleet engine power	Average No. of cabins	Total pax. places	Average No. of pax. places
Unit	[pcs]	[m]	[kW]	[kW]	[pcs]	[pcs]	[pcs]
2019	573	233.2	38 997	13 754 924	1 022		2 286
2020	583	238.7	40 113	14 157 606	1 059		2 366
2021	594	244.2	41 229	14 560 288	1 096		2 446
2022	604	249.6	42 344	14 962 652	1 132	698 351	2 526
2023	615	255.1	43 460	15 365 653	1 169	710 344	2 605
2024	625	260.6	44 576	15 768 335	1 205	722 337	2 685
2025	635	266.1	45 692	16 171 017	1 242	734 330	2 765
2026	645	271.6	46 807	16 573 699	1 278	746 323	2 845
2027	656	277.0	47 923	16 976 381	1 315	758 315	2 925
2028	666	282.5	49 039	17 379 063	1 351	770 308	3 004
2029	676	288.0	50 155	17 781 746	1 388	782 301	3 084
2030	686	293.5	51 270	18 184 428	1 425	794 294	3 164
Δ30/18	+20.8	+90.5%	+117.3%	+37.0%	+181.1%	+14.5%	+159.1%

According to the estimates, the fleet should grow by little more than 20% which represents 686 vessels. This should be mentioned in conjunction with the calculated lower limit of projection (LLP) – 682 and the upper limit of projection (ULP) – 691. This means a good match with the forecast and a narrow margin of error.

It is interesting to consider the forecast average length of cruise ships, with the figure expected to double (over 90% growth) and a very large spread between LLP and ULP: 265.3 metres and GGP 332.6 metres, respectively. It could be argued therefore that the world cruise fleet will increase not only in size but also in craft length.

This argument is borne out by the estimated average values for number of cabins per ship and number of berths available. The first parameter is expected to grow by 181%, while the second by 159%. We may therefore go further and say that cruise ships will not only become longer but will also grow in capacity to accommodate increasing passenger traffic. As we analyze the ranges of estimates for these two parameters, we see that the forecast is consistent. For an average of 1425 cabins, LLP is 1115 and ULP is 1734. For an average of 3164 berths, LLP stands at 2514, while ULP at 3975. In terms of carrying capacity, it can be seen that individual craft may vary considerably in size, which further supports the previous conclusion.

Estimates for the average engine power of cruise ships show a +117% growth. This means that energy demand will rise much more quickly than the fleet's size. LLP for this parameter was 42,980 kW, and ULP – 59,561 kW. The spread of estimated values is therefore wide.

The combined fleet power is estimated to reach 18.18 MW with narrowly spread LLP and ULP, standing at 18,017,083 kW and 18,351,773 kW, respectively. To conclude, while the average for an individual ship may differ with respect to other craft within the analysed fleet, the combined figure for power does not display considerable inconsistencies and therefore seems reliable.

Conclusions

In closing, it should be pointed out that tourism becomes increasingly popular worldwide year after year. At the same time, it is undergoing constant changes, creating new challenges related to aligning the modernization and adaptation processes with ever-changing demand. These tendencies affect product creation in that they determine products'

perceived attractiveness, quality, and innovativeness. One of the most characteristic features of maritime tourism development recently is the rapid increase of ship sizes, especially in North American waters, the largest maritime tourism market at present. The tendency to build increasingly larger ships makes economic sense. In the face of growing competition, many shipping associations believe that long-term survival on the market is impossible without reducing operating costs. A single large ship is more economical than two smaller craft, leading to lower costs, better passenger comfort and more attractive entertainment options.

In 2018, 28.5 million people, including two million Germans, took cruises, and the figure is rising. What used to be an impossible dream is now available to a larger clientele due to price cuts. Environmentalists criticize the trend, arguing that cheap holiday tours exact a high cost in terms of environmental damage. Most of the 300 craft are still powered by heavy fuel oil (mazut), classified as among the most toxic of fuels, with negative effects on the environment. Burning mazut releases high doses of CO₂, sulphur oxides, dust, and heavy metals. Ships need to run air conditioning, lighting, and heating also when moored at berth or in the harbor, leading to increases in complaints among seaside populations about air pollution. To remedy this, most ships are now switching to more expensive and more environmentally friendly diesel engines during stoppage times in port (Schlagwein, 2019).

A survey of the climatic impact of cruise shipping needs to consider that cruising makes up a mere 2% of worldwide tourism. For comparison, 60% of holiday makers in 2018 chose travelling by plane. In that regard, we also need to remember that the development of the tourist industry heavily affects nature and local communities, that is to say, exactly the things that attract tourists to a specific locality. The problems plaguing tourist areas include mounting road traffic, crowded venues and congested walking trails, storming of tourist attractions, landscape damage due to poor designs and layouts for buildings and other infrastructure, depletion of natural resources, shrinkage of wildlife areas, climate change, and undesirable social phenomena such as prostitution and begging, followed by displays of uncouth tourist behavior. These problems can even threaten the success and continuation of tourism in particular places.

Therefore, it is necessary to strive for the sustainable development of the tourist industry wherein our desires to travel will not prevent others or future

generations from enjoying the possibility. However, this cannot be achieved without taking action to preserve natural and wildlife resources, as well as to support local communities and their cultures and economies. Among current trends within the industry is so-called 'responsible tourism,' which means organizing and engaging in tourism in an economically, environmentally, and culturally responsible way.

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