DIFSLIVE

INDONESIAN – DUTCH PROGRAMME ON FOOD SECURITY, POULTRY & DAIRY SECTOR

Dutch-Indonesian programme on Food Security in the livestock sector (DIFS-live): poultry meat

Results of the poultry meat programme 2014-2018; main report

Peter van Horne, Rick van Emous, Frank Joosten, Gemma Tacken, Ferry Leenstra

Rapport 1259

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Peter van Horne[1], Rick van Emous[2], Frank Joosten[3], Gemma Tacken[1] and Ferry Leenstra[2]

1 Wageningen Economic Research
2 Wageningen Livestock Research
3 Advance Consulting

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Samenvatting NL.
In dit rapport worden de opzet en resultaten van het pluimveevleesprogramma in het Dutch Indonesian Food Safety Programme (DIFSlive) gepresenteerd. Het programma bestond uit een consumentencampagne ter bevordering van de handel in en consumptie van gekoeld pluimveevlees, scenariostudies naar de ontwikkeling van de pluimveevleesproductie, verbeteringen in het kleinschalig slachten en koelen van pluimvee en verbeteringen in de houderij van vleeskuikens.

Summary UK.
In this report, the design and results of the poultry meat program in the Dutch Indonesian Food Safety Program (DIFSlive) are presented. The program consisted of a consumer campaign to promote trade in and consumption of chilled poultry meat, scenario studies into the development of poultry meat production, improvements in small-scale slaughtering and cooling of poultry and improvements in broiler farming.

This report can be downloaded for free at https://doi.org/10.18174/525324 or at www.wur.nl/livestock-research (under Wageningen Livestock Research publications).

P.O. Box 338, 6700 AH Wageningen, The Netherlands, T +31 (0)317 48 39 53, E info.livestockresearch@wur.nl, www.wur.nl/livestock-research. Wageningen Livestock Research is part of Wageningen University & Research.

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All our research commissions are in line with the Terms and Conditions of the Animal Sciences Group. These are filed with the District Court of Zwolle.

Wageningen Livestock Research Report 1259

Table of contents

Foreword

The Governments of Indonesia and the Netherlands work together on strengthening the food security situation in Indonesia. This bilateral food security programme centres on the priority commodities identified by the Indonesian Government, including vegetables, fish, poultry meat and dairy products. The Indonesian - Dutch programme on Food Security on Livestock (DIFS-Live) focused on the development of the poultry meat and dairy sub-sectors in West Java. West Java is the main production and sourcing area of dairy and poultry meat products for Greater Jakarta. Poultry meat and dairy products are important animal protein products for the consumers in Indonesia. Every year the demand for these products is increasing.

It is essential that the production and supply of these products are organised in a safe and responsible manner. Both public and private sector partners in these livestock sectors have a responsibility to realise the sustainable growth of these livestock sectors and that the Indonesian consumers will continue to have access to safe and affordable products.

The supply chain partners – comprising input suppliers, primary producers, processing companies, traders and consumers – were the main target groups of this programme.

This report focuses on the results of the poultry meat programme, focussing on consumer awareness, developments in the poultry slaughter sector and developments in broiler production. The work was carried out in cooperation between Wageningen Livestock Research (WLR), Wageningen Economic Research WEcR), Advance Consulting, and partners from the Livestock Department from the Indonesian Ministry of Agriculture and Food and from the Bogor Agricultural University.

Chapter 1 gives an introduction to the poultry programme. The results of the poultry programme are described in five chapters:

- Consumer awareness, with Gemma Tacken en Jos van den Puttelaar (WEcR) as main researchers (Chapter 2)
- Cool chain improvements, with Ferry Leenstra, Henny Reimert (WLR) and Denny Lukman (Bogor Agricultural University) as main researchers (Chapter 3)
- Scenarios for the slaughter sector, with Peter van Horne (WEcR), Ferry Leenstra (WLR) and Coen van Wagenberg (WEcR) as main resarchers (Chapter 4)
- Small scale poultry slaughter facilities, design and lay out with Jos van den Nieuwelaar (Marel), Henny Reimert (WLR) and Peter van Horne (WEcR) as main researchers (Chapter 5)
- Broiler farming recommendations with Rick van Emous and Sander Lourens (WLR) as main researchers (Chapter 6).
- Finally, in Chapter 7 the main lessons learned are summarized.

Ivo Claassen (WBVR) and Frank Joosten and Irma Verhoosel (Advance Consulting) are acknowledged for their role in initiating and guiding the project.

Summary

Through partnership arrangements between private sector stakeholders, knowledge institutes and governmental institutes different pilots and capacity building initiatives were designed and implemented related to broiler farming, slaughtering and marketing of poultry meat. The DIFS-Live programme was structured around these support activities and interventions into three components.

Component 1: Consumer awareness & supply chain initiatives
In general, consumers in Jakarta prefer uncooled freshly slaughtered poultry meat that is sold on wet markets and by street vendors. The market is based on trust between vendor and buyer, that only poultry meat is offered from birds slaughtered a few hours before. This requires slaughtering in the city, to minimize transport time of poultry meat. Food safety and public health regulations in Greater Jakarta, however, require that meat is slaughtered and sold under hygienic, cooled conditions. Enforcement of these regulations is difficult. When more and more consumers in Jakarta and other cities start to accept cooled or frozen poultry meat as a healthy and safe alternative, the slaughter practices in the cities can be phased out and law enforcement will become more feasible.
DIFS-Live therefore developed and implemented a consumer campaign aimed at increasing the awareness of and interest for cooled chicken. This campaign targeted urban consumers and was implemented on behalf of the Indonesian veterinary public health authorities in Jakarta and of the Directorate General on Livestock and Animal Health Services from the Indonesian Ministry of Agriculture and Food Safety. Consumers in West Java need to become confident that cooled and frozen poultry meat is of the same or better quality than uncooled, fresh poultry meat.

Component 2: Slaughterhouse sector developments
The increasing demand for poultry meat leads to investments in slaughter capacity and increase of broiler production. A transition needs to take place from the traditional small home-based slaughter points in urban areas towards medium sized (semi-)automated slaughter houses with higher hygiene standards located outside urban areas. With an increased physical distance between the place of slaughtering and the market, the conditioning of the poultry meat during distribution and marketing becomes essential for meeting freshness and food safety standards. As part of DIFS-Live, scenario studies were conducted to study how the poultry meat production chain can grow in a responsible and sustainable way.
It is estimated that around 2015, 75% of the chickens in the West Java region were slaughtered through home-based slaughter points that are located in urban areas close to the market. The growing demand for poultry meat could, however, not be met in a responsible and sustainable way by these existing slaughter points. Therefore, the goal of this project component was to improve the slaughtering and processing standards of poultry meat. Through interventions, DIFS-Live assisted with the (re-)design of slaughter facilities, the upgrading of existing facilities with specific elements, training, and co-financing for improved (pilot) slaughtering facilities, waste treatment and conditioning of the meat. Together with a selection of independent slaughterhouses in West Java, DIFS-Live worked towards increasing the supplies of poultry meat that is slaughtered under hygienic and safe conditions and that is supplied to the market via a well-organized cool chain. Barriers for these developments were identified.

Component 3: Broiler production improvements
The poultry farming sector needs to increase its production to meet the increasing demand for poultry meat. In Indonesia, broilers (chickens bred and raised specifically for meat production) are mostly produced by small and medium scale farms. These farms, often open sheds, offer little biosecurity, have limited access to clean water and have no or insufficient facilities to control temperatures. As a result, the broilers suffer from heat stress and poor health, which contributes to inefficient feed conversion rates, high mortality rates, high use of antibiotics and other veterinary medicines and reduced farm incomes. The average slaughter weight of the birds is well below the optimal weight for modern broilers. A combination of training in and demonstration of modern broiler farming practices

and investments in broiler house infrastructure is needed to improve the performance and economic viability of the small and medium scale broiler farming sector. Several interventions were therefore implemented on a selected number of broiler farms in West Java. DIFS-Live assisted with co-financing of the Dutch and Indonesian hardware required for the interventions, the development of on-site training programmes, improved designs of broiler houses and equipment and with management concepts.

1 Introduction

The Governments of Indonesia and the Netherlands work together on strengthening the food security situation in Indonesia. This bilateral food security programme centres on the priority commodities identified by the Indonesian Government, including vegetables, fish, poultry meat and dairy products. The Indonesian - Dutch programme on Food Security on Livestock (DIFS-Live) focused on the development of the poultry meat and dairy sectors in West Java. West Java is the main production and sourcing area of poultry meat and dairy products for Greater Jakarta. This report focuses on the poultry meat sector. Poultry meat is an important animal protein product for the consumers in Indonesia. Every year the demand for poultry meat is increasing.

It is essential that the production and supply of poultry meat is organised in a safe and responsible manner. Both public and private sector partners in the poultry meat sector have a responsibility to realise the sustainable growth of poultry meat production and that the Indonesian consumers will continue to have access to safe and affordable poultry meat.

The supply chain partners – comprising input suppliers, primary producers, processing companies, traders and consumers – were the main target groups of this programme.

The **overall goal of DIFS-Live programme** was:

- to develop viable models for domestic production and supply of affordable, nutritious and safe animal-based products.

With the development and testing of these models the programme aimed to contribute towards higher income levels of Indonesian smallholder producers and improved access to affordable and safe poultry meat among urban consumers. This is in line with the overall aims and strategies of the Indonesian government on self-sufficiency in the production of major agricultural commodities and the Dutch policies on food security.

When people have access to sufficient, safe and nutritious food to maintain a healthy and active life at all times, we speak of 'food security'. The concept of food security includes both physical and economic access to food. The Dutch food security support foresees outcomes in one or more of the following areas: (a) sustainable increase in food production; (b) more efficient markets for agricultural and food products; (c) improved access to healthy and safe food; (d) an enabling environment for agri-business development.

At the start of the DIFS-live programme, in Indonesia most poultry meat was purchased at wet markets. Buyers prefer warm poultry meat, as this is perceived as fresh. Most poultry is slaughtered manually in small slaughter points in urban areas close to the markets. The live broilers are transported to the urban areas. Most broilers are raised in open sheds, with limited climate control and limited attention for drinking water quality. Consequently health problems among chickens are (too) common and use of antibiotics is frequent and high.

DIFS-live Work package 1 aimed at consumers to introduce cooled poultry meat. Chapter 2 provides the results of this work package. Work package 2 aimed to analyse and improve hygiene circumstances in the poultry slaughter sector, with a focus on small and medium sized slaughter points and plants. Besides, potential consequences for labour, costs and logistics were estimated for different scenarios for development of the poultry slaughter sector. Chapters 3, 4, and 5 provide the results of the work on the poultry slaughter sector and poultry meat value chain. Work package 3 aimed at improvements in the broiler production sector and the results are described in Chapter 6. In each of these chapters the output and the outcome of the work package is given. The main lessons learned are described in Chapter 7.

The Dutch Embassy contracted Wageningen Bio-Veterinary Research (WBVR) of the Animal Sciences Group (ASG) of Wageningen University & Research as the coordinating and partner of DIFS-Live. Other partners participating in the different project components are listed in the table below. The different private sector partners participated in the programme on a cost-sharing basis.

Component	Main Implementation Partners
Consumers & sector studies (work package 1)	○ Wageningen Economic Research (WECR), IPB FEMA, Schuttelaar & Partners, Rabobank, Amonra, Wageningen Livestock Research (WLR)
Poultry slaughtering (work package 2)	○ Wageningen BioVeterinary Research (WBVR), WLR, WECR, IPB (Bogor Agricultulture Universitiy) Centras, Marel, PT Amindo, DKI Jakarta, Tondeur VCTA
Broiler farming (work package 3)	○ WLR, PT Medion, Sommen BV, Roodbont Agricultural Publishers, PTC+
DIFS-Live Coordination, monitoring & evaluation:	○ The Directorate General on Livestock and Animal Health Services of the Indonesian Ministry of Agriculture (DGLAHS) and the Embassy of the Kingdom of The Netherlands (EKN) in Jakarta oversaw project implementation ○ WBVR, Advance Consulting and National Programme Coordinator were responsible for day-to-day management and coordination ○ IPBFood & Agribusiness Centre (FAC) was contracted as local support office ○ Wageningen Centre for Development Innovation (CDI)CDI assisted with M&E activities

The implementation phase started in the fourth quarter of 2014 and the programme continued until early 2018. The overall budget of DIFS-Live (Poultry and Dairy sector) was Euro 4.84 million of which nearly Euro 3.96 million was contributed by EKN and Euro 0.88 was co-funded by the private sector partners.

2 Consumer Awareness

Gemma Tacken and Jos van den Puttelaar

2.1 Background

Demand for and consumption of poultry meat in Indonesia will increase in the upcoming decennia due to increasing welfare of inhabitants. This growth of poultry meat consumption cannot be met without civilian health risks caused by traditional chains of uncontrolled slaughtering and distribution by wet markets and street vendors. In order to realize an increase in supply of safe poultry meat a shift from classic wet markets and classic street vendors to cooled chains is necessary. This requires more than only changing the chain.

The perception of cold poultry meat needs to shift as well as the demand from warm to cold poultry meat, otherwise the demand for cooled meat would be smaller than the offer. Changing the consumer image of cooled poultry meat can only be reached by positioning cooled poultry meat as equally good or better than the poultry meat sold on the wet market. Poultry meat from the wet market was until the campaign developed in this project perceived as the most fresh, affordable and the only halal product. Therefore consumers have to be made aware of the qualifications of cold poultry meat and should be convinced that cooled meat is not old meat, or more expensive and of lower quality. A communication campaign was developed in this project that aimed to make consumers aware of and emphasize the positive characteristics of cooled meat and to empower them to buy cooled poultry meat.

In Indonesia, wet markets are by far the most popular place to buy chicken meat, the main Indonesian meat source, for household consumption. Next to wet markets, street vendors are also an important distribution channel for poultry meat. All income groups consume poultry meat from the wet market, while poultry from street vendors is bought relatively more by low income groups. Two groups of consumers can be identified in wet market visitors:

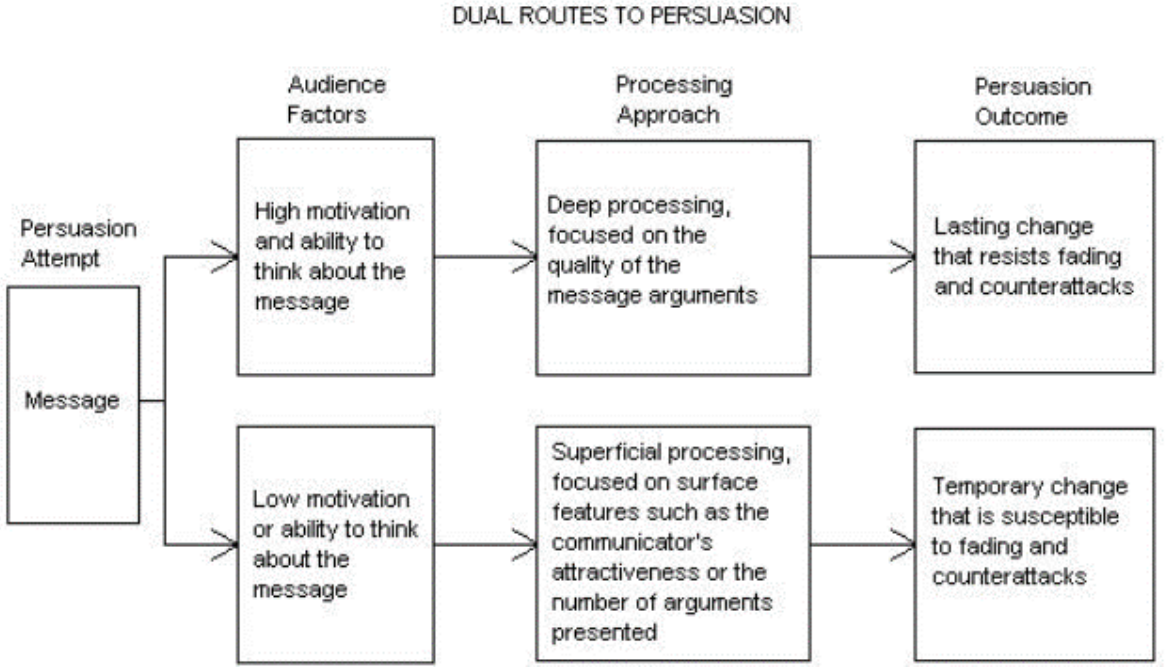
- the first group chooses for wet markets from a traditional cultural viewpoint (routine in the family)
- the second group prefers the wet market for the better product quality on freshness, the price level and the guarantee of halal slaughtering.

Although health is an important motive to buy poultry meat, Tacken et all (2014) showed that food safety is a relatively low prioritized buying motive for consumers in the region Jakarta. Consumers prefer healthy poultry meat but prioritize safety substantially lower. Quality, price/quality relationship and price are the most important buying factors in choosing an outlet, closely followed by trust. The food safety motive rating is not income dependent and hardly dependent on consumption.
End 2013, most consumers were satisfied with the food safety of poultry meat at the preferred outlet. Next to that clients of the wet market and clients of the supermarket rated the food safety of their preferred channel equally. Only clients of the street vendors perceived the poultry meat quality at the street vendor lower.
The most important quality determinants for poultry meat are: color, smell, firmness and texture. Therefore it is difficult for consumers to determine the quality of pre-packed cooled chicken since it is difficult to determine whether the chicken smells right and feels right. In general, smell is the second quality determinant for consumers. When enforcement of regulation 2007/4 in Jakarta is aimed, quality control of cooled chicken has to be indicated. In particular, a solution has to be found for consumers to trust cooled pre-packed poultry meat, even though the quality cannot be checked on smell before buying the chicken.
The outbreak of Avian Influenza has changed the consumption and buying behavior of 40% of the Jakarta consumers. In general, only 17.8% of the consumers has changed their purchasing behavior

from street vendor and wet market to modern markets in the last years. 14.9 % changed from wet market to street vendors, 6% changed from street vendor to wet markets and 1.4% from modern markets to wet markets (Tacken et al, 2014). All these changes were probably based on trust in the supplier which changes or became stronger due to the outbreak of Avian influenza.
To develop a situation in which a large fraction of the poultry meat reaches consumers via cooled chains with conditioned slaughtering, higher food safety and quality levels, both the chain and the consumers' food safety and quality perception of cooled chains needs improvement. The perception of freshness, affordability and halal guarantees of cooled chains has to be cultivated.

2.2 Development of an Ayam Dingin Segar Campaign

The design, implementation and impact assessment of the consumer campaign is based on the Elaboration Likelihood Model ('ELM' developed by Petty and Cacioppo, 1986). The diagram below provides a simplified version. Based on the ELM, attitude change may occur via two routes of influence: the central route and the peripheral route.



The two routes differ in the amount of thoughtful processing of information or elaboration. Individuals taking the central route think critically and logically about issue-related arguments and scrutinize the merits and relevance of those arguments before forming an attitude about the advertisement or product. Conversely, individuals taking the peripheral route make less cognitive effort and rely on shortcuts such as the number of arguments and physical attractiveness of endorsers when forming an attitude. Elaboration likelihood is determined by an individual's motivation and ability to elaborate. In this campaign, both central and peripheral route communication is necessary to convince the consumers, since some people in the target group lack information while others lack interest and buy routinely the warm poultry meat at the wet market or the street vendor.
The goal of the consumer campaign was to increase the awareness, interest and desire for cooled chicken among consumers in the West Java region. To do so the perception of cooled (ASUH) chicken needs to be improved by the end of the campaign (2016).
The campaign team had set the following objectives based on consumer research and expert judgement.

a. By mid-2017 the number of consumers in the target group who are aware that cooled chicken is fresh, versatile and convenient is increased with 30% as a result of the campaign.

b. By mid-2017, the number of consumers in the target group who perceive cooled chicken as fresh, versatile and convenient as warm chicken will have increased with 20% as a result of the campaign.

c. By mid-2017, the number of consumer the target group who prefer cooled chicken above warm chicken will have increased with 20% as a result of the campaign.
d. By mid-2017, the number of consumers in the target group who are motivated to change their buying behavior to an outlet where they can buy cooled chicken will have increased with 20% as a result of the campaign.
e. By half 2017, the number of the target group in the selected area who have an intention to buy cooled chicken on basis of the perception that cooled poultry meat is healthy, affordable, convenient, halal and of good quality will have increased with 20% as a result of the campaign.
Campaign material is presented in Paragraph 2.8 of this chapter.

Primary target groups were consumers from higher income groups, considered as early adopters, who buy the poultry meat from wet markets and/or street vendors. We consider this group as early adopters of new products and expect that they are key influencers of the buying behaviour in other income groups. These consumers find convenience, quality, price/quality, brand and availability important. Within this group there was a focus on women who are responsible for buying the groceries for their families and who also shop in supermarkets, and therefore already have access to cooled chicken. A few target areas within Jabodetabek in the western Java district were selected for the campaign in which wet market and modern market are both present. This region was selected since all income groups are present in these areas, with interference between groups. Next to that for chain improvement the same area was selected..

2.3 Introduction to the impact analysis

The consumer campaign was a social intervention within the scope of a larger effort to improve the food chain of cooled chicken. The design of the campaign was built upon three established theories of marketing and food behavior: the ELM model as described in the previous chapter, the AIDA model as used by Hassan, Nadzim, & Shiratuddin, 2015 and Food Choice Motivations (Steptoe, Pollard, & Wardle, 1995). Where the ELM model was taken into consideration before the design of the campaign started, the AIDA model and the Food Choice Motives (FCM) were an integral part of both the design and the impact assessment.
The *AIDA model* exists out of the steps, awareness, interest, desire and action. It is a widely used model for marketing and advertising that describes several steps consumers go through when they get into contact with a new product, or in this case a range of products. The model is sequential, meaning that consumers ordinarily move from awareness gradually towards actions. That consumers go through the steps sequentially is however not necessarily so. The linearity in steps counts for both cognitive processes (what people are aware of) and affective (emotional) processes. The model helps understanding the parts of the marketing campaign that? are useful and in which stage people are.
The *food choice motivations* are primarily used as a good predictor of food choice. And thus knowing what the food choice motives are gives a good insight into what needs to be changed about the product or campaign to adhere to what people really find important. The Food Choice Questionnaire (FCM) was originally developed by Steptoe and colleagues (1995). The FCQ is often used for measuring food choice motives and consists of 36 items to measure 9 underlying motivations: health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity and ethical concern. The FCQ has been used and tested in many different studies (Insch & Jackson, 2014; Onwezen & Bartels, 2011; Sautron et al., 2015; Steptoe et al., 1995; Verain et al., 2012). The original questionnaire is aimed to ascertain insights into the importance of these constructs on an average day, but differences in importance ratings exist across consumer groups, across situations and across product categories (Verain, Sijtsema, & Antonides, 2016). The original FCQ was developed in the United Kingdom, but is validated in many countries, amongst others in Belgium, The Netherlands, Hungary, Romania and the Philippines.
Apart from the AIDA model and the FCM insights into behavior of the population are needed to quantify the effects of the social campaign. Previous studies on the effect of social campaigns on cooled poultry in Indonesia have not dealt with an effect measurement that compared pre and post intervention data.

The purpose of this study was to quantify the effects the consumer campaign had on the population of the greater Jakarta area (Jabodetabek). We distinguished the following aspects of consumer perceptions and behavior:

- Awareness
- Interest
- Desire
- Motivation
- Behavior

See Chapter 2.4, methods, for a brief explanation of concepts as awareness and food choice motivations. This chapter gives also a brief overview of the methods used and the design of the study. Chapter 2.5 provides the results of the effect measurement. Finally the conclusions will be provided and discussed.

2.4 Methods: measures before and after the campaign

2.4.1 Inception phase

Prior to development and implementation of the consumer campaign, research was done in an inception phase (Tacken et al, 2014). The inception phase provided insight into the current choice behavior and choice motivations regarding poultry meat. From that study we were able to use information regarding the use of the Food Choice Motivation Questionnaire, the perception of chicken with regards to the same motives and where people buy their chicken.

2.4.2 Sample and procedure

The research design for the effect measurement of the consumer campaign was to do a longitudinal study with 2000 women in the Jabodetabek region, who were interviewed before the campaign and after the campaign. By doing so the difference in awareness, interest and desire towards cooled poultry meat was measured. Participants were recruited by PT Masasi. Participants were recruited across the following regions: Bekasi East Jakarta, Central Jakarta Tangerang Bogor, South Jakarta, West Jakarta, Depok, North Jakarta. The initial sample consisted of 2056 woman of which 37 dropped out for the second questionnaire.
The campaign consisted of multiple parts, from roadshows with live cooking, celebrity endorsement, on- and offline articles and social media accounts.
Prior to commencing the structured interviews, informed consent was asked. After consent the participants went through a questionnaire the first time (T0). The questions were asked by trained interviewers, students of IPB, and the answers were immediately reported by the interviewer on a tablet.
The first interviews were held during August and September 2016 (T0) among 2056 woman living in the greater Jakarta region, this was prior to the start of the campaign. The participants were not told about the campaign. After the campaign had run for 6 months, the subsequent survey questionnaires were given after Ramadan 2017 (T1).
The final panel consisted out of 2022 woman with an average age of 38 years. Participants were thanked for their time and effort and received a small gift for their participation.

2.4.3 Measures

The questionnaire consisted of questions related to; social demographics; awareness about cooled, frozen and warm chicken; interest for cooled, frozen and warm chicken; buying behavior related to cooled, frozen and warm chicken; usage behavior related to chicken; food choice motivations related to all three types of chicken. At T1 the demographics were not asked again, questions about the awareness and interest in the ADS campaign were added. When possible, 7-point Likert scales were used.
The Food Choice motives questions were added with questions regarding the importance of halal and adapted to ask for the perception of cooled chicken rather than the standard, "the importance of X on a typical day". Finally the questionnaire was translated into Bahasa Indonesia and translated back into

English as a check-up. To increase the reliability of measures, non-related measures were included in the initial survey (T1) to be able to compensate for possible ceiling effects (when people mainly score as high as possible on a scale). Finally they did not seem necessary since we did not encounter a ceiling effect.
Some example questions are the following:

- Awareness: "How much do you know about cooled chicken?"
- Where to buy it; How to prepare it, etc.
- Interest: "What type of information do you use related to cooled chicken?"
- e.g. "I will often use recipes regarding [...]"
- Desire: "I desire to buy cooled chicken in the near future"

Data analysis were performed in using R (version 3.4.0), IBM SPSS statistics 23 and Microsoft Excel 2016.

2.5 Results

The purpose of the consumer campaign was to increase the awareness, interest and desire for cooled chicken. Next to that changes on the participates evoked choice set (all the possible options one considers to buy) were expected and finally possible changes in their buying behavior (which can also be considered as the action phase of the AIDA model). Figure 2.1 gives the results of the 0-measurement (in green) and in blue the translation of the goals set by the campaign team, in quantitative values per question.

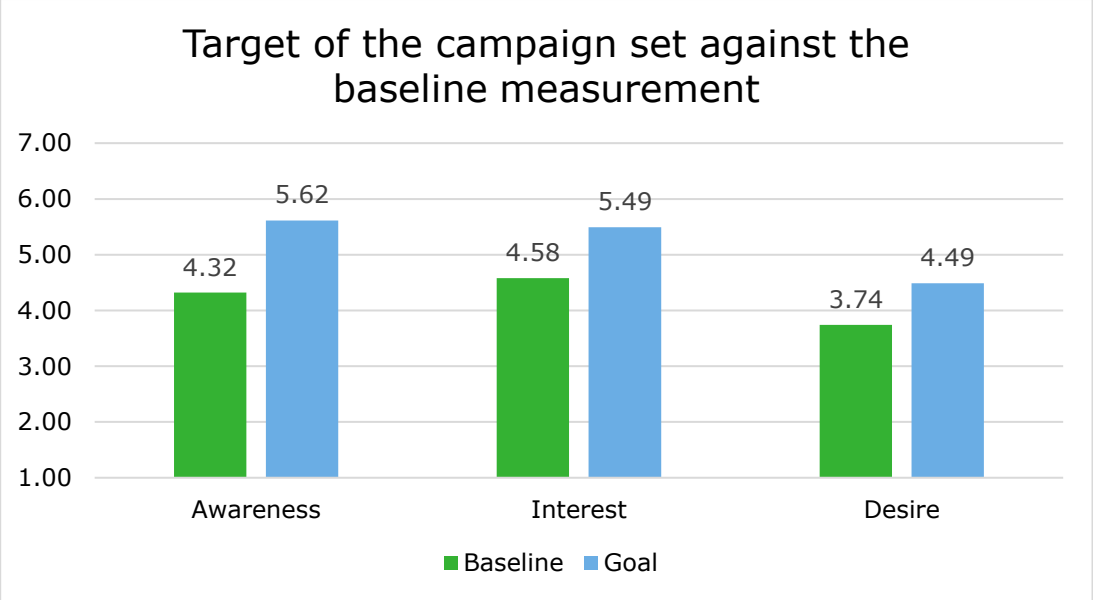


Figure 2.1 *0-measurement (baseline) scores compared to the goals of the campaign.*

2.5.1 AIDA results

The first set of questions aimed to gain insights into the constructs of awareness, interest and desire. Figure 2.2 provides the overview of the baseline measurement at T0 and the effect measurement at T1. It is apparent from this table that the goals have not been reached, as no change is seen for awareness. This explains that already a large group of consumers is aware of cooled poultry meat. However, more specifically, we found that people who did not eat cooled chicken in the first place, did show an increase in awareness. In interests and desire we did find a significant increase. Simple statistical (paired sample t-test) analysis was used to test if the two measurements were different. Therefore, it can be concluded that exposure to the campaign led to greater interest ($t(2004)=-6.99$, $p < 0.05$) and desire ($t(1921)=-12.28$, $p < 0.05$), but not for awareness ($t(2000)=0.10$, $p>0.05$). However the increase in interest was not as high as objected. For people that did not eat cooled chicken at baseline ($n=1218$) the mean score on awareness increased from 3.84 to 4.32 ($t(1218)=-$

8.85, p < 0.05) and is significantly different from the baseline. There are multiple explanations why this effect is not found in the total sample, this will be discussed in more detail in the discussion.

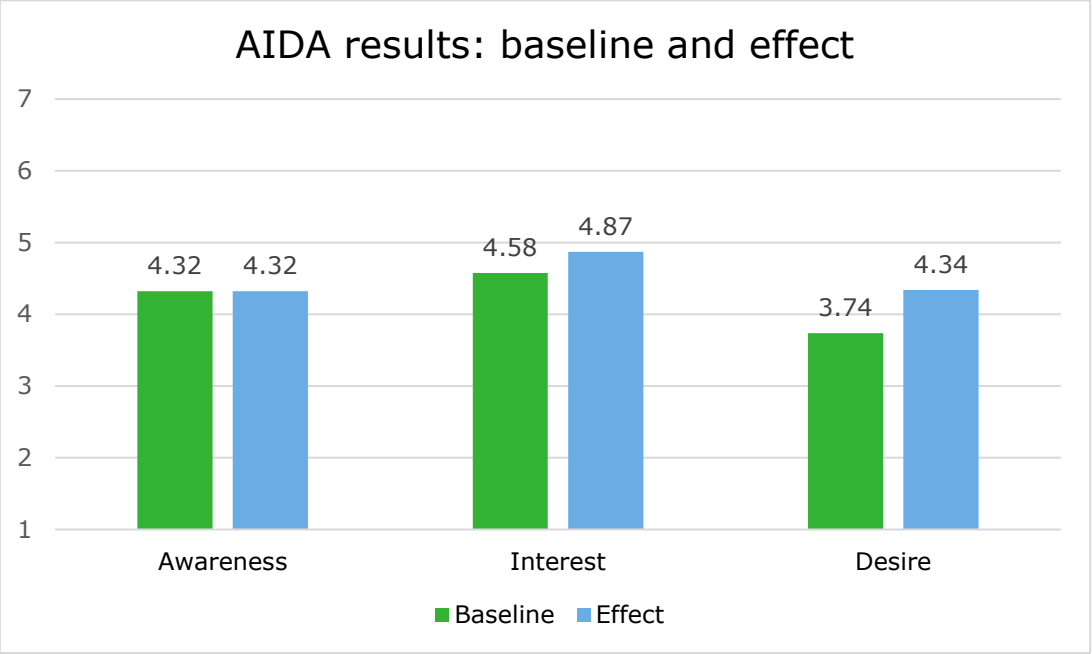


Figure 2.2 *Baseline and effect measurement of awareness, interest and desire (0 = not at all, 7 = very much).*

Although our hypothesis was that there would be no large effect in the action phase of the AIDA model, this effect was measured indirectly. In Figure 2.3 a big increase for consumption of cooled chicken (t(2004)=-15.61, p<0.05) and a small increase for consumption of frozen and warm chicken can be seen. As for interest, the increase was slightly less than objected.

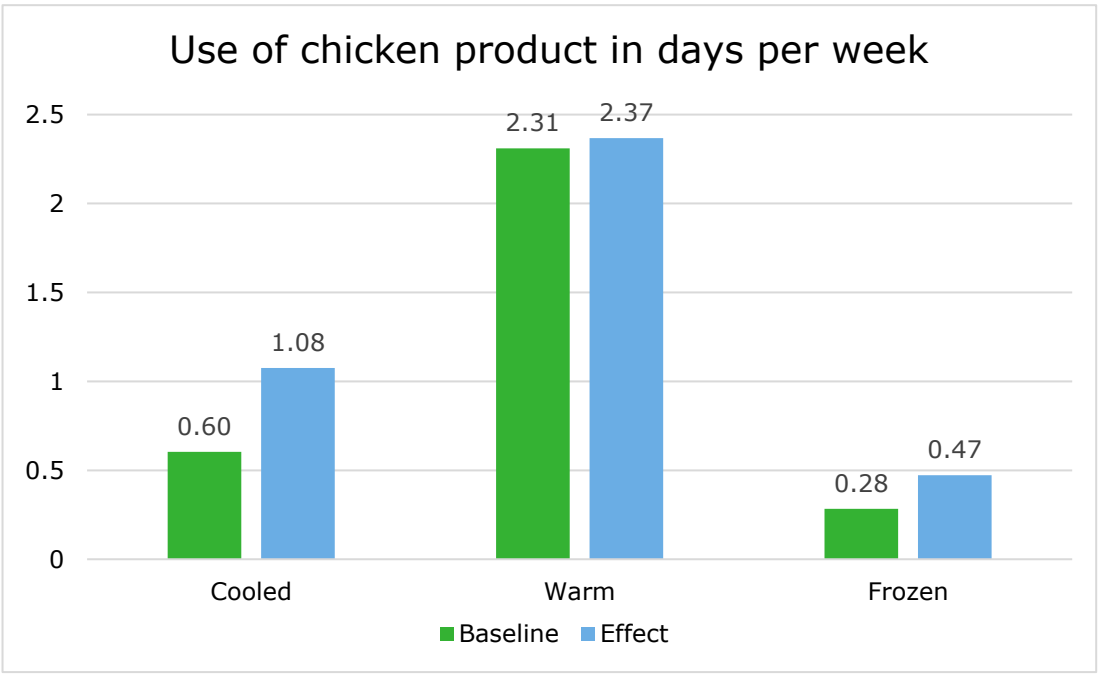


Figure 2.3 *The average number of days per week a family eats cooled chicken. Here the baseline is compared to the effect measurement.*

Interestingly the increase in consumption of cooled chicken does not seem to cannibalize the consumption of warm chicken. Rather total poultry consumption increased (Figure 2.3). All the differences are statistically significantly.

2.5.2 Evoked Choice set and other buying behavior

The evoked choice indicates which types of chicken (warm, cooled or frozen) people consider to buy. It seems apparent that the campaign had a large effect on the evoked choice (Table 2.1). There is an increase in number of people that also considered cooled and frozen chicken when compared before and after the campaign. The effect seems larger than what we have seen for the other factors such as interest and desire.
Even when taking into account the difference between the people who are sure they have seen the campaign and those who are unsure and have not seen the campaign, the effect remains (Table 2.2).

Table 2.1 *Evoked choice set for the whole population.*

N=2060	Baseline	Effect
Warm chicken	1969	1911
Cooled chicken	560	1038
Frozen chicken	258	531

Table 2.2 *Evoked choice set for only people who have seen the campaign.*

N=479	Baseline	Effect
Warm chicken	462	443
Cooled chicken	146	362
Frozen chicken	76	210

2.5.3 Perception of cooled chicken

The campaign was aimed at changing the perception of chicken on the factors of quality (including freshness), nutritional value and convenience of cooled chicken. What stands out in Figure 2.4 is the large positive increase on the factors of quality ($t(2004)=-16.73$, $p<0.05$, $r=0,30$) and nutrition perception ($t(2004)=-13.34$, $p<0.05$, $r=0,35$) of cooled chicken when the baseline and the effect measurements are compared. We can also see significant decreases on the factors of quality and nutrition for warm chicken, the effect is however smaller (0,27). Furthermore it can be seen that the perception of warm chicken is still rated higher overall on all attributes.

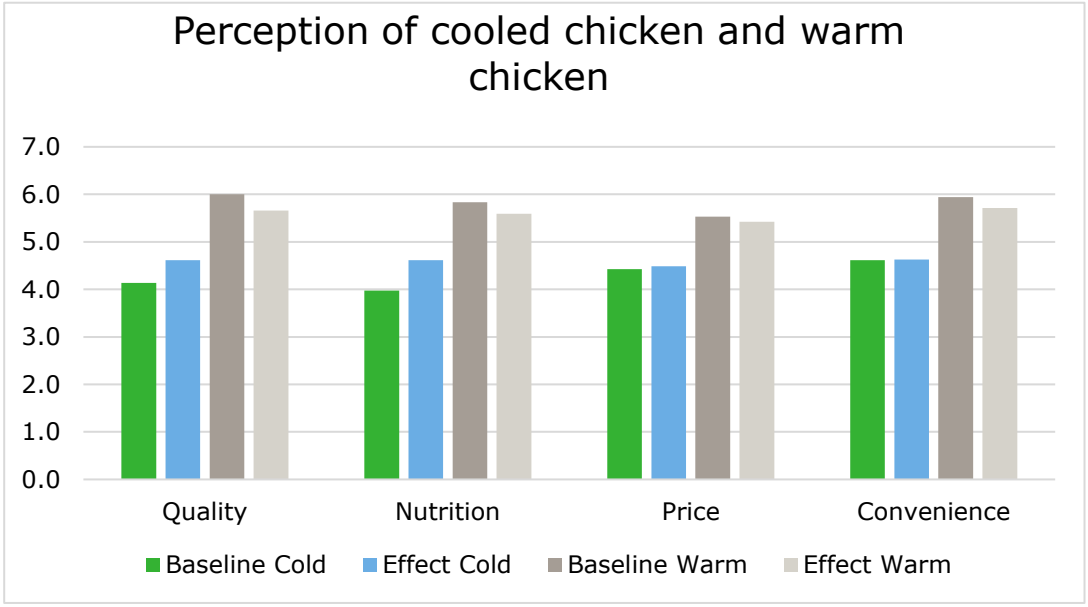


Figure 2.4 *Perception of cooled and warm chicken (0 = very poor, 7 = very good).*

2.5.4 Manipulation check

Due to the lack of ability to create a truly randomized controlled trial we included a manipulation check in the questionnaire. The check was a question whether the participant has seen the campaign or not. Although not a clean measure, it can give indications into the effect of the campaign. The majority of the people were not sure if they had seen the campaign (832), 696 people thought they did not see the campaign and 487 were sure they had seen the campaign.

2.6 Conclusion and general discussion

The present study was designed to determine the effect of the consumer campaign on the perception of cooled chicken. The campaign had set several goals before its start, of which a couple were reached (changing buying intention and increasing positive perceptions of cooled chicken). There was an increase found on the interest, and desire factors, but not on the awareness factor. A possible explanation is that these people were already aware of cooled chicken and that this goal was not so suitable for this general population (rather than targeting only people who are not consuming cooled chicken).

The most compelling finding however, is that a significant improvement was found in the evoked choice set and the action phase of the AIDA model. Significant increases in the use of cooled chicken were reported by the panel, which is an effect that was not even expected yet by the campaign team. Even though the conclusion is that not all the goals were reached, one could also conclude that overall there is a positive outcome. Interestingly the effects on the evoked choice set were a lot larger than what was seen in the effect on interest and desire. It is possible that an increase in for example desire is much more meaningful than only changing the considered options. When someone truly desires something, she or he will buy the product when possible, while considering the product does not mean she or he will buy it. Desire is thus probably more impactful.

It is encouraging to see these changes by a relatively small campaign, in a large city with a relatively small sample (roughly 2000 people on a city of millions). That the initial campaign goals were not met could be due to the fact that the campaign was aimed, among others, at the higher income groups rather than the whole population. The higher income families were chosen because they were most likely to act as early adopters of cooled chicken and from there on this behavior would trickle down to the other income classes. This is a valid way of reasoning, notwithstanding that these specific people were already more informed about cooled chicken. Future research could widen the scope and look into the effects on all income levels rather than only the higher income levels.

Another interesting and important result is the change of the perception of cooled chicken on the construct from the food choice motives. Food choice motives have repeatedly shown to be very important factors in explaining consumer behavior. Furthermore are food choice motives seen as relatively stable traits that do not change all of a sudden, which in turn means that changing these believes might relate to a longer lasting effect of the campaign.

We included the question whether people had seen the campaign as a manipulation check. It is however doubtful if the check itself was good enough. There were more people in doubt whether they had seen the campaign (832) than there were people who claimed they had not seen the campaign (696) or who were sure they had seen a part of the campaign (487). For that reason the manipulation check should be treated with caution. There are several possible explanations for this result, one of which is that there were many parts to the campaign, from social media messages to roadshows, which could have confused the participants. The effects were persistent even when people thought they did not see the campaign. That the effects are also measured for the people that had not seen or were unsure if they had seen the campaign could possibly be explained by an autonomous increase in desire for cooled chicken. This effect can for example be seen in the evoked choice set, where we see a larger effect for people who have seen the campaign than for people who have not.

A key strength of the present study was that the information of the 0-measurement was used in the design and the implementation of the campaign by the campaign team. After this sharing of information the campaign team and the evaluation team worked independently to assure no conflict of interest.

These results have important implications for the cooled poultry chain. Whereas research and policy often focusses on the chain itself, this research has shown that focused attention on the consumer perception can make/ create the demand for the product, and thus being a factor as the driving force for change. Without the demand for the cooled products the effects elsewhere in the food chain might become sub-optimal.
Finally as a result of the campaign and these investigations, the efforts to change attitude towards cooled chains might be taken up by commercial companies and in that way try to improve the cooled poultry chain.

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2.8 Annex: Materials developed for the campaign

Materials developed for the campaign were:

- The campaign logo, leaflet and flyers
- website: https://ayamdinginsegar.com/
- poster
- banner
- food truck was stickered with the logo, to be used during the roadshow
- Facebook page, was constantly updated: https://www.facebook.com/ayamdinginsegar/
- Instagram account was fed by the main endorser Edwin Lau: https://www.instagram.com/ayamdinginsegar/
- Twitter account, was regularly filled with news: https://mobile.twitter.com/ayamdinginsegar

A short overview of the key numbers of the outputs of the campaign:

- Social media: 28,564 followers on Facebook (weekly growth 12%); the majority is female (99%), between 18-24 yr. (43%), followed by 25-34 yr. (40%), mostly living in Bekasi and Jakarta; total reach per day 2821,13, engagement rate 0.76% (means people who liked or commented on Facebook posts).

- Road show: in total 2,000 – 2,300 people visited the food truck events on 20 locations.

PR: nearly 30 bloggers have covered the campaign (resulting in 11,727 hits). The media in Jabodetabek published over 135 articles about the campaign (online, print, television) on a.o. the launch of the campaign, start of the road show and the other 19 road shows; all with a positive tone of voice, adding to a total PR value of Rp 6,761,269,500 (€ 470,186).

3 Cool chain improvements

Ferry Leenstra, Henny Reimert and Denny Lukman

3.1 Background

Poultry meat is healthy and nutritious food but it can also be an extremely good medium to grow micro-organisms. Therefore, in Indonesian circumstances warm poultry meat should be cooked within a few hours after slaughter to prevent consumers from getting food poisoning. With the high temperatures and humidity in Indonesia, poultry meat can become unsafe for human consumption after 4 to 5 hours. Adequate chilling after hygienic slaughter can considerably extend the shelf life of raw poultry meat to up to several days after slaughter. Adequate chilling means that the temperature of poultry carcasses (on the outside and deep inside) should be below 4 ^{o}C within 4 hours after slaughter. To chill poultry carcasses three methods can be used: immersion in iced water, spraying with cold water, and cooling with cold air. In hot climates and for small to medium sized poultry slaughter plants, chilling by immersion in iced water is the most effective and cheapest solution. Poultry meat of which the temperature has not been below -2 ^{o}C can be sold as 'fresh' chicken meat and does not have to be labelled as "deep-frozen".

3.2 Current situation in poultry slaughter

About 75% of the total Indonesian poultry production is slaughtered manually in small scale slaughter locations. Generally, these slaughter locations do not have chilling facilities. They slaughter during the night to be able to sell the warm carcasses at the traditional market in the early morning of next day. Due to traffic problems, there is a serious risk that the time between slaughter and cooking of the poultry meat is too long (exceeding 4 to 5 hours) to guarantee safety of the poultry meat.
About 10% of the production is slaughtered in medium sized slaughter plants or at governmental slaughter locations. On most of these locations, chilling of slaughtered poultry is possible. However, this is in general only done with carcasses that are destined to be deep-frozen. Only a few slaughter locations produce chilled, fresh poultry meat.
About 15% of the production is slaughtered in modern, fully certified slaughter plants. In these plants, chilling is standard procedure and according to HACCP standards.

3.3 Current chilling practices

Students of IPB, under supervision of Professor Denny Lukman, examined the chilling process at three locations (X, Y, and Z) in Jakarta and Depok in November and December 2016. They visited the locations every week for 8-10 weeks and measured the temperature of carcasses, slaughter rooms and chilling water. At these locations, chilling was done in a water tank cooled with lumps of ice. Their findings were quite disconcerting; in the hundreds of carcasses they measured at the three locations, an adequate temperature was never found. None of the carcasses had an interior temperature below 4 ^{o}C. In most carcasses, the temperature after cooling was far above the temperature required to be considered as safe poultry meat. Table 3.1 provides an overview of their findings averaged across weeks.

Table 3.1 *Average and lowest temperature of poultry carcasses in 3 slaughter plants.*

	Average temperature (°C)			Minimum temperature (°C)		
Location	X	Y	Z	X	Y	Z
Water chilling tank	11.9	11.0	13.5	6.5	5.9	13.5
Carcass, deep inside	18.8	12.6	15.8	10.0	7.4	13.9
Carcass, skin	16.2	19.3	9.1	10.3	7.6	15.4

3.4 Impact of storage temperatures and contamination level at the start of the chilling process on the safety of poultry meat

Figure 3.1 shows the importance of correct, low storage temperatures for the shelf life of poultry meat. The data in Figure 3.1 are based on poultry slaughtered with a high level of hygiene resulting in clean carcasses with low contamination levels.

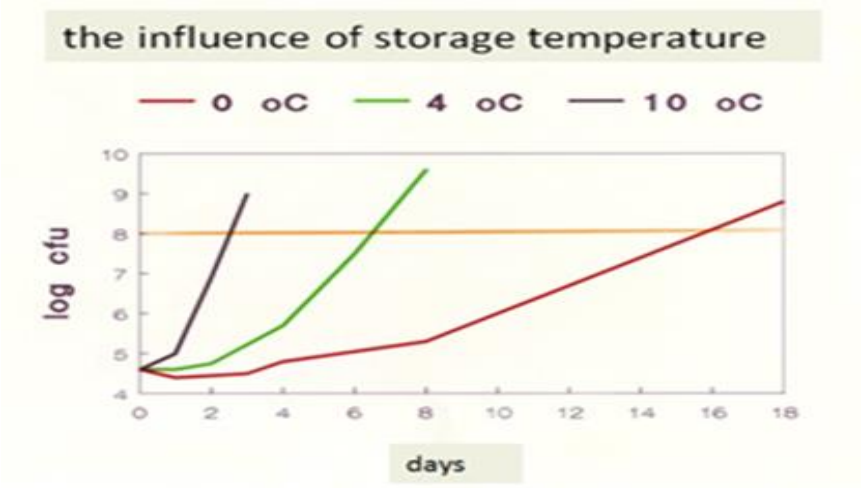

Figure 3.1 *Relation between temperature of the carcass (0, 4 or 10 °C) and shelf life in poultry. At 10^8 CFU the meat is unfit for human consumption due to spoilage bacteria (Bolder, personal communication).*

As can be seen from Figure 3.1, with clean carcasses and carcass temperatures continuously below 4 °C, meat can be safe for human consumption up to 6 days after slaughter. However, keeping clean carcasses at 10 °C will result in chicken meat that becomes unsafe for human consumption within 48 hours.
Based on the observations of the project team, it is very likely that broilers slaughtered in small scale and medium sized slaughter plants in Indonesia start at a much higher level of contamination. This higher level of contamination prior to chilling, combined with the high observed temperatures in the Indonesian situation (see Table 3.1), implies a much shorter shelf life for safe poultry meat than 48 hours for most carcasses, probably less than 24 hours. It is therefore important to work more hygienically to get clean carcasses and to chill them rapidly and to lower temperatures than we observed.

3.5 Recommended chilling practices

A practical way to chill poultry meat and increase hygiene is a two-step washing and chilling procedure. Immediately after evisceration, carcasses should be washed and pre-chilled by spray-washing. After being spray-washed they can be placed into a tank filled with a mixture of water and slush ice. The water temperature in this tank should always be around 0 °C. In this tank the carcasses are chilled to a temperature below 4 °C. A rule of thumb is that around 1.5 l/carcass is required for spray-washing and at least 1 l/carcass for chilling. Chilling is fastest in a mixture of about 70% slush ice and 30% water. This will increase the cost price of poultry meat, dependent on the specific situation of the slaughter plant (availability of clean water, own ice machine or purchased ice blocks, etc.). For effective chilling, the ice should be processed into shivers. Lumps of ice, as used in most small and medium slaughter facilities we visited, are far less effective.
The time to chill carcasses properly in the tank depends on the agitation of the ice/water mixture. Agitation can be provided by inserting compressed air at the bottom of the chilling tank. Without agitation it takes more than 60 minutes to chill a carcass properly; with agitation the chilling time can be reduced to 30-40 minutes.
A very effective way for chilling is to have a counter current in the chilling tank resulting in the movement of carcasses in one direction and of the chilling water in the opposite direction. The advantage of this method is that the water is coldest and cleanest where the carcasses leave the tank. Such a system requires a kind of spin chiller and is more suitable for medium sized slaughter plants (see Figure 3.2).

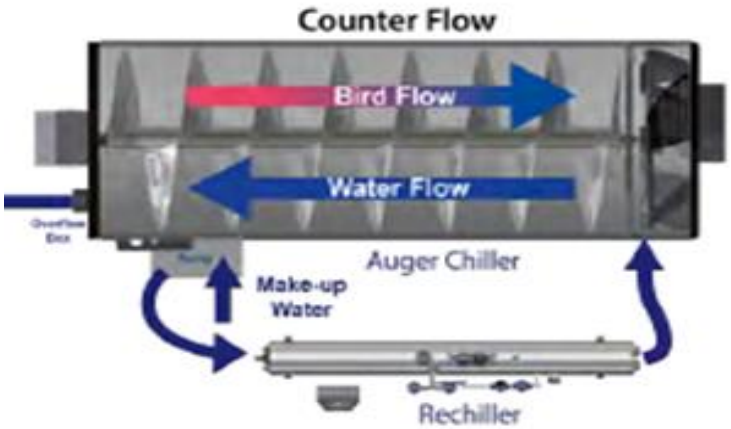

Figure 3.2 *Principle of counter flow two step chilling of poultry in a spin chiller system (from Barbut, 2015).*

A blast freezer to chill poultry is not a good idea if the meat has to be sold as "fresh"; although the desired temperature of below 4 °C of the inside of the carcass can be achieved by storing in a blast freezer, the outside of the carcass will be frozen. This will reduce the quality of the poultry meat.

3.6 What after chilling?

After letting the carcasses drip for a short period, they can be packed in plastic bags, preferably in a cooled room, and be stored in a cold storage that has temperatures of between 0 and 4 °C.
If the carcasses have to be cut up and marinated, a cooled room becomes a must. The temperature of the carcasses should stay below 4 °C when they are cut up and marinated.
Chilled carcasses are also suitable for deep-freezing. To do so, they have to be placed in a blast freezer and kept deep frozen at temperatures below –18 °C.

3.7 How to check if chilling is done properly?

With rather complicated formulas it is possible to calculate chilling time dependent on the type of tank, the weight of the carcasses, and the amount of ice and water used. However, it is preferred to continuously evaluate the chilling process in the slaughter plant and adjust according to the findings. The quality manager can be made responsible for the evaluation of temperature of the carcasses. Evaluation of the chilling process can be done with a standard digital food thermometer which can be purchased for 300-500.000 IDR (see Figure 3.3).

Figure 3.3 *Examples of thermometers, to check the temperature of carcasses.*

With this device, the temperature of a number of carcasses can be measured by placing the device under the breast meat against the breast bone. The temperature of the ice/water mixture can also be measured with the thermometer. If the temperature deep inside the carcasses is measured at below 4 °C, than the chilling process is considered as satisfactory. If the temperature is measured at above 4 °C while the temperature of the ice/water mixture is between 0 and 2 °C, then it can be concluded that the carcasses have been chilled for a too short period. Either the chilling time needs to be increased and/or the agitation in the chilling tank needs to be increased. If the ice/water mixture is too warm, i.e. above 2 °C, it should be checked whether ice shivers were used (no lumps) and whether sufficient ice was added.
Of course, all temperature measurements should be logged to be able to show customers the reliability of the chilling process. This can be done in writing in a logbook or electronically in a computer file (e.g. Excel). The logging and filing of temperature data has to be done continuously, even if the quality manager is experienced and is able to adjust the chilling process just by looking and feeling.

3.8 Hygienic slaughter is crucial

For good quality chilled poultry meat slaughter should be hygienic. This implies that clean water (drinking water quality) for spray-washing and chilling should be used, good quality of ice that is stored and chopped in a clean spot, carcasses should not be laying on the floor but instead only on ceramic or stainless steel tables. In addition, workers should wear protective and clean cloths dedicated for poultry slaughter, wash their hands before and regularly during works, not smoke during work, clean knives, and eviscerate in a correct manner to prevent contamination of the carcasses with manure.

3.9 Further reading

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4 Small scale poultry slaughter plants; design & layout

Jos van den Nieuwelaar, Henny Reimert, Peter van Horne

4.1 Introduction

Consumption of poultry meat is increasing worldwide. In Indonesia, poultry production increased from about 1.2 million tonnes in 2010 to nearly 2 million tonnes in 2015, while a production of about 2.5 million tonnes is expected for 2020 (Forecast RABO-bank). The DIFS-live program focused on stimulation of the production of safe and affordable poultry meat in West Java. Currently about 1 to 1.5 million chickens are consumed per day in West Java. About 75% of the poultry meat that is consumed in Greater Jakarta is slaughtered manually in small scale backyard facilities located in the urban areas. The public health risks associated with these slaughter practices are large and the Jakarta government authorities issued Decree no. 4 in 2007 to put a stop to these practices. Given the sustained growth in supply and consumption of chicken meat it is important that more sustainable and hygienic solutions are found for the slaughtering and logistics of chicken. The slaughtering of poultry should be relocated from residential areas to public or private slaughter facilities outside the residential areas where it is possible to take adequate care of food safety, hygiene and waste management.

There are several free access handbooks on hygienic poultry processing. The Science of Poultry and Meat Processing is a textbook by Shai Barbut (2016) for students, management and staff involved in poultry slaughter giving an overview of modern poultry industry. FAO and Fanatico (2003) focus more on small scale poultry slaughter. Ample field experience of the project partners and these publications were used for design and layout of a small scale poultry slaughter facility that fits in the Indonesian poultry meat production system and that can provide safe poultry meat. A number of such small scale slaughter facilities can be combined on a communal location with shared facilities.

Where the previous chapter aimed specifically at cooling of poultry meat in SME type slaughter facilities, this chapter aims at improving facilities for especially the slaughter points, currently in residential areas.

Training material was developed and trainings given related to hygienic small scale poultry slaughter. This chapter describes the requirements for small scale poultry slaughter, the design of a demonstration and training unit and the courses developed.

4.2 Requirements for hygienic small scale poultry slaughter

There are clear prerequisites for slaughter plants in Indonesia. Of course, the facility has to meet the requirements of NKV (Nomor Kontrol Veteriner, the governmental certificate issued to a slaughter plant meeting the official requirements for safe and hygienic poultry slaughter). Requirements directly related to layout of the slaughter facility are summarized below. In the slaughter facility the following conditions should be met:

1. Separate dirty and clean areas and processes
2. Collect and process all slaughter offal
3. Treat all waste water in a waste water treatment facility

These are discussed in more detail in the next sections.

4.2.1 Separate dirty and clean areas and processes

The basic principle for hygienic poultry slaughter is to work from 'dirty' to 'clean' areas and processes and from warm to cool. Dirty are the processes of taking in live birds up to killing, scalding and plucking. After plucking, carcasses go to the evisceration area, that should be separated from the killing and plucking area. After evisceration, carcasses are washed and only then they enter the area for cutting up and/or packing. Evisceration and even more so cutting up and packaging are clean processes.
The 'dirty' areas can be in open rooms with natural ventilation. The clean processes (evisceration and cutting up and packaging) should be in closed rooms where no insects, wild birds or feathers from the dirty area can enter. Preferably these rooms have air conditioning and can be cooled. Then the carcasses go from warmer (dirty) areas to cooler and clean areas.
Carcasses should be never put on the floor. The floor is, no matter how clean a room is, always a risk for hygiene. Carcasses, therefore, should be on (stainless steel or ceramic) tables or hung on a rack or a conveyer belt with shackles.

4.2.2 Collect and process all slaughter offal

A second requirement is collection and correct processing of all slaughter offal and waste water. Blood and feathers are valuable resources (for fish feed), if collected separately and not disposed of in waste water. Not only is the added value lost when disposed of in waste water, treating them in the waste water facilities is expensive (blood) or even not possible (feathers). The same is true for heads, feet and intestines, that can be a valuable resource when collected separately and not disposed of in waste water. In contrast, intestinal content and manure either can be collected separately or can be processed into fertilizer or treated with waste water in the waste water treatment facility.
Waste water flow should be from the clean areas to the dirty areas and from there to the waste water treatment facility. The gutters for waste water transport within the slaughter facility should be open everywhere to facilitate cleaning. Such gutters can be made along the walls of the slaughter facility, provided the floor levels in the right direction. An epoxy coating on floor and waste water gutters is effective in keeping hygiene.
It is essential to reduce the amount of solid material in the waste water stream as much as possible. If a simple sieving system is introduced and all solid material is collected and valuated as resource, less waste water treatment capacity is required. Such final removal of solid wastes from the water stream can be done with, for instance, a stainless steel sieve, but also a well-positioned plastic laundry basket can do the job. The sieve or basket has to be cleaned regularly and at least when slaughter is finished. In the Additional Material section a leaflet on treatment of slaughter offal and waste water is given.

4.2.3 Treat all waste water in a waste water treatment facility

A medium to large scale slaughter plant has its own waste water treatment, but for waste water treatment a certain scale is necessary. For small scale slaughter points this can be achieved by combining several slaughter points that have a shared waste water treatment facility on one location. Such a location can be governmental or private. In the current situation the governmental facilities have waste water treatment, while private concentrations of slaughter points are often at illegal locations and dispose waste water directly into a river. The latter is a high risk for public health and is an important source of river pollution in Indonesia.

4.3 Facilities at a communal slaughter location

Due to logistics a communal location for small scale poultry slaughter can handle a maximum of 100.000 to 150.000 birds/day. For the Greater Jakarta area then at least 10-15 of such locations are required, that together can handle the about 1 million birds/day that are currently slaughtered in small scale, often illegal, slaughter points. These communal locations have to provide sufficient and good quality processing water, take care of collection and evaluation of waste and waste water treatment. Moreover a facility to clean chicken coops and lorries should be operated. A cooperative ice machine and cleaning and laundry services are also options.

Rawa Kepiting and Rawa Lele are examples of such locations. However, at these locations the lay-out of slaughter units can be improved. Internationally there are standards for manual slaughter and published by, for instance, FAO. See the references for links to these standards, that take hygiene, labour circumstances and economics into account. Based on these standards the DIFS-live program developed together with slaughter men at Rawa Kepiting a layout for the Indonesian situation.

4.3.1 Layout for a hygienic and efficient slaughter unit

A slaughter unit should be as small as possible, but as large as necessary for hygiene and effective input of labour. At least four spaces are required for:

1. receiving live birds, cutting and bleeding (mostly not a room, but an outside area, shade and forced ventilation to cool birds that are waiting for slaughter is essential)
2. scalding and plucking (inside, but may be natural ventilated)
3. evisceration (inside, and preferably cooled)
4. cutting up, deboning and/or packaging (inside, and preferably cooled)

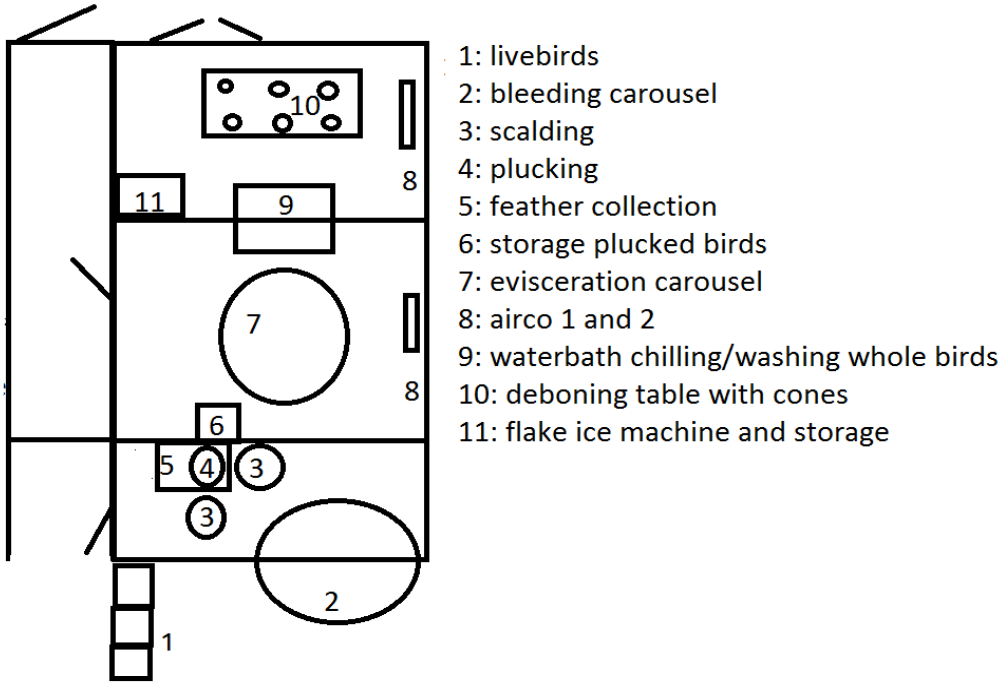

Figure 4.1 *Schematic layout of a small scale, manual slaughter unit.*

Between the evisceration and the packaging room the carcasses are washed. Figure 4.1 gives the layout of a slaughter unit. The whole unit measures about 5 x 15 m^2. Figure 4.2 provides the lay-out for two adjacent units on a communal slaughter location. Openings between the different rooms are such that carcasses can pass, but staff not. It is essential for overall hygiene that staff cannot go without thorough washing and changing of cloth and footwear from the dirty area to a cleaner area. Figures 4.3 provides an impression of the bleeding and the evisceration carousel.

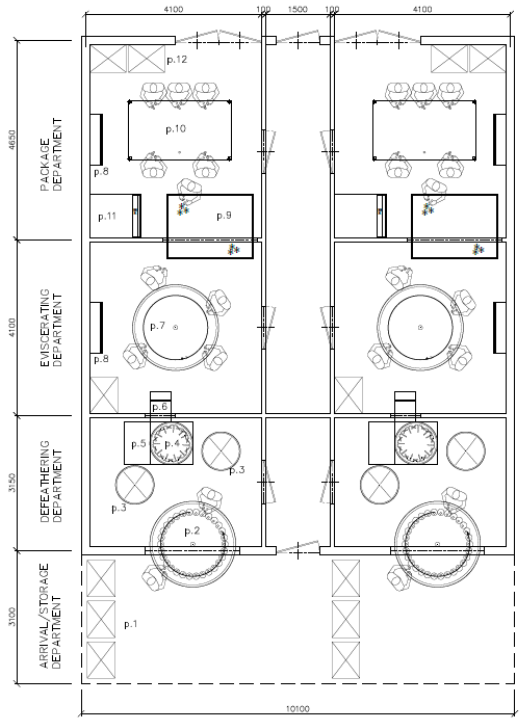

Figure 4.2 *Layout and dimensions of two adjacent hygienic slaughter units for a communal location.*

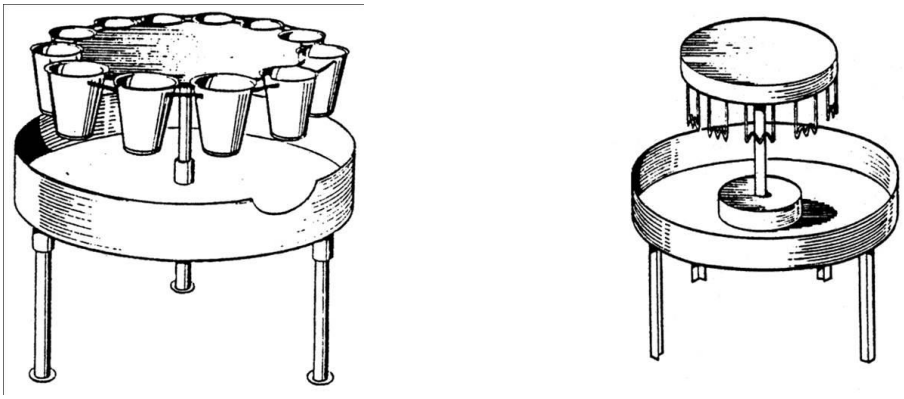

Figure 4.3 *Bleeding carousel (left) and evisceration carousel (right).*

This layout was installed at Rawa Kepiting and at the training center of IPB in Bogor. Of course such a unit should meet the NKV-criteria, which implies a smooth, solid, epoxy coated floor and walls protected with smooth tiles. The pictures in Figure 4.4 give an impression of the current situation in these units at Rawa Kepiting and IPB Bogor.

Figure 4.4 *Bleeding carousel (top left), from the plucker to the evisceration room (top right), evisceration carousel (bottom left) and cutting up with cones in the room for cutting up and/or packaging (bottom right).*

4.3.2 Scalding and evisceration

Hygienic slaughter facilities according to an international standard are not the only determining factor for safety and quality of poultry meat. Also skilled, well trained and accurate staff and controlled standard operating procedures (SOP's) are essential. During visits of the DIFS-live team to a large number of slaughter plants and slaughter points it was noted that most of them can improve considerably in varying aspects. Many use too high scalding temperatures, resulting in damaged skin and reduced meat quality. With regard to proper scalding it is advised to measure the temperature of the water in the scalding tank on a regular basis and adjust it, if necessary. Scalding temperatures should be between 52 and 60°C. When the scalding basin is above 60°C the upper skin will be removed and the carcass will show discoloration.
Often a hazardous technique to open carcasses for evisceration is used with a high risk that intestines are cut and intestinal content contaminates the carcass. According to food safety rules in most countries carcass parts that are contaminated by intestinal content should be discarded as they are not fit for human consumption.
The incisions for evisceration should be made in such a way that intestines and crop are not damaged. This can be done by cutting around the anus/cloaca (Figure 4.5) instead of opening the abdominal cavity besides the cloaca.

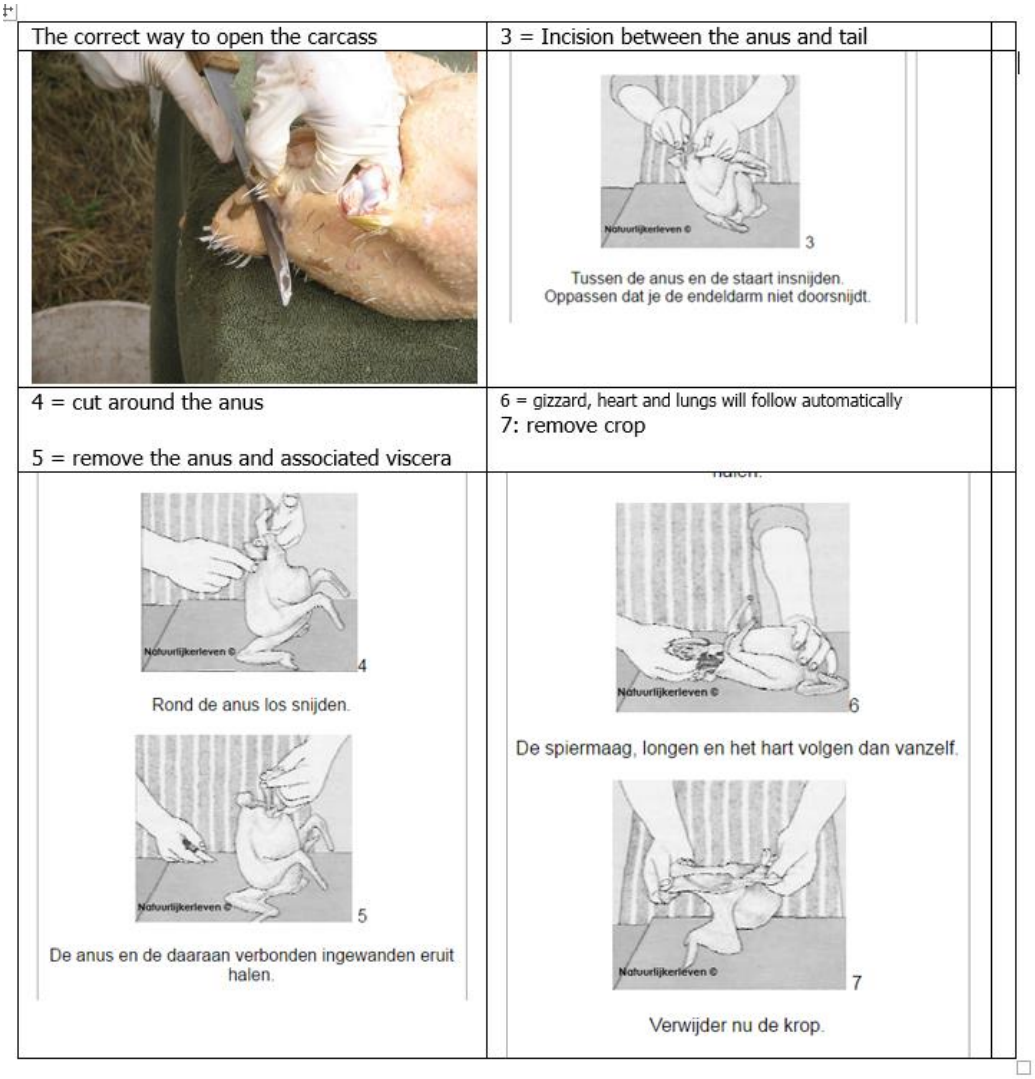

Figure 4.5 *The correct way to open a carcass and remove the intestines and giblets without damaging the intestines.*

4.3.3 Other requirements

Sufficient water of drinking water quality should be available and a supply of sufficient ice of food grade standard. A rule of thumb indicates, that for cooling poultry carcasses to an acceptable temperature (0-45°C) 0.5kg ice per kg bird is required, if ice shivers are used. Ice shivers are much more efficient in cooling than chopped ice from purchased ice blocks. It should be considered to have an ice making machine on location. For cleaning of a slaughter facility a high pressure hot water cleaning device is essential and saves a lot of labour. Both ice makers and high pressure cleaners are available at a suitable capacity for an affordable price.

4.4 Slaughter costs and efficiency

Slaughter costs are dependent on costs of labour, equipment, consumables, the location and the extent to which services can be shared. For the Jakarta situation is was estimated that the total investment in equipment will be 10.000 to 15.000 euro. However, labour costs are the highest cost factor in small scale poultry slaughter. With the equipment now installed at Rawa Kepiting it is possible to slaughter 200-400 birds/hour, based on at least 2 minutes bleeding time in the carousel. The amount of labour is similar or less than with manual slaughter on the floor: 1 man for shackling and cutting for bleeding, 1 for scalding and plucking and three for evisceration and transfer to the chiller tank. Dependent on the system the chilled carcasses can be processed by additional labour or by the same team after they have washed themselves and put on clean cloths.

4.5 Training programmes and material

Training and course material has been developed for two specific training programmes. The first training programme was the course "Pre-Requisite Programmes for Poultry Abattoir Supervisors and District Officers". This was held from 18 April to 19 May 2016 in Bogor at the training centre Cinagara. The second training programme was on hygienic poultry slaughter and was developed as a curriculum for vocational training of poultry slaughter men (training of trainers).
A new slaughter line lay-out with a small waste water treatment facility was installed at IPB in Bogor to train the students and staff of slaughter plants. The lay-out is similar to the one installed in Rawa Kepiting.
Several other outlets were used to disseminate results found in the programme to those interested. These include a leaflet on waste and waste treatment, a leaflet on cooling of chicken meat and a report on Temperature Monitoring in Poultry Slaughterhouses in Jakarta. Annex 5 gives an overview of the material developed for training and outreach.

4.5.1 District advisors of food safety control authority (NKV) trained

Four district advisors participated in the training course "Pre-Requisite Programmes for Poultry Abattoir Supervisors and District Officers". As the course was aimed at real live improvement of slaughter plants to obtain the NKV certificate, this was for the district advisors both a course in background and theory of the NKV certificate and in analysing and advising in a real live situation of slaughter plants.
Besides, district advisors were present during visits of the programme team to governmental and private slaughter plants. During these visits options for improvement were discussed.

4.6 Further developments

The slaughter units in Rawa Kepiting and IPB can be used for actual slaughter (both have a capacity of a few thousand broilers per day) and for demonstration and training of slaughter plant staff. The equipment is such that it can be copied by local producers. Also the building, its floor and walls can be produced with local availabe materials. If more units for hygienic poultry slaughter are set up, more workers are familiar with the system and its efficiency will develop further. This will lead to more safe poultry meat of higher quality on the Indonesian market.

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5 Slaughtering scenarios for the poultry industry

Peter van Horne, Ferry Leenstra and Coen van Wagenberg

5.1 Supplying DKI Jakarta with chicken; overview of the main challenges

The overall meat consumption in Indonesia has grown considerably over the past years. Poultry meat is most popular (see figure 5.1 below). The annual growth has been over 10%[1] in the period 2008-2013 and growth in consumption of poultry meat is expected to be around 4-5% in the period up to 2020. Despite the growing demand, poultry meat prices have been depressed due to an oversupply in the period 2014 – 2015. The situation has improved since October 2015 when the Government and broiler industry worked together to reduce the production and supply of day-old-chicks (DOC).

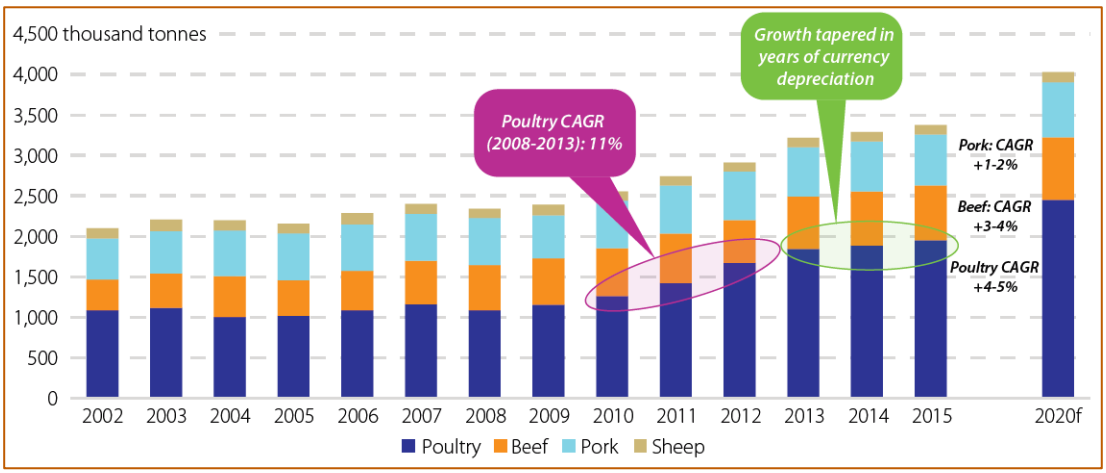

Figure 5.1 *Indonesia meat market 2002-2015 and forecast 2020 (source: Rabo Research - Indonesian Poultry).*

Around 75% of the chicken meat that is consumed in Greater Jakarta[2] is slaughtered manually at small scale backyard facilities located in the urban areas. The public health risks associated with these slaughter practices are enormous and the DKI Jakarta authorities issued decree no. 4 in 2007 to put a stop to these practices. Given the sustained growth in supply and consumption of chicken meat, it is important that more sustainable and hygienic solutions are found for the slaughtering and logistics of chicken. The slaughtering of poultry should be relocated from residential areas to public or private slaughter facilities outside the residential areas where it is possible to take adequate care of food safety, hygiene and waste management and reduce the risk of outbreaks of Avian Influenza among the human population.

There are different scenarios how this can be organized by the Government and the private sector. The implication of phasing out the home slaughtering in the residential areas is that investments are required in additional slaughter capacity elsewhere around the city. Furthermore, the logistics within the poultry supply chain will be differently organized as a result of phasing out home slaughtering. The transport and redistribution of live birds into the residential areas will reduce and (cool chain) logistics

[1] compound annual growth rate (CAGR)

[2] Greater Jakarta or Jabodetabek is the urban conglomerate in West Java formed by five municipalities and three regencies; the name is formed by combining the initial syllables of Jakarta, Bogor, Depok, Tangerang and Bekasi.

of fresh meat (carcasses and cuts) will increase. Local governments in Greater Jakarta have invested in a few public slaughter facilities where small scale slaughterers can rent space for (manual) slaughtering. The existing capacity of these public facilities is by no means adequate to absorb all home slaughter activities. Should the (local) Government invest in additional public slaughter facilities or is the slaughtering better done at privately owned and managed abattoirs? If private investment in additional slaughter facilities is to be promoted, what legal, economic and institutional arrangements should be in place for private investors? Under which scenario can hygiene and food safety, slaughter efficiency and veterinary public health be organized most effectively and efficiently?

5.2 Scope

Objective:

1. *Describe current state of affairs in the poultry slaughterhouse sector in Greater Jakarta from a policy and a private sector point of view*
2. *Inform a public-private dialogue on how to balance the different public and private interests.*

This chapter aims to provide an overview of the current state of affairs in the poultry slaughterhouse sector in Greater Jakarta from a policy and a private sector point of view. In addition, the authors wish to inform and facilitate a public-private dialogue on how to balance the different public and private interests in the sector.
The chapter describes the current trends and developments in the poultry slaughterhouse sector in Jakarta. This overview is prepared in the context of the official policy objectives aimed at reducing public health risks posed by the poultry slaughterhouse sector. Based on desk study[3], interviews, data collection and discussions with key players in the DKI broiler slaughtering and supply sector the main barriers to public and private sector investments in expanding and improving the small and medium sized enterprises (SME's) in the broiler slaughter industry in Greater Jakarta were identified. These are presented in this document and cover the following issues:

- the regulatory framework for the establishment and operation of a poultry slaughterhouse (section 5.3.1);
- public sector investments in the establishment and management of facilities for micro propagators (section 5.3.2);
- private investments and associated risks for SME slaughterhouses (section 5.3.3);
- levels of competition from large integrators (section 5.3.4).

Balancing the public and private interests requires consideration for many different factors. With this paper, we wish to inform public officials at national and regional level as well as sector organizations on the different policy and business development options. Large-scale, SME and micro-scale slaughterhouses compete with each other to capture a greater share of the growing poultry meat market. Consumers wish to have affordably priced meat. The public health risks in terms of lack of hygiene, zoonoses and ineffective slaughter waste treatment need to be reduced, but in such a way that it does not affect availability and affordability of the products, employment of vulnerable groups in society, etc. too much. To inform a public-private dialogue on how to balance these different objectives, different growth scenarios have been calculated for the sector in Greater Jakarta and questions have been formulated that can guide the discussion between public and private sector partners. The outcome of this public-private dialogue should lead to a joint investment in the poultry slaughterhouse sector in order to supply the consumers in Jakarta with poultry meat in a safe and sustainable way.

[3] The study was implemented in close cooperation with the FAO Emergency Centre Transboundary Animal Disease (ECTAD) Indonesia

5.3 Current state of affairs in the slaughterhouse sector

5.3.1 Regulatory framework

The production of livestock and livestock produce in Indonesia has been regulated in the ministerial regulation 18/2009 on husbandry and animal health. This regulation describes in general terms livestock breeding, production, animal health and animal welfare issues. Articles 60 to 63 of this regulation address slaughtering. Article 60 states that all businesses that slaughter animals and supply animal products should apply for a veterinary control number (NKV[4]). Exempted for NKV are slaughtering for reasons in the interest of religious festive days, customary slaughtering and emergency slaughtering. Small businesses, like home slaughterers, are also exempted and subject to the direct control of the local regency or municipality government.
In 2010 a ministerial regulation 13/2010 was adopted regarding the requirements of slaughterhouses and meat cutting plants (No 13/PERMENTAN/OT.140/1/2010). Even though this regulation is specifically for slaughtering of ruminants it can also be used for poultry slaughterhouses. This national regulation describes technical requirements, location requirements, design and layout requirements. The aim of the regulation is to ensure safe and hygienic slaughtering with minimal impact on health, safety and environment. Supervision and enforcement of this regulation is left to the local government.
Indonesia has a decentralized system of governance. This also applies to the implementation and enforcement of the regulations mentioned above. For the Greater Jakarta area (Jabodetabek) this means that the different regencies and municipalities may address the planning of industrial sites, the issuing of operational permits and licenses and the supervision and enforcement issues in their own way. The process to obtain an official permit to operate a slaughterhouse, as is mandatory by law, is complex, lengthy and costly. As a result the majority of the slaughterhouses, even larger ones, operate without a full set of official permits and licenses.
A recent inventory study concerning the regulatory framework for poultry slaughterhouses in Jabodetabek revealed that up to 16 different permits or licenses need to be obtained from up to nine different issuing offices. The permits address issues like planning, building, and environmental impact. The above permits do not include NKV and Halal certificate which are also mandatory. In addition, only a few regencies have included space in the public infrastructure planning for slaughterhouse activities. Depok is an exception to the rule since it has designated an area for relocation and building of new slaughtering facilities.
In conclusion, the regulatory framework at a national level is available and forms the basis for local regulations on building and management of poultry slaughterhouses. However, there are no incentives for small and medium sized slaughterhouses to apply for the official status due to lack of law enforcement. It is considered too complex and time consuming and brings no benefit to the current market. As a result there is a lot of illegal uncontrolled slaughtering in residential areas. Simplifying the bureaucratic procedures to obtain permits and enforcement of existing regulations could be a start for restructuring of slaughtering activities to make it safer and more environmental friendly.

5.3.2 Public facilities for micro-slaughterers

With the Regional Regulation/Perda No. 4 year 2007 the local government of Jakarta implemented legislation to prohibit the slaughter of poultry in residential neighbourhoods in Jakarta City. For micro-enterprises who slaughter their poultry in such neighbourhoods, the government built public facilities in designated locations around the city. In such government facilities, the government provides the location, electricity, water, waste management, and sometimes semi-automatic slaughter line equipment, depending on the location and building. The slaughterers pay a fixed fee per slaughtered chicken (between IDR 100 and 200 / bird, depending on the location). Other equipment, such as pluckers and boilers, the slaughterer should provide himself. This chapter discusses the availability of public facilities, the willingness to move from neighbourhoods to public facilities, and the (dis)advantages of public facilities experienced by micro-slaughterers working at public facilities.

[4] Nomor Kualitas Veteriner

5.3.2.1 Availability of public facilities in Jakarta in 2017

Up to 2017, three public poultry slaughter facilities have been built and are operational in Jakarta: Rawa Kepiting in East Jakarta, Northern Petukangan in North Jakarta, and Rawa Lele in West Jakarta. These facilities are located within Jakarta and are surrounded by residential neighbourhoods. They all have a capacity for slaughtering up to 120,000 chickens per day, but the actual daily production is around 20,000 chickens. In 2009, INTERCAFE IPB&FAO[5] estimated the number of small micro-slaughterers in the Jakarta region at 685. In 2017, the number of such micro-slaughterers is still expected to be in the same range, between 600 and 800, but only 50 of them (less than 10%) could be persuaded to move to the public facilities. Rawa Lele and Rawa Kepiting are used by a mix of small companies using manual and semi-automatic slaughter equipment, Northern Petukangan is used by only one company using semi-automatic equipment. All companies slaughter seven days a week, 52 weeks in a year. Slaughter hours are between 8.00 PM and 7.00 AM, because they want to deliver fresh chicken to the customer early in the morning. During the daytime, no slaughter activities take place. During several field visits in 2016 and 2017, the DIFS Live team observed several shortcomings to all three working public facilities, such as blockage of access of waste water to the waste water system by feathers and other residues, broken and not-used equipment for cleaning trucks and cooperatives, lacking or broken pavement, and limited facilities for storage of ice blocks.
Although the public facilities are currently not used to their full capacity, in 2017 in the Jakarta region, insufficient public poultry slaughter capacity is available for all micro-slaughterers still slaughtering in residential neighbourhoods. All public facilities are surrounded by residential neighbourhoods and due to lack of maintenance, show several shortcomings resulting in similar problems as observed in (illegal) slaughtering in residential neighbourhoods. Additional public slaughter capacity is needed and effluent and solid waste treatments need improvement if public slaughter facilities are to be a larger part of the solution to remove the slaughter of chickens from residential neighbourhoods.

5.3.2.2 Poultry slaughterers' willingness to move to public facilities

In 2009, INTERCAFE IPB and FAO conducted a socio-economic analysis of the public-sector driven poultry market restructuring in the Jakarta region due to the implementation of Regional Regulation/Perda No. 4 year 2007. Just over one third of the 46 slaughterers interviewed indicated to be willing to move even with a law enforcement of the Perda No. 4 (INTERCAFE IPB&FAO, 2009). Almost 90% of them indicated to prefer relocation to a similar operational area within the regency/town of their current business. Almost all (97.5%) indicated to be willing to move to a public facility, if the conditions are meeting their requirements. Just under two third of the 46 respondents indicated not to be willing to move from their current location. With a tight enforcement of the Perda No. 4, two third of the slaughterers unwilling to move voluntarily indicated they would move to a new location in the same operational area. Slaughterers with over 20 years' experience in chicken slaughtering did not expect a movement to cause a change in customer purchase behavior. The 45% of the slaughterers with less experience expected a reduction in customer purchases, mainly because of tighter competition in the new location (if also new slaughterers were to be allowed in the new location) and having to search for new customers due to leaving of old customers. Having to switch to frozen chickens and increased costs were also mentioned, but to a lesser extent. Almost all respondents expected a relocation to increase slaughter costs. The respondents considered slaughtering of chickens as an in-home activity. Therefore, relocation is considered as moving home and would change their work pattern and household living.
In 2016, Vangerven (2016)[6] analyzed the chicken slaughter community in the neighbourhood of Pondok Rumput in Bogor. She showed that the chicken slaughterers are fully embedded in the local society and slaughter point owners keep the neighbourhood happy by providing informal loans, donating money for local social activities, and offering meat for big festivities. Generally, work is done by family members. Often workers live in the same building as the slaughter point, in rooms made available by the owner. The owner of the slaughter business also lives close to the slaughter point, making it easier to combine the business with family life. Most slaughterers have a rather tight relationship with booth owners at the wet market, who sell the carcasses to the end-consumers.

[5] INTERCAFE IPB & FAO (2009). Socio-economic study of poultry market restructuring in Jakarta. Report INTERCAFE IPB & FAO, Bogor, Indonesia.
[6] Vangerven, A. (2016). Muddling through a sturdy process: Case study on the lack of a dynamic fit between the broiler slaughtering regulation and community life in Bogor, Indonesia. MSc thesis Wageningen University and Research, Wageningen, the Netherlands.

Carcasses are often supplied on credit to booth owners. Slaughterers slaughter during the night, to be able to provide the sellers with carcasses early in the morning. This relationship was built over a multitude of years, standing guarantee for the quality of the meat. When the slaughterers moved from the Bandung area to this area, Pondok Rumput was still on the outskirts of town and not yet a residential area. Slowly, other people moved in this area, changing it to a residential neighbourhood. The chicken slaughter chain came thus into existence during a time when slaughtering in Pondok Rumput was not illegal and did not cause societal or public hygiene problems and it was the business of a specific ethnic group. In fact, many slaughterers wonder why their slaughtering area got declared a residential area. For them, it would have been more logic to stop the encroachment of other people settling in their slaughtering area. This well-established chain of merchants and buyers is now a positive feedback mechanism reinforcing illegal slaughtering and hampering the movement of slaughtering activities to outside Pondok Rumput. Slaughterers are only willing to move their slaughtering activities if they can move as a community. Furthermore, they will expect that their new living area has all necessary facilities (e.g. a fresh market, mosque, school) and that they are regarded as high level citizens, even though they are from a different ethnic background.
The micro-slaughterers are fully embedded in the local society where they have lived for years and have tight relationships with suppliers and (local) customers. This makes most micro-slaughterers unwilling to move because they not only move their job but also need to move their home or even community.

5.3.2.3 Advantages and disadvantages of slaughtering at a public facility

In April 2017 the DIFS Live team interviewed broiler slaughter men at Rawa Lele and Rawa Kepiting about why they moved there and what they see as advantages and disadvantages of such public slaughter facilities. The scale of production at the respondents' companies varied between 100 and 6,500 broilers handled per day. The smaller companies (less than 1,000 per day) slaughtered all handled broilers. Many of the larger companies (over 1,000 per day) slaughtered only part of the handled broilers, the rest they sold as live birds. Of the micro-slaughterers that already slaughtered chickens before they came to the public facility, almost 75% indicated the government relocation program as a reason for moving there, and 20% indicated that a fire destroyed their previous location at the traditional market Pasar Senen or mentioned complaining neighbours.
Respondents from both Rawa Lele and Rawa Kepiting mentioned many advantages of slaughtering there (Table 5.1).

Table 5.1 *Micro-slaughterers' perceived advantages of slaughtering at Rawa Lele and Rawa Kepiting.*

Advantage	Rawa Lele	Rawa Kepiting	Total
Security/safety	6	5	11
Complete facility provided (electricity, water, parking, security)	2	3	5
Cheaper	1	4	5
Clean	3	1	4
More space	2	1	3
No problem with environment and neighbours	1	2	3
Close to home	0	1	1
Know other vendors	0	1	1
Close to collector yard	0	1	1
Hope for better quality carcasses	1	0	1
It is legal	1	0	1
Total	17	19	36

Security/safety (11 times), completeness of the facilities (5), lower costs compared to other slaughter locations (5), and cleanliness of the location (4) were mentioned most. Security/safety is related to the risk of being threatened, risk of suddenly being shut down, or having to pay 'security money' when illegally slaughtering in a residential neighbourhood. At a government location, such risks are not present. The government providing all infrastructures (electricity, water, parking, security) gives a government location an advantage over other locations, where the slaughter man has to arrange that

himself. Several respondents hinted that the costs of 'security money' were quite high, exceeding the slaughter fee they paid at the government location, thereby making slaughtering at a government location cheaper than elsewhere. The fact that the location is cleaned every day was also mentioned as an advantage. Respondents also mentioned many disadvantages, although most disadvantages were only mentioned by one or two respondents, indicating that there are not many broadly recognized disadvantages (Table 5.2.).
Seven respondents indicated that water availability was insufficient, especially when all slaughter men are slaughtering at the same time. Three respondents were not satisfied with the quality of the water, due to bad smell and to the water having a colour. A lower volume of chickens slaughtered compared to the previous location was mentioned by three recently moved respondents. A larger distance to the market, a larger distance to home, and overcrowded facilities resulting in insufficient slaughter space were each mentioned by two respondents.

Table 5.2 *Micro-slaughters perceived disadvantages of slaughtering at Rawa Lele and Rawa Kepiting.*

Disadvantage	Rawa Lele	Rawa Kepiting	Total
Water availability	4	3	7
Water quality	2	1	3
Lower volume	3	0	3
Larger distance to market	2	0	2
Too far from home	1	1	2
Too crowded, not enough slaughter space	1	1	2
No maintenance of building by the government	0	1	1
Need to pay retribution	1	0	1
Distance between live bird collection and slaughter too far	1	0	1
Equipment (knives, chopping-block, etc.) disappear	1	0	1
Feathers are put on a pile and those are very smelly	0	1	1
Wall separating clean/dirty area should be removed to make it easier to move between these places	0	1	1
Not all slaughterers have been moved here by government	1	0	1
More competition, so lower carcass prices	1	0	1
Total	18	9	27

The interviewed micro-slaughterers at Rawa Kepiting and Rawa Lele needed a trigger to leave their previous slaughter location, such as the governmental relocation program, a fire, or complaining neighbours. Dealing with the disadvantages and explaining the advantages of government slaughter locations could help to induce slaughter men slaughtering outside government slaughter locations to move to there.

5.3.2.4 Conclusion

In conclusion, only a limited number of public slaughter facilities have been developed, with a capacity of between 5 and 10% of all chickens slaughtered in Jakarta. The locations of the current facilities are surrounded by residential neighbourhoods and lack of maintenance of the facilities result in similar problems as observed in residential neighbourhoods. Live chickens remain to be brought into the city. Willingness to move voluntarily of micro-slaughterers in residential neighbourhoods to other slaughter locations is low, but can be increased through tight enforcement. In terms of creating the conditions under which live chickens are no longer brought into the residential areas of Greater Jakarta anymore, the construction and management of public slaughter facilities seem to provide an interim, but not yet a final solution. Further stimulicould be given through promotion of the advantages of public facilities and solving the disadvantages.

5.3.3 SME financing and investment options

Small and medium enterprises (SME's) in the chicken slaughter industry in Indonesia slaughter a few thousand to up to 30,000 birds per day. Often, these SMEs are family enterprises with a focus on sustainable growth and long term subsistence. SMEs operate semi-automated slaughter plants. These slaughter plants can be on a location owned by the SME or on a government slaughter location rented from the government. A chicken slaughter plant on an own location needs up to 16 different permits or licenses, addressing issues like planning, building, and environmental impact (see chapter 5.2). In addition, the enterprise needs an NKV-certificate. Almost all SMEs that the DIFS Live team visited during the project were missing one or more of such licenses. On a government location, licenses are all arranged. Furthermore, the government provides the location, waste management, and sometimes semi-automatic slaughter line equipment, depending on the location and building.

SMEs tend to develop themselves in a kind of integrated production chain, where several stages of the chicken meat supply chain, such as chicken production, slaughter, meat processing, or retail, are present within the company. Incidentally they develop from broiler farming, but mostly from small slaughter points. In general, SMEs prefer to have control over their market downstream, by having a close connection to a specific market, i.e. often cut-up and marinated chicken parts for fast food services, catering, or restaurants. Often, they have access to a blast freezer and a cold store, either owned or rented from the government. In this way, they cope to some extent with the volatility of the market for live birds and poultry meat. When live broilers are cheap, the cold store is filled, when poultry meat yields a relative high price the cold store is emptied.

Mostly, the owners of the SME's are not used to work with debt funding. Formal credit is difficult to obtain without the full set of operational licenses, permits and business registrations. Furthermore, many SME's lack a source collateral. For the SMEs on governmental facilities it is the collateral that is lacking. For SME's with own facilities, often the licensing situation is limiting. It is very difficult for a SME to find a legal slaughter location. A recent inventory study concerning the regulatory framework for poultry slaughterhouses in Jabodetabek revealed that only a few districts have included space in the public infrastructure planning for slaughterhouse activities. Depok is an exception to the rule since it has designated an area for relocation and building of new slaughtering facilities.

The slaughter companies operating on a governmental location depend on the governmental authorities for maintenance of the location. However, local governmental authorities (DINAS) often lack the budget for sufficient maintenance of the governmental locations. The SME's do not want to do long-term investments, because they do not have long term certainty that they can continue slaughtering on the government slaughter location. So, SME's only tend to invest in more or less mobile equipment. Therefore, equipment such as semi-automatic slaughter lines, cleaning and disinfection equipment, waste water treatment, and general infrastructure are in a sorry state on many government locations.

5.3.4 Competition from large integrators

According to the Indonesian Poultry Slaughterhouses Association (Arphuin) the larger scale slaughterhouses, which are owned and operated by the integrated poultry companies, currently have around 15% of the market share in the broiler meat sector. The level of automation, hygiene and quality control are higher in this segment of the broiler slaughtering industry. Despite some economies of scale, the slaughterhouses of the integrators claim to have higher costs due to extra costs for cooling, quality and safety procedures, etc. Main market outlets are the organised retail chains such as super and hyper-markets as well as the mini-marts and the hotel and restaurant chains.

According to the Arphuin members, the Decree 4/2007 and the NKV food safety standards should be more effectively enforced. This would create a more level playing field in the market and improve the competitiveness of the slaughterhouses and broiler meat processing plants owned and operated by the large integrators (including Charoen Pokphand, Japfa Comfeed, Malindo, Sierad Produce).

Aside from these concerns about market regulations and enforcement, each of the companies appears to have also a strategy aimed at market expansion. Although feed production and supply remains the more lucrative part in the supply chain, the growth and margins in slaughtering and further processing also provide attractive investment opportunities. It is expected that the integrators will take a higher degree of control of the supply chain by getting more involved also in the end-markets. The

companies involved appear to have developed different strategies aimed at further modernization and capturing a larger share in the poultry meat consumer markets. These strategies include the following:

- Supplies of fresh poultry carcasses and chicken pieces to selected traders at the wet markets; branding of the products in combination with a franchise formula for the wet market traders should distinguish the poultry meat products from the standard chicken from the micro slaughterers.
- Establishment of own small scale retail outlets and/or supplies of the mini-marts in the main residential areas with cooled and frozen poultry products under own brand.
- Direct sales to consumers using e-commerce tools for order registration and logistics; this is particularly aimed at the young urban professionals as an upcoming consumer group with adequate disposable income to choose for convenience goods and home deliveries.
- Further processing of chicken meat and incorporation of chicken in ready to eat meals so that more value is added.

It is evident that the level of competition from the integrators on the poultry meat market will increase. Their focus is not only anymore on the higher market segment, but there is an ambition also to get access to other market segments where traditionally the micro and medium scale slaughterers have operated. Not all of the planned marketing and distribution strategies may turn out to be highly successful. However, the combined effect is likely to lead to a higher market share of the integrators in the poultry meat consumer markets, particularly if the independent micro and medium scale slaughterers do not improve their product quality and marketing strategies.

5.4 Investment and growth scenarios

5.4.1 Policy implementation challenges

From the current state of affairs in the poultry slaughterhouse sector in Greater Jakarta it becomes clearthat a transition towards a sharp reduction of public health risks cannot be expected in the short term. The legal framework is in place and the policy objectives are clear, but enforcement of regulations is difficult without undermining the sustained supply of poultry meat to the urban markets. Compliance with all business regulations, environmental and safety procedures and licensing requirements appears difficult at local level. Conversion of largely unregistered and unlicensed micro and SME slaughter businesses to formally registered operations that comply with environmental, safety and business regulations is not to be expected on a voluntary basis. Supervision and enforcement is, however, a major challenge for the public authorities, given the large number of micro slaughterers involved. Furthermore, there is insufficient capacity at the public slaughter facilities and the incentives for micro slaughterers to use the available facilities are limited. Opportunities for SME slaughter facilities to invest in the upgrading of the businesses are limited due to the limited availability of credit.

Without any changes in the sector the market share of the large scale slaughterhouses is likely to increase because of higher quality requirements of consumers and the economy of scale. This may be at the expense of employment and may lead to a price increase of the end product. However, compliance with environmental and public health regulations may be easier to oversee and enforce. The challenge for the public authorities will be to balance the different public and private interests. Environmental and public health regulations need to be adopted throughout the sector. It requires close cooperation and joint planning and efforts with the key players in the sector to achieve this. To facilitate the public-private cooperation in this field, various growth and investment scenarios have been calculated. These are presented in the next section (5.4.2). The final section (5.4.3) poses some questions based on which public and private partners may find a common direction for growth and development in the poultry meat sector that combines the interests of consumers, businesses and Government.

5.4.2 Growth scenarios and their implications

The different paragraphs in 5.3 focused on the legal and commercial environment and existing supply chain configurations through which chicken meat reaches consumers in Jakarta. Each supply chain configuration has advantages and disadvantages in terms of employment creation, affordability of

chicken meat, environmental impact, public health and food safety. Micro-slaughterers slaughtering in residential neighbourhoods provide cheap chicken meat, create much employment and are close to the consumers market. However, micro-slaughters generally pay no attention to environmental concerns. Blood and waste water flows into the open sewage systems and rivers without any treatment.

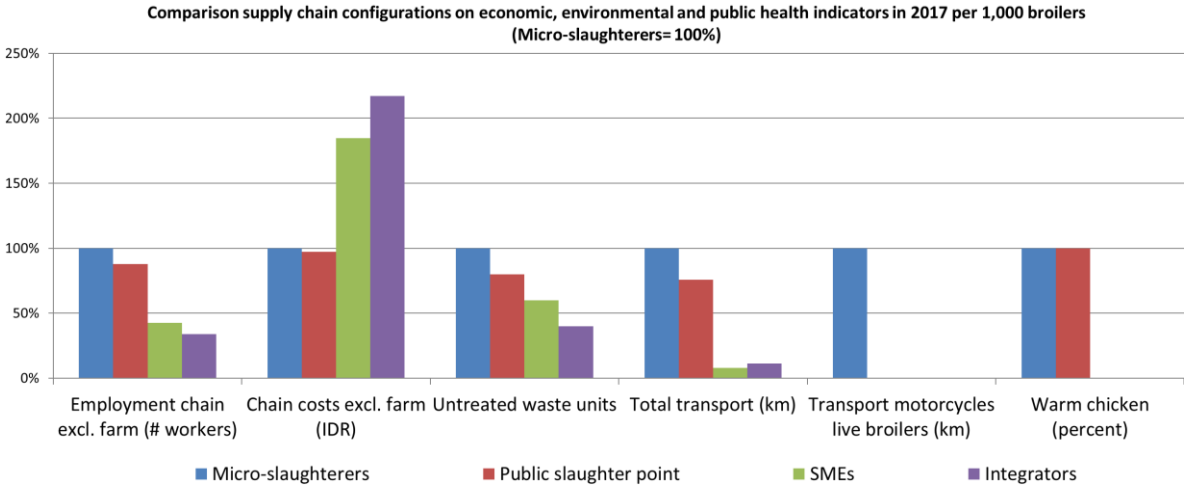

Figure 5.2 *Impact of supply chain configuration on selected economic, environmental and public health indicators.*

They also pose high risks for the public health in the residential areas. For example, the practice of bringing live birds on motorbikes and keeping them in holding pens in the urban areas increases the risk of spreading of zoonoses such as avian influenza. Selling warm chicken meat and slaughtering in unhygienic conditions results in high food safety risks.

Public slaughter points also provide cheap chicken meat and create much employment. Environmental concerns are less than on the locations of micro-slaughterers because blood and effluent water is collected and there are possibilities to treat waste water. The number of live chickens being brought into a residential neighbourhood is reduced, which is positive in terms of public and veterinary health risks. However, the public slaughter facilities are further away from the consumer markets and the slaughterers using these facilities do not have a cool chain in place. Hence, food safety risks are still high in this supply chain configuration.
SMEs pay more attention to environmental concerns by collecting blood and treating waste water in open basins and (often) have a form of a cool chain in place. However, the chicken meat is more expensive, and the SME slaughter houses are further away from the consumer markets. In terms of employment creation, SMEs provide fewer jobs due to the use of (semi-)automatic slaughter equipment.
Finally, large integrators have a strong focus on environment and food safety and public health concerns, but have the highest chicken meat price and provide the least employment due to full automation. Figure 5.2 provides the differences on several of these indicators.

Thus, each supply chain configuration favours some of the following public and private interests (a) employment creation, (b) supply of affordable chicken meat to urban consumers, (c) reducing environmental pollution, (d) safeguarding public health, and (e) reducing food safety risks. However, none of the supply chain configurations addresses all these issues and all have a negative effect in one or more areas of public or private interests. Balancing the different public and private interests is therefore a challenge. Priorities among the different aspects have to be set and choices will have to be made by policy makers.
The future impact of the whole chicken supply chain (consisting of a combination of the supply chain configurations) in relation to the different public and private interests depends on the development of these supply chain configurations in the coming years. Three growth scenarios have been defined for the chicken supply chain in 2025, each focusing on specific fields of interests and policy directions:

- Scenario Employment: Half of the growth of the poultry meat market of 4% per year (from 365 million chickens produced per year in 2017 to 500 million in 2025) will go to public

slaughter facilities and the other half to large integrators. Micro-slaughterers and SMEs will remain at the size of 2017;

- Scenario Public Health: Half of the growth of the poultry meat market with 4% per year will go to public slaughter facilities and the other half to large integrators. All micro-slaughterers will move to public slaughter facilities. SMEs will remain at the size of 2017;
- Scenario Food Safety and Environment: The whole growth of the poultry meat market with 4% per year will go to large integrators. All micro-slaughterers will move to public slaughter facilities. SMEs will remain at the size of 2017.

Figure 5.3 presents the impact of these three potential poultry supply chain scenarios on indicators for employment creation, affordability of chicken meat indicated as chain costs post broiler farm, environmental impact, public health, and food safety in comparison to the baseline situation of 2017, which is set at 100% for each indicator.

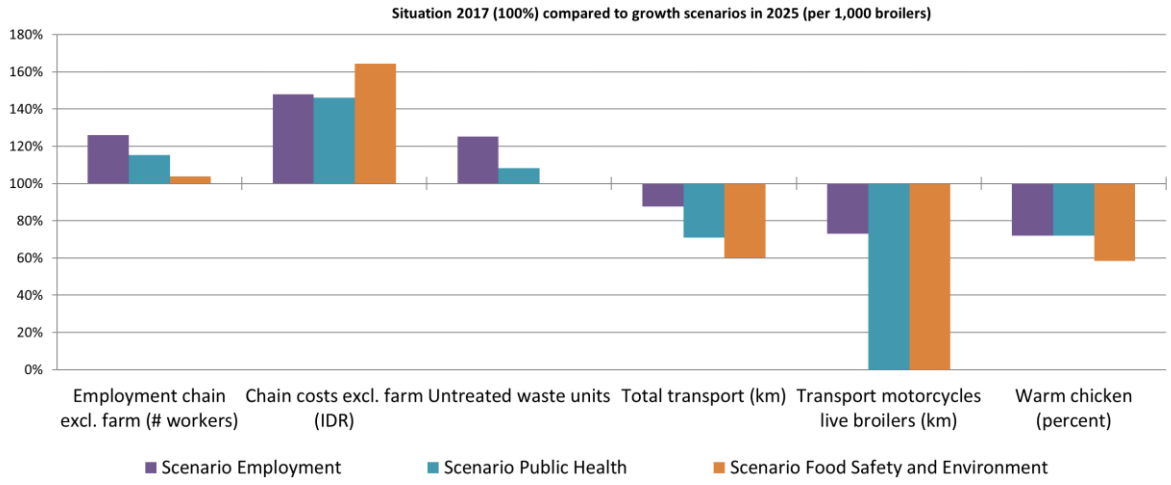

Figure 5.3 *Comparison current situation in 2017 with potential future chicken sector situations in 2025 on selected economic, environmental and public health indicators.*

Table 5.3 provides the total number of chickens produced in each growth scenario and the distribution of the percentage of these chickens in each supply chain configuration.

Table 5.3 *Number of chickens in each growth scenario and distribution of these chickens between supply chain configurations.*

Growth scenario	Number of chickens produced per year (million)	% of chickens in supply chain configuration			
		Micro-slaughterers	Public slaughter points	SMEs	Integrators
2017	365	75	5	5	15
2025 Scenario Employment	500	55	17	4	24
2025 Scenario Public Health	500	0	72	4	24
2025 Scenario Food Safety and Environment	500	0	58	4	38

In the scenario Employment, the level of employment creation is highest, and the supply chain costs are low resulting in the most affordable chicken meat. However, much blood and waste water is not treated well and the environmental pollution levels in residential areas will further increase. Furthermore, the spread of zoonoses and food related diseases will remain high as live chickens are still moved to residential neighbourhoods, much transport of live and dead chickens occurs in the city, and much chicken meat is sold warm to consumers. In the scenario Public Health, no live chickens will be transported through residential neighbourhoods minimizing the risk of Avian Influenza infections in humans and supply chain costs are low. However, employment is less, due to automation and shorter supply chains, much blood and waste water is not treated optimally, much transport of live and dead chickens occurs in the city, and much chicken meat is sold warm to consumers. In the scenario Food

Safety and Environment, much blood and waste water is treated well, no live chickens are transported through residential neighbourhoods, and much chicken meat is sold through a cool chain to consumers. However, employment is lowest due to full automation and shorter supply chains and chain costs are higher, due to higher slaughter costs and the cool chain.

5.5 Discussion

Today, several supply chain configurations can be distinguished for poultry meat in Jakarta: micro-slaughterers, public slaughter points, SMEs, and large integrators. Each supply chain configuration favours different public and private sector interest related to employment, affordability of chicken meat, the environment, public health and food safety, but at the same time opposes others. Pursuing an effective transition towards a more sustainable slaughter sector in Greater Jakarta requires a common understanding by public and private sector on the key priorities that need to be pursued. A dialogue is therefore required on the prioritization of public policy directions in the fields of employment, affordability of chicken meat, environment, public health and food safety. It is essential that national and regional government bodies as well as private sector stakeholders share their prioritisation and find ways over bridging differences where necessary.

Subsequently, policy implementation issues need to be revisited. For example, in case sustained employment in the sector is to be given high priority, it seems inevitable also that the capacity of the public slaughterhouses need to be extended considerably. The question then arises whether there is sufficient budget availability to do so.

In all scenarios, the total market size of SMEs was not expected to grow due to the existing legal and financial obstacles. It is a common pattern in most highly industrialised countries that scaling takes place and that only a few large poultry slaughter plants are left (benefitting completely from economy of scale). Small and medium sized slaughter plants are few in these countries and normally only focus on specific niche markets. However, that does not rule out that the poultry slaughter sector in West Java should follow the same pattern. In case SME's would be stimulated, a review and reform of the licensing and registration system in the sector seems necessary. Would there be sufficient interest to do so? And if so, will SME slaughterhouses invest in hygiene and a cool chain if it is possible to become fully registered and licensed?

These and other questions require answering by the main public and private stakeholders in the slaughterhouse sector in West Java. On the basis of a common understanding of the priorities, both government agencies and slaughter companies (micro-slaughterers, SMEs and large integrators) and their organizations can work in the same direction.

6 Broiler farming recommendations

Rick van Emous and Sander Lourens

6.1 Challenges for Indonesian broiler farmers

Broiler production in Indonesia is still mainly carried out in a traditional farming system with so called 'open houses', but with modern broiler strains with a high growth potential. These houses are built from local material as bamboo and have basic equipment. The traditional open house is a simple broilers house with a high roof, natural ventilation, manual feeding/water, open side walls and a slatted floor (Figure 6.1). This type of farming does not utilize the full potential of the broiler birds that are being fattened. The impaired production performance in open broiler houses is in the first place caused due to the limited possibility for temperature control. Particularly in het beginning of the growing period broilers are suffering of cold during the night due to inadequate heating equipment. During the day, especially when broilers are ageing (from 2 weeks onwards) they are suffering of heat stress which is caused by the high daily temperature and relative high humidity. This results in panting (fast breathing to cool), decreased growth performance, increased mortality, decreased welfare, etc. Another characteristic of current broiler production in open houses is also the low biosecurity and high antibiotic use. Also the quality of the drinking water is poor due to limited access to clean water sources combined with poor water management. Due to market structure broilers are slaughtered at relatively young age and low weight due to customer preference (affordable complete but small carcasses). In general, the genetic potential of the modern fast growing broilers in terms of growth, production efficiency and uniformity is not fully exploited in traditional farming system with open houses.

Figure 6.1 *Traditional open broiler house with a high roof, natural ventilation, open side walls and manual feeding and water system.*

6.2 Data collection

For improvement of technical and economic results the basis is intensive data collection in standard formats, to collect uniform data at different farms in order to be able to compare results. A data collection protocol was developed and introduced on several farms to test its applicability in practise. Technical data included general data about house dimensions and the number of bird places, cleaning time and performance data as body weight development, feed consumption, mortality, slaughter age. Economic data included the price of the day old chicks, feed and broiler selling price and costs for

electricity, water, heating /gas, health care, litter, catching and transport, cleaning, levies, and carcass disposal. Based on this, feed margin (slaughter income – feed and day-old chick price) per 100 broilers can be calculated per round and per year. An overview of the other costs can be made per 100 broilers, which can be used to estimate the annual income of the broiler farm. Using this data, the pay-back time can be estimated of any investment.
Even though not all selected farms were customers of project partner Medion, Medion farm supervisors assisted the broiler farmers in the project to collect the data and to enter the data per cycle and per house in an excel sheet. The digital data were used for further analysis.
After testing the protocol in practise, it was first used to test effects of cheap feed and day-old chicks. After that, an improved water sanitation procedure (with UV-radiation) was introduced as part of the integrated water quality control program at each farm. The data collection tool was used to monitor if innovations in broiler farms practices are effective in both technical and economic performance. The next step was to proceed from manual data collection to more automated data collection. This work was carried out at the MBLC (the demonstration and training centre of Medion), who implemented this in their daily management system. The first attempts were made to develop the automated data collection system into a practical ready-to-use application for broiler farmers, which is now already available.

6.3 Variation among farms

From the initial 8 farms, 6 farm owners started to collect data and returned the data. Broiler houses were open with natural ventilation, some had additional ventilators to force some air movement across the chicks. Floors in general existed of bamboo slats, water was taken from own wells and given in drinking bells either manually or automatically. Feed was given manually in feed bins. On average 4880 birds were placed in a house at a density of 10.5 birds per m^2. Production period was on average 30 days, and the cleaning period around 26 days. Slaughter weight was on average 1,339 g, at a feed conversion ratio of 1.52. Total mortality was on average 6.0%.
The differences between farms and between houses per farm were large. To compare broiler farms and houses per farm, the economic returns are calculated per 100 day old chicks (DOC) placed. Based on the technical results of a specific farm, the average kg of live weight poultry produced from these 100 DOC can be calculated This figure is dependent on mortality and final body weight. Combined with the price that broiler farmers get from traders or slaughter houses, the financial returns can be calculated per 100 DOC. Next, the costs for electricity, water, heating / gas, health care, litter, catching and transport, cleaning, levies, and carcass disposal are calculated per 100 DOC. Not all data are recorded per broiler house per cycle. For example electricity or water use is registered per cycle, or even per year. Bags with rice hulls are bought as litter, and manure is often sold either for the same amount of money or given to the farm workers as a bonus for the cleaning. Fluctuations in prices for DOC, feed and broiler meat are shown in Figure 6.2.
Large differences in both technical and economic results are present between broiler farms. The difference in income per cycle between the worst (30 euro) and best performing farm (1,836 euro) is large. The data collection protocol was evaluated as an effective tool, despite the relative large effort to note all costs in a structural way. At the same time, insights in costs and revenues showed to the broiler farmers many opportunities to reduce costs and to select feed and doc suppliers better.
From Table 6.1 it can be seen that prices for DOC and slaughter ready chickens fluctuate largely, as already shown in Figure 6.2. Also feed prices differ between farms. Cheap feed may not necessarily result in better economic returns, because feed quality is often closely related to price. The effect of cheap feed and cheap day-old chicks is illustrated in Chapter 6.4, at a new farm that participated in the next testing period.

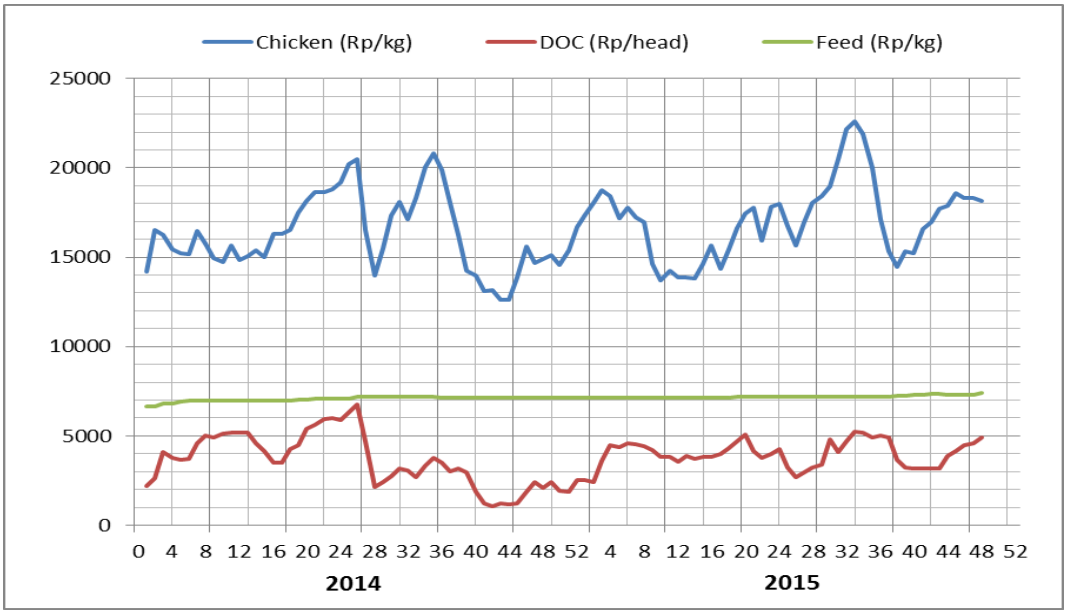

Figure 6.2 *Prices for slaughter ready chicken, day old chicks (doc) and feed in 2014-2015, averaged for the districts of Bogor, Sukabumi, Bandung, Bekasi and Tangerang.*

Table 6.1 *Performance of broiler farms in the pilot project (April – June 2015).*

Production data	Unit	Lowest income farm	Highest income farm	Average
Stocking density	#/m^2	7.5	8.8	10.5
Production period	days	24	30	30
Cleaning period	days	14	30	26
Slaughter weight	g	1,106	1,483	1,339
Mortality	%	5.3	3.3	6.0
FCR	kg/kg	1.66	1.53	1.52
Economics				
DOC price	IDR/doc	3,900	2,700	3,864
Feed price	IDR/kg	6,797	7,000	6,967
Broiler price	IDR/kg	16,504	16,800	18,119
Profits per 100 DOC				
Slaughter ready chicken	kg	105	143	126
Income	IDR	1,728,950	2,408,857	2,276,489
Costs per 100 DOC				
DOC	IDR	390,000	270,000	386,364
Feed	IDR	1,179,633	1,531,053	1,278,180
Electricity	IDR	29,167	2,475	10,377
Water	IDR	-	-	-
Heating (gas, charcoal)	IDR	46,500	33,771	55,548
Feed additives	IDR	-	-	25,982
Water additives	IDR	-	-	3,269
Health care - medicines	IDR	12,321	30,727	34,264
Health care - vaccinations	IDR	8,603	8,741	11,043
Litter (dry rice hulls)	IDR	30,250	15,842	25,449
Litter (manure sold)	IDR	-	-16,089	-16,170
Catching and transport	IDR	-	-	6,000
Cleaning	IDR	25,800	3,537	14,702
Margin per 100 DOC				
Feed gain	IDR	159,317	607,804	558,238
Gross margin	IDR	15,974	528,800	416,460
Gross margin/year	IDR	153,430	3,216,864	2,727,477
Gross margin/m^2/ year	IDR	11,507	283,646	307,282
Margin per house				
Per cycle	IDR	479,206	29,374,813	18,749,791
Per year	IDR	4,602,895	178,696,776	121,653,035
Per cycle	EUR	30	1,836	1,172
Per year	EUR	288	11,169	7,603

6.4 Chick and feed quality

The data collection protocol provided an effective tool to monitor both technical and economic results at broiler farms. Broiler farmers are forced to deal with large price fluctuations of the slaughter ready chicken they sell at the gate. With the farm gate selling price determining financial results to a large extent, farmers are forced to reduce costs and the largest cost components are feed and day-old chicks. At one farm, with 6 identical houses, an experiment was conducted to test the effect of cheap feed and cheap day-old chicks on performance. Cheap feed was bought at IDR 5,743 per kg instead of 6,656 per kg, cheap day-old chicks at IDR 4,000 instead of IDR 5,250 per head. The gate selling price was IDR 16,000 per kg.

Table 6.2 *Technical results for the effects of cheap feed and cheap chicks.*

	Control	Cheap feed	Cheap chicks	Cheap feed + cheap chicks
Production period (d)	33.5	35.0	32.0	35.0
Cleaning period (d)	21.0	21.0	21.0	21.0
BW at slaughter (g)	1,399	903,0	1,288	935,0
Mortality (%)	10.9	21.6	13.9	17.2
FCR (kg/kg)	1.82	2.91	1.83	2.88

In the houses where chicks received cheap feed, mortality was very high (21.6%) and feed conversion ratio was high (2.91). Growth of the chicks was retarded, chicks weighed only 903 g at 35d of age. Buying cheap day-old chicks did affect performance less, however mortality was higher (13.9%) and birds weighed about 100 g less (1,288 vs. 1,399 g) at slaughter age. The combination of cheap feed and cheap chicks yielded similar results than control chicks receiving cheap feed.
The margins per 100 DOC are shown in Table 6.3. Under these circumstances, in this particular period it was not possible to gain a positive income from broiler farming, but economic losses were higher on cheap feed than on the control feed. In this case it was better to buy cheap chicks than to buy cheap feed, but cheap chicks did not improve financial results.

Table 6.3 *Margins in the experiment using cheap feed and cheap chicks, where feed gain is income from broilers sold minus feed costs.*

	Control	Cheap feed	Cheap chicks	Cheap feed + cheap chicks
Margins per 100 DOC				
Feed gain/cycle (IDR)	-158,426	-818,461	-109,572	-803,306
Gross margin/cycle (IDR)	-235,863	-894,973	-186,084	-877,092
Gross margin/year (IDR)	-1,582,922	-5,833,308	-1,281,523	-5,716,761
Gross margin/m²/year (IDR)	-428	-1,535	-337	-1,429
Margins per house				
Per cycle (IDR)	-8,726,941	-34,008,988	-7,071,200	-35,083,686
Per year (IDR)	-58,568,102	-221,665,723	-48,697,885	-228,670,454
Per cycle (EUR)	-545	-2,126	-442	-2,193
Per year (EUR)	-3,661	-13,854	-3,044	-14,292

6.5 Interventions in water system

The data collection protocol was also used to evaluate the effect of improved water sanitation procedures at selected broiler farms. Water quality programs need to have an integrated approach, because water quality need to be optimal from entrance to the farm to the moment the birds drink it. It appeared that water quality at entrance of the farm is often poor, with a high load of bacteria. All farms have some kind of water collection and storage system, and a well-functioning UV system with water recirculation may reduce the bacteria load in the water storage to acceptable levels. This was tested and effects on broiler technical and economic results were analysed using the data collection method.
6 farms were selected for this procedure, and all agreed to install UV equipment. Medion took water quality samples before and after installation to evaluate results. Only 3 broiler farmers with open houses and one broiler farmer with closed houses were able to produce the right data in the requested format to make a complete overview of production results and economic returns before AND after water treatment.

Table 6.4 *Broiler production data before and after UV installation in open and closed houses.*

	Open house		Closed house	
	Before	**After**	**Before**	**After**
# Farms	3	3	1	1
# Cycles	5	3	2	2
# DOC	24,477	22,840	51,405	51,325
Surface (m^2)	1,973	1,740	2,880	2,880
#DOC/m^2	12.8	13.8	17.8	17.8
Production period (d)	31.0	30.7	31	31
Cleaning period (d)	24.0	24.0	21	21
BW (kg)	31,547	30,219	90,163	88,520
BW to slaughter (g)	1,381	1,392	1,812	1,815
Mortality (#)	1,556	1,269	1,213	1,727
Mortality (%)	7.0	5.5	2.4	3.4
Feed (kg)	48,622	45,317	123,325	124,950
FCR (kg/kg)	1.60	1.50	1.37	1.41

Table 6.4 shows that the general production results in the farms with open houses were better after UV installation. No statistics were carried out on these limited data (3 farms completed the data collection for several succeeding rounds), but in general the mortality and feed conversion ratio are lower. The differences in final body weight can be attributed to market demands at the different slaughter dates. Technical results in the broiler farm with closed houses were less after UV installation, with higher mortality and higher feed conversion ratio. This closed house made the transition from buying fresh drinking water using trucks, to drinking water from own well including UV disinfection. This might have influenced the technical results. Table 6.5 provides the economic data.

Table 6.5 *Costs and revenues of broiler farming before and after UV installation in open and closed houses.*

	Open house		Semi-closed house	
Economics	**Before**	**After**	**Before**	**After**
DOC price (IDR)	4,800	5,067	5,300	5,000
Feed price (IDR/kg)	7,202	7,286	7,300	7,343
Broiler price (IDR/kg)	17,162	18,933	16,825	17,113
Profits per 100 DOC				
Slaughter ready chick(kg)	135.9	139.0	179.6	178.5
Slaughter ready chick(IDR)	2,339,151	2,622,041	3,021,642	3,053,878
Litter (manure sold, IDR)	8,937	1,760	19,609	19,640
Costs per 100 DOC				
DOC	480,000	506,667	530,000	500,000
Feed	1,697,136	1,601,410	1,751,383	1,787,777
Electricity	27,887	31,662	9,727	9,742
Water	-	-	31,126	-
Heating / gas / charcoal	39,302	36,363	32,682	32,733
Feed additives	1,234	2,716	-	-
Water additives	101	143	584	585
Health care - medicines	18,559	25,224	248	497
Health care - vaccinations	21,092	15,986	12,304	12,324
Litter (dry rice hulls)	20,159	18,976	19,609	19,640
Catching and transport	3,154	25,000	2,500	2,500
Cleaning	6,021	6,460	17,975	17,975

Using the costs and profits calculations per 100 day-old chickens, the economic returns can be calculated as explained before. In Table 6.6, it can be seen that broiler farm income increased. This cannot be explained from improved water sanitation only. These broiler farmers were trained on broiler farm management aspects in the DIFS-Live project and paid attention to many more

management issues. The overall financial results on both farms with open and closed houses improved. The price of broilers at the gate was a major contributing factor, but especially at farms with open houses also technical results improved by the installed water treatment system.

Table 6.6 *Economic returns after UV water quality improvements in open and closed houses.*

	Open house		Semi-closed house	
	Before	**After**	**Before**	**After**
Margins per 100 DOC (IDR)				
Feed gain/cycle	162,016	513,965	740,259	766,101
Gross margin/cycle	33,442	353,196	633,115	689,719
Gross margin/year	314,567	2,298,111	4,443,980	4,841,295
Gross margin/m²/yr	163	2,013	44,440	48,413
Margins per house (MIDR)				
Per cycle	20	70	325	354
Per year	164	480	2,287	2,488

6.6 From open to semi-closed housing

6.6.1 Performance on pilot farms

Production performance data were measured at two broiler farms in West Java, Indonesia (Table 6.7). Both farms had a traditional house and a closed house for broilers. The closed houses were built in 2016. On both farms, the broilers had a similar harvesting age in both systems. However, in the closed housing system on both farms the final live weight was higher, and feed conversion and mortality were lower. From the collected data we can conclude that a closed compared to an open house improved body weight with 4% (Farm A) and 13% (Farm B) 9%, decreased FCR with more than on average 11%, decreased mortality with almost 51% (Farm A) and 64% (Farm B) and improved the production index (IP) with on average almost 30%. The production performance results differed between the two farms.

Table 6.7 *Comparison between open and closed houses for broilers at two different farms.*

Parameter	Farm A		Farm B		Average		Dif.
	Open	**Closed**	**Open**	**Closed**	**Open**	**Closed**	(%)
Body weight (kg)	1.60	1.67	1.46	1.65	1.53	1.66	+8.5
Harvesting age (d)	30.1	29.6	30.5	30.5	30.3	30.0	-1.0
FCR	1.54	1.39	1.67	1.45	1.60	1.42	-11.3
Mortality (%)	6.8	3.3	9.0	3.2	7.9	3.2	-59.5
IP[1]	326	393	289	375	291	377	+29.6

[1] IP = Production Index (Total Harvest Weight x 100) divided by (FCR x average harvest age)

6.6.2 Investments

To get more insight in the costs and returns of closed versus open housing, calculations were made for the investment on a farm with only open housing and on a farm with only closed housing. We assume that on both farms 40,320 broilers are kept. On the farm with open housing, these broilers are kept in 7 houses of 8 meter wide and 80 meter long. The total ground surface area of the open houses is 4,480 m^2. The average density is 9 broilers per m^2 poultry house. The average empty period between flocks is 28 days. On the farm with closed housing, the broilers are housed on 2 levels in a house of 12 meter wide and 105 meter long. The total ground surface area of the house is 1260 m^2. The total surface available for the broilers is 2,520 m^2, because they are kept on 2 levels. The average density is 16 broilers per m^2 living area. The average empty period between flocks is 28 days.
Table 6.8 gives the investment in the poultry houses and equipment for a farm with the open and a farm with the closed housing system. The total investment on a farm with closed housing is almost 9

times higher than that on a farm with open housing. With closed housing, higher investments per m^2 are needed for the electricity installation (mechanical ventilation and automatic feeding). Furthermore, the investment for equipment per m^2 with closed housing is higher as a result of the higher density and a higher level of automation. Finally, with closed housing an extra investment is needed in a generator as a backup for a situation with an electricity power cut.

Table 6.8 *Investment (IDR per m2 ground surface area) for building, electricity, equipment and generator on a broiler farm with open and closed housing and total investment (IDR).*

Object	Open	Closed
Poultry house, building	125,000	700,000
Poultry house, electricity	5,000	300,000
Equipment	40,000	400,000
Generator	0	100,000
Total	170,000	1,500,000

6.6.3 Production costs

Production costs were calculated for the farms with an open and closed broiler house assuming a price of 4,500 IDR per day-old chick and a feed price of 7,000 IDR per kg. For the open housing, the depreciation period was 10 years for the house and 8 years for the equipment. For the closed housing, the depreciation period was 15 years for the house and 8 years for the equipment. The total production costs per broiler houses were almost equal in both housing systems (Table 6.9). For closed housing, the variable costs for feed and electricity were higher and variable costs for heating and animal health lower. Fixed costs for housing and equipment were clearly higher for closed housing. This was partly compensated by lower labour costs for the closed housing.
Although the total production costs in the two systems are quite similar, the production costs per kg broiler meat produced per broiler housed are different. This is because in our calculation model the technical production data differ between the two systems. We used the technical data as given in Table 6.7. The amount of meat per broiler housed produced in the closed house system is higher than in the open housing system, because of a higher final live weight and a lower mortality. For the open housing, the total production per broiler housed is 1.41 kg and this results in production costs of 17,190 IDR per kg final live weight. For the closed housing, the total production per broiler housed is 1.61 kg and this results in production costs of 15,276 IDR per kg final live weight. Production costs per kg final live weight are thus about 11% lower on a farm with a closed housing system compared to a farm with an open housing system, provided that our findings of differences in performance between the housing systems are valid.

Table 6.9 *Production costs (in IDR per broiler housed and per kg live weight) for open and closed broiler housing in West Java (Indonesia).*

Costs	Open	Closed
Day old chick (DOC)	4,500	4,500
Feed	15,782	15,972
Electricity	100	400
Heating	700	400
Animal health	600	450
Other variable costs	1,040	1,040
Total variable costs per broiler housed	*22,722*	*22,762*
Poultry house	369	629
Equipment	138	484
General costs	35	35
Labour	958	636
Total fixed costs per broiler housed	1,501	1,784
Total costs per broiler housed	24,223	24,546
Production in kg live weight	1.41	1.61
Total costs per kg live weight	17,190	15,276

6.6.4 Payback period of investment in closed broiler housing

The payback period is calculated taking the total investment for the closed house divided by the annual cash flow. To estimate annual cash flow, a farm gate price of 16,000 IDR per kg live weight was used. For the basic situation the payback period is 4.5 years (Table 6.10).

Table 6.10 *Payback period for a closed house at different production results and prices.*

	Years
Closed housed average situation	4.5
Farm 1 production results	3.6
Farm 2 production results	6.1
Lower revenue price (16,000 to 15,750)	6.0
Lower feed price (7,000 to 6,500)	2.7
Higher price day old chicks (4,500 to 5,000)	6.5

6.6.5 Sensitivity analysis

Many factors influence the payback period, of which the most important are the production results, revenue prices, and costs of feed and day-old chick. Table 6.10 also provides an overview of the impact of changes in these factors. When production performance in the closed housing was above average (production performance of farm A), the payback period was reduced to 3.6 years. At lower than average production results (farm B), the payback period was longer: 6.1 years. Slightly lower revenue prices (from 16.000 to 15.750 IDR per kg live weight) resulted in a longer (1.5 years) payback period of 6.0 years. A lower feed price resulted in a shorter payback period (2.7 years), whereas a higher price of day-old chicks in a longer payback period (6.5 years).

6.6.6 Discussion

Before a farmer can invest in closed housing for broilers, some conditions have to be met. First, a location has to be available with a good connection to the electricity network. Access to reliable electricity is essential for climate control in the closed house with mechanical ventilation. In case of power cuts, a back-up system is necessary, such as a generator.
Second, the farmer has to realize that well qualified workers are needed to manage the poultry house. These workers need the knowledge and skills to control the climate and to use the other automated equipment. In most cases, a higher salary and/or bonus is needed to attract these qualified workers.
Third, investments in closed housing are high. Therefore, most farmers will need a loan. As a rule of thumb on West Java 70 to 80% of the total investment can be financed by a loan, 20 to 30% should be funded by the farmer. Banks in Indonesia have strict conditions for loans in the poultry sector, resulting in high interest rates and short repayment periods. Showing good production results and keeping record of technical data and financial results of several previous years (usually 3) is often needed to convince the bank of the potential of the investment. Some banks have special programmes for investments in closed housing.

6.7 Automated data collection at MBLC and broiler farms

Broiler farmers considering innovations to improve technical and economic results, are strongly advised to use standard data collection protocols to evaluate the efficiency of innovations. Due to market fluctuations in price and product quality it is advised to follow up on several succeeding rounds of data collection to determine farm results. It appeared difficult for farmers to use different data collection formats at the same time (own and DIFFS-Live forms). Only four (out of six) farmers were able to provide sufficient and adequate data. An on-line automated data collection system would provide valuable recordings to monitor the effect of management decisions. This next step into automation was taken by the Modern Broiler Learning Centre (MBLC) of project partner Medion, where parts of the Sommen Farm Management Software was integrated into their daily management practise.

At the MBLC, all technical and economic data are collected and stored in an automated data collection system developed for this purpose by project partner Sommen BV. This ICT-based farm monitoring and management tool was developed in 2015 and 2016. This system was first implemented in practice in the MBLC in Q4 2016. Real time data as well as historical technical and climate data can be used for training purposes and production improvement. Data can be entered on a website manually or data can be sent to the website automatically. A web application including the development of a portal, software and a Chain Management & Information System can be equipped with many levels (see text box) depending on the user's interests and future plans. For a regular independent farmer owning one farm with multiple broiler houses, the Lite Version will be sufficient to collect the relevant technical and economic data, and to make technical and economic overviews per round and per broiler house. This information will be needed as baseline, and as reference guide of how to improve production results and economic gain. For larger independent farmers with more farms or more than 100,000 bird places, the Enterprise version will be more suitable, especially for future references. In this project, it was decided to develop the Enterprise version, which includes the modules "Basic" and "Lite".
The hand-held device can be installed and connected to the central data base of Medion, where on-line and ready-to-use data is generated to provide direct insight in the broiler production process and financial consequences. This allows broiler farmers for example to see the effect of early or delayed delivery of slaughter ready chicken to the market at different prices, in relation to more or less feed delivery.

6.8 Training on Animal Focussed Management (AFM)

To increase the Animal Focused Management (AFM) knowledge and skills among the staff of the broiler pilot farms several training activities were carried out during the project. This was done by direct training of the farm managers and staff but also via the training of trainers (ToT). Therefore employees of DINAS were invited to join the training as well. The training material that was developed is available in the Additional Material section of this report.

6.8.1 Trainings conducted

Several training missions on different topics were carried out (Table 6.11). Due to the transition to closed houses more knowledge and skills on climate, control equipment and other automated systems are necessary. Therefore a 2 day training program was carried out for broiler farm managers, DINAS, Medion staff, Chiami vocational school, and GOPAN representatives in 2017. This Expert Broiler Farm Manager training contained the following subjects:
Part 1:
- Essentials of good brooding practise
- The right feed at the right time
- How to improve broiler health + dissection practical training

Part 2:
- Data collection to optimise technical and economic results
- Ventilation principles for broilers in hot climate
- Water quality in broiler houses
- Innovations in the broiler sector based on AFM

Purpose of the first training was to increase the Animal Focused Management (AFM) knowledge and skills among broiler farm trainers. Purpose of the second training was to increase the Animal Focused Management (AFM) knowledge and skills among trainers for broiler farmers. For the total training program more than 40% of the participants were farm managers or staff, around 30% were employees of the organising partner PT Medion, about 15% work for the regional livestock services (DINAS), 10% are representatives of GOPAN, and 5% are working for other organisations.

Table 6.11 *Overview of trainings.*

Title training	Place	Farms	Duration	Participants
Broiler management	Bogor	CV KSJ / Berkah Group	Day	17
Broiler management	Bekasi	Galus Prima Farm / BPC	Day	19
Broiler management	Bandung	Panggih Mulia Utama	Day	27
Closed house management	Bogor	BPC	½ day	17
Closed house management	Bekasi	Berkah Group	½ day	18
Management of the MBLC	Bandung	Medion	Day	16
Water management	Bekasi	Berkah Group	½ day	94
Water management	Bogor	BPC	½ day	12
Broiler management	Bogor	Anindys Farm	½ day	16
Closed house management	East Jakarta	AM Santi Farm	½ day	19
Water management	Bogor	Soma Farm	½ day	6
Expert Broiler Farm Man. Part 1	Bandung	Several	1 day	40
Expert Broiler Farm Man. Part 1	Bogor IPB	Several	1 day	53
Expert Broiler Farm Man. Part 2	Bandung	Several	1 day	33
Expert Broiler Farm Man. Part 2	Bogor IPB	Several	1 day	62
			Total	**447**

6.8.2 KAP analysis of the trainings

Due to timing of the project and the course we did not make an inventory of existing knowledge among participants. However, after the major part of the training sessions a KAP (Knowledge, Attitudes and Practices) survey was performed to collect information on what is known, believed and done in relation to the different training sessions. A list of major items, who were addressed during the trainings, were filled in together with the different attendees. Besides the topics also information was collected about issues who were not implemented in daily practice by the farmers. In Table 6.12 an overview of the items and the results of implementation in practice and the reasons of not implementing are presented. Overall the training program was successful with 80% of all items being reported as implemented in daily practice of the pilot broiler farms. From this Table it is clear that particularly the items 'comparison of data', measuring body temperature 1st week and prevention of heat stress need more attention within the training program. A more practical approach must be discussed and the training program had to be adjusted to a combination of lectures and implementing of the theory in a more practical setup.

Table 6.12 *Implementation of training issues and reasons for not implementing.*

Items	Yes	No	Yes (%)	Reasons for not implementing
Basic principles of broilers:				
Data collection: water intake, feed intake, mortality, remarks per flock	15	0	100	
Data collection: calculation of FCR, IP per flock	15	0	100	
Comparison between flocks, houses and farms	10	5	67	They don't see benefits for comparison
Environment of broilers:				
Measuring body temperature 1st week	3	12	20	Not enough equipment Use bird behaviour (spreading through the house) for temperature monitoring No practical training with real DOC's
Prevention of heat stress, e.g. cold water, adding electrolytes, etc.	9	6	60	Costs of these methods related to the benefits are prohibitive
Cleaning water pipes during the empty period	15	0	100	
Improved water system: e.g. preventing heating up water, etc.	12	3	80	Costs of these methods related to the benefits are prohibitive Not convinced about the positive effects of implementing Inferior quality of the materials
Extra recirculation fans	12	3	80	Costs of these methods related to the benefits are prohibitive More motivated to invest in closed houses than just additional extra fans
Broiler Signals:				
Recognize 'panting' behaviour	15	0	100	
Use the principle of Look-Think-Act	14	1	93	Education level of farm staff is low Method is not so easy to use Need more clear description

6.9 Future improvements based on AFM

A list of future improvements based on Animal Focussed Management is formulated and presented below. In general, an integral approach to improve management factors is recommended throughout the entire production chain to diminishes failure costs in the chain:

1. Consistent and adequate data collection
2. Improved transport from hatchery to broiler farm
3. Improved brooding practise
4. Development of on farm hatching systems
5. (Semi)closed houses and improved ventilation techniques
6. Improved water quality management
7. Decreased antibiotics use
8. Alternatives to antibiotics

Ad. 1 Consistent and adequate data collection

Improvements in technical and economic results start with proper and uniform data collection. Insight in performance and economic data is a prerequisite for production improvement, climate control and resource optimisation and decreasing the pay-back time of investments. Without uniform data collection and data processing, no structural improvements in technical or economic results can be expected. When data collection is more automated the Indonesian broiler industry will benefit.

Ad. 2 Improved transport from hatchery to broiler farm
Quality of eggs and one-day old chicks are influenced by several factors like transport conditions (e.g. temperature and relative humidity), transport distance, infrastructure, road quality, etc. Improvement of these conditions is necessary to improve day-old chick quality.

Ad. 3 Improved brooding practise
The incubation process plays a crucial role when to optimise technical and financial results in the broiler meat chain. Improved brooding practices are the key for a more efficient and profitability. This results not only in an increased hatchability, but also in an improved chick quality, chick survival, broiler growth, feed conversion and slaughter yield.

Ad. 4 Development of farm hatching systems
A development in the Netherlands is to hatch the eggs not in the hatchery, but on the farm in the broiler house. The last five years different systems e.g. (X-treck and One2Born) are developed and tested in research facilities and in the field. Advantage of this system is the direct access to feed and water after hatch. Above this, cross-contamination in the hatchery might be reduced, and chick handling stress and transportation stress would be no issues any more.

Ad. 5 (Semi) closed houses and improved ventilation techniques
Using open houses (without forced ventilation systems) for broilers is a low cost solution. Open houses, however, give broiler farmers serious problems due to the low biosecurity levels and the limited opportunities to control temperatures and minimize heat stress. This leads to increased disease pressure, high levels of use of antibiotics and increasing heat stress in older animals. The growth of birds slows down and the mortality rate in the traditional broiler farms is high. The genetic potential of the broilers (growth, efficiency, and uniformity) is not fully used and productivity and animal health and welfare can be improved by an investment in improved broiler houses. A transition from open to semi-closed (or totally closed) houses is necessary to bring the broiler meat industry to the next level. Product quality and safety will become a very important issue in the nearby future in Indonesia. Especially in a climate (high temperature in combination with high humidity) as in Indonesia, open houses are very unproductive, unhealthy (AB use) and impaired welfare.
Installing semi-closed or even closed houses improved production performance with more than 30% and payback time of the investment is around 4.5 year.

Ad. 6 Improved water quality management
Water is an essential biological ingredient of life and not only a vital nutrient, but it is also involved in many essential physiological functions (e.g. digestion and absorption of nutrients, thermoregulation and an essential part of blood and body tissues). Good water quality is essential for production performance, health and welfare. Therefore actions must be taken to improve the water quality by decreasing bacterial contamination, improved water systems and improved water quality protocols.

Ad. 7 Decreased antibiotics use
Antibiotic (AB) use in Indonesia is a serious concern for human health due to Antimicrobial Resistance (AMR). A small inventory revealed that average AB use in Indonesia is, compared to the Dutch situation, extremely high. Improved conditions for broilers, improved farm management and awareness on the risks of use of AB is required to reduce the use of AB to more acceptable levels.

Ad. 8 Alternatives for antibiotics
The debate over the risks associated with the use of antibiotics has fuelled interest in alternative means to control disease and maintain current production levels. Different alternatives for antibiotics, such as probiotics, prebiotics, phytotherapeutics, bacteriophages, organic acids and enzymes have been investigated for their improvement of intestinal health and animal performance in general.

7 Main lessons learnt and outlook for future implications of the programme

Ferry Leenstra, Peter van Horne, Rick van Emous and Gemma Tacken

In this section, we discuss the main lessons learnt concerning the implementation process of the programme, for the consumer campaign, the activities with regard to the poultry slaughter sector and those for the broiler sector respectively.

7.1 Consumer campaign

The pilot campaign learned that the combination of a social media campaign (especially for creating awareness) and food truck events (for creating intention to buy) is a good formula. Especially the personal approach of women in Indonesia seemed to be effective.
The positive tone of voice in all *media coverage* was very remarkable, given earlier publications about this issue. Journalists endorsed the campaign message and the necessity of a transition towards a cooled poultry meat chain that is supplied by local farmers and includes medium sized slaughterhouses with higher hygiene standards located outside urban areas. A media overview learns that ASUH is a business-to-business term for cooled chicken, while Ayam Dingin Segar, as we used in the consumer campaign, is more business-to-consumer language.
The actual desire to try and buy cooled poultry meat, turned out to be bigger than expected. On social media and during the food truck event people were very interested to know where they can buy the Ayam Dingin Segar poultry meat. This indicates that the targeted consumers in Jakarta are receptive to the campaign message. Selling poultry meat during the road show is effective to 'capitalize' on the interest and desire of the target group. While preparing and eating the meat they bought during the road show, they 're-live' the event and the information for a second time. Next to that the effect measurement of the campaign learned that is was mainly effective in the last two steps of the AIDA model: Desire and Action.
Engaging influencers (such as bloggers) and VIPs to endorse the campaign and bring across the message seemed to be also essential. For the press, the contribution of a high level employee of the Ministry as a spokesperson was important to cover the news. For consumers, the endorsement of 'media cook' Edwin Lau helped a lot in attracting and engaging people. Social media is essential in this modern age. Not only to educate and inform consumers about cooled poultry meat (from production process to preparation and recipes), but also to generate peer pressure by involving consumers in the conversation on cooled chicken.
An important side effect of the campaign was the support from stakeholders in the poultry chain. Throughout the campaign (and its development), we have informed and consulted the main stakeholders in the Indonesian poultry chain. In public and one-on-one meetings, we have informed them about the progress and discussed the design, strategy and results of the campaign.
One of the main lessons of this programme is that social media campaigns not automatically result in converting buying behaviour. In this work package, most followers were from Bekasi, while the buying intention in Bekasi was not higher than in other regions. This is presumably due to the fact that the Jakarta region is so large, that targeting a significant proportion of the consumers in the area requires a multitude of the budget of this pilot campaign. The observed effects are hopeful for further enrolment of the campaign, but the people in the longitudinal test were not especially targeted. Next time this connection could be made more profound.
Furthermore, it was found that the communication between the people that measured the impact and the people that made the campaign can contribute to the quality of work by both sides. For the campaign team it meant more insights into how to make goals more concrete (e.g. increase in %), but also to steer the campaign into directions where it was needed (e.g. important food choice motives). The impact measurement also benefitted because it could focus the measurements on what the campaign tried to achieve (e.g. perception of quality).
The negotiations on the letter of intent learned that Indonesian and Dutch law with regard to copy rights on campaigns are different. In the Netherlands the creative owner of a campaign remains his rights, while in Indonesia, this is not (always) the case.

7.2 Poultry slaughter sector

7.2.1 Main lessons learnt

The inception phase of the programme was carried out by a different team than the programme itself. Due to the background of the teams the inception phase focused more on logistics and business development, while in the implementation phase the focus was on realization of hygienic slaughter and a cool chain for poultry meat. Due to this shift in focus there was also a change in one Indonesian programme partner. This shift in focus and partner was time consuming as the specific situation of small scale slaughter plants in West Java now became only clear during the programme. A better link in focus and staffing between inception phase and programme implementation might prevent such delays and provide programmes with a head start.
All participating slaughter men acknowledged the advantages of hygienic slaughter, a cool chain in place and good waste water treatment. Although the slaughter plants were willing to develop business plans for investment in hygiene, cool chain and waste water treatment, none were actually converted in an investment. This was because the customers of these slaughter plants were not interested in improvements on these topics. Therefore, the participating slaughter men did not want to invest in such improvements, which would only increase the production costs, without any direct revenues for their business. When their customers will start demanding for such investments, they would be happy to receive aid from a programmes as this. This implies that the timing of such programmes should match the development in the market as well as the investment scheme of the companies. Although there was a lot of interaction with different stakeholders in the programme, it would have been more effective to put more efforts in evaluating and matching the specific goals and demands of all stakeholders at the start of the programme.

At the start of the programme, the focus was on small and medium sized private poultry slaughter plants. Later in the programme we found that most of these slaughter plants did not have all required permits and licenses. It was decided by the programmes steering committee that only fully legal companies could be supported in investments. This shift in focus was not efficient, as relations built up with a number of slaughter plants had to be ended and with others new relations had to be built. Especially the possibilities for investments in slaughter facilities with financial help of the programme suffered from these decisions. Also the uncertainty about the position of the governmental slaughter locations (this position and the management of the facilities changed in the course of the programme several times) hampered the effective implementation of the programme. Advantage of the shift in focus with regard to slaughter companies was, that quite a large number of slaughter company managers was exposed to ideas on development of their business, more hygienic slaughter and options for waste utilisation.

It would have been more effective to introduce the demonstration and training slaughter facilities in an earlier stage and done so, have the opportunity to assist in hands-on training of slaughter men for a longer period. Training for and implementation of new techniques and new equipment requires a longer period than the two months that were now available. The latter limited the number of contact moments, which should be more and wider apart for full implementation of new techniques in standard procedures.

Involvement of students in interviewing slaughter plants and measuring of details in the process was positive. This serves two goals: the information is gathered and students obtain hands-on experience on improvements in fields where they might be employed.

7.2.2 Outlook for future implications of the programme

The consumption of poultry meat in Jakarta is expected to increase in the coming years due to higher incomes and an increased population. Furthermore, the higher income consumers will demand more and more safer chicken meat, produced under hygienic circumstances. At the same time, it can be expected that small-scale slaughter men will remain an important part of the market because they are an integrated part of society providing a lot of employment. Any developments that can help such small-scale slaughter men to improve hygiene and food safety and reduce environmental nuisance in a simple way will be very relevant the coming years. The new slaughter line lay-out, which can be easily copied in Indonesia can be such an important development. The training courses developed on these topics aid in preparing the slaughter company management and slaughter company staff to deal with the demands on improved hygiene, environmental impact and food safety.

The resistance of people against poultry slaughter in residential areas due to pollution, smell and public health hazards is growing. The pressure on the government to remove the chicken slaughter from these areas is increasing. A clear policy on the future of the chicken slaughter sector is needed that balances different public and private interests. This policy should be consistent at all governmental levels.
Several supply chain configurations co-exist in the chicken supply chain in Jakarta: micro-slaughterers, public slaughter points, SMEs and large integrators. Each supply chain configuration favours different public and private sector interests related to employment, affordability of chicken meat, the environment, public health and food safety, but in the same time opposes others. Prioritisation of public policy directions in these fields is required before any structural development can be made. It is essential that national and regional government bodies as well as private sector stakeholders share their prioritisation and find ways over bridging differences where necessary.

The new slaughter line lay-out installed at the public slaughter facility Rawa Kepiting is currently being used by a small-scale slaughter man. The new slaughter line lay-out and the new waste water treatment installed at IPB Diploma Programme in Bogor is being used for training of students that will be working in the poultry meat sector in the future and will provide training for private slaughter men. The Indonesian counterparts in the programme (IPB, private consultants, students) have gained relevant knowledge on hygienic poultry slaughter through the programme and they will continue to use this knowledge to advise on Indonesian poultry production.

The private slaughterhouse that invested in building, equipment, training of staff and procedures to obtain the HACCP-certificate to become preferred supplier to KFC, will continue to use the equipment and management practices installed for higher hygienic standards, effective cooling of carcasses (e.g. screw chiller with contra flow and ice flakes), slaughter processes (e.g. opening of the carcasses for evisceration of the animals) and welfare of the received animals. The company will be an example for other growing poultry slaughter enterprises.

The policy advice on growth scenarios of the poultry sector is already being used, as can be deducted from a government representative indicating at the final programme workshop that they will open a new governmental slaughter facility in 2018. A representative of the training centre in Cinagara indicated to have integrated part of the course material "Pre-Requisite Programmes for Poultry Abattoir Supervisors and District Officers" in their normal curriculum for poultry slaughter.

7.3 Broiler production

7.3.1 Main lessons learnt

The implementation of innovations and interventions on pilot broiler farms was seriously delayed due to two important external factors. The first factor was the market circumstances of the broiler meat industry in Indonesia which caused a decreased interest of farmers in interventions and innovations on the farms. Probably this also caused pilot farms to leave the programme which had a negative impact on the progress of implementing the interventions on the pilot farms. Another important external factor was the illness of the initial work package leader. This resulted in roughly half a year delay in especially the pilot farms activities and interventions.

Another important factor in implementing innovations is the difference in culture which led to different expectations. During conversations people were very friendly, helpful and willing to join the programme and interested in interventions. However, after leaving the meeting they often returned to the same daily well known routine without changing management style or implementing innovations. For innovations that require substantial investments, availability of money is a problem: the bank sector considers poultry production too risky, therefor private money seems a prerequisite for such investments in broiler houses. However, money is not a limiting factor in improving farm management. After contracting a local Indonesian Poultry Coordinator, more energy and progress was put in the programme. The lesson we learnt is that such a programme needs a full time, or at least 50%, local coordinator with good contacts with the local industry, different government levels (ministry, provincial, local), extension service people like DINAS and representatives of the membership organisations of independent poultry farmers in Indonesia (GOPAN). Moreover, the local coordinator must be an employee of one of the partners in the programme. Local partners in such a programme have a high interest in a smooth progress of the programme and positive appearance of the programme and the results. Another lesson is that especially local partners are important for the

energy, critical mass and progress of the programme. More commitment and progress of the programme and implementing of innovations can be improved by clear agreements supported by LOI's (Letter Of Intents), fast follow-up, more support during implementing and more training of farm managers and staff about innovations.

7.3.2 Outlook for future implications of the programme

In general, the outputs and outcomes of the programme are relevant for the next five to ten years. Improving performance, health and product quality are major factors for the profitability of broiler farms. Therefore the outputs and outcomes of the programme should be used in daily broiler practices to improve the above mentioned topics. The pilots in improvement of water quality and/or semi-closed houses showed a positive return on investment. The improved water system is a short-term adjustment on broiler farms which will be rolled-out at more broiler farms within the next five years. PT Medion developed a blue print of the innovations which improves the quick implementation at other farms. The results of the improved broiler house (semi-closed broiler house) of this programme will be very relevant for roll out for a longer period (up to ten years or more). The results of the programme will be the beginning of a transition from traditional open houses to more controllable modern type (semi-closed or even total closed) broiler houses. The MBLC (Modern Broiler Learning Centre) will play a major role in this transition in broiler housing in the Indonesian Small and Medium Enterprises broiler sector.

Improving the water quality is a very important factor to improve the production performance and hygienic quality of broiler meat. The improved production performance resulted in a roughly 10% higher Production Index and income. This will improve the profitability of the Small and Medium Enterprises. In turn, this will lead to a more sustainable and stronger broiler meat sector. Due to the lower bacterial contamination of the water, antibiotic use can be decreased. Therefore more farmers will be willing to invest in an improved water system.
It is likely that within ten to twenty years all open broiler houses in West Java Indonesia will be replaced by semi-closed or even closed broiler houses. Financing of the required investments is still a major obstacle to a faster transition to (semi-)closed housing. Farm managers and staff are convinced of the benefits of this new type of broiler house. In the Indonesian climate (high temperature in combination with high humidity) open houses are unproductive, unhealthy (and thus increasing use of antibiotics) and impair animal welfare.
Particularly the MBLC and PT Medion will play an important role in knowledge transfer about the transition to the semi-closed houses for broilers. An intensive training programme using the MBLC, supported by PT Medion, will be very relevant for the coming years.

To explore the potential of nature to improve the quality of life

Wageningen Livestock Research
P.O. Box 338
6700 AH Wageningen
The Netherlands
T +31 (0)317 48 39 53
E info.livestockresearch@wur.nl
www.wur.nl/livestock-research

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