**For information**
**on 29 June 2004**

**LegCo Panel on Food Safety and Environmental Hygiene**

**Forecasting of Slaughtering Throughput of Livestock in Hong Kong**

## PURPOSE

This Paper briefs Members on the outcome of the forecasting exercise on the slaughtering throughput of livestock in Hong Kong from 2005 to 2007.

## BACKGROUND

2. The Director of Audit observed in Report No. 36 of March 2001 that there had been a continuing decline in the demand for fresh meat over the years. This resulted directly in the declining slaughtering throughput of livestock. As the Tsuen Wan Slaughterhouse (TWSH) slaughtered pigs only, The Audit Commission examined the capacity at the Sheung Shui Slaughterhouse (SSSH) to ascertain if TWSH's slaughtering throughput of pigs could be absorbed by SSSH. Given that in 2000, the average daily slaughtering throughput of pigs in Hong Kong was 6 287 (comprising 4 427 pigs at SSSH, 1 860 at TWSH and excluding the Cheung Chau Slaughterhouse's throughput at 36), there would have been a daily shortfall in slaughtering capacity of 1 287 pigs if SSSH had taken over all the slaughtering operation of TWSH.

3. The Audit Commission, however, considered that taking into account the then 'surplus' slaughtering capacity of cattle and goats at SSSH, its daily slaughtering throughput of pigs could be increased to more than 6 000 to absorb the slaughtering throughput of TWSH.

4. The Audit Commission therefore recommended that the Food and Environmental Hygiene Department (FEHD) should carry out a forecasting exercise on the slaughtering throughput of livestock in Hong Kong for the coming years, having regard to the demand for fresh meat and the eating habits of the population. In the Audit Commission's view, the results of the forecasting exercise would facilitate the long term planning of slaughtering facilities in Hong Kong, including the feasibility of centralizing the slaughtering

operation of livestock at SSSH.

5. In the Report of the Public Accounts Committee (PAC) of July 2001, the Architectural Services Department (Arch SD) advised the following when asked whether it was feasible to centralise the slaughtering operation at SSSH and whether it would take some time before centralization could be implemented:

(a) operation of a slaughterhouse was very complicated. The most complicated issue was the treatment of waste water, which was related to the slaughtering throughput and the water requirement. As pig slaughtering would use more hot water than cattle slaughtering in the scalding tank and dehairing machine, the additional hot water required would increase the temperature of the bioreactor, which might bring the operation of the waste water treatment plant to a standstill;

(b) if the daily slaughtering throughput of SSSH was 5 000 pigs, the waiting lairage was required to have a holding capacity for 12 000 pigs. The increase in the holding capacity of the waiting lairage would cause noise, odour and ventilation problems. The situation would be worse in summer as pigs generated more odour at high temperatures;

(c) another problem concerned meat despatch. The meat despatch bank was already very crowded. There would be difficulties in handling more carcasses;

(d) increasing the daily slaughtering throughput would require an increase in the number of parking spaces. It would be very complicated to carry out modification works while SSSH was in operation. Although there was a fallback boiler, it was not designed to cope with an increase in the daily slaughtering throughput. There was also the problem of the emergency power supply; and

(e) with the centralization of the slaughtering throughput at SSSH, a standstill in its operation would disrupt the overall supply of fresh meat. Arch SD had to address the technical issue of how to carry out modification works without affecting the normal operation of SSSH.

6. FEHD informed PAC that it would carry out a forecasting exercise on the slaughtering throughput of livestock in Hong Kong in the coming years. PAC recommended that FEHD should, based on the result of the exercise, carry out a detailed study to ascertain the feasibility of centralizing operation of livestock at SSSH.

## CONSULTANCY STUDY

7. FEHD commissioned Policy 21 Limited of the University of Hong Kong as a Consultant in October 2002 to conduct a comprehensive study on meat consumption in Hong Kong. The study is now completed and the objective, methodology and findings of the study are set out in the following paragraphs.

### Objective

8. The key objective of the study is to forecast the local demand for slaughtering services of pigs and cattle, with regard to the demand for fresh meat and eating habits of the population. The results of this forecasting exercise would form the basis for a feasibility study by Arch SD on centralizing the slaughtering operation of livestock at SSSH.

### Methodology

9. The consultancy study comprises two parts: a desktop research using time series models for sequential data collected over a time period, and a household survey for collecting information on the change of eating habits of fresh pork and fresh beef in the population. The survey results serve as a reference for supplementing the forecasting results.

10. In the desktop research, the per capita consumption of fresh pork and that of fresh beef are used as the key parameters in forecasting, as adopted in previous rounds of exercise. Based on the historical monthly data from 1980 to September 2003, separate forecasts on fresh pork and fresh beef consumption are compiled by using the most appropriate time series models[1] after a process of statistical model fitting and model selection.

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[1] The method used for forecasting per capita fresh pork consumption is a smoothing method while for forecasting per capita fresh beef consumption is the "Autoregressive Integrated Moving Average (ARIMA)". Time series forecasting methods have been adopted in previous rounds of exercise since 1990.

## Findings

11. Statistics on number of pigs and cattle slaughtered and per capita consumption of fresh pork and fresh beef from 1980 to 2003 are shown at **Annex**.

12. The forecast period was originally up to 2010. According to the Consultant, the results in 2008 to 2010 may not achieve sufficient reliability statistically. Therefore, only figures from 2005 to 2007 are presented in this paper.

13. The Consultant recommends using the average daily number of pigs and cattle to be slaughtered in January as the basis for reviewing the future throughput need of pigs and cattle in slaughterhouses as the forecasts show that January will be the month in a year with the highest average daily throughput of pork and beef.

14. Based on the forecast results, the trends of the per capita fresh pork consumption and per capita fresh beef consumption are found to be decreasing from 2005 to 2007. By taking into account the results of the population projections and the average meat yield, the forecasts on per capita fresh pork and fresh beef consumption are converted into forecasts on the daily number of pigs and cattle to be slaughtered. Findings for the month of January are presented in **Tables 1 and 2**.

**Table 1 – Forecasts on average daily number of pigs to be slaughtered in January and 95% confidence limits[2], 2005 – 2007**

| Month/Year | Daily number of pigs slaughtered | Lower limit | Upper limit |
|---|---|---|---|
| Jan 2005 | 6 090 | 5 110 | 7 250 |
| Jan 2006 | 5 970 | 4 780 | 7 440 |
| Jan 2007 | 5 860 | 4 510 | 7 580 |

[2] The true value to be forecasted will be between the lower and upper limits with a 95% probability. In other words, if we are in the business of doing forecast repeatedly with this methodology, we will be correct 95% of the time.

**Table 2 – Forecasts on average daily number of cattle to be slaughtered in January and 95% confidence limits[2], 2005 – 2007**

| Month/Year | Daily number of cattle slaughtered | Lower limit | Upper limit |
|---|---|---|---|
| Jan 2005 | 121 | 91 | 158 |
| Jan 2006 | 113 | 80 | 155 |
| Jan 2007 | 106 | 70 | 152 |

15. Based on the results of forecasts shown in Tables 1 and 2 above, the daily slaughtering throughputs of live pigs and live cattle in January are 5 860 and 106 respectively in 2007. These figures represent a 17% over and 74% under the designed throughput capacities of 5 000 pigs and 400 cattle per day in the SSSH. The Consultant observes that for pig slaughtering, it is still pre-mature to propose centralizing the slaughtering operation of livestock at SSSH unless the technical feasibility of the SSSH to increase the slaughtering throughput has been examined.

16. For Members' information, the forecasts on the average daily numbers of pigs and cattle to be slaughtered over the whole year are shown in Tables 3 and 4:

**Table 3 – Forecasts on average daily number of pigs to be slaughtered over the whole year and 95% confidence limits, 2005 – 2007**

| Year | Daily number of pigs slaughtered | Lower limit | Upper limit |
|---|---|---|---|
| 2005 | 5 770 | 4 740 | 7 020 |
| 2006 | 5 660 | 4 460 | 7 170 |
| 2007 | 5 550 | 4 220 | 7 290 |

**Table 4 – Forecasts on average daily number of cattle to be slaughtered over the whole year and 95% confidence limits, 2005 – 2007**

| Year | Daily number of cattle slaughtered | Lower limit | Upper limit |
|---|---|---|---|
| 2005 | 111 | 69 | 173 |
| 2006 | 103 | 58 | 176 |
| 2007 | 97 | 50 | 178 |

17. In order to collect up-to-date information on the future throughput of slaughterhouses, the Consultant considered that it would be appropriate to update the results of this desktop research exercise in every two to three years' time.

18. The household survey collected information on the population concerning the changes in the consumption pattern of fresh pork and fresh beef in the past five years and that in the coming five years. 1 101 successful interviews were conducted in this survey, with a response rate of 77.6%. Based on the survey results, 20.1% of respondents indicated their current consumption pattern of fresh pork had decreased, when compared with that five years ago; 65.4% remained unchanged, 11.4% increased and 3.1% expressed no comments. Similar findings were obtained for beef. The corresponding percentages were 27.5%, 61.6%, 7.6% and 3.3%. With regard to the future consumption pattern, 15.8% of respondents indicated their future consumption of fresh pork would decrease in the coming five years; 65.6% would remain unchanged, 6.7% would increase and 11.9% expressed no comments. The corresponding percentages for beef were 11.8%, 74.3%, 2.5% and 11.5%. The survey results are consistent with the forecasts showing decreasing trends of the average consumption of fresh pork and beef per person which result in the diminishing of daily number of pigs and cattle slaughtered in the coming few years.

## Limitation of the Study

19. It should be noted that the results of the forecasts are based on the assumption that the conditions that entailed the past trends and seasonal fluctuation of the time series data would be stable in the coming years.

## WAY FORWARD

20. To follow-up on Audit Commission's recommendation, the findings of the consultancy study have been forwarded to Arch SD for ascertaining the technical feasibility of centralizing the slaughtering operations of livestock at SSSH. We will report the results of Arch SD's study to Members in due course.

**Health, Welfare and Food Bureau**
**Food and Environmental Hygiene Department**
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**Annex**

## Number of Pigs and Cattle Slaughtered and Per Capita Fresh Pork and Fresh Beef Consumption, 1980 – 2003

| Year | No. of Pigs Slaughtered | No. of Cattle Slaughtered | Per Capita Fresh Pork Consumption (kg) | Per Capita Fresh Beef Consumption (kg) |
|---|---|---|---|---|
| 1980 | 3 424 851 | 234 654 | 23.4 | 5.62 |
| 1981 | 3 406 909 | 220 843 | 22.7 | 5.59 |
| 1982 | 3 470 057 | 214 523 | 23.5 | 5.80 |
| 1983 | 3 454 989 | 200 391 | 22.8 | 5.61 |
| 1984 | 3 535 382 | 178 155 | 23.2 | 5.44 |
| 1985 | 3 584 926 | 186 569 | 24.6 | 5.59 |
| 1986 | 3 656 953 | 184 359 | 25.0 | 5.74 |
| 1987 | 3 580 339 | 181 084 | 24.5 | 5.78 |
| 1988 | 3 491 758 | 179 557 | 24.5 | 5.63 |
| 1989 | 3 313 929 | 168 825 | 23.5 | 5.25 |
| 1990 | 3 186 264 | 165 070 | 22.1 | 5.50 |
| 1991 | 3 046 988 | 156 795 | 20.8 | 5.29 |
| 1992 | 2 943 690 | 149 858 | 19.6 | 4.87 |
| 1993 | 2 721 763 | 136 372 | 18.0 | 4.40 |
| 1994 | 2 707 316 | 131 899 | 17.3 | 3.87 |
| 1995 | 2 605 047 | 108 440 | 16.8 | 3.32 |
| 1996 | 2 532 046 | 80 042 | 16.2 | 2.68 |
| 1997 | 2 429 050 | 59 651 | 15.6 | 2.13 |
| 1998 | 2 356 516 | 64 579 | 15.4 | 2.40 |
| 1999 | 2 238 809 | 60 521 | 15.0 | 2.24 |
| 2000 | 2 313 959 | 58 077 | 16.1 | 2.17 |
| 2001 | 2 303 609 | 50 646 | 16.6 | 1.92 |
| 2002 | 2 165 300 | 47 766 | 16.4 | 1.83 |
| 2003 | 2 156 864 | 45 318 | 16.4 | 1.72 |