
OPERATIONS RESEARCH IN THE CRUISE INDUSTRY

Darshani Mehta*¹, Aryan Agarwal*², Dishi Aggarwal*³, Divam Nangia*⁴,
Dharti Raghuvanshi*⁵

*^{1,2,3,4,5}Students, Anil Surendra Modi School Of Commerce- NMIMS, Mumbai, Maharashtra, India.

ABSTRACT

The growing interest in cruising industry came to a halt when Covid – 19 spread worldwide. The purpose of our research here is to analyze how global cruise brands are going to come back into operation and the methods they can adopt to do this efficiently. Previously published literature suggests that these lines will be using methods such as capital expenditure reductions, payroll reductions, and even making the lines leaner. However, the limitations of all these studies and even our own is the lack of sufficient data. Secondary data had to be used and making future predictions was not easy because there were no past patterns to analyze and no real time values. We then analyzed the measures that the biggest cruising brands will be taking to get back into business. Royal Caribbean divided their post-pandemic measures into 4 phases – Testing and Health Screening, Sanitation and Ventilation, Response Planning and Destination Planning. Celebrity Cruises and Norwegian Cruise Lines took similar measures including the Small Group Discovery lines platform for private tours. To make rebeginnings efficient, we suggested two OR models – Berth Allocation and Queuing Theory. Following recommendations can be further discussed– Vessel Call Intimation or allotment of berths after receiving the electronic communication.

Keywords: Cruise Industry, Covid-19, Operations Research, Berth Allocation, Queuing Theory, Royal Caribbean, Celebrity Cruises, Norwegian Cruise Lines.

I. INTRODUCTION

The worldwide cruise industry's income has risen to more than 27 billion US dollars in recent years, however travel limitations caused by the coronavirus (COVID-19) pandemic affected this sector severely in 2020. Despite a rise in cruise passenger numbers from 17.8 million in 2009 to about 30 million 10 years later, there were only about six million passengers in 2020.

Fighting against all odds, cruise industry might be able to begin functioning again in 2022 as normal. The techniques suggested in our study for the future of cruise industry are Berth allocation and Queuing theory. Berth allocation basically makes a reference to the advance planning done of which cruise vessels will drop by the given sea port on a particular day for a particular timespan, whereas the queuing theory is used to bring about a sequence of customers advent time and to choose randomly between different services.

Repressed interest as of now has prompted a gigantic flood in appointments in 2022 and 2023 from cruisers who have had their excursions dropped or postponed due to the pandemic. While Covid will plague the world and cruise industry with its effects for a prolonged time, the two models presented here will ease the functioning of the industry after its rebeginning. They will help disperse crowds and plan a schedule avoiding all possible medical mishaps.

The worldwide cruise business is now controlled by a few US-based companies, particularly Carnival Corporation, Royal Caribbean Cruises, and Norwegian Cruise Line. International travel restrictions imposed in 2020 to minimize the spread of the virus interrupted cruise vacations across the world. As a result of the health issue, the world's major cruise firms reported a significant reduction in revenue. Royal Caribbean Cruises and Norwegian Cruise Line reported revenue declines of up to 80%. We further analyse three different cruise lines- Celebrity Cruises, Royal Caribbean and Norwegian Cruise Line to see what their future looks like. Therefore, we aim at the following

RESEARCH OBJECTIVES

1. Analyze steps taken by major cruise lines to face the catastrophe
2. Suggest models for efficient rebeginning of cruise industry post the pandemic.

In the next section, we present a literature review about existing theories. In the third section, we have given methodology followed by analysis, limitations, recommendations, conclusion and references.

II. OVERVIEW OF THE INDUSTRY

Tourism is not a science (Bouillon, 1990, Dávila & Di Campo, 1997) as tourism was not born out of a theory but of a spontaneous reality, and in the same way, its components are material and not ideal. Nevertheless, tourism industries have their own sets of rules. In order for any type of tourism to exist, it is necessary for a person to stay away from his usual residence for at least one day and to stay the night at a place other than his habitual residence.

(Cruise tourism explained: What, why and where, 2020) Cruise tourism is a form of travelling for relaxation purposes that involves an inclusive holiday on a cruise ship. It is a big business. However, the cruise industry is undergoing tremendous changes (Delgado, 2017). Although this industry has been the one to experience the most rapid climb of all during the last decade. Not only this but the cruise industry also has to face the complex problem of supply and demand factors. In order to meet its demand factors this industry is not only targeting the first-time cruise passengers but also struggling to manage and efficient fulfilment of demands by their experienced passengers. This demand by the passengers further nudges the industry to seek out new locales to maintain the customer base. This sector must adhere to customer service for its successful operations. There has not only been a change in the physical shaping of ships but also changes have been identified in the geographical front. To be able to survive and function the cruise lines have had to adjust their itineraries (Baker, 2016) drastically. To make it more convenient for their passengers the industry has chosen to direct its ships towards the drive friendly ports. However, it becomes of utmost necessity to take into consideration the techniques to maintain the balance between the demands and supplies. As per the existing research on the operation planning of this industry, it is noted that the planning problems must be in line with the further improvements in order to not only increase profits in the future and cut down costs but also to improve the service experience. On the service front the cruise industry is constantly evolving and adapting (Baker, 2016). Over the years cruises have incorporated various activities and services to keep their passengers hooked. Ships have increased their involvement in providing specialized kids services on them. Also, they have indulged in out stage performances like movies, theme cruises, yoga and meditation and not to forget ocean shoots too.

Pandemic's Catastrophic Effects

As per (Mathew, 2021), cruise industry came to a standstill with the onset of the pandemic as passengers resorted to mass cancellation. Cruise companies themselves annulled bookings and stopped further cruise announcements. The focus immediately shifted to cruise ships that were still on the waters as COVID-19 cases began to be reported from these ships still suspended away from the shores or from passengers who got off.

More than 700 passengers and crew members tested positive in the Diamond Princess ship that was anchored in Yokohama, Japan, earlier in 2020 ((Manoharan & James, 2021). Grand Princess ship reported second highest number of cases and they were referred as "floating petri dishes".

To battle the pandemic, the industry took efforts like capital expenditure reductions (including sales and admin projects), reduced payroll and related expenses by means of layoffs, reduced work weeks and salary reductions (including senior management) and sale of least efficient ships quotes (Rodrigues, 2021).

(Coulter, 2021) reported that cruise lines will be leaner considering the number of ships scrapped in the past 12 months.

A proof of this is given by (Insider, 2021) in which the condition of Turkey's port and scrap yard where thousands of ships have been sold and are being torn apart is shown. Economic activity linked to cruising dropped by \$77 billion and over 500000 jobs were lost. 2020 was supposed to be a record-breaking year with over 32 million passengers but the pandemic shattered all dreams.

Future Trends and Predictions

"Venice entices 24 million tourists each year, which is same as the number of customers cruise industry attracted in 2019." (McCormick, 2021) Thus, there is definite scope for growth and improvement in the industry, as innovation slashes some costs and global expansion pierces new markets. McCormick believes that with second wave left behind and vaccination efforts beginning to rise rapidly, future news will be much more positive. Norwegian Cruise Line Holdings Ltd. (NCLH) reported stronger bookings for 2022 than 2019. NCLH

has more visibility in the future business than they have ever had. However, (Rodrigues, 2021) believes that in the most reasonable case scenarios as well revenues are not expected to return to 2019 levels until 2025.

But (Critic, 2021) are optimistic that one year without cruises won't turn into two. The reasons they believe so are because - 1) cruise ships are already sailing. (Royal Caribbean's Quantum of the Seas having a very successful season in Singapore). 2) Vaccination drives are on a rise. 3) Investment in health and safety protocols. As per (McCormick, 2021) Several trends are set to emerge. For starters, the concept of "Instagram-able cruise travel" emphasizes onboard connectivity and passengers advertising their "diverse travel experiences" both on and off board the cruises to their networks. As a result, the ships must be made to appeal to the "Instagram savvy mind" which leads to the next trend; luxury spa and rejuvenation services.

(Rodrigues, 2021) predicts these positive trends into the future: monitored shore excursions like a social bubble, cruises to nowhere (4 day cruises without stops like in Singapore), private islands and broad range of onboard technical facilities.

Technology At the Forefront of the Post-Pandemic Recovery

"Tech will be at the center of cruise ship experience as the pandemic made the use of advanced technology a norm", believes (Coulter, 2021) Ship's mobile app will be used to navigate the ship, locate kids, onboard expenses tracking and to book onboard facilities like meals, spas, shore excursions, etc.

Like siri and alexa, MSC Cruises' newest ships have in-cabin voice-activated artificial intelligence which will answer all queries that once had to be enquired on the reception.

As per (Bowman & Huang, 2021) if cruise lines follow Centre for Disease Control's recommendations, travellers will be seeing a lot more gadgetry. Some of the recent add-ons could be-

Virtual Check-in

With technology streamlining, quite a lot of ports have started a 'smart check-in' system which in its essence is check-in before departure.

Wearable Tech

Say no more key cards. MSC Cruises' wearable bracelet and Carnival and Princess Cruises' Ocean Medallion offer wearable bracelets can not only be used as replacement to keycards but can store essential information and provide 130 different services. These wrist bands can track food allergies, location, store credit card information, control light and temperature and provide a seamless experience throughout.

Chatbots

MSC Cruises' have introduced a smart assistant called Zoe that is available in each guest's cabin to help them with tasks that cannot be done manually.

Augmented Reality

Using just an app, guests can be guided to all parts of the ship without even stepping out of the cabin.

Geo-Location

Due to the enormous sizes of cruises, some guests can face difficulty in reaching on board services. The app can help guests reach door-to-door, find their luggage and even follow people around.

III. METHODOLOGY

We aimed to systematically describe the characteristics of cruise lines and to explore an under-researched topic- future of cruise industry post pandemic. In order to gain a better insight into the feasibility of rebeginning, information was accumulated from the official websites of the cruise lines. In the lack of any real time data present and restrictions imposed by the pandemic on in person interviews, we had to use theoretical knowledge present on models. We suggested two OR models by meticulous research and thorough reading on the topics.

IV. ANALYSIS AND FINDINGS

As per (Pallis & Papachristou, 2021), the three largest cruise lines, Carnival (47% including its nine brands), Royal Caribbean (approximately 25% with 3 brands), and Norwegian (9.5%) represent 80% of the market concentration of the cruise industry.

We analyzed three different cruise companies- Royal Caribbean, Celebrity Cruises and Norwegian Cruise Lines to inspect their functioning during the pandemic, how they managed their operations to minimize losses and plan to operate in the future.

Royal Caribbean:

For the full year starting March 31st 2020, Royal Caribbean recorded a Net Loss of \$5.8 billion. The company took a major hit, as a consequence of which many of the employees and crew members lost their ways of earning a living.

Despite of all this, lately, the number of bookings this quarter went up almost 50% as compared to the last. The latest prediction is that by the end of this year 80% of their ships should be in service. They have even laid out an itinerary for the sail of each of their ships this year, starting with Adventure of the Seas.

They promise to have a fully vaccinated crew and at least 95% guests vaccinated. They have divided all protocols into different sub categories of measures:

a) Testing and Health Screening

Each guest and crew are required to get a test done between and 5 and 1 days of leaving.

b) Sanitation and Ventilation

Guests will be educated on the sanitary measures on board. HVAC systems like MERV 13 filters are in place for cleaner air.

c) Response Planning

On board, increased number of medical personnel to handle potential cases with increased capacity in clinics. Isolation cabins will be assigned and mobilized plans for debarkation of passengers.

All these measures will be the future of Royal Caribbean till the situation worldwide settles.

Celebrity Cruises:

They will sail at a reduced capacity to offer more space for greater luxury, and in accordance with CDC recommendations, all staff will be vaccinated.

The following protocols will be followed by the company:

Before the boarding, all guests are needed to finish a health form. In some homeport countries, which were worse struck by the virus, testing will be required for all guests regardless of vaccination status.

A new HVAC system allows cruisers to relax, knowing that the sturdy system's levels of protection render aerosol particle transmission across places extremely low to nearly impossible.

High-quality onboard medical care has been prioritized and strengthened, with more physicians and nurses on each ship and state-of-the-art equipment upgrades.

Small Group Discoveries will be offered, as well as Private Journeys for those who wish to tour with their family or group. Their improved cleaning and sanitization processes, as well as the upgraded medical facility, set a new standard for the industry.

The company continues to work with the Centres for Disease Control and Prevention in the United States and government authorities throughout the world.

Norwegian Cruise Line:

Very few cruise lines are having as difficult a time as the Norwegian Cruise Line (NCL). The third largest Cruise Operator in the world, after Royal Caribbean and Carnival, Norwegian has been fighting to stay afloat since the beginning of the pandemic, its market shares plummeting in the first few months of the year while their expenses skyrocketed.

a) Norwegian's Fall During Covid-19

After generating profits of approx. \$6.4billion in 2019, Norwegian's share price traded at nearly \$60 at the end of December. In the six months that followed, this value dipped drastically going as low as \$10 per share by June witnessing a fall of over 80% since the beginning of the year.

b) What Lies Next for The Norwegian Cruise Line

Ben Cordwell, a Global Data travel and tourism analyst, comments "A situation where [Norwegian] has to offer the ships and the islands as collateral shows the gravity of the situation, how serious it is and how essential and desperate companies are to raise finances." He adds that this may prove efficient in the case of NCL but there was no way that it will be sustainable in the months to come.

Instead of that a more long-term option was more viable for the Norwegian Cruise Line, which was to sell the stakes in the company itself. This way, Norwegian could guarantee financial stability in the future as it would avoid the stock prices to reduce even more.

Yet nothing will help the Norwegian Cruise Line more than new bookings for the future cruises to increase their long-lost popularity due to the pandemic.

Cruise industry remains one of the worst affected industries by the pandemic and the future remains hazy with the Delta variant being active as of now. We suggest a few Operations Research models that will assist the future rebeginning of the Cruise Industry in light of the Covid-19 pandemic and its medical constraints still remaining in place for a few years ahead.

Operations Research Models for the Future

Today, the biggest cruise ships have a capacity of 6687 passengers and an industry average 3220 passengers' capacity. After being struck by a pandemic, these numbers seem frightening. The arrival of two average size cruise vessels at a given port means more than 6000 travellers disembarking simultaneously. Two OR techniques that can be beneficial to the future of the cruise industry that will remain plagued by the pandemic for a few more years are-

1) Berth Allocation

2) Queuing Theory

Berth allocation is a practice referring to the advance planning of which cruise vessels will visit the given port a specific day for a specific timespan. Given the restrictions imposed by the geographical distances between ports included in an itinerary, the lengths of cruises and medical constraints as of Covid-19, berth allocation can resolve a lot of problems in the future. The problem of berth allocation is even more essential in the case of minor, subordinate, cruise ports. In scenic destinations which are relatively smaller or a seasonal activity, cruises debarking without an allocation might mean the relatively hostile situations of a crowded location at certain days or hours. In larger ports at the time of arrival of huge ships on which thousands of people are cruising, this might take the form of mobbing. Without effective planning, during some days these destinations are subject to the burden and the catastrophic effect of too many passengers. Berth allocation demands the progress of two types of coordination. The first one is the coordination between cruise ports and cruise lines in order to orchestrate or synchronize the system at the port and the operations happening at the port terminal. The other is that the coordination of tourist destinations, including local public establishments, museums, retailers and, foremost transport service providers (coaches, buses, taxis) and industries involved in travel, so as to create smooth and hassle-free embarkation and disembarkation processes and passengers flow in the destination.

Berth allocation can be complimented by Queuing theory.

As said by (S. Shanmugasundaram & P. Umarani, 2015), queuing is used to generate a sequence of customers' arrival time and to choose randomly between different services. With regards to cruise industry, queuing can help generate a sequence for cruises' arrival time and these services could be: start of a cruise from the port, a quick pit-stop, or the last stop of a cruise where complete disembarkation takes place and cruise might stop for a little while before beginning again just like with trains. Different periods of time for each service can be considered in the model. A queuing system can be described by the flow of cruises for service at a port, forming or joining the queue, and leaving the port after the completion of the work. Computer simulation is one of the popular approaches to the design of the model. Various configurations such as embarkation methods, number of docks and ports, and types of cruises must be used in the future. Performance measures such as average queue length, average waiting time, maximum queue length, and maximum waiting time at the ports can be compared. Cruise industry represents a multi- server model where a single system (port) has a number of

parallel channels (docks) each which can host a cruise. Both of these models in cooperated in future planning of the cruise industry can bring about a huge head start in the rebeginning of the cruise industry after the pandemic.

V. LIMITATIONS

The empirical results of this research have to be seen in light of some limitations. The time available to study the research topic was constrained by a deadline. Unavailability of information (real time data) on the topic proved to be one of the biggest hurdles in the exploration of the full extent of the topic. Restrictions imposed by the pandemic did not permit us to interview a cruise industrialist or an avid cruise traveler in person and we used secondary data for the purpose of our study. Predictions involving future scope and modelling can never be fully accurate and always will have to have space for uncertainties as no information retrieved can be a hundred percent efficient. Lack of technical knowledge prevented us from solving a problem in real time with respect to berth allocation and queuing theory models.

VI. RECOMMENDATIONS

In lieu of the recent rise of the pandemic and the problem of berth allocation, the following measures are recommended.

Vessel Call Intimation: This action must be undertaken by the vessel agent port or the concerned port authorities. The concerned vessel agent will have to electronically provide estimated time of arrival at regular intervals, since priority berthing is necessary.

Allotment of Berths: The Agent must offer a precise estimated time of arrival and make a request for berth allotment via electronic means. Also, the manager, similar officials of the relevant port should electronically assign berth and time of berthing within 12 hours of the request to be able to practice hassle free and efficient berth allocation. The epidemic may be viewed as a wake-up call for everyone including the cruise sector. During the peak of the epidemic, more collaborations were witnessed among cruise lines than maybe ever before, with businesses focusing on the larger benefit of the industry rather than their own enterprises. This tendency can be expected to continue in the long run, particularly in terms of visitor health and safety. Similarly, the drumbeat of over-tourism, which peaked in 2019, will be examined more carefully in 2022 and beyond, with lines collaborating closely with one another and destinations to avoid overwhelming an island or town with several arrivals all on the same day. Cruise lines will consider how many ships were demolished in the last year, with the major companies keeping significantly fewer smaller and elderly ships in their fleets.

Hence, for the future scope of study what matters is how the lines plan for and respond to future onboard instances. Some long-term adjustments will help to alleviate this: Ships will designate additional staterooms as isolation areas; the upgraded medical facilities provided onboard will remain; and increased ventilation and deep cleaning with hospital-grade equipment will become the standard.

VII. CONCLUSION

Previously, cruise lines focused on modernizing their fleets of ships with ever-outlandish amenities such as zip lines, go-kart courses, and water parks, generating publicity and buzz in the process. However, there were still friction points at important stages in the client experience. Now, technology can help to simplify the traveler's experience from pre-cruise to post-cruise, countering the consequences of long lines at embarkation and overcrowding while also giving unexpected and delightful moments. We analyzed the top three cruise lines in the world – Caribbean Cruises, Celebrity Cruises, and the NCL. By taking these three cruise lines as our models, we found out that most of these cruise lines have had a huge fall in their stock prices shaking their financial position due to lack of customers and the government imposing a no sail order. This could only be countered by attracting as many customers as possible by means of marketing and reducing the cruise charges, along with increased amenities. The only goal of the cruise industry was to get as many customers as possible to get in profits and this will be possible in the future with the help of suggested models in the pandemic struck world.

The future of cruise industry after Covid-19 is showing an increase in popularity as people go for cruising not just for the sake of transportation but to enjoy the facilities that the cruises have to offer. Cruise Industry, being

one of the largest industries in the world, can skyrocket their number of customers and increase their popularity if they play their cards right.

VIII. REFERENCES

- [1] Baker, D. M. (2016). The Cruise Industry: Past, Present and Future. *Journal of Tourism Research*: Volume 14, 143-154.
- [2] Bowman, E., & Huang, P. (2021, May 29). The Buffet Can Stay: What The Future Of The Cruise Line Industry Looks Like. Retrieved from npr: <https://www.npr.org/2021/05/29/1001354354/the-buffet-can-stay-what-the-future-of-the-cruise-line-industry-looks-like>
- [3] CelebrityCruises. (2021). Health and Safety. Retrieved from Celebrity Cruises: <https://www.celebritycruises.com/health-and-safety>
- [4] Chen, J., Petrick, J., MacKay, K., & Nijkamp, P. (2020). Decision-making in cruise operations management: A double-hurdle. *Research in Transportation Business & Management*.
- [5] Coulter, A. (2021, July 7). The Future of Cruises and the Cruise Industry, 2022 and Beyond. Retrieved from *Cruise Critic*: <https://www.cruisecritic.com.au/articles.cfm?ID=5908>
- [6] Critic, C. (Director). (2021). Could One Year Without Cruises Turn Into Two? 3 Reasons We're Optimistic (and 1 Reason We're Not) [Motion Picture]. Retrieved from https://www.youtube.com/watch?v=TCU_LGv7OFM
- [7] Cruise tourism explained: What, why and where. (2020, October 10). Retrieved from *Tourism Teacher*: <https://tourismteacher.com/cruise-tourism/>
- [8] El-Bawab, N. (2021, August 4). Royal Caribbean posts wider-than-expected loss as Covid delta variant hurts its ability to fill ships this summer. Retrieved from *CNBC*: <https://www.cNBC.com/2021/08/04/royal-caribbean-cruises-q2-2021-earnings.html>
- [9] El-Bawab, N. (2021, August 4). Royal Caribbean posts wider-than-expected loss as Covid delta variant hurts its ability to fill ships this summer. Retrieved from *CNBC*: <https://www.cNBC.com/2021/08/04/royal-caribbean-cruises-q2-2021-earnings.html>
- [10] FutureCruise. (2020, August). NORWEGIAN: A MAJOR CRUISE CASUALTY OF CORONAVIRUS? Retrieved from *Future Cruise NRI Digital*: https://futurecruise.nridigital.com/future_cruise_aug20/norwegian-cruise-coronavirus
- [11] Group, R. C. (2021, February 22). Royal Caribbean Group reports on 2020 results and provides business update. Retrieved from *Cision PR Newswire*: <https://www.prnewswire.com/news-releases/royal-caribbean-group-reports-on-2020-results-and-provides-business-update-301232477.html>
- [12] Insider, B. (Director). (2021). The Rise And Fall Of The Cruise Industry | Rise And Fall [Motion Picture]. Retrieved from <https://youtu.be/U5Ncbs-bE8Q>
- [13] Lau, Y.-y., & Yip, T. (2020). The Asia cruise tourism industry: Current trend and future outlook. *The Asian Journal of Shipping and Logistics*, 190-201.
- [14] Majumdar, A. (2020, March 17). Cruise Vision 2020: The Future of Cruising in Australia and New Zealand. Retrieved from *Cruise Critic*: <https://www.cruisecritic.com.au/articles.cfm?ID=4481>
- [15] Manoharan, D., & James, S. (2021). Cruise tourism in India: Sailing into troubled waters.
- [16] Mathew, E. (2021). Tiding over the pandemic: The prospects of cruise tourism. *International Journal of Hospitality and Tourism Studies (IJHTS)*, 78-86.
- [17] McCormick, E. (2021). Post-COVID Recovery of the Cruise Industry.
- [18] Pallis, A., & Papachristou, A. (2021). Cruise Industry. *Research Gate*.
- [19] Panel, t., & Panel, t. E. (2020). Advice to cruise operators to advance their public health response to COVID-19, improve safety, and achieve readiness for the safe resumption of operations. *Recommendations from the Healthy Sail Panel*, 1-69.

- [20] Protocols, H. A. (n.d.). Healthy At Sea. Retrieved from Celebrity Cruises:
<https://www.celebritycruises.com/health-and-safety>
- [21] Rodrigues, J. (2021). A Forced Disrupt: "The Next Normal".
- [22] RoyalCaribbean. (2020, September 21). Recommendations from the Healthy Sail Panel. Retrieved from Royal Caribbean: https://www.royalcaribbeangroup.com/wp-content/uploads/2020/09/Healthy-Sail-Panel_Full-Recommendations_9.21.20_FINAL.pdf
- [23] RoyalCaribbeanGroup. (2021, February 22). Royal Caribbean Group reports on 2020 results and provides business update. Retrieved from PR Newswire: <https://www.prnewswire.com/news-releases/royal-caribbean-group-reports-on-2020-results-and-provides-business-update-301232477.html>
- [24] S. Shanmugasundaram, & P. Umarani. (2015, April). QUEUING THEORY APPLIED IN OUR DAY TO DAY LIFE. International Journal of Scientific & Engineering Research, 6(4), 533-541.
- [25] Wikipedia, the free encyclopedia. (n.d.). Royal Caribbean International. Retrieved from Wikipedia: https://en.wikipedia.org/wiki/Royal_Caribbean_International#References.