



## **A time-series analysis regarding livestock management for future planning: a case study of Balochistan province, Pakistan.**

**<sup>1</sup>Abdullah Dostain, <sup>2</sup>Ahmed Ali Mengal, <sup>3</sup>Shahida Habib Alizai,**

<sup>1</sup>Livestock and Dairy Development Department, Government of Balochistan

<sup>2</sup>Agribusiness, Agriculture Research Institute ARI, Sariab Quetta Balochistan

<sup>3</sup>Gender Study Department, University of Balochistan

\*Corresponding author: [ahmedagric@gmail.com](mailto:ahmedagric@gmail.com)

### **Abstract**

Effective management not only increases the income generation direction of the rural masses but also developed the nation economy. This study describes an empirical study of modeling and forecasting time series data of red meat production of Balochistan province. The Box-Jenkins ARIMA models and regression models (year as explanatory variables) were used for forecasting of the red meat production. By using these models ten years ahead forecast was made. This study was an effort to apply univariate methods to forecast the production of red meat production. In univariate time series models, we have used ARIMA (Autoregressive Integrated Moving Average) models primarily based on the work of Box and Jenkins (1970). Based on outcomes following were the recommendations of the study. There should be strict meat price control of the government. A comprehensive training package/projects need to be launched for rural areas of target districts to improve livestock productivity by introduction of commercial feeds. Exotic species of fodder for rain fed areas of Balochistan may be introduced to come up with the shortage of fodder. The government should take efforts to arrange loaning facilities for the herders for livestock management and improving the animal health. To disseminate timely information to the various stake holders regarding the rearing of livestock, vaccination, drenching, and treatment techniques etc.

**Keywords:** livestock, Balochistan, time-series analysis, management, Pakistan.

### **Introduction**

Balochistan is the area-wise largest province of Pakistan, but the cultivated area is only 4.00 percent. However, rangelands provide more than 90 percent of the total feed requirements of small ruminants (sheep and goats). The rangelands in the northern part of Balochistan are relatively better in grazing which is associated with the higher average rainfall. The rangelands in the northern Balochistan cover only 38 percent of the total area under rangelands, but 76.00 of the total livestock is produced in the province. The remaining 62 percent area of Balochistan produces only

24.00 percent of the small ruminants. The climate in most of the areas of Balochistan province is arid and conducive for the sheep and goat production. Out of the total sheep and goat population of 20 million in the country, 46 percent sheep and 23 percent goats are only in Balochistan province. The migratory sheep and goat composes almost 90 percent of the livestock population, moving from uplands to lowlands in winter and they back in summer. Balochistan province of Pakistan is renowned for high livestock population and livelihood of majority population of this province is dependent on livestock production (Balochistan Development Statistics, 2008-09).

**Table; 1.Livestock population Balochistan 2006**

S.#	Name of the District	Cattle	Buffalos	Sheep	Goats	Camels	Total
1	Quetta	11,244	25,547	163,799	120,384	1,377	322,351
2	Pishin	91,433	994	837,233	504,510	745	1,434,915
3	Killa Abdullah	53,111	479	325,020	115,405	359	494,374
4	Chagai	6,576	20	205,725	299,363	17,543	529,227
5	Sibi	54,709	6,133	200,946	208,133	1,866	471,787
6	Kohlu	174,167	1,463	1,306,734	813,575	58,318	2,354,257
7	Dera-Bugti	144,860	6,795	506,095	775,361	35,573	1,468,684
8	Ziarat	1,929	12	120,054	138,440	34	260,469
9	Loralai	131,806	4,628	784,961	331,737	716	1,253,848
10	Musa-Khel	197,318	1,650	977,748	464,126	17,639	1,658,481
11	Barkhan	117,286	2,005	413,840	155,581	3,930	692,642
12	KillaSaifullah	69,361	151	1,066,690	783,624	21,751	1,941,577
13	Zhob	178,658	5,524	1,174,735	875,922	1,010	2,235,849
14	Jafferabad	268,721	156,427	241,444	283,922	8,252	958,766
15	Naseerabad	165,765	84,226	148,501	213,294	1,871	613,657
16	Bolan	151,736	4,151	124,569	766,109	34,401	1,080,966
17	Jhal-Magsi	78,294	4,275	61,295	298,687	3,898	446,449
18	Lasbella	101,084	7,980	367,262	794,296	32,202	1,302,824
19	Mastung	8,628	456	466,894	334,906	2,802	813,686
20	Kalat	31,896	592	1,239,499	807,608	10,264	2,089,859
21	Khuzdar	103,375	5,782	1,105,410	1,036,004	28,006	2,278,577
22	Awaran	18,485	40	125,772	344,318	5,335	493,950
23	Kharan	14,854	118	665,903	635,731	76,069	1,392,675
24	Kech (Turbat)	43,433	306	64,693	455,391	6,061	569,884
25	Gwadar	12,344	51	18,363	88,901	1,432	121,091
26	Panjgur	22,508	49	91,032	139,383	8,074	261,046
<b>Total</b>		<b>2,253,581</b>	<b>319,854</b>	<b>12,804,217</b>	<b>11,784,711</b>	<b>379,528</b>	<b>27,541,891</b>

Source Livestock and Dairy Development Department Balochistan 2006.

### World Meat consumption

The United States Department of Agriculture has released the world meat consumption statistics for 2009-2010. Accordingly, the world beef, pork and broiler production during 2009-2010 was 56365, 100542 and 71065 thousand tons. The world's highest meat consumer is United States, with meat consumption of 12268, 48732 and 12933 thousand tons of beef, pork and broiler, followed by European

Union i.e. 8317, 20683 and 12210 thousand tons; while in Pakistan, the total meat consumption is 1230, 1480 and 1536 thousand tons of beef, pork and broiler, respectively. It showed that Pakistan is one of the 10 leading meat consuming nations of the world and ranks 9<sup>th</sup> after United States, European Union, Brazil, China Argentina, Russia, India and Mexico. The ranking of Pakistan in meat production and meat consumption was similar i.e. 9<sup>th</sup> in the world.(Table 2).

**Table-2 World meat consumption (2009-2010)**

Country	Meat consumption (000 tons)		
	Beef	Pork	Broiler
World	56,365	100,542	71,065
United States	12,268	48,732	12,933
European Union	8,317	20,683	12,210
Brazil	7,374	8,995	8,589
China	5,746	3,044	7,802
Argentina	2,749	2,467	3,272
Russia	2,172	2,423	2,700
India	2,020	1,876	2,549
Mexico	1,971	1,770	1,951
Pakistan	1,230	1,480	1,536
Japan	1,210	1,283	1,371
Canada	1,010	968	1,327
Other countries	10,298	6,821	14,825

Source: U.S. Department of Agriculture, Foreign Agricultural Service, Livestock and Poultry: World Markets and Trade, annual. <http://www.fas.usda.gov/currwmt.asp>, Internet release 2010.

The current scenario regarding meat consumption of low and high income classes reflects a significant gap; and the FAO studies indicate that the annual average meat consumption of Americans is 124 kg against world average per capita annual meat consumption of 31 kg; lowest (3 kg per person) is reported in Bangladesh (FAO, 2006).

### **Meat consumption in Pakistan**

Reportedly, more than 50 percent Pakistanis prefer meat over vegetables and pulses. The survey results showed that obviously meat is the most essential food item in people's daily diet; however, 52% prefer meat, 37% would choose vegetables, 10% would like to have pulses. Over the years, many changes have been observed in the pattern of meat consumption in the country (Gallup Pakistan, March 30, 2009).

### **The state of Meat Industry**

In Pakistan, as a whole, the state of meat industry from animal rising to the marketing of beef and mutton is poor. It is obvious that due to lack of essentially required facilities for animal production, the meat processing industry cannot come forward to export their meat products and cannot ensure their benefits from this business. A minor part of meat shortage is covered by a cross border smuggling of the animals. Some imported meat particularly from Australia is also marketed and such imported meat is generally consumed by the elite class in big cities. The

production of beef has steadily increased over the years (Ismat, 2004). In India, goat farming had not attained the status of commercial farming due to poor investment capacity of the households; goat population is increasing, but scope of goat farming is mainly dependent on the availability of proper markets for goats, their products and by-products.

Proper planning on ground realities is the key factor for composite development of any sector; considering the area specific potentials, opportunities and proper execution and implementation of the policies, the success could just be a dream. Balochistan is a real potential area of the country where production of Red meat animals (sheep, goat cattle, buffalo and camel) can be more economical than any other area of the country. The 90% of Balochistan area is uncultivated comprised of the pastures and rangelands. With the proper planning and implementation of the decisions regarding development of red meat, the existing goat/sheep or cattle/buffalo and camel population can increase the red meat production manifold. On the basis of past development in the red meat production, the future forecasts may be put in order, so that the yearly targets are set and achieved fully. The present study was carried out to examine the existing red meat (Mutton and Beef) production and consumption in Balochistan and forecast red meat production potentials and set achievable targets for future on the basis of statistical models for accurate future predictions.

Pakistan ranks 9<sup>th</sup> in global meat production scenario after United States, European Union, Brazil, China, Argentina, Russia, India and Mexico. The world beef production stands 57017 thousand tons, pork 100,780 thousand tons and broiler 71,760 thousand tons, while the world beef consumption is 56,365 thousand tons, pork 100,542 thousand tons and broiler 71,065 thousand tons. Pakistan shares 1,745 thousand tons of beef, 1,225 thousand tons of pork and 1,772 thousand tons broiler. The meat consumption trends showed that the domestic beef consumption in Pakistan is 1,230 thousand tons, pork 1,480 thousand tons and broiler 1,536 thousand tons showing a remarkable surplus beef and broiler meat quantity, while deficit in pork production is witnessed over the domestic consumption (FAO, 2008; Dawn, 2010; GoP, 2012).

Pakistan meat industry is in growing fast and the demand for meat from Pakistan is increasing in the Muslim world. Pakistan has the potential to increase its export and earn foreign exchange and promotes Pakistan high quality meat worldwide. The production trend for ruminants as source of red meat in Pakistan showed that goat population from 1990 to 1995 increased continuously and then in 1996 and 2008 a slight decrease in population was noted. The cattle and buffalo population from 1990 to 2010 followed an increasing trend; while camel population followed a sharp decline in 1996 and this decrease persisted up to 2004. However, in the year 2006 increase in camel population was noted and this trend was maintained up to the year 2010. The extraordinary fluctuation in camel population was mainly associated with the reason that rough estimates for population of 1996 did not coincide the actual population recorded in the 1996 census and hence it was considered that the estimated population was unrealistic. However, in the year 2006 again animal census was conducted which rejected the projected/estimated population and detected that estimated populations are far ahead of the actual population (Dawn, 2010).

The economic survey of Pakistan showed that the cattle population during 2010-11 was estimated at 35.6 million heads increased to 36.9 million heads in 2011-12; and buffalo production during 2010-11 was estimated at 31.7 million heads increasing to 32.7 million heads during 2011-12. The country sheep population during 2010-11 was estimated at 28.1 million heads increasing to 28.4 million heads during 2011-12. The goat's production in the country during 2010-11 was 61.5 million heads which increased to 63.1 million heads during 2011-12. Similarly, the

camel population in Pakistan during 2010-11 was 1.0 million heads which remained static during the year 2011-12 (GoP, 2012).

There has been a continuous increase in the meat production in Pakistan during last decade and during 2009-2010, the total meat production in the country was 2965 thousand tons which increased to 3095 thousand tons in 2010-11 and 3232 thousand tons in 2011-12. The beef production during the years 2009-10, 2010-11 and 2011-12 was 1655, 1711 and 1769 thousand tons, which mutton production was 603, 616 and 629 thousand tons, respectively. However, during 2009-10, 2010-11 and 2011-12 the production of poultry meat remained 707, 767 and 834 thousand tons, respectively (GoP, 2012). These figures indicate an encouraging trend where the meat production followed a continuous increase over the years.

## Justification of the study

Without proper planning on the basis of ground realities, considering the area specific potentials, opportunities and proper execution and implementation of the policies, the success could just be a dream. Balochistan is a real potential area of the country where production of Red meat animals (sheep, goat, cattle, buffalo and camel) can be more economical than any other area of the country. The 90% of Balochistan area is uncultivated comprised of the pastures and rangelands. With the proper planning and implementation of the decisions regarding development of red meat, the existing goat/sheep or cattle/buffalo and camel population can increase the red meat production manifold. On the basis of past development in the red meat production, the future forecasts may be put in order, so that the yearly targets are set and achieved fully. The present study aimed at studying the existing red meat (Mutton and Beef) production and consumption in Balochistan and forecast red meat production potentials and set achievable targets for future on the basis statistical models for accurate future predictions.

## Objectives of study

The research objectives of this study are outlined as follows;

1. To predict future changes in demand for red meat (mutton and beef) in the province.
2. To analyze /correlate changes in demand and supply production with population trends in Balochistan province.

3. To suggest policy measures towards addressing the gaps between demand and supply of red meat (mutton and beef) in Balochistan province.

### Research Methodology

Balochistan is the area-wise largest province of Pakistan that constitutes about 44 percent of the total land mass; while population-wise this province is smallest among four provinces of Pakistan. The provinces borders to Afghanistan in north and

northwest, Iran in the southwest, Punjab and Sindh in the east, and Khyber Pakhtoonkhaw and FATA in the northeast; while the Balochistan is bordered by Arabian Sea in the south. Quetta is the capital and largest city of the province. Among habitants, Baloch, Brahvi and Pashtoons contribute major part of the total Balochistan population; while Sindhi, Punjabi, Hazara, Kurd, Irani communities also constitute some part of the population. However, some people belong to Sikh, Uzbek, Turcoman and Hindu communities compose some part of the minorities.

**Table-3. Area, Population by Sex, Sex Ratio, Population Density, Urban Proportion Household Size & Annual Growth Rate - Balochistan 1998 Census**

DISTRICT	Area	Population			Sex	Pop.	Urban	Avg.	Pop.	Growth
	(S.km.)	Both	Male	Female	Ratio	Density	Prop.	H.H	1981	Rate
		Sexes				/sq:km		Size		( % )
<b>Balochistan</b>	<b>347190</b>	<b>6565885</b>	<b>3506506</b>	<b>3059379</b>	<b>114.6</b>	<b>18.9</b>	<b>23.9</b>	<b>6.7</b>	<b>4332376</b>	<b>2.47</b>
Chagai	50545	202564	108736	93828	115.9	4.0	17.7	6.7	120455	3.10
Pishin	7819	367183	196330	170853	114.9	47.0	6.2	6.8	202256	3.57
Quetta	2653	759941	412064	347877	118.5	286.4	74.3	8.5	381566	4.13
K.SF Saifullah	6831	193553	105174	88379	119.0	28.3	13.4	7.0	148362	1.58
Mastung	5896	164645	87334	77311	113.0	27.9	15.2	7.9	132044	1.31

Source Balochistan Development statistics (2009-10)

This section provides an outline the research methodology, research design, sampling techniques, in depth survey, data analysis. The study was carried out to analyze the red meat (mutton and beef) production and consumption patterns; and to forecast the production for coming 10 years on the basis of last 20 years production data in province level. The study also entails meat production, population and consumption under different conditions of various districts of the province through various statistical techniques. This study describes an empirical study of modeling and forecasting time series data of red meat production of Balochistan province. The Box-Jenkins ARIMA models and regression models (year as explanatory variables) were used for forecasting of the red meat production. By using these models ten years ahead forecast was made. These forecasts of red meat production would be helpful for the policy makers to plan the future requirements in terms of internal consumption and export to adopt

appropriate measures in this regard. This study was an effort to apply univariate methods to forecast the production of red meat production. In univariate time series models, we have used ARIMA (Autoregressive Integrated Moving Average) models primarily based on the work of Box and Jenkins (1970). These models have been extensively used in practice for forecasting econometric time series (Brown, 1974 and Holt *et.al.*, 1960). Newbold and Granger (1974) found that ARIMA models performed well among other forecasting models. Several methods have been suggested for fitting ARIMA models by Box-Jenkins and others. Makridakis *et.al.*, (1982) and Meese and Geweke (1982) have discussed the method of identifying univariate models by using multistage sampling. The Questionnaire designed covered household information, demographic information, producer level information, using McCall (1980) table of “determining sample size of the given population.

## Results and Discussion

In order to study the existing production and consumption of red meat (Mutton and Beef) in Balochistan and forecast production potentials of red meat. The study was based on set achievable targets using statistical models for accurate future predictions.

In Pakistan, the population cattle, buffalo, sheep, goat and camel was collected; and Fig.4.16 indicated the yearly trend in animal population in the country. The population of cattle and buffalo showed an increasing linear trend from the year 1990 to 2010, while the population of sheep increased from 1990 to 1995 and then a sharp decline in the sheep population in the year 1996 was noted which later on followed a gradual increase up to the year 2010. The goat population from 1990 to 1995 followed an increasing trend, but in the year 1996 and 2008 a slight decrease was noted. However, the camel population followed a sharp decline in 1996 and this decrease persisted up to 2003 and again a decrease was observed in 2004. However, in the year 2006 increase in camel population was noted and this trend was maintained up to the year 2010. The extraordinary fluctuation in camel population was mainly associated with the reason that before 1996 the populations were estimated, while in 1996 actual census was conducted that corrected the population that was estimated in an unrealistic manner. However, in the year 2006 again animal census was made which rejected the

projected/estimated population which had shown lower population than the actual.

The results for regression analysis in regards to prediction of red meat production in Pakistan for the next ten years (2010-11 to 2020-21). The results indicated that there was a significant ( $P < 0.01$ ) increase of 37.50 thousand tons per year in red meat production in Pakistan. The 81.3% value of coefficient of determination showed that the fitted model is very close to the observed values, which is an indication of better fit of the model. The coefficient of determination also suggested that 81.3 percent variation in the meat production was guided by the time period (years). The forecasted values with their respective standard error and 95% confidence interval. The forecasted values were ranged from 2147.60 to 2485.1 tons production of red meat from year 2010-11 to 2020-21, respectively. These findings coincided the results of Koutroumanidis *et al.* (2010) using ARIMA modeling for sheep time production over time. These models may be of assistance for the consequences of different natural and political incidents; while at the same time can be used to assess the effectiveness of the applied specific policies for livestock at European and international level 29-32. Finally, sheep meat production modeling allows us to derive a short term prediction in the sheep meat production for each EU country, given that the defined factors which cause the volatility in the sheep meat production are stable. This result is extremely important for the organization and the management of the sheep meat production.

Fig-1. Year variation in the number of animals (cattle, buffaloes, sheep, goats and Camel) in Pakistan.

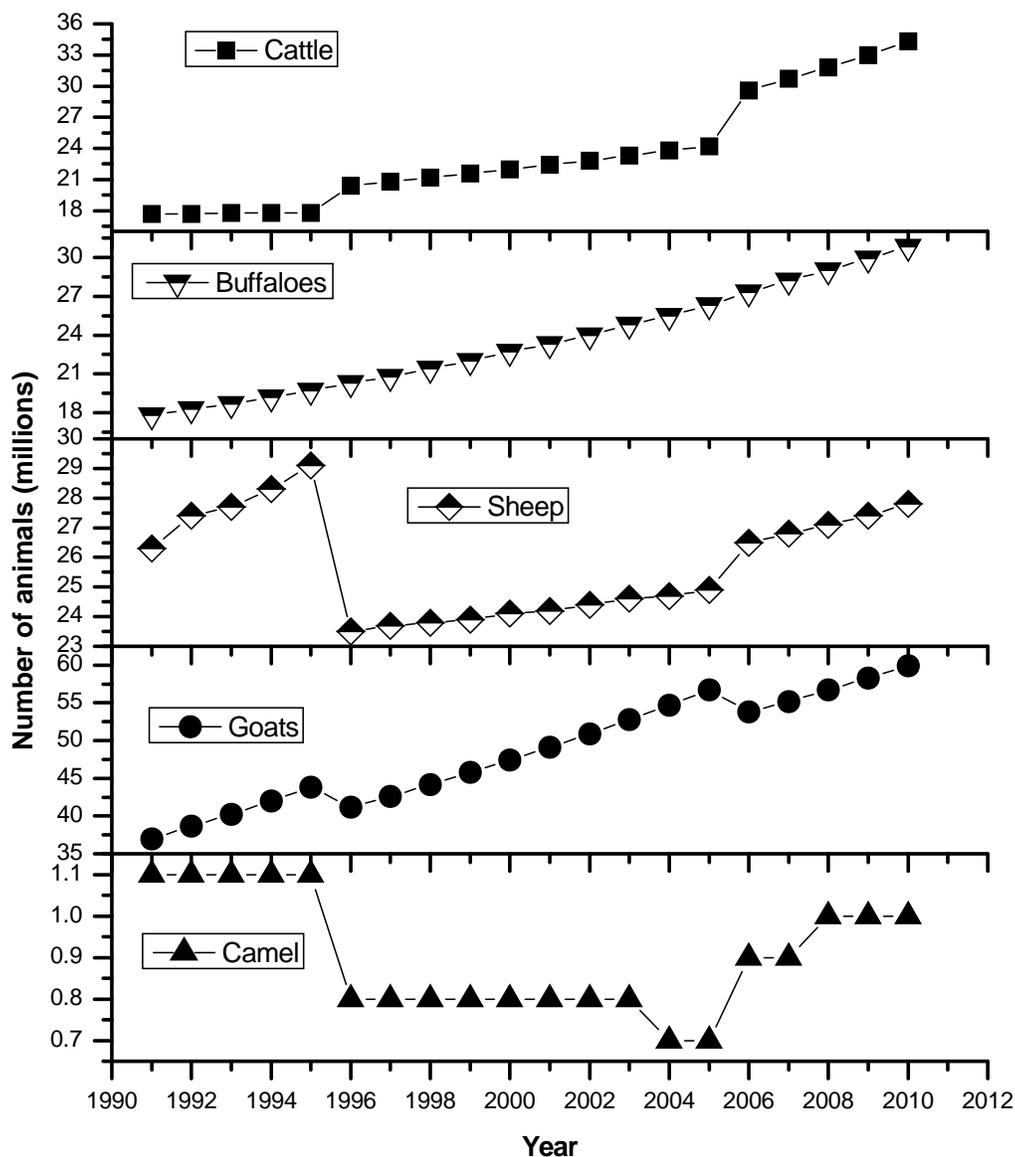


Table-4. Regression analysis of production of red meat for Pakistan.

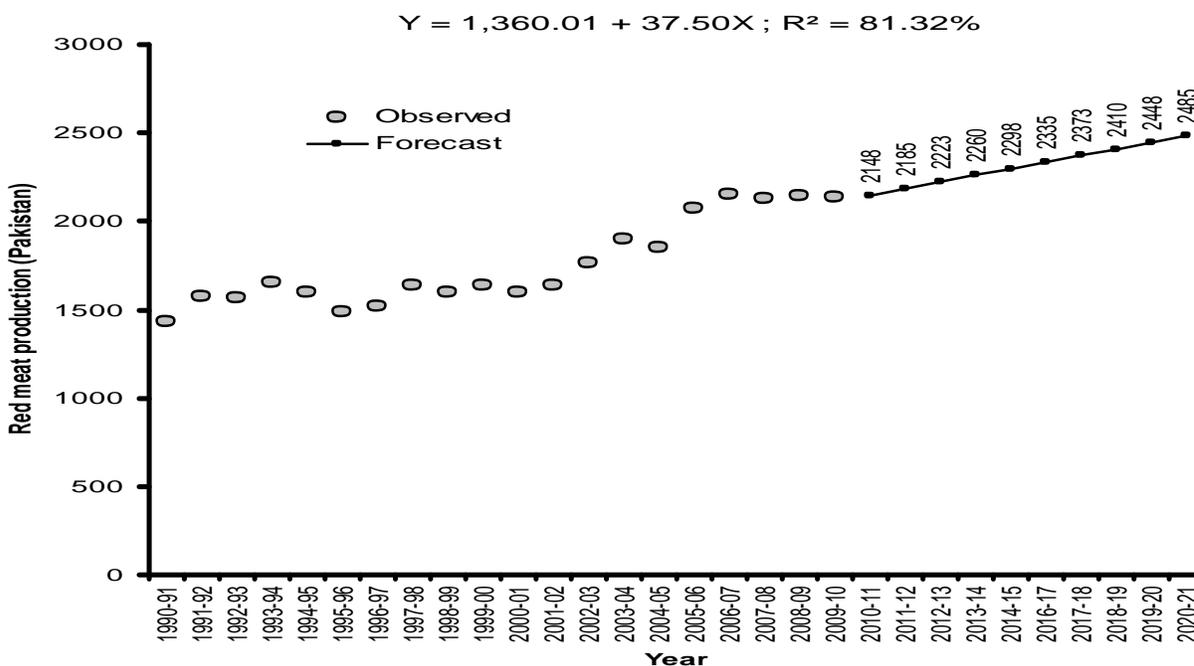
Predictor	Coefficient	SE of coefficient	t-value	Prob.
Constant	1360.01	50.75	26.80	0.000**
Year	37.50	4.24	8.85	0.000**
R <sup>2</sup> (%)	81.3			
Adj. R <sup>2</sup> (%)	80.3			
F-value	78.36**			

\*\* = Highly significant (P<0.01)

Table-5 Forecast values for year 2010-11 to 2020-21

Year	Forecast	SE for forecast	95% confidence interval	
			Lower limit	Upper limit
2010-11	2147.6	50.8	2041.0	2254.2
2011-12	2185.1	54.5	2070.6	2299.6
2012-13	2222.6	58.3	2100.1	2345.1
2013-14	2260.1	62.2	2129.4	2390.8
2014-15	2297.6	66.1	2158.7	2436.5
2016-17	2335.1	70.1	2187.9	2482.3
2017-18	2372.6	74.1	2217.0	2528.2
2018-19	2410.1	78.1	2246.1	2574.1
2019-20	2447.6	82.1	2275.1	2620.1
2020-21	2485.1	86.2	2304.1	2666.1

Fig-2, 20 Year red meat production and forecast for 10 years.



### Conclusions and Recommendations

Present study was aimed at investigating the existing production and consumption of red meat (Mutton and Beef) in Balochistan and forecast production potentials of red meat. The study was based on set achievable targets using statistical models for accurate future predictions. Five representative districts (Quetta, Pishin, KilaSaifullah, Chagai and Mastung) were included in this study. From the results, the following conclusions were drawn: In Pakistan, the predicted yearly increase in red meat production is 37.50 thousand tons; and on the basis of red meat production 2147.60 thousand tons during 2010-11, the forecasted red meat production in 2020-21 is 2485.1 thousand tons. Based on outcomes following were the recommendations of the study.

### Recommendations:

- There should be strict meat price control of the government.
- A comprehensive training package/projects need to be launched for rural areas of target districts to improve livestock productivity by introduction of commercial feeds.
- Exotic species of fodder for rain fed areas of Balochistan may be introduced to come up with the shortage of fodder.
- The government should take efforts to arrange loaning facilities for the herders for livestock management and improving the animal health.

- Construction of slaughter houses.
- Strict checking on smuggling of animal borders.
- Establishment of marketing channels.
- Conduct trainings for officers /social workers.
- To disseminate timely information to the various stake holders regarding the rearing of livestock, vaccination, drenching, and treatment techniques etc.

## References

- Balochistan Development Statistics, (2008-09). Planning and development department, Government of Balochistan.
- Box, G.E.P. and Jenkins, G.M. 1970. Time series analysis, forecasting and control. San Francisco, Holden-Day, California, USA.
- Brown, R.G. 1974. Statistical forecasting for inventory control. McGraw-Hill Book Co. Inc., NY, USA.
- Dawn, 2010. Pakistan to export meat, farm products to Maldives. Daily Dawn, 14<sup>th</sup> February, 2010.
- FAO, 2008. Meat production and consumption grow. U.N. Food and Agriculture Organization (FAO), FAOSTAT Statistical Database, Rome.
- FAO. 2006. Egg marketing: A guide for the production and sale of eggs. Book on Rural Finance of the Food and Agriculture Organization of the UNO, Rome, Italy, Pp. 121-124.
- Gallup Pakistan, 2009. Survey on meat consumption trends in Pakistan. rabea.haque@gallup.com.pk
- GOP. 2012. Pakistan Economic Survey of Pakistan .Economic Advisor’s Wing, Finance Division, Government of Pakistan, Islamabad.
- Holt, C.C., F. Modigliani, J.F. Muth and H.A.Simon. 1960. Planning, production, inventories and work force. Prentice Hall, Englewood Cliffs, NJ.
- Ismat, S. 2004. Market review (End August Review). Daily Jang Monthly Economic Review, August, 2004. P:1.
- Koutroumanidis, T.C., E.A. Zafeiriou, S.C. Aggelopoulos and S.C. Sofios. 2010. A study of the volatility of the sheep meat production in European Union (EU). Journal of Food, Agriculture & Environment, 8 (2): 736-742.
- Makridakis, S., Anderson, A., Fildes, R., Hibon, M., Lewandowski, Newton, J., Parzen, E. and R. Winkler. 1982. The accuracy of extrapolation (time series) methods: Results of a forecasting competition, J. Forecasting 1:111-153.
- McCall, C. 1980. Sampling and statistics Handbook for research in Education: National Education Association: USA.
- Meese, R. and J. Geweke. 1982. A comparison of autoregressive univariate forecasting procedures for macroeconomic time series, unpublished manuscript (University of California, Berkeley).
- Newbold, P. and Granger, C.W.J. 1974. Experience with forecasting univariate time series and the combination of forecasts. J. Roy. Statist. Soc. Amer., 137:131-165.

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