# CHAPTER 5 DISCUSSION AND CONCLUSIONS

#### 5.1 Discussion

5.1.1 The situation of meat provision in Vietnam

While there are encouraging signs for increases in the pig production sector in Asia-Pacific countries, conditions in the majority of traditional Asian slaughterhouses, when compared with other developed regions such as Europe, are extremely poor (FAO, 2008). Many of them do not fulfill minimum hygienic requirements to produce safe and wholesome meat. Improvement is needed urgently. Fortunately, hazards can be contained if slaughterhouses function properly and produce meat according to stringent hygiene and environmental rules and regulations. Yet, meat marketing as high hygienic standards as found in Western countries cannot be considered. Instead, the regional benchmark should be that facilities supply the traditional 'wet' meat markets with clean, hygienic, unrefrigerated meat.

Pork, with poultry, plays the key role in providing protein for the Vietnam population, accounting for approximately 90% of meat consumed by Vietnamese. Pork accounts for 75% of this meat. The pig sector is one of the fastest growing subsector in Vietnamese agriculture. There are several existing pig production systems: state-owned farms account for 4 - 5% of the total pig production, private commercial farms produce about 15% of all pigs, 80% of pig production is from small-scale farms and a few of integrated system. In small-scale farms, there are only 1 or 2 sows and less than 10 fatteners (Lapar, 2003). The slaughterhouse system in Vietnam is part of the subsequent marketing channels: pigs are most commonly sold to traders who collect fattened pigs from farmers. Pigs subsequently are purchased by retailers and are slaughtered by privately employed butchers and workers at private or, against a fee, at municipal slaughterhouses (Minh, 2007). Vietnamese consumers prefer to buy fresh pork from wet markets. Thus, almost all pork produced in Vietnam is sold as fresh meat, processed meat accounts for less than 6% of meat sold (Tung et al., 2005).

In Vietnam, the slaughterhouse sector has been neglected compared to other sectors of national and regional livestock development. There is one large-scale pig abattoir in Hai Phong, which was designed in the 1980s for export purposes and which uses a continuous-line slaughter system. The second abattoir with continuous-line slaughter of cattle and pigs is the VISSAN abattoir in Ho Chi Minh City, built in 1974 by the West- German Government. Elsewhere, semi-line pig-slaughter systems use traditional ways of moving of carcasses (dragging) from running and bleeding to scalding and scraping.

The largest group of slaughterhouses are small- to medium-sized private or municipal abattoirs. This group entails a wide scope of types and categories in terms of availability and quality of equipment and slaughter hygiene, ranging from acceptable handling procedures to absolutely disastrous and hazardous practices that result in heavily contaminated meat (FAO, 2008).

The overwhelming majority of private and public slaughterhouses cater to the traditional meat markets with "hot" or unrefrigerated meat. This is the sector where profound technical and hygienic improvements are needed.

Severe shortcoming areas of the floor-dressing slaughterhouses are (WB, 2008):

- Animal welfare issues (pre-stunning of slaughter animals); slaughter methods (slaughter and handling facilities; carelessness by workers).
- The slaughterhouse infrastructure and installations usually are in poor condition and the slaughter workers feel un-obliged to work hygienically. Lack of funding make municipal slaughterhouses keep their costs low, hence the primitive slaughtering practices.
- Basic process control is difficult to implement because of the large number of businesses and workers involved in the slaughter; all operations, from bleeding to splitting and further carcass cutting, are typically taken place on the floor and are done simultaneously. Carcass transport, slaughterhouse waste disposal, meat inspection and sanitary management are uncontrolled properly.

5.1.2.1 Overview of Enterobacteriaceae in the 10 slaughterhouses

In this study, the average Enterobacteriaceae numbers from all 10 slaughterhouses, summarized over all sampling sites, were  $3.4 \log_{10} \text{cfu/cm}^2$  and  $3.1 \log_{10} \text{cfu/ml}$  before and 2.7  $\log_{10} \text{cfu/cm}^2$  and 2.4  $\log_{10} \text{cfu/ml}$  after cleaning and sanitation, respectively. The 2.7 value is biased due to lower numbers at 2 sites (scale and table), while for the remaining sites, numbers were above  $3.0 \log_{10} \text{cfu/cm}^2$ .

Reductions in Enterobacteriaceae numbers as outcome of cleaning and sanitation at the end of the slaughter process, compared to numbers during the process, overall were statistically not significant. No true effect of measures restricted to the use of water were achieved; rather, water use only lets to a dilution of microorganisms, not to their decisive removal.

Taking the Enterobactericeae counts on pig carcasses as indicator for the hygienic quality of a slaughterhouse, the European Union (EU) by its Regulation 2073/2005 has set the limit for Enterobacteriaceaee at a daily mean value of 2.0  $\log_{10}$  cfu/cm<sup>2</sup>. From the results of this study, it can be safely inferred that pig meat leaving the study slaughterhouses had considerable higher bacterial loads. For the largest pig slaughterhouse in Laos, Enteriobacteriaceae counts of 2.8 – 3.0  $\log_{10}$ cfu/cm<sup>2</sup> at the end of line were reported (Inthavong et al., 2006).

EU regulations prescribe that carcasses not fulfilling the criteria of a daily mean value of Enterobacteriaceaee not to exceed 2.0  $\log_{10}$  cfu/cm<sup>2</sup> must be withdrawn or recalled from sale. This is, under present Vietnam conditions, unrealistic.

5.1.2.2 Enterobacteriaceae in the hoisting system versus the floor-dressing system

From study results of the 10 slaughterhouses, cleaning and sanitation did not lead to justifiable reductions in Enterobacteriaceae loads. The hoisting slaughterhouse overall did fare better, whilst results for each of the 5 slaughterhouse types yielded totally unacceptable results. More important, while all types yielded low results, individual slaughterhouses did even fare worse than the other ones. On average, the higher the initial number of Enterobacteriaceae was, the lower was the effect achieved by cleaning.

## 5.1.2.3 Enterobacteriaceae counts by seasonal variations

Seasonal variations of Enterobacteriaceae in meat and environment encountered in the study were object of several investigations. In activated sludge from the municipal wastewater treatment plant at the "Kremikovtzi" Holding in Bulgaria, Enterobacteriaceae loads were highest during summer at 2.6 x  $10^5$  cells/ml and lowest during winter at 1.2 x  $10^4$  cells/ml (Mehandjiyska, 1995). The isolation rate of Enterobacteriaceae from local poultry meat samples in Pune and Mumbai in India was observed to have dropped in January, the winter season, while the rate increased in the months of March, April, May and July, indicating a rise in summer and the early monsoon seasons (Jayant et al., 2005). Enterobacteriaceae counts in the Długie Wigierskie Lake water in Poland did peak in the summer; related to the higher temperature of the lake water. Higher temperature can play some role, but does not necessarily favour the survival of those bacteria (Wiśniewska et al., 2007).

## 5.1.2.4 Enterobacteriaceae contamination by sites

Between sample sites, particularly highly contaminated 'animal-related' sites like the pig pens, floors and knives could be differentiated from still high, but relatively lower contaminated 'meat-processing' sites like boards, scales, table, saw. This ranking was maintained after cleaning and sanitation. Without doubt, no or only extremely poor process control was exerted in the slaughterhouses in regards to cleaning and sanitation, due to shortage of knowledge, experience and technical means. Therefore, every surface coming into contact with live animals or/and carcasses as well as every piece of equipment touching carcasses or/and meat have to be considered as risk factors for Enterobacteriaceae contamination because of their high load of Enterobacteriaceae. 5.1.3 Cleaning and sanitation of the slaughterhouses

FAO (2008) has listed the needed elements of cleaning and sanitation of slaughterhouses. Sanitation refers to cleaning and disinfecting as well as controlling of insects and rodents through the use of chemical substances. Conditions for efficient cleaning and sanitation are that the premises and equipment must be 'cleaning-friendly', meaning having easy and practical access to all contaminated areas. Surfaces have to be smooth and materials for building structures and equipment adequate. Proven methods must be available and personnel must be regularly instructed, trained and supervised.

These conditions are rarely observed. The study attempted to categorize slaughterhouses according to their physical infrastructures (floors, water for scalding, water for cleaning). The results of this classification on differences of Enterobacteriaceae counts were inconclusive. On one hand, the low number of slaughterhouses in each category has to be considered; on the other hand, the chosen classification criteria likely were not precise enough to be able to discriminate between slaughterhouses.

Principally, meat plant cleaning and sanitation will be mostly incomplete or impossible to carry out effectively due to the unhygienic structure of premises displaying inadequate building materials, floor and wall cracks and damages as well as heavy corrosion through the unavailability of anticorrosive materials.

'Cleaning' means the removal of dirt and organic substances, such as fat and protein particles from surfaces, walls, floors, tools and equipment as is achieved by techniques of: dry cleaning (physical removal of scrap, such as coarse solid particles, with a dry brush (broom); wet cleaning (using brushes and water hoses); high pressure cleaning (pressurized water is applied with high-pressure units and special spraying lances); use of chemical cleaning solutions (detergents). Premises in this study did not permit and attitudes of workers did not aim at such effective cleaning. The total absence of use of detergents was particularly noticeable. 'Disinfection' is the complete removal of microorganisms; achieved by either using hot water, steam or chemical disinfectants. Common chemical disinfectants include: chlorine-containing compounds, aldehydes, quaternary ammonium compounds and oxygen-releasing substances (peroxide compounds). Best disinfection results are achieved when intensive dry/wet cleaning precedes chemical disinfection.

No disinfection at all was carried out in any of the study slaughterhouses.

Particular notorious areas were identified during the study, including pig pens, knives and scalding water. For pig pens, pressure washing did produce a significant reduction  $(2.2 \log_{10} \text{cfu/cm}^2)$  in the Enterobacteriaceae count in lairage areas than did mains water  $(1.7 \log_{10} \text{cfu/cm}^2)$  (Small et al., 2007). No such pressurized water was available in all study slaughterhouses nor was applied properly.

Improvements on the hygiene of knives on red meat slaughter floors, have been described by Eustace et al. (2007). Slaughter knives could be disinfected during the slaughter process by using two knives alternatively, rinsing them in hand wash water, then immersing them between uses in 60°C water or rinsing them and momentary dipping in 82°C water. Such techniques were not encountered in the study slaughterhouses.

Warm or hot water is a particular problematic area. Scalding is a step which is expected to result in a considerable decrease in the numbers of microorganisms on carcass surfaces (Berends et al.,1997). Study slaughterhouses either used to pour hot water on the carcasses or dipped the carcasses into a vat of hot water. No information is available on the actual temperature of the water used. Temperature of the scalding water should be at 60-64 degree Celsius. Putting carcasses into scalding vats carries particular problems. This method requires necessary periodical refreshing of the water which is often not done. Vats further often are heated by fuel wood, not allowing for temperature control. 5.1.4 Future challenges for hygienic improvements of pig slaughterhouses in Vietnam

The slaughterhouses and slaughter slabs in Vietnam generally and in Hanoi particularly, in summary, often operate in a 'grey zone', this means they have low- to medium capacity and supply traditional meat markets with "hot" (unrefrigerated) meat.

The predominant floor-dressing systemically leads to serious crosscontamination due to a large number of workers involved in the slaughter, parallel rather than serial processing, most/all processes carried out on the floor, many products being dragged across the floor from one point to another. Health and sanitation practices are non-existent or very rudimentary. This extensive informal sector is largely uncontrolled with potentially significant health risks.

Three new abattoir projects in Ho Chi Minh City and one in Hanoi indicate the Government's interest in making fundamental improvements (FAO, 2008). In June 2009, one slaughter complex including 2 slaughterhouses in this study and another investigated slaughterhouse were inspected by local authorities and these slaughterhouses will be closed in the end of this year (Anninhthudo 2009; Cand 2009). In the schedule, in the end of 2010, Hanoi will have a modern slaughtering system from several projects that are implementing such as a project of abattoir construction with 600 pigs and 1,000 poultry slaughtering capacity in Ha Binh Phuong industrial zone - Thuong Tin district of Anh Vinh Food Technology Joint Stock Company; an abattoir project of Dong Thanh Co., Ltd. (capacity for slaughtering of 1,000 pigs per day) in Xuan Noi commune - Dong Anh district; One member State Co., Ltd. for Investment and Development is investing 2 projects of livestock and poultry slaughterhouses in Trach My Loc commune - Phuc Tho district and Le Loi commune - Thuong Tin district; Livestock and Poultry Business -Production Joint Stock Company is constructing a slaughterhouse in Le Chi commune - Gia Lam district (Anninhthudo 2009).

One key responsibility of the government is to develop and provide the necessary hygiene and environmental legislative frameworks for abattoirs and the meat sector as a whole. These need to be supplemented by regulatory systems to be issued by government and designed to implement and strictly enforce the laws.

One principle of modern meat hygiene is the sharing of responsibilities for consumer protection between the meat business operator and the government health official and hygiene control entities. Meat business operators must be prepared to accept the primary responsibility for the hygienic quality and safety of meat and meat products. They are supervised in this task by the official government control authorities.

## **5.2 Conclusions**

High Enterobacteriaceae counts were obtained from 10 pig slaughterhouses in Hanoi during the slaughtering process as well as after cleaning and sanitation. Slaughterhouse sanitation was mostly incomplete, no detergents nor disinfectants were used, or impossible carried out.

The majority of pork consumed in Hanoi is obviously produced by substandard processes, poor sanitation and without animal welfare methods.

In short-term solution, these slaughterhouses need to apply cleaning and disinfection program properly under supervision of veterinary services to eliminate Enterobacteriaceae loads from slaughter equipment as well as slaughtering areas.

For long-term strategies, improved regulatory systems on hygiene at slaughterhouses and their related sectors replacing current improper regulations should be issued by the Government in near future. In Vietnam's centrally planned economic system, the veterinary authorities are in a stronger position than in many other Asian countries. The Vietnam Animal Health Department is encouraging the introduction of chilled meat sales in up-market butcher outlets. This is certainly the meat-marketing system of the future and has strong implications on the structure improvements of slaughterhouses. Vietnam will most likely be one of the first countries in Asia, after China, to undergo such structural changes (FAO, 2008).