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Export of Marine Product: Time Series Model

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Abstract: ***In this paper, the variations of Export of Marine product from Ratnagiri and Raigad district have been studied. Also, by using forecasting of the export by Value and Quantity, some suggestions have been recommended.***

Keywords: Arima model, Box-Jenkins technique, Export of Marine Product, Forecasting

1. Introduction

Indian marine products are wanted internationally. There is potential for a higher market share in importing countries. As the report shown from authority of India, India exports marine products to many countries as European Union (EU),US, China, Japan, USA, South East Asia, Middle East, Other countries like Libya, Reunion islands, Australia, Puertorico, Dominican Republic, Kenya, Tanzania, Ukraine, Brazil etc. registered a positive growth. Ports like Pipavav, JNPT, Chennai, Kolkata, Mumbai, Mangalore, Goa, Ahmadabad, Trivandrum and Agarthala have shown an increase in the exports compared to the previous year while ports like Vizag, Tuticorin, Hill Land Customs, and Karimganj etc. showed a declining trend.

The marine fish production in India has gone up from 0.5 million tonnes in the early fifties to 1.4 million tonnes during early and middle seventies and after which, stabilized itself at about 1.3 million tonnes. The Handbook on Fisheries statistics 2014 [6], recorded that India is the second largest producer of fish in the world contributing to 5.68% of global fish production. India is also a major producer of fish through aquaculture and ranks second in the world after China.

The Marine Products Export Development Authority (MPEDA) (2014) recorded the total fish production during 2013-14 is at 9.58 million metric tonnes with a contribution of 6.14 million metric tonnes from inland sector and 3.44 million metric tonnes from marine sector respectively [8]. The overall growth in fish production in 2013-14 has been 5.9%, which has been mainly due to 7.3% growth in inland fish production [8]. Indian Marine product has been broadly accepted in the International market. During the financial year 2014 – 15, exports of marine products reached an all-time high of USD 5511.12 million [9].

The potential market for marine exports is in value added products (cooked, ready to eat and ready for table), freeze dried shrimps (wherever reduced transportation cost can bring in competitive advantage), surimi and canned fish. While infrastructural requirements are essential in the entire supply chain, the quality of infrastructure in the pre-processing stage is significantly lower than the processing and post-processing stages.

The paper [2] in International Journal of Fisheries and Aquatic studies describes strength, weakness, opportunities and threat in the global supply chain of Marine product. Recently Indian factories have grown to have world class facilities, with better quality control. On the other hand, International Seafood trade has been changing over the years. In last decade significant changes had seen in the supply, demand and International norms; due to the compulsions from the importing countries.

Forecasting is a common task used in Business, where it helps for taking decisions about scheduling of production, transportation and personnel. Also, it provides guidelines for long-term strategic planning.

2. Study Area

The study area is ports in Ratnagiri and Raigad**district. R**atnagiri is a coastal district of Maharashtra state, situated in the western coast of India. It has north-south length of about 180 km and average east-west extension of about 64 km. Sahyadri hills surround it in the east beyond which there are Satara, Sangli and Kolhapur districts, Raigad district in the north, the Arabian Sea in the west and Sindhudurg district in the south. Ratnagiri can be physically divided into 3 zones viz. Coastal, Middle Hill area and zones [7].

Fishing season commences from September and lasts till the end of May. Sharks, skates, rays, mackerels, sardines, *tuna, surmai*, pomfret, *karel*, and catfish are the main varieties of the fish in the district. The total population of fishermen in the district is estimated at 70,000, out of which about 14,000 are active fishermen. The fishermen are scattered in 118 fishing villages along the coast [7].

3. Observations

We visited Angre, Dabhol, Harnai, Ratnagiri port, College of Fisheries Ratnagiri, MPEDA Office Ratnagiri and Gadre Marine Export to collect the information on Fisheries and Fishery industry. From the Ports mentioned above in Ratnagiri District, I can't get sufficient information of the Export data. So, I extended the study area to Raigad district and visited to the JNPT port Raigad for my research.

Jawaharlal Nehru Port is located east of Mumbai in Maharashtra. It the largest container port in Indiaand is on the Arabian Sea. This port is also the terminal of Western Dedicated Freight Corridor proposed by Indian Railways. Jawaharlal Nehru Port is run by the Jawaharlal Nehru Port

Trust (JNPT), an autonomous corporation wholly owned by the Government of India.

JNPT accounts for more than half of total container volumes handled at India's 12 public ports and around 40 percent of the nation's overall containerized ocean trade. Major exports from Jawaharlal Nehru Port are textiles, sporting goods, carpets, textile machinery, boneless meat, chemicals and pharmaceuticals. This port has three dedicated container terminals namely JNPCT, NSICT & GTIPL. It handles about 56% of total containers handled by all Major Ports in India. The export of Marine product from JNPT in terms of Quantity and Value from 1995 to 2015 is given below.

Port		1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02
JNPT export	Quantity in ton	24144	29081	29403	42664	56428	100348	91483
	Value in Crore	211.88	237.17	242.18	368.67	443.78	690.69	699.19
	US$ Million	67.26	66.34	66.81	87.99	102.89	151.81	147.11

Port		2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
JNPT export	Quanti. in ton	107972	95584	109430	120492	137153	104670	126853
	Value in Crore	916.29	837.25	965.32	1173.04	1279.48	1120.86	1487.28
	US$ Million	190.12	183.35	215.24	265.59	283.51	279.25	329.52

Port		2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
JNPT export	Quantity in ton	129318	155829	148891	145723	142073	149585
	Value in Crore	1564.42	1970.65	2151.66	2399.8	3531.36	3939.46
	US$ Million	331.46	437.73	452.57	448.46	584.74	648.48

(*Source: The Marine products Export Development Authority*)

The trend in export from JNPT port is shown below.

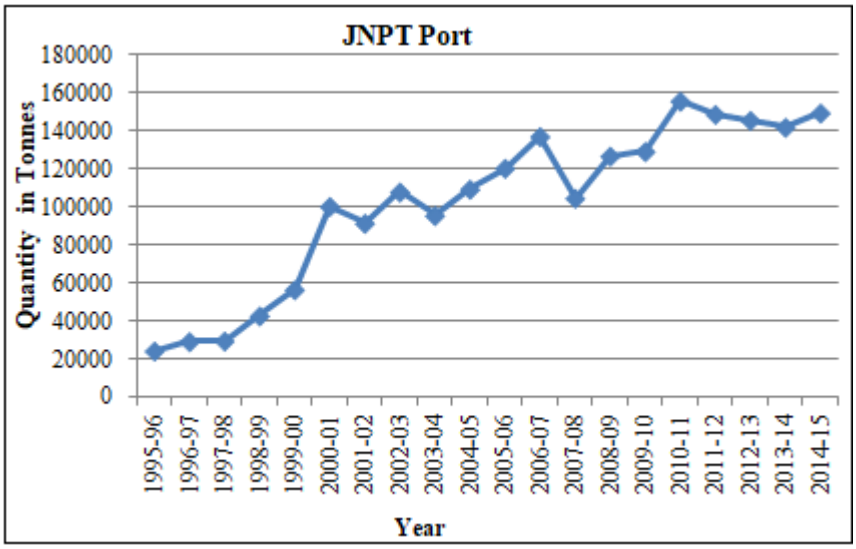


Figure (A)

A study of the Fishing settlement noted that near Dabhol bay found a gradual decrease in fish production from 2006 [1].

4. Materials and Methodology

Field visits were conducted during the Fishing season (December to February). Primary data was collected by visiting to various ports, MPEDA Office, Marine Exports companies, Fishery College Shirgaon etc. Secondary data was collected from Handbooks of Fisheries, Press release MPEDA stats, Books, various Research papers etc. Then by using Forecasting technique the conclusion can be drawn which helps for taking decisions about scheduling of production, transportation and human resources.

Arima Model

Autocorrelation Function

Given measurements, Y_1, Y_2, ..., Y_N at time X_1, X_2, ..., X_N, the lag k autocorrelation function [5] is defined as

$$r_k = \frac{\sum_{i=1}^{N-k}(Y_i - \overline{Y})(Y_{i+k} - \overline{Y})}{\sum_{i=1}^{k}(Y_i - \overline{Y})^2}$$

Although the time variable, X, is not used in the formula for autocorrelation, the assumption is that the observations are equi-spaced. Autocorrelation is a correlation coefficient. However, instead of correlation between two different

variables, the correlation is between two values of the same variable at times X_i and X_{i+k}.

This correlation function can be used for the following two purposes

a) To detect non-randomness in data.
b) To identify an appropriate time series model if the data are not random.

Autoregressive Component

The autoregressive or AR component [3] of an ARMA model can be written in the form:

$$x_t = \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \cdots\cdots + \alpha_p x_{t-p} + z_t$$

where the terms in α are autocorrelation coefficients at lags 1,2… p and z_t is a residual error term. This error term specifically relates to the current time period, *t*.

First order AR model is given by $x_t = \alpha \cdot x_{t-1} + z_t$.

These expressions state that the estimated value of *x* at time *t* is determined by the immediately previous value of *x* (i.e. at time = *t*-1) multiplied by a measure, α, of the extent to which the values for all pairs of values at time periods lag 1 apart are correlated (i.e. their autocorrelation), plus a residual error term, *z*, at time *t*.

Similarly, the second order AR model is given by

$$x_t = \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + z_t$$

The first step in developing a Box-Jenkins model is to determine if the series is stationary. If the series is not stationary then make it stationary by using the autocorrelation function (ACF) and Augmented Dickey-Fuller test (ADF).

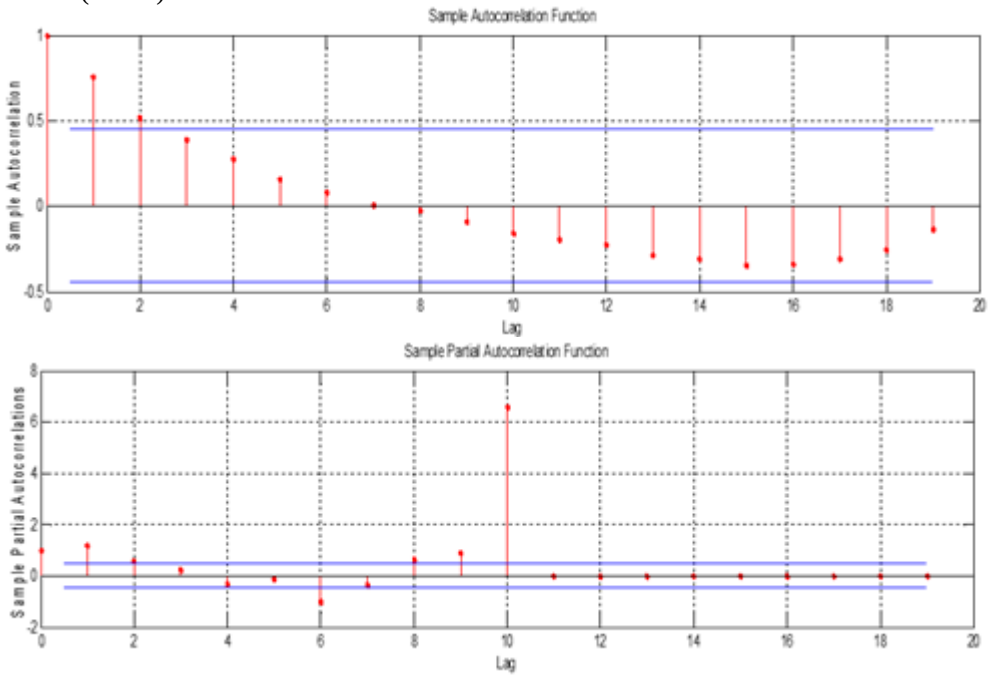
By using Akaike criteria the proper ARIMA (Autoregressive Integrated Moving Average) model for the data is selected. Then check the validity of the Model and forecasting is computed by reaggregation of different components.

The data presents some fluctuations and hence it is not stationary. By making use of autocorrelation function (ACF) and Augmented Dickey-Fuller test (ADF) it made stationary.

```
>> n = length (y)
                                    n = 20
>> subplot (2,1,1)
>> autocorr (y)
>> subplot (2,1,2)
>> parcorr (y)
```

The autocorrelation function (ACF) and partial autocorrelation function (PACF) are as follows.

Autocorrelation and Partial Autocorrelation



By applying the ADF test for the series of the first order differences the series becomes stationary.

As a result, we have applied the Box- Jenkins procedure on the stationary data series and we want to identify the corresponding ARIMA (p, q) process. By starting with an AR (1) process and further analyzed the residual correlogram in order to catch the correlations and autocorrelations from lags bigger than 2. From Akaike criteria's point of view, the proper model to adjust the data is ARIMA (2, 1, 0).

Conditional Probability Distribution: Gaussian

Parameter	Value	Error	Statistic
Constant	101.54	168.494	0.602629
AR{1}	0.154499	0.68123	0.226794
AR{2}	0.642048	0.800545	0.802013
Variance	57189.2	17049.3	3.35434

where AR {1}- Autoregressive model of order 1,

AR {2}- Autoregressive model of order 2.
fit = ARIMA (2,1,0) Model:
Distribution: Name = 'Gaussian'

Here P - Highest order seasonal autoregressive parameter in the model = 3.
D-Number of times the series was seasonally differenced = 1.

Q - Highest order seasonal moving average parameter in the model = 0,
Constant: 101.54.
AR: {0.154499 0.642048} at Lags [1 2]
Variance: 57189.2
[yf, ymse] = forecast (fit,10)

Then the Forecasted values for next 10 years by using ARIMA (2, 1, 0) model are listed below.

4040.96	4259.76	4663.36	5272.36	6133.26

7266.46	8705.06	10467.26	12577.06	15049.86

5. Results

It was observed that, the demand of Marine product is increasing time to time. By using parameters mathematical expression as time series model was obtained. It can be shown that time series model such as ARIMA (2,1,0) model is fit for the given data. By using this model, we can forecast the quantity of Marine product in future.

6. Conclusion

Day to day the demand of Marine Product is increasing. Forecasting is a common task in business, where it helps to inform decisions about scheduling of production, transportation etc. By using time series model such as Arima model fitting by box-jenkins technique, study the growth of Export of Marine Product from Ratnagiri and Raigad district. It is concluded that, by using this model, we can get an idea of the rate in which the export is growing. Which helps us to develop the necessary resources like scheduling of production, transportation and personnel.

Remark

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