This is to certify that the

dissertation entitled

ECONOMICS OF ESTABLISHING A LOW-VOLUME POULTRY PROCESSING PLANT: A COMPUTER APPLICATION DESIGN

presented by

Vusumuzi Dhladhla

has been accepted towards fulfillment
of the requirements for

Doctor of Philosophy degree in Animal Science

Allan P. Rahn
Major professor

Date December 27, 1991

ECONOMICS OF ESTABLISHING A LOW-VOLUME POULTRY PROCESSING PLANT: A COMPUTER APPLICATION DESIGN

By

Vusumuzi Dhladhla

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Animal Science

1991

ECONOMICS
PROCESSING

Poultry process

poultry production.

low-volume broile

ume processing co

small scale broil

mation. The objec

the mechanical trans

completeness of this

application design t

plant and then deter

In a manual pro

threshold is reached

50, 40, or 30 birds

rate is $1.00, $2.00

respectively. Beyond

for labor is desirabl

ABSTRACT

ECONOMICS OF ESTABLISHING A LOW-VOLUME POULTRY PROCESSING PLANT: A COMPUTER APPLICATION DESIGN

By

Vusumuzi Dhladhla

Poultry processing is a crucial stage or phase of poultry production. This study concentrates on the economics of low-volume broiler processing. The rationale for low-volume processing consideration is that a previous MSU study on small scale broiler processing has attracted considerable attention. The objectives of this study were to determine the mechanical transition threshold, refine and expand completeness of this previous study. Then make a computer application design that could be used for synthesizing a plant and then determine the processing costs.

In a manual processing plant the mechanical transition threshold is reached when the plant processes 165, 80, 60, 56, 40, or 30 birds per hour when the labor compensation rate is $1.00, $2.00, $3.00, $4.00, $5.00 or $6.00 per hour, respectively. Beyond these points, substitution of equipment for labor is desirable.

Four mechanized

processing capacitie

birds per hour.

Plant A, B, C or D,

requirements for pla

,498; $186,510;

Processing cost

techniques. On a per

,6529, $0.6346, $

respectively, ind

processing cost per

that these plants we

days a week, 8 hours

assumptions were: a

, a building cos

per annum inter

A sensitivity a

Labor compensation r

was made to infer th

The impact of intere

compared to

changes. When relati

increase of $1.00

reducing the rate

Percent capacity util

Four mechanized processing plants were synthesized. The processing capacities of these plants were 200, 350, 500 or 1200 birds per hour. These plants will be referred to as Plant A, B, C or D, respectively. The total investment requirements for plant A, B, C or D were $139,498; $186,510; $263,476 or $510,056; respectively.

Processing costs were determined using budgeting techniques. On a per bird basis, the processing costs were $0.6929, $0.6346, $0.5915, or $0.4539 for plant A, B, C or D, respectively, indicating that as output is increased the processing cost per bird declines. The base assumption was that these plants were operated at 100% capacity. That is 5 days a week, 8 hours a day, and 50 weeks per year. The other assumptions were: a labor compensation rate of $6.00 per hour, a building cost of $150 per square foot and an 8 per cent per annum interest rate.

A sensitivity analysis using capacity utilization, labor compensation rates, building costs and interest rates was made to infer their impact on processing costs per bird. The impact of interest rates and building cost changes were minimal compared to capacity utilization and labor cost changes. When relating labor cost to capacity utilization, an increase of $1.00 in labor compensation rate is similar to reducing the rate of plant operation to between 50 and 60 percent capacity utilization.

To my wife (Mon

[illegible] who were a

my parents (Israe

[illegible] and my sister

[illegible] soon after be

[illegible] of the Apart

[illegible] Republic of Angol

[illegible] said, "we sha

[illegible] country (South

[illegible] and want to re

[illegible]ratic South Afr

The Rahns: Dr. A

[illegible]ittee), Letha (w

[illegible] thanks for bec

[illegible] was a wilderness

To my committee

[illegible] Roy Emery, thank

[illegible] a word of thank

[illegible]ck and Ashly f

[illegible]pment and the pr

ACKNOWLEDGEMENTS

To my wife (Monica), and my two sons (Shaka and Sbusiso) who were a source of support and encouragement. And to my parents (Israel and Peggy), my brothers (Dan and Sipho) and my sisters (Sesi and Thandi). I hope to see my family soon after being separated from them since 1976 because of the Apartheid system. As the late President of The Republic of Angola, Agostinos Neto (The Poet of the People) said, "we shall return" I am planning to return to my own country (South Africa). I have spent fifteen years in exile and want to return to a non racial, non-sexist, democratic South Africa that is in the making.

The Rahns: Dr. Allan Rahn (chairperson of my committee), Letha (wife), Jennifer (daughter), and Michael (son) thanks for becoming my second family, otherwise the USA was a wilderness.

To my committee: Denise Smith, Cal Flegal, Bob Deans, and Roy Emery, thanks for your time and input in my study. Also a word of thanks should be forwarded to Brower, Pickwick and Ashly for providing information on the equipment and the price lists.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Poultry pro
the declining
ward greater c
creased mechan
e of capacity
fficient to of
vestment requi
erton (1986) es
r week plant.
om the ground-
volves remodel
lants.

The focus o
enterprises. The
perations in th
egligible. This
There is a limit
rocessing since
perations. Ther
re interested i
low-volume opera-

Chapter 1.

OVERVIEW OF THE STUDY

I. INTRODUCTION

Poultry processing plants continue to grow in size while declining in numbers, leading to a longrun trend toward greater concentration. The larger plants with increased mechanization, greater scale economies and better use of capacity produce efficiencies that are more than sufficient to offset rising input costs. The capital investment required to establish a large plant is sizeable. Barton (1986) estimates $25,000,000 for a one million birds per week plant. Very few new plants have been constructed from the ground-up in recent years. Most of the activity involves remodelling or add-on (expansion) of existing plants.

The focus of this study is on low-volume poultry enterprises. The contribution of low-volume poultry operations in the U.S. to the total production of poultry is negligible. This is not the case for developing countries. There is a limited amount of information on low-volume processing since most of the attention is on large scale operations. There are several reasons some entrepreneurs are interested in low-volume operations in the U.S. First, low-volume operations have low capital requirements. Second,

ere is the n

ible. Sinc

sts the "opp

-volume pla

ecial market

ree concerns

environmen

ncern and (

ople are loo

ese product

aturally gr

eroids". A

nagement Sy

nsumers are

oducts (Ha

Third,

System. For

airy, beef

ultry prod

iversificat

isk.

For peo

elling chic

eople who a

aising poult

there is the notion that low-volume operations can be flexible. Since fixed costs are low relative to variable costs the "opportunity cost" of inactivity are reduced. The low-volume plants can easily adjust to produce for a special market niche. These niche markets are the product of three concerns:
(a) environmental concern, (b) health and nutritional concern and (c) taste consciousness. In these markets people are looking for a differentiated product. Usually these products are marketed with appealing phrases such as "naturally grown", "chemical free", "without hormones or steroids". A recent survey by Consumer Information Management System (CIMS) of Georgia indicate that some consumers are dissatisfied about the quality of such claimed products (Haung and Sukant, 1990).

Third, this can be considered as an alternative farming system. For farmers engaged in other enterprises such as dairy, beef or cherry production, involvement in low-volume poultry production could supplement their farm income. Diversification of business enterprises can also help spread risk.

For people working in off-farm occupations, raising and selling chickens can also supplement their income. For people who are unemployed or underemployed in rural areas, raising poultry can be a major source of income. Involvement

poultry meat

employ some

tries (e.g

se because

ined there

tries. The

sed on small

farmers. Pr

licy implica

ective, by

come generat

e able to ope

d well organ

A distinc

f size should

rm economies

appens to per

tupled, tripl

economies of s

per unit cost

e halved, whi

ncrease in pr

f size in the

rizontal inte

easons why ver

in poultry meat enterprises can substitute for off-farm jobs and employ some underutilized resources. For developing countries (e.g., in Africa), low-volume operations make sense because of their low capital requirements. Also, it is claimed there is labor in excess in the developing countries. The development strategy in many countries is based on small holder farmers that constitute the majority of farmers. Promoting low-volume operations has social policy implications in addition to the profit motive objective, by creating opportunities for people to have an income generating activity. The low-volume plants will never be able to operate as efficiently (technically) as larger and well organized plants.

A distinction between economies of scale and economies of size should be made. According to Debertin (1986) the term economies of scale could be used to describe what happens to per unit cost of production when all inputs are doubled, tripled, or halved. On the other hand, the term economies of size could be used to describe what happens to per unit cost of production when output is doubled, tripled, or halved, while the input levels do not necessarily increase in proportionate amounts. The technical economies of size in the poultry industry shows that both vertical and horizontal integration should be the norm. There are several reasons why vertical integration has taken place in the

ustry. Ar

nstant supp

oduction ac

ality, and

II. PURPOSE OF

An MSU st

time process.

existing and po

internationally

this study for

computer appl

additions and (

highlighted.

Three siz

, 500 and 1

as to determi

economically p

total investme

some necessary

refrigeration,

number of labo

based on proces

This resulted i

farmers and of

industry. Among those reasons is the need to assure a constant supply of uniform sized birds, scheduling production activities to ensure operation at optimum capacity, and ensure control and/or power.

II. PURPOSE OF THE STUDY

An MSU study (unpublished MS Thesis, 1988) on low-volume processing has received a lot of attention from existing and potential entrepreneurs, domestically and internationally (See Appendix C). There is a need to refine this study for completeness and ease of accessibility (computer application). A brief review of the study, and the additions and enhancements that are to be made need to be highlighted.

Three sizes of processing plants were synthesized, a 350, 500 and 1200 birds per hour. The thrust of that study was to determine the capital investment requirements for economically plausible equipment and labor combinations. The total investment requirement in that study did not include some necessary peripheral equipment like boilers, refrigeration, generators, and ice making machines. The number of laborers needed in the processing plant was only based on processing line equipment operation assignments. This resulted in excluding labor needed for removing feathers and offal during processing, cleaning of the plant

nd removing

ppers, and

as also excl

nsidered. F

n put suppl

spector's c

In this

ressed. Al

ur capacity

he smallest

The appr

processors, c

processor? Fo

operations ca

producer and

them for home

By definition

The seco

this consists

birds, then s

then pick up

The thir

motivated ent

own, but only

custom proces

and removing by-products, the moving of live birds to the hangers, and to the refrigeration area. Management personnel was also excluded. The logistics for the plants were not considered. For example, where to store the produce, where to put supplies, what to do about by-products, docking area, inspector's office space and equipment.

In this study the above mentioned concerns will be addressed. Also, an additional plant size of 200 birds per hour capacity will be synthesized. This plant will represent the smallest size of the low-volume plants.

The appropriate question is: who are the low-volume processors, or what is the definition of a low-volume processor? Four categories of low-volume processing operations can be considered. The first group is the "hobby producer and processor" that raise a few birds and processes them for home consumption, and/or for friends and neighbors. By definition this group is not profit motivated.

The second is the commercial producer or grower, and this consists of profit motivated entrepreneurs. They grow birds, then send them to custom processors for processing, then pick up the processed birds and sell them.

The third group is the custom processors who are profit motivated entrepreneurs. They do not raise chickens of their own, but only process at a fee for other poultry producers. Custom processors do not only process broilers, but include

ther poultry sp

nits.

The fourth

e commercial

e birds or co

erate supply

The basis

llowing chara

luency of pr

ocessor has a

s the main obj

The plant

ynthesized in

easonal custo

easibility c

quipment comm

plant design

ccount for mo

nvestment, ha

gineered des

easonal-hobby

hey are not

eals are not

er satisfact

irds and cos

other poultry species (ducks, geese, pheasants, quail and/or rabbits.

The fourth group is the commercial producer/processor. The commercial producer/processor may personally raise all the birds or contract with other producers to ensure adequate supply of birds.

The basis for this classification is based on the following characteristics: activities, profit motive, and frequency of processing. In this study a low-volume processor has a commercial operation, and the profit motive is the main objective.

The plant sizes of 350, 500 and 1200 birds per hour synthesized in the previous study are also "too big" for seasonal custom processors. This is due to the economic plausibility constraint that was used in selecting the equipment combination of the systems. This constraint forced a plant design where any capital item, if anticipated to account for more than 10 percent of the initial equipment investment, had to be utilized at more than 80% of its engineered design capacity. From the above criteria, seasonal-hobby processors (with idle equipment most of the time) are not economically sound ventures, but maybe their goals are not solely of profit motive. Maybe these people get satisfaction from processing their own or neighbors' birds and costs are not their primary concern. To make

ormation ava
ess than 350 b

This also
mber of birds
mpletely man
processing equ
oves, bucket
and thermomet
physically pos
manual process
mechanical tec
will need to b
referred to as

The requi
categories of
with the hobby
rudimentary to
followed by mo
different size

information available for such clientele, a plant size of less than 350 birds per hour was synthesized.

This also aroused interest in determining the maximum number of birds that could be processed per unit time in a completely manual processing plant. A plant where no processing equipment is used except loose tools such as knives, buckets, barrels, containers, heating devices, and hand thermometers. At some volume point it will not be physically possible or economically desirable to only use manual processing techniques. At this point and later some mechanical technology that substitutes equipment for labor will need to be introduced. This point in this study will be referred to as the "mechanical transition threshold".

The requirements for establishing the different categories of low-volume operations will differ. Beginning with the hobby producer/processor, being the simplest or rudimentary to the low-volume commercial enterprise, then followed by moderate and large processing plants. The different sizes of plants will be identified.

II. OBJECTIVES

To determine
processing
without us

To synthesi

To refine a
and improv

III. METHODOLOG

The three
and 1000 birds
set as a base
synthesized. T
1000 birds per
B, C or D, res
using secondar
processes, eq

The "mech
using time an
actually obse
performed. Co
was made for
equipment (ty
either be by
contact at th

III. OBJECTIVES

1. To determine the "mechanical transition threshold" where processing is not feasible or economically desirable without using mechanization.
2. To synthesize a processing plant of 200 birds per hour.
3. To refine and update the earlier study for completeness and improved accessibility.

IV. METHODOLOGY

The three synthesized processing plants of 350, 500, and 1200 birds per hour, from the 1988 MSU study, will be used as a base. Another plant of 200 birds per hour will be synthesized. The four processing plants 200, 350, 500 or 1200 birds per hour will henceforth be called plant size A, B, C or D, respectively. A thorough and systematic search using secondary sources will be used for identifying all the processes, equipment, machines, manufacturers and dealers.

The "mechanical transition threshold" was determined by using time and motion data from previous research, and by actually observing and measuring some processing activities performed. Contact with equipment manufactures and dealers was made for obtaining current information on processing equipment (types, availability and prices). The contact was either be by telephone, correspondence and/or personal contact at the Southeastern International Trade Show in

...ta. Enqui

...itects, e

...ormation ab

...inent iter

A survey

...ner informa

...e visits we

Computeri

...ing a comput

...d a screen m

...f this menu-d

...rst, to all

processing sy

...ailable in

...ice, detai

supplier of

technically

...o calculat

different

which var

sensitivity

Atlanta. Enquiries also were made from relevant people (architects, engineers and building contractors) to gather information about building cost, utility rates, and other pertinent items concerning processing plants.

A survey was sent to custom and hobby processors to gather information concerning their processing activities. Some visits were made to custom/hobby processors.

Computerized information manipulation will be made using a computer programming language (TopSpeed Modula-2), and a screen manipulating program (Repertoire). The essence of this menu-driven computer application is three fold. First, to allow a potential investor to synthesize a processing system by selecting equipment combinations available in the database (providing equipment type, model, price, details about the equipment, and the manufacturer or supplier of equipment) to set up a processing system that is technically feasible (the program will ensure that). Second, to calculate the processing cost per unit based on the different sized plants, organization, and equipment selected (which vary by manufacturer or supplier). Third, to make sensitivity analyses.

Historical P

According

the early st

meat was pr

flocks for egg

consisted of he

replacement hat

haphazard and r

there was expar

satisfy the eve

well, 1963).

expansion. The

also had a pro

products. Incr

of this indust

The initi

1944, did much

industry (Tobi

interest was to

the broad brea

and developmer

of poultry has

Chapter 2.

LITERATURE REVIEW

I. Historical Perspectives of Poultry Processing

According to Gordy (1974) the 1920's could be regarded as the early stage of the broiler industry. The poultry sold for meat was primarily a result of the keeping of laying flocks for egg production. The typical poultry meat consisted of hens culled from laying flocks, and male of the replacement hatch. During this period production was haphazard and not well organized. As the industry developed there was expansion of low-volume operators attempting to satisfy the ever rising demand for poultry meat (Rogers and Badwell, 1963). World War II furnished even more impetus for expansion. The war, with its meat shortage and rationing, also had a profound influence on the consumption of poultry products. Increased poultry consumption promoted the growth of this industry.

The initiation of the "chicken of tomorrow" contest in 1944, did much to enhance the development of the broiler industry (Tobin and Arthur, 1964). The challenge in this contest was to develop a broad-breasted chicken similar to the broad breasted turkey. Since the contest, the breeding and development of highly specialized strains of all types of poultry has revolutionized all aspects of the poultry

ustry. The

specially of

ntrol and pr

D) to read

feed conversio

states that in

our pound bod

or a pound of

produce a four

of feed per po

II. Substituti

Live bird

the industry.

slaughter or

packer, the ec

In the early

industry its

New York
evis
incl
scal
evis

Ready to
prot
down
traci
orgar

industry. The other aspects include nutritional discoveries (especially of Vit D and B12), disease prevention and control and processing technology (from New York Dressed[1] [NYD] to ready-to-cook[2] [rtc]). Broiler growth rate and feed conversion have improved dramatically. Rogers (1990) states that in 1949 it took 94 days to bring a bird up to four pound body weight and 3.85 pound of feed were needed for a pound of gain. By 1990, it only took 42 days to produce a four pound bird and feed conversion of 1.98 pounds of feed per pound of weight gain.

II. Substitution of Capital for Labor

Live bird marketing was the norm at the early stages of the industry. As the industry developed mechanized primary slaughter or processing was inevitable. The invention of the picker, the equipment that removes feathers from the bird, in the early thirties probably gave the poultry processing industry its stimulus. Before this time, picking of birds

[1]New York Dressed (NYD) - processed birds that are not eviscerated. The processing activities involved include: hanging, stunning, killing, bleeding, scalding, picking, chilling and packaging without eviscerating.

[2]Ready to cook (rtc): any slaughtered broiler free from protruding pin feathers, vestigial feathers (hair or down) and from which head, feet, crop, oil gland, trachea, esophagus, entrails, mature reproductive organs, and lungs have been removed (FSIS, 1895).

as done by ha

ment of the

ber of proc

put volumes

The trans

processing was

s are still,

ed when refe

matized pla

tomization

resource alloc

s to ensure i

fficiency in

The evolu

tegorized in

-line or co

plants can b

cking equip

time, hence

time plants

cking fifte

scaler can s

There is no r

ach differen

echnology),

was done by hand and this was a laborious task. With the advent of the picker and other processing equipment, the number of processing plants grew rapidly. Plant sizes and output volumes and pounds increased.

The transition from hand tools to mechanized equipment processing was gradual since some of the activities were, and are still, done by hand. Different terminologies are used when referring to the use of equipment. For example, mechanized plant or semi-automated plant or automated plant. Mechanization in the processing plants indicates a shift in resource allocation. The substitution of capital for labor is to ensure increased output, uniform quality, and efficiency in the plant operation.

The evolution of the processing activity can be categorized into: (a) "batch or discrete" processing and (b) "in-line or continuous" processing. The "batch processing" plants can be defined as plants that have scalding and picking equipment that handles a certain number of birds at a time, hence the name batch. This set-up is typical in low-volume plants. The batch pickers have a maximum capacity of picking fifteen broilers in thirty seconds, while the scalder can scald thirty birds in one minute (Brower, 1990). There is no reason to think that today's batch equipment is much different from that used in the forties (same technology), except the stainless steel construction

equipment in

e.g. processi

batch process

implement rep

processing sta

The incre

incentives for

equipment. Acc

people who con

improvement of

to Gordon John

and Sherman Wh

manufacture a

built the firs

invented the

equipment res

the "continuo

"Continu

the processin

evisceration

shackles on a

during proces

processing sp

few laborers

processing to

requirement imposed by USDA for federally approved plants (e.g. processing more than twenty thousand birds per year). "Batch processing" still depends largely on the labor complement required for moving birds between the various processing stages.

The increased demand for poultry meat produced incentives for company engineers to improve their processing equipment. According to Gordy (1974), among the long list of people who contributed with invention, development and improvement of processing equipment, credit should be given to Gordon Johnson, Seth Baker, George Hunter, Jesse Jewel, and Sherman White. For example, Johnson was the first to manufacture a manually operated mechanical picker; Baker built the first automatic scalding machine; and Hunter invented the rubber finger. The improvement in processing equipment resulted in the shift from the batch processing to the "continuous or in-line" processing.

"Continuous processing" refers to plants where most of the processing activities (e.g., scalding, picking, evisceration and chilling) are done while the birds are in shackles on a conveyor line. Less manual bird handling during processing is ensured which results in higher processing speeds and therefore output. In these plants very few laborers are needed in the initial stages of primary processing to work as equipment back-up. The adoption of

[illegible]ontinuous [illegible]

[illegible]ause of th[illegible]

[illegible]opted in 19[illegible]

[illegible].

Accordin[illegible]

[illegible]ed as a com[illegible]

[illegible]leanness[illegible]

[illegible]he noticeab[illegible]

[illegible]as brought [illegible]

[illegible]mmant end [illegible]

[illegible]f the birds [illegible]

[illegible]rds. Second[illegible]

[illegible]he wholesome[illegible]

[illegible]he product,[illegible]

[illegible]he plant san[illegible]

[illegible]ded. Fourth,[illegible]

[illegible]o meet the r[illegible]

[illegible]alls, floors[illegible]

[illegible]rocessors to[illegible]

[illegible]verhead cost[illegible]

[illegible]Some proces[illegible]

[illegible]feasible to s[illegible]

[illegible]"small" or lo[illegible]

"continuous processing" became common or widely adopted because of the mandatory inspection for wholesomeness adopted in 1959, and for increased output (Brant, et al. 1982).

According to Tobin and Arthur (1964), inspection was used as a competitive selling device rather than for product wholesomeness. The introduction of compulsory inspection had some noticeable effects that need to be highlighted. First, this brought the elimination of NYD poultry. NYD was the dominant end product of poultry processing. The evisceration of the birds was now the norm of processing resulting in rtc birds. Second, inspection increased consumer confidence for the wholesome product. Third, to ensure the wholesomeness of the product, inspection imposed by law the minimum standard for plant sanitation and of the equipment that could be used. Fourth, inspection required major capital expenditures to meet the requirements. This included the structure of walls, floors, and stainless steel equipment. This forced processors to increase their capacity to spread their overhead costs over more output units. The fate of low-volume processors was in jeopardy. It was economically not feasible to satisfy the inspection requirements and remain "small" or low-volume.

... Time and

The time

...nique used

...st effective

...fficient moti

...an element c

Several studie

...ave been done

In this s

...oing to be us

...are applicab

...nthesizing a

... Process Co

The insp

...ile that of

...ter the pas

...957. Until t

The inspectio

...mmerce (exc

Processed pou

...SIS, 1984).

Since in

...ndergoing ch

...nditions. I

III. Time and Motion Studies on Processing Activities

The time and motion study is an industrial engineering technique used to analyze an operation for determining the most effective work area lay-out, the minimum and most efficient motions to use, and the time required to perform each element of the operation (Childs and Rogers, 1958). Several studies on time and motion on processing activities have been done (Table 1.1).

In this study, the motion studies in Table 1.1, are going to be used as standards for processing activities where applicable. These studies will provide insight to synthesizing a plant where processing equipment is not used.

IV. Process Control

The inspection of red meat became mandatory in 1907, while that of poultry was not until 1959. This occurred after the passage of the Poultry Products Inspection Act of 1957. Until that time, inspection of poultry was voluntary. The inspection law covers all raw poultry sold in interstate Commerce (except small farm flocks) as well as all Processed poultry products such as frozen dinners and soups (FSIS, 1984).

Since inception, the inspection procedures have been Undergoing changes (modification) to suit the prevailing Conditions. The issues of concern are the production of

Tabl

Processing activities
birds
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] (120 F, [illegible] (126-13[illegible] [illegible] (138-14[illegible]
[illegible]
[illegible] gland remov[illegible]
[illegible]ening
[illegible]ection
[illegible] vent
[illegible]viscera
[illegible]emoval
[illegible] heart & l[illegible]
[illegible] clean gi[illegible]
[illegible] gizzards
[illegible]reck verteb[illegible]
[illegible] crop and [illegible]ope
[illegible] stuff gib[illegible]

Table 1.1 Timed Processing Activities

Processing Activities	Time Required (min.)	Reference Sources
Hanging birds	0.056	Brant et al. , 1982
Stunning	0.12	Brant et al. , 1982
Killing	0.015	Brant et al. , 1982
Bleeding	1.5 2.5	Perry, 1989 Brant et al., 1982
Scalding soft (120 F) semi (126-130 F) sub (138-140 F)	3.5 2.5 2.5 2.0 1.5	Perry, 1989 Brant et al., 1982 Stadelman et al., 1987 Stadelman et al., 1987 Stadelman et al., 1987
Picking	4.8	Perry, 1989
Preen gland removal	2.72	Childs and Walters,1962.
Bird opening	2.58	Childs and Walters, 1962
Inspection	4.74	Childs and Walters, 1962
Remove vent	6.41	Childs and Walters, 1962
Draw viscera	7.30	Childs and Walters, 1962
Lung removal	4.02	Child and Walters, 1962
Remove heart & liver	7.04	Childs and Walters, 1962
Remove, clean gizzard	8.55	Childs and Walters, 1962
Peel gizzards	2.61	Childs and Walters, 1962
Snip neck vertebrae	2.70	Childs and Walters, 1962
Remove crop and windpipe	4.74	Childs and Walters, 1962
Wrap & stuff giblets	7.81	Childs and Walters, 1962

olesale pr

arges have

parts Cra

These chang

. Acceptab

These

mplemented

. Traditio

In tra

physica

was not a

rected o

. Modifie

MTI w

he introd

of increas

inspector

other ins

other bir

required.

wholesale product and processing speed maintenance. Several changes have taken place in the inspection of processing plants (Crawford, 1988; Lefens, 1986 and Kushner 1986). These changes in inspection procedures include:

1. Acceptable Quality Limits (AQL)

These are sets of processing standards. They were implemented in 1973, though never published as rules.

2. Traditional Inspection

In traditional inspection, the inspectors are required to physically examine every bird. This inspection procedure does not address itself to contaminants that are not detected organoleptically on broiler carcasses.

3. Modified Traditional Inspection (MTI).

MTI was introduced in 1978, then implemented in 1989. The introducing of this procedure was the first in the line of increasing the inspection procedures. In MTI one inspector checks all birds on the outside, and then two other inspectors check the inside and viscera on an every other bird basis. This reduces the number of inspectors required.

New-line E

The impl

significant c

Acceptable Qu

the Partial Q

processors co

system. NELS

significantly

Streamline

SIS was

shifting

manufacturing

employees. SI

this system t

each bird. Th

FDC.

Second Gen

In this

carcasses with

inspectors on

third bird for

fourth inspect

to trim specif

4. New-line Evisceration Line Speed (NELS).

The implementation of NELS in 1984 resulted in a significant change in traditional inspection. In NELS the Acceptable Quality Control (AQC) procedure was replaced by the Partial Quality Control (PQC), which relied on the processors commitment to develop their own quality control system. NELS permitted processing line speeds to increase significantly.

5. Streamline Inspection System (SIS).

SIS was implemented in 1986. SIS is an extension of MTI, shifting the responsibility for identifying manufacturing defects from inspection personnel to plant employees. SIS eliminated one of the three inspectors. Under this system two inspectors share the complete examination of each bird. This procedure applies Total Quality Control (TQC).

6. Second Generation Inspection.

In this procedure, USDA trained trimmers trim the carcasses without direct USDA supervision. There are three inspectors on the line, each responsible for checking every third bird for total bird disposition and wholesomeness. The fourth inspector at the end of the line verifies adherence to trim specifications.

Third Gene

The Thir

system, the

from condemna

reduces the

time by the p

inspector to

and sorters'

Hazard Ana

HACCP, a

products was

cooperation w

Administratio

for use in sp

the identi

hazard may in

unsafe, unwho

may result, i

Critical Cont

by identifyin

then establis

Accordin

application o

product. This

7. Third Generation Inspection.

The Third generation was implemented in 1987. In this system, the USDA trained plant employees would sort normal from condemnable carcasses. This procedure dramatically reduces the number of inspectors since most of the work is done by the plant employees. A computer is used by the inspector to track the actions of plant sorters, and analyze each sorters' performance.

8. Hazard Analysis Critical Control Point (HACCP)

HACCP, a rational approach to process control for food products was developed by the Pillsbury Company in cooperation with the National Aeronautics and Space Administration (NASA) in 1971, when asked to develop foods for use in space (Lazar, 1991). This control system depends on the identification of hazards during the process. A hazard may include any point when the product may become unsafe, unwholesome, or adultered. Any point where a hazard may result, if the process goes out of control, is called Critical Control Point (Adams, 1990). The control is placed by identifying each of the Critical Control Points (CCP) and then establishing a method for controlling that step.

According to Crawford (1988), HACCP depends on the application of controls throughout the life of a food product. This ideally means that controls are in place from

...mal produ...

...thority to...

...rough proc...

Though...

...n an attemp...

...ustry, the...

...cludes the...

...e funding sh...

...ocessors st...

...llowing foo...

Listeria mono...

animal production through consumption. FSIS has the authority to implement the HACCP system from slaughter through processing.

Though the FSIS procedures have changed over the years, in an attempt to be "in-step" with the dynamics of the industry, there are indications of shortcomings. This includes the shortage of personnel to "man" the plants due to funding shortages, line speeds not fast enough by processors standards and food safety concerns involving the following foodborne pathogens: Salmonella enteridis, Listeria monocytogenes, and Campylobacter jejuni.

The in

nterated

he locatio

ay-out, a

he locatio

n should

nnities

nd allow

. Location

Ideal

hysical,

ality en

pproach f

he other,

mpanies

Location

he severa

stablishi

a Proxim

ntinuous

ost, comp

nd reliab

Chapter 3.

PROCESSING PLANT DESIGN

The importance of proper planning needs to be reiterated. Issues to be considered during planning include: the location of the plant, total land area needed, plant lay-out, and the processing activities that are to be done. The location should satisfy the basic requirements, the lay-out should ensure ease of product flow and the processing activities should be arranged in the order that they occur and allow ease of work for employees.

I. Locational Consideration

Ideally a complete appraisal of all the economic, physical, and environmental qualities of the site where the poultry enterprise is to be located needs to be made. The approach for appraisal may be different from one company to the other, or from industry to industry. In practice many companies make this appraisal especially when considering relocation. According to Ridlen and Johnson (1970). there are several factors that need to be considered when establishing a poultry processing plant. This includes: (a) Proximity to market, (b) Supply of birds sufficient for continuous and efficient operation, (c) Labor availability, cost, competence, stability and reliability, (d) Adequate and reliable utilities and services, including water,

electricity

Transpo

disposing o

Ownersh

expansion,

drainage, (

Tax rat

Land re

The l

processing

high volume

The land ha

been select

and how the

ensured. Fu

must be con

The total l

the categori

1. area fo

(receiv

employ

2. area fo

3. area fo

4. buffer

electricity, fuel, gas, communications, and sewerage system, (e) Transport access to good highways, (f) Means of disposing of processing wastes (rendering plant), (g) Ownership of sufficient land to accommodate future expansion, (h) Topography should provide good air and water drainage, (i) Population density, (j) Zoning and (k) Tax rates.

II. Land requirements

The land needed for establishing a low-volume processing plant will not be as large as is the case for high volume plants. Land may be an expensive cost provided the land has a high alternative use cost. When the site has been selected, proper design of the facilities, equipment and how the activities are going to be performed must be ensured. Future possible developments, such as expansion must be considered at the early planning of the facility. The total land area for establishing a processing plant can be categorized into four areas:-

(1) area for the building
(receiving area, processing area, storing, offices and employee facility)

(2) area for parking

(3) area for dumping or disposing of wastes

(4) buffer area (between the plant and neighbors).

Accordi

the propo

parking

recomm

less than

ility as a

In contr

land

ilding. Thi

ds *et al*.

volume p

the synth

ble 3.1.

Table

Plant	Min. requ (1
A	40
B	50
C	70
D	150

should be

plant lay-

According to Childs et al. (1970), the rule of thumb for the proportions of the different areas is: building, 20%; parking 10%; dumping, 5%; buffer, 65%. Childs et al. (1970) recommends that the processing plant site should not be less than five times the actual size of the plant facility as a minimum for land requirement.

In contrast, Shupe et al. (1975) recommends that the minimum land requirement should be twenty times the building. This study used the former recommendation of Childs et al. since the latter seemed more ideal for the high volume processing plant. The minimum land requirement for the synthesized plants in this study is shown in the Table 3.1.

Table 3.1 Proportionate Land Requirement for a Processing Plant

Plant	Min. Land requirement (100%)	Building (20%)	Parking (10%)	Dumping (5%)	Buffer (65%)
	sq.ft.				
A	4000	800	400	200	2600
B	5000	1000	500	250	3250
C	7000	1400	700	350	4550
D	15000	3000	1500	750	9750

It should be noted that these minimum requirements are based on plant lay-out recommended by equipment manufacturers. It

s always be

a helpful e

ture.

III. Princip

Establi

planning to

1972) devel

arranging eq

operation ac

arranged in

kept short a

tracking, re

minimum; saf

non-producti

is equally

The fun

developing a

1972) are:

1. Make goo

Need to

based o

of mover

is always better to have more than the minimums. This could be helpful especially when expansion is a possibility in the future.

III. Principles of Lay-Out Planning.

Establishing a processing plant needs well thought out planning to ensure success. According to Clearance, et al. (1972) developing a good lay-out can be thought of as arranging equipment, work areas, and other elements of an operation according to good common sense. Operations are arranged in the order that they occur; travel distances are kept short and direct; congestion, delays, and back tracking, rehandling, and interferences are held to a minimum; safety and protection of employees are built in; non-productive effort is minimized; and work is distributed as equally as possible among workers.

The fundamental principles that should be considered in developing a good lay-out, according to Clearance, et al. (1972) are:

(1) Make good use of space.

Need to have a formula/methodology for space allocation based on the equipment dimensions, worker space, ease of movement of inputs and workers.

Move men/women a

The distances a

minimized by lo

another as clos

operations is e

products) move

areas. Transpor

trip and reduci

amount of mover

Provide good proc

Locate and arra

products flow s

to the next wit

interference (S

Plan so future c

The plant lay-o

can be provided

permanent struc

partitions shou

they limit chan

Possible expans

(i.e. attachment

Provide safe, sat

conditions.

Firms that provi

(2) Move men/women and materials minimum distances.

The distances and frequencies of movement can be minimized by locating operations that follow one another as close as possible. The location of operations is especially important where men/women (or products) move frequently between operations and work areas. Transporting the maximum number of birds per trip and reducing the distance travelled reduces the amount of movement.

(3) Provide good product flow.

Locate and arrange work areas, rooms, and equipment so products flow smoothly from one operation and work area to the next with minimum backtracking, rehandling, or interference (See Figure 3.1).

(4) Plan so future changes can be made.

The plant lay-out should be flexible. Future expansion can be provided for in several ways. For example, permanent structures, such as cooler walls or partitions should be used only where essential, because they limit changes that can be made. Allow more space. Possible expansion points should be at the outside (i.e. attachment).

(5) Provide safe, satisfactory, and efficient working conditions.

Firms that provide and maintain good working conditions

Figure 3.1 Operat
Poultry to rtc (S

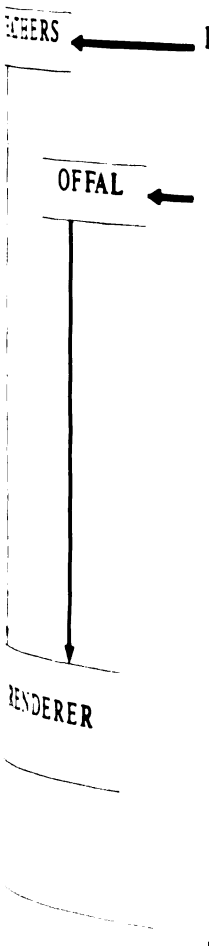
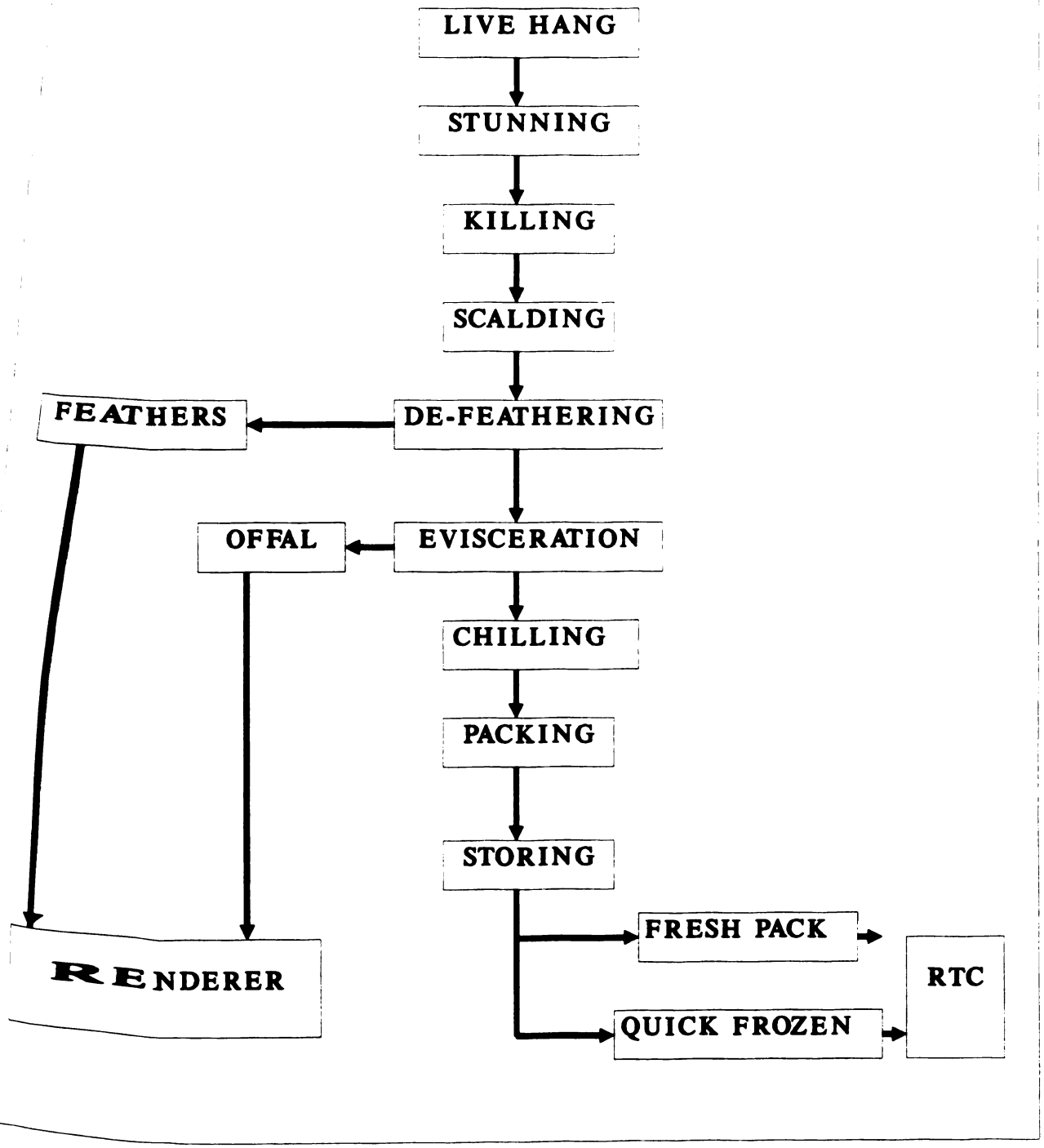


Figure 3.1 Operations in the Conversion of Live Poultry to rtc (Source: Stadelman et. al. 1988)



can expect to ha

lower insurance

firms that maint

. Bring together a

unit.

An additional f

above principle

process and pro

. Processing Plant

The poultry proc

mponents or areas b

e components of a p

oduct can be catego

ocessing area consi

lling and Defeather

ea, (d) Offal area

Shipping Area.

Second, the non-c

e office area, and

). It is important

mple, it is mandato

lling and defeatheri

operation area.

can expect to have less absenteeism, higher moral, lower insurance rates, and greater productivity than firms that maintain poor working conditions.

(6). Bring together all factors to make a total working unit.

An additional factor that needs to be included in the above principles concerns the protection of the process and products contained therein.

IV. Processing Plant Lay-out.

The poultry processing plant consists of several components or areas based on the type of activity performed. The components of a processing plant that produces rtc product can be categorized into two areas. First, the processing area consisting of: (a) Receiving Area, (b) Killing and Defeathering Area, (c) Evisceration and Chilling Area, (d) Offal area (e) Packaging, (f) Storage and/or Shipping Area.

Second, the non-operational areas consisting of: (a) Office area, and (b) Employee facilities (See Figure 3 - 2). It is important to separate the processing area. For example, it is mandatory, by FSIS regulations, that the killing and defeathering area be separate from the evisceration area.

Figure 3.2 Pro
Indicating Flow of

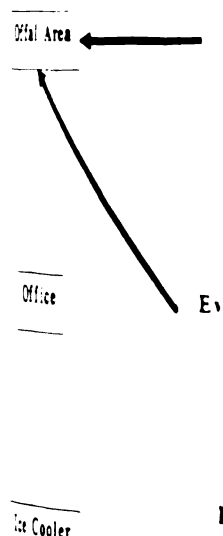
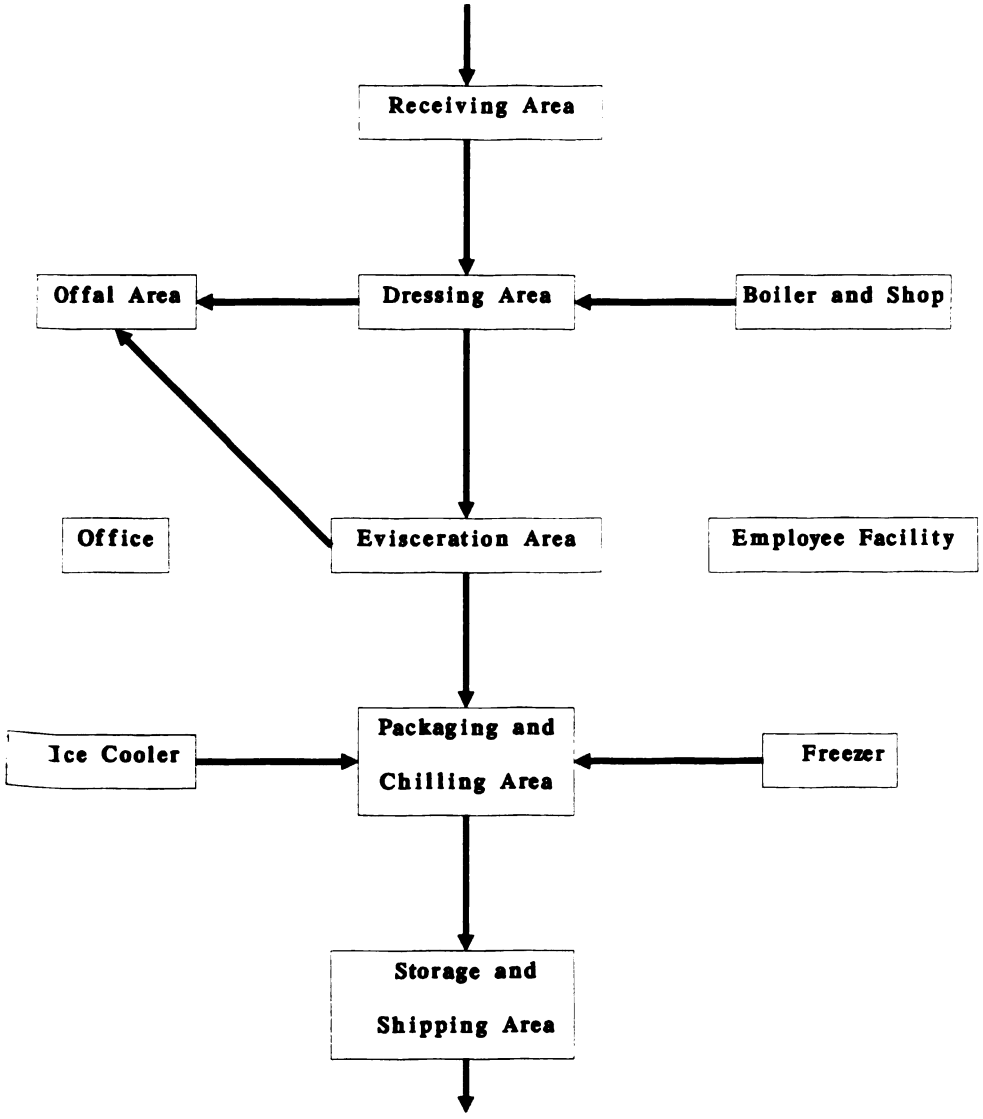


Figure 3.2 Processing Area Relationship Indicating Flow of Product (Source: Shupe, 1973)



The plant lay-o
s not rigid. Flexib
ccommodate future c
ossibility. Usually
n recommend plant l
eems advisable to p
rea, instead of giv
ject.

A. Receiving Area

The incoming bi
entilation and a co
he receiving area m
lace even during ad
equirement for the
space for a truck to
ck. A dock 12" high
should be pitched at
o facilitate drainin

B. Dressing Area:

The FSIS regula
dressering area mu

The plant lay-out should be designed in a way that it is not rigid. Flexibility should be emphasized to accommodate future changes, especially if expansion is a possibility. Usually the equipment manufacturers do provide or recommend plant lay-outs to potential processors. It seems advisable to provide the proportions of the processing area, instead of giving rigid processing areas in square feet.

OPERATIONAL AREAS

A. Receiving Area

The incoming birds are received at this area. Adequate ventilation and a comforting environment should be ensured. The receiving area must be covered so processing can take place even during adverse weather conditions. The minimum requirement for the receiving area is to have an adequate space for a truck to unload and be able to maneuver its way out. A dock 12" high extend across the back. The floor should be pitched at 3/4" per foot toward the drain-trough to facilitate draining (FSIS, 1987).

B. Dressing Area:

The FSIS regulation states that the killing and defeathering area must be separated from the evisceration

rea. Floors and dra

moval of blood and

s to provide smooth

ext to floor drains

HIS, 1987).

. Evisceration Area

This area accor

eparated from the pr

visceration (assumi

rackles) include: tr

ging birds on the

moval, cut open the

move heart and lung

fifty percent of the

rea (Shupe, et al.,

hould be given to th

ble space, ventilat

facilities. The gene

ork station is three

viscerating trough,

isher assistants (

area. Floors and drains should be designed for efficient removal of blood and cleanup of wastes. A standard practice is to provide smooth floors sloped approximately at 1/4" per foot to floor drains that are no more than twenty feet apart (FSIS, 1987).

C. Evisceration Area

This area according to FSIS regulations must be separated from the previous areas. The activities of evisceration (assuming a two-point suspension on the shackles) include: transfer of birds from the picker table, hanging birds on the shackles, pinning, singeing, oil gland removal, cut open the birds, draw viscera, inspection, remove heart and lungs, gizzard cleaning, and cut the hocks. Fifty percent of the plant workers work in the eviscerating area (Shupe, et al., 1975). Therefore particular attention should be given to the design and lay-out of work stations, aisle space, ventilation and proper placement of personnel facilities. The generally recommended space allocation for a work station is three feet for each worker at the eviscerating trough, and four feet for the inspector and his/her assistants (FSIS, 1987).

offal Area

Approximately

discarded as inedib

feathers, viscera,

located close to, b

evisceration areas

Packaging and Ch

This area that

ntain space and e

apping and clippi

ith running water

evisceration statio

Storage and ship

The volume of

final product influ

location of the sto

ivided into: (a) n

toring packaging m

sed as a temporary

F. The rule of t

apable of holding

od insurance for c

which consists of t

D. Offal Area

Approximately 25% of each broiler processed is discarded as inedible material in the form of blood, feathers, viscera, feet, and heads. The offal area should be located close to, but separate from defeathering and evisceration areas to minimize transport distance.

E. Packaging and Chilling Area

This area that adjoins the eviscerating area must contain space and equipment necessary for carcass packing (bagging and clipping), weighing, and icing. Chill tanks with running water must be placed next to the final evisceration station (i.e. inside and outside bird washer).

F. Storage and shipping area

The volume of product processed and the form of the final product influence the type, size and sometimes the location of the storage area. The storage area can be divided into: (a) non-refrigerated dry area, used for storing packaging materials; (b) refrigerated cooler, is used as a temporary storage keeping the product at 32 to 36°F. The rule of thumb is that a cooler facility should be capable of holding at least one days' production. This is a good insurance for contingencies; and (c) the freezer area, which consists of two compartments, each of which require

separate rooms (i)
room held at 0°F for
loading area la
standard lay-out for
Hope, et al., 1972
may be employed, whi
the location of the
area and the cold st
distance. Various di
given situation or p

Office

Floor space occu
plant averaged 7 perc
Childs et al. (197
Adequate sitting
private offices f
concentration without
lay-out for two or mo
frequently used busi
who use them; (4) se
general office staff
supplies, records an

separate rooms (i) blast freezer (-20 to -60°F) and (ii) a room held at 0°F for storage of frozen products.

Loading area lay-out and procedures vary so much that a standard lay-out for all plants is difficult to develop (Shupe, et al., 1972). However some basic lay-out principles can be employed, which would benefit most plant operations. The location of the loading dock is usually near the packing area and the cold storage area to ensure minimum travelling distance. Various dimensions are adopted depending on the given situation or preference.

NON-OPERATIONAL AREAS

A. Office

Floor space occupied by offices in a large processing plant averaged 7 percent of the total plant area. According to Childs et al. (1970) office facilities requirements are: (1) Adequate sitting room for visitors and reception; (2) private offices for persons whose work requires concentration without interruption; (3) a general office lay-out for two or more workers with space for files and for frequently used business machines located near the persons who use them; (4) separate rest room facilities for the general office staff; (5) a secure place for office supplies, records and funds; (6) natural light argumented by

...ficial lighting

... for business m...

... flexibility wit...

...fabricated secti...

... Employee facilit...

A wide range i...

...ilities is possi...

... workers, and thi...

...proved workmanshi...

...nover. The facil...

...nstitute:

... Lunchroom - it i...

... used. Lunch faci...

... there is suffici...

... Dressing rooms -...

Separate dressing r...

...quired (unless or...

...om should provide...

... Toilet rooms - s...

...essing rooms by t...

...oors. FSIS recomme...

...e number of toile...

artificial lighting and several electric outlets on each wall for business machines; and (7) provisions for expansion and flexibility with nonload-bearing walls or movable, prefabricated sections.

B. Employee facilities

A wide range in the size and type of employee facilities is possible. Personal facilities provide comfort to workers, and this results in greater worker productivity, improved workmanship, better morale, and lower labor turnover. The facilities according to FSIS (1987) may constitute:

1) Lunchroom - it is recommended that 15 sq.ft. per person is used. Lunch facilities can be provided in dressing rooms, if there is sufficient space.

2) Dressing rooms - must be separated from toilet rooms. Separate dressing rooms for employees of each sex is required (unless only one sex is employed). The dressing room should provide lockers, shower and bath facilities.

3) Toilet rooms - should be separated from adjoining dressing rooms by tight, full height walls and self closing doors. FSIS recommends the following formula for determining the number of toilet bowls required (Table 3.2).

Table 3.
determin

Persons
1 to 15 em
16 to 35 em
36 to 55 em
56 to 80 em
For each ad employees m

Source: Fe
*Urina
bowls
of bo

Table 3.2 FSIS recommendations for determining toilet bowls required

Persons of same sex	Toilet bowls required
1 to 15 employees	1
16 to 35 employees	2
36 to 55 employees	*3
56 to 80 employees	*4
For each additional 30 employees more than of 80	*1

Source: FSIS, 1987

*Urinals may be substituted for toilet bowls but only up to 1/3 of the number of bowls required.

EQUI

Introduction

The combinatio

plants has enabled

resulting in bigger

processing is a lab

other stages of poul

is to use mechanized

installing mechanize

not only increase ca

quality improvements

caused by absenteeis

processing activitie

stress, and cumulat

1989).

The need to con

becomes more evident

increases. Before th

during the early dev

in the 1930's, birds

use of mechanized eq

Chapter 4

EQUIPMENT AND LABOR REQUIREMENTS

I. Introduction

The combination of equipment and labor in processing plants has enabled increased speed in processing activities, resulting in bigger plants with large outputs. Poultry processing is a labor intensive process when compared to other stages of poultry production. The trend in processing is to use mechanized equipment with humans as back-up. Installing mechanized equipment in the processing plant will not only increase capacity but also will provide product quality improvements and reduce disruptions that may be caused by absenteeism. It is a known fact that some of the processing activities are monotonous and arduous can lead to stress, and cumulative trauma disorders or CTD (Hebert, 1989).

The need to complement labor with mechanical equipment becomes more evident as the size of processing plants increases. Before the invention of processing equipment, and during the early development stage of the poultry industry in the 1930's, birds were processed manually (without the use of mechanized equipment). Increased demand of poultry

ade it necessary fo

as done by substitu

This trend of s

the norm even today.

eding desire to rea

of product produced,

ny large plants ar

hat need manual, hu

ncludes for example

the plant, checking

setting or correctin

inspection of the ki

achines and the surr

The foregoing i

poultry processing p

low-volume processin

asic questions that

poultry processing a

information not incl

of scale/size, by de

perations. In a lo

echanization is no

the early forties i

prominent role. The

to only consider p

made it necessary for plants to increase their output. This was done by substituting equipment for labor.

This trend of substituting capital with labor is still the norm even today. Mechanization is based on the never ending desire to realize the lowest possible cost per pound of product produced, as well as a uniform product. Though many large plants are mechanized, there are some activities that need manual, human activities at the moment. This includes for example, hanging of live birds upon arrival at the plant, checking individual machine performance and setting or correcting the machine if required, visual inspection of the killed birds, cleaning and dissinfencting machines and the surroundings.

The foregoing information provides the status of poultry processing plants. The task at hand is to focus on low-volume processing plant. This will provide answers to basic questions that would share light to the evolution of poultry processing as well as providing additional information not included in the studies concerning economies of scale/size, by depicting the lowest plant output operations. In a low-volume poultry processing operation mechanization is not that advanced. The technology used in the early forties is still the norm, where labor plays a prominent role. The scope of this study will be restricted to only consider plants that do not process more than 2.25

illion birds per yea

. Processing Plant

It is possible t

ithout the use of me

ools. This type of

tensive. It is reas

ant an increase in

creasing the number

There are three

visaged in manual p

. Perform one activi

All the laborers

roceed to the next.

volved in killing t

ick, eviscerate, chi

oncept is practiced

rocessed are killed

leeding. Then all th

essence here is to d

oose tools refer t
ockets, knife shar
nd heating device

ersonal communicat
anaging director
uring her visit

million birds per year.

II. Processing Plant without mechanized equipment

It is possible to manually process poultry (i.e. without the use of mechanized equipment) with loose hand tools[1]. This type of a plant would be highly labor intensive. It is reasonable to conceptualize that in such a plant an increase in output would need to be matched by increasing the number of laborers.

There are three procedural approaches that could be envisaged in manual processing plants:

A. Perform one activity at a time.

All the laborers become engaged in one activity, then proceed to the next. For example, all the laborers will be involved in killing the birds to be processed, then scald, pick, eviscerate, chill and pack. This procedural or stage concept is practiced in Tanzania[2]. The birds that are to be processed are killed then put in drums for restraint and bleeding. Then all the birds are scalded and picked. The essence here is to do one activity completely before

[1]Loose tools refer to knives, scissors, rope and a block, buckets, knife sharpener and hand thermometer(s). A table(s) and heating device to boil water is needed.

[2]Personal communication with Mrs Halima Makwaia who is a managing director of Kandalla Poultry Farm in Tanzania, during her visit to Michigan State University.

roceeding to the ne

There are some

rocedure. First, if

ere could be a prob

ere could be a big

r example the time

elay time in pick

ather-holding stre

icking process. Alt

ilers can still be

icking of up to four

ddressed and modifie

Discrete batch pro

In this procedur

rocessed, from the b

atch is processed. T

anging of birds on a

ine. Then killing b

f the neck. It is i

o reduce blood spla

Birds are then

ontained in buckets

s necessary for mo

need to have some

proceeding to the next stage.

There are some questionable issues concerning the above procedure. First, if the killed birds are not well bled, there could be a problem of cadavers and red wings. Second, there could be a big time lapse between processing stages, for example the time between killing and picking processes. A delay time in picking after slaughter increases the feather-holding strength, and substantially hinders the picking process. Although Gregory (1988) states that broilers can still be satisfactorily picked after a delay in picking of up to four hours. These concerns could be addressed and modified where necessary.

B. Discrete batch processing

In this procedure a batch of birds (5 to 8 birds) is processed, from the beginning to the rtc stage, then another batch is processed. The activities that are done include hanging of birds on a rope and a block (Sheperd and Flegal, 1985). Then killing by cutting the jugular vein on the side of the neck. It is important to hold the head after cutting to reduce blood splattering.

Birds are then scalded in water at 128-140°F which is contained in buckets or other containers. A hand thermometer is necessary for monitoring the water temperature. There is a need to have some heating device like a stove or heater.

The birds are

stored temporarily i

evisceration process

some containers/wate

wash and reduce car

packaged in plastic

shipment. The seque

loose hand tools in

Figure 4.1).

. Continuous batch

This processing

"Discrete batch" pr

assigned specific t

responsible for han

There is some speci

of people doing a b

Another process

preceding procedure

"continuous batch" p

management moves th

and troughs of proc

beginning of the da

hanging, killing a

some workers will

The birds are then picked by hand, then washed and stored temporarily in cold water bins awaiting the evisceration process. The eviscerated birds are then put in some containers/water tanks/barrels with running water to wash and reduce carcass temperatures. The carcasses are then packaged in plastic bags and chilled with ice awaiting shipment. The sequence of the processing activities, and the loose hand tools in a manual plant need to be highlighted (Figure 4.1).

C. Continuous batch processing

This processing method is nearly similar to the "Discrete batch" processing method, except that laborers are assigned specific tasks. For example, one person being responsible for hanging and killing birds all the time. There is some specialization involved, and this will result in people doing a better job over time.

Another processing method can be derived from the preceding procedures, and could be called the "Adaptive continuous batch" processing. In this processing method, management moves the workers around depending on the peak and troughs of processing needs. For example at the beginning of the day more help may be needed for unloading, hanging, killing and scalding birds for start-up. Gradually some workers will be released to assume the other processing

Figure 4.1 Proc

Hanging

Killing

Bleeding

Scalding

Defeathering

Eviscerating

Chilling

Packaging

Figure 4.1 Processing Activities and Hand Loose Tools

Hanging	ropes and blocks
Killing	knives
Bleeding	
Scalding	buckets and/or containers
Defeathering	hand(s)
Eviscerating	hand, knives and table(s)
Chilling	buckets, barrels, conatiners
Packaging	plastic bags

ctivities. As the f

orkers should be co

en gradually moved

ctivities. Towards

e beginning of the

lean up their area,

e eviscerating lin

mill and packaging

Logically, amon

pproach is more rea

mployees become mor

e activity over ti

pecific tasks have

. Determining the

Two processing

iscrete batch proce

echanical transitio

ill be the basis o

ctivities.

ssumptions:

Plant capacit

Number of Lab

activities. As the flow of slaughtered birds increase, workers should be concentrated at the eviscerating line, then gradually moved to the chilling and packaging activities. Towards the end of the work period, workers at the beginning of the processing activity should begin to clean up their area, and progress to other areas. Those in the eviscerating line should be merged with those in the chill and packaging activities.

Logically, among the three procedures, the specialized approach is more reasonable. Through this procedure employees become more proficient, resulting in mastery of the activity over time. Less confusion is ensured because specific tasks have been assigned to each worker.

III. Determining the Mechanical Transition Threshold

Two processing procedures (One activity at a time and Discrete batch processing) will be used for determining the mechanical transition threshold. The time and motion studies will be the basis or standards for performing processing activities.

Assumptions:

Plant capacity = 200 birds to be processed

Number of Laborers = 10

tandards:

Table 4.1

Proce Acti
H = Ha
K = Ki
B = Bl
S = Sc
P = Pi
D = Ev

It is important

he standards, from

tained from plants

e.g., shackles) wer

tandards used are c

s considered. The h

etter presentation

some processing acti

1. One Activity at

There are thre

eeds to be subject

Standards:

Table 4.1 Summary of Processing Standards
(Derived from Table 1.1)

Processing Activity	Time Required
H = Hanging	0.056 min.
K = Killing	0.015 min.
B = Bleeding	1.5 min.
S = Scalding	2.5 min
P = Picking	4.8 min.
D = Eviscerating	3.5 min.

It is important to note that the values/numbers used as the standards, from the time and motion studies were obtained from plants where some processing equipment (e.g., shackles) were used. It may be argued that the standards used are on the lower side when manual processing is considered. The hanging of birds on shackles ensures a better presentation of the bird to the employee, easing of some processing activities.

A. One Activity at a time

There are three constraints that the proposed solution needs to be subjected to:

a. Time taken to p

This can be cal

perform the processi

until evisceration (

The total time requi

assumption here is t

processed. The evisc

tank for cooling.

b. Travel distance

activities.

During the processi

around during proce

plant lay-out. For

minutes is used for

The total time req

17.37 minutes.

(a). Time taken to process one bird

This can be calculated by summing the time required to perform the processing activities, from hanging the bird until evisceration (Equation 1).

$$T_x = (H+K+B+S+P+E) \ldots . (1)$$

where T_x = time taken to process one bird (for other equation notations refer to Table 4.1)

The total time required is 12.37 minutes. Note the assumption here is that the viscera is discarded and not processed. The eviscerated bird will be placed in a chill tank for cooling.

(b). Travel distance for repositioning and doing processing activities.

During the processing activity some time is wasted by moving around during processing. This could be reduced by proper plant lay-out. For this example, let us assume that 5 minutes is used for travelling or repositioning.

$$T_x = (H+K+S+P+E+TD) \ldots . (2)$$

where TD = travel distance

The total time required for processing one bird will then be 17.37 minutes.

c. Required area fo

The processing p

ney are a function o

ms will provide the

abcrers that can be

he processing activi

If it takes 17.3

will take 3474 minute

process 200 birds. In

it takes them 5.79 h

packaging stage). Th

plant with a process

n the above informa

per hour and labor r

The partial calculat

and output in manua

Table 4.2
Using On

Birds Pro (per hou
10
35
79
100
124
145
180
190
200

(c). Required area for processing a bird

The processing plant dimensions are necessary because they are a function of the travelling distance (TD). Also this will provide the insight of the possible number of laborers that can be put and be efficiently productive in the processing activity.

If it takes 17.37 minutes to process one bird, then it will take 3474 minutes (or 57.9 hours) for one person to process 200 birds. In our example there are ten workers, so it takes them 5.79 hours to process 200 birds (excluding the packaging stage). This could be translated as a manual plant with a processing capacity of 35 birds per hour. Based on the above information, the determination of plant output per hour and labor requirement is possible. Table 4.2, shows the partial calculations of the relationship between labor and output in manual processing.

Table 4.2 Worker-Output Relationship when Using One Activity at a Time Processing

Birds Processed (per hour)	Workers (No.)	Incremental change
10	3	
35	10	3.57
79	23	3.38
100	29	3.50
124	36	4.80
145	42	3.50
180	52	3.50
190	55	3.33
200	58	3.33

To make a general
nput and labor requ
lants, a Regression
SSTAT, 1990) was ma
elationship. A linea
quation 3).

Y

The model depicting

Y=0.3

The equation depicts
laborers by one (x)
rocessed per hour.

3. Discrete Batch p

A batch of 8 b
laborers. Based on
laborers could be a
activities:

1 person to ha

To make a generalization about the relationship of output and labor requirements in manual broiler processing plants, a Regression Analysis using the statistical package (SYSTAT, 1990) was made to determine the functional relationship. A linear function model format was used (Equation 3).

$$Y=a+bX.....(3)$$

where Y = Birds processed per hour
a = a constant
b = coefficient
X = number of workers

The model depicting the relationship is shown in equation 4.

$$Y=0.333+3.515x.....(4)$$

The equation depicts that an increase in the number of laborers by one (x) will result in 3.515 additional birds processed per hour.

B. Discrete Batch Processing

A batch of 8 birds is processed at a time using 10 laborers. Based on the standards in Table 4.1, the 10 laborers could be assigned the following processing activities:

1 person to hang, stun, kill and bleed the birds.

1 pe

4 pe

4 pe

n the di

miscerat

The labor

Table 4.3

Acco

for both

Processin

Laborers

Increase

Processed

1 person for scalding and moving the birds

4 people for picking birds

4 people for eviscerating birds.

In the discrete batch processing procedure, the picking and eviscerating activities determines the speed of processing. The labor and output (birds processed per hour is shown in Table 4.3.

Table 4.3 Worker-Output Relationship when Discrete Batch Processing

Birds processed	Workers (No)	Incremental change
50	10	
63	11	13.0
75	13	6.0
88	15	6.5
100	17	6.0
113	19	6.5
125	21	6.0
138	23	6.5
150	25	6.0
163	27	6.5
176	29	6.0
188	31	6.5
200	33	6.0

According to the standards of time and motion studies, for both the One activity at a time and Discrete batch processing, there is a linear relationship between number of laborers and birds processed per unit of time Figure 4.2. An increase in the laborers will result in an increase in birds processed.

F

Outpu

250

200

150

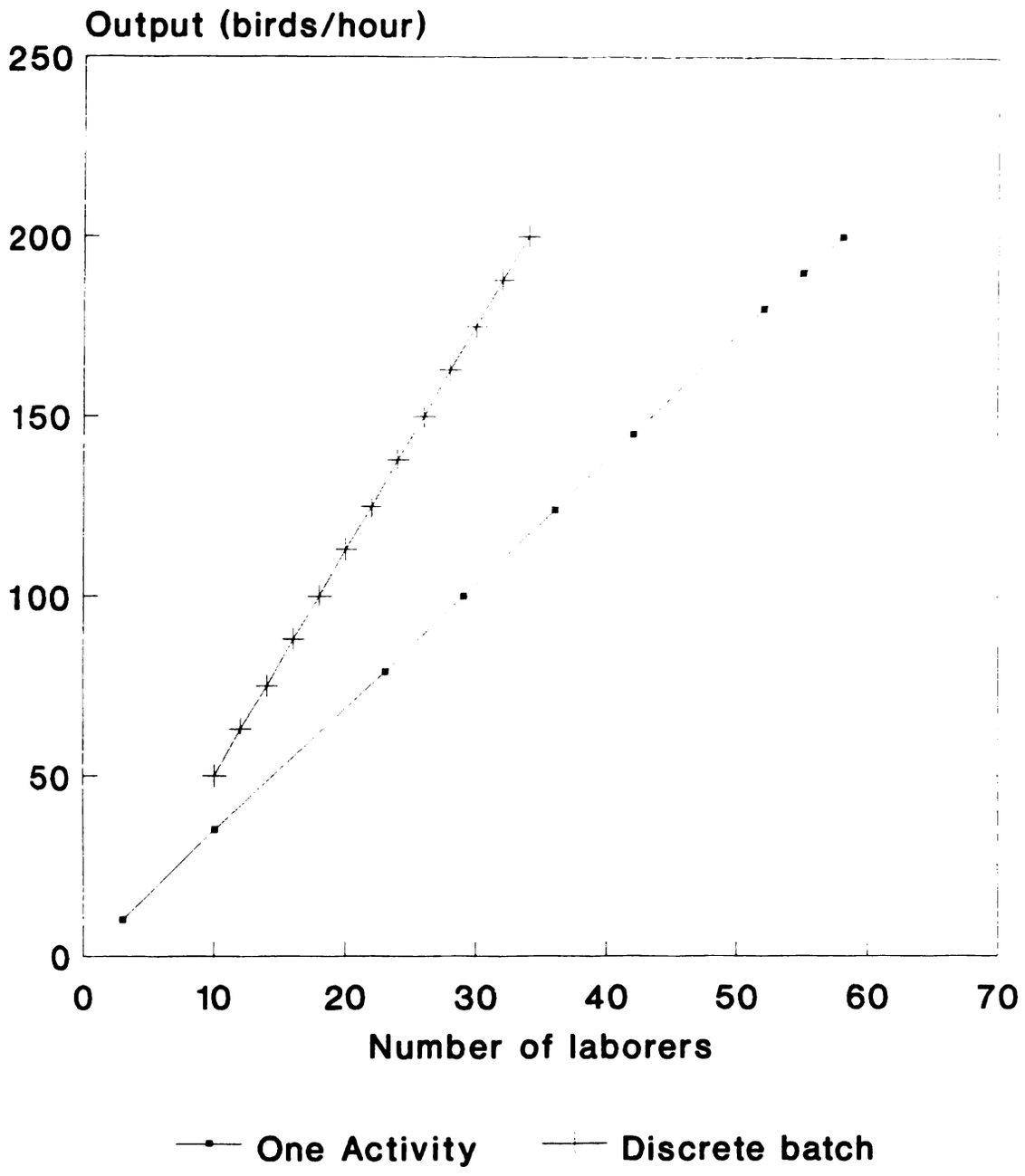
100

50

0

0

Figure 4.2 Worker-Output Relationship



Fi

efficie

in bir

activit

needed

Th

to be m

the th

of some

efficie

counter

returns

of bird

plant m

will ne

therefo

thresho

Th

not suf

mechani

coeffic

The La
a vari
fixed
that i
total
198

Figure 4.2 show that Discrete batch processing is efficient than One Activity at a time procedure. To process 200 birds per hour 60 laborers are needed in the One Activity at a time procedure, while only 30 laborers are needed for Discrete batch processing.

The linear relationship portrayed in Figure 4.2 needs to be modified to accommodate some practical factors. It is true that an increase in laborers will increase output. But at some point and time there will be crowding of laborers, difficulty of movement, accidents, etc. that result in counter productivity. This reflects the law of diminishing returns[3]. An appropriate question is, "at what point (number of birds processed per unit time) is manual processing in a plant not practical?" That is where some other technology will need to be introduced. This range in this study will henceforth be regarded as the "mechanical transition threshold".

The time and motion study information is necessary but not sufficient for being the only basis for determining the mechanical transition threshold. This is due to the fixed coefficients that are built in when the time motion studies

---

[3]The Law of Diminishing Returns states that additions of a variable input (i.e. labor in this case) to a set of fixed inputs at some point will result in a total product that increases at a decreasing rate, and eventually in a total product that decreases (Harsh, Connor and Schwab, 1981).

are performed. The alternative procedure is to determine the processing cost per bird of the smallest mechanized plant operating at different capacity utilizations[4], then compare them to those of manual processing. The premise of this comparison is based on the concept that when labor is free or inexpensive plants will prefer to use more laborers to increase output (manual processing scenario). To determine the importance of the labor compensation rate, a wage rate range of $1.00 to $6.00 per hour was used.

Figures 4.3 and 4.4 show the processing cost curves for manualprocessing and the mechanized plant, respectively. The mechanical transition threshold is derived from a comparison of Figures 4.3 and 4.4 (see Table 4.4 and Figure 4.5).

Table 4.4 Mechanical Transition Threshold

Wage rate ($)	Birds processed (per hour)
1	165
2	80
3	60
4	56
5	40
6	30

[4]Note: investment on building and furniture is not factored in the calculations for a manual plant. Unlike the manual plant, the mechanized plant must have a building for the equipment

Figure 4.3 Manual Processing

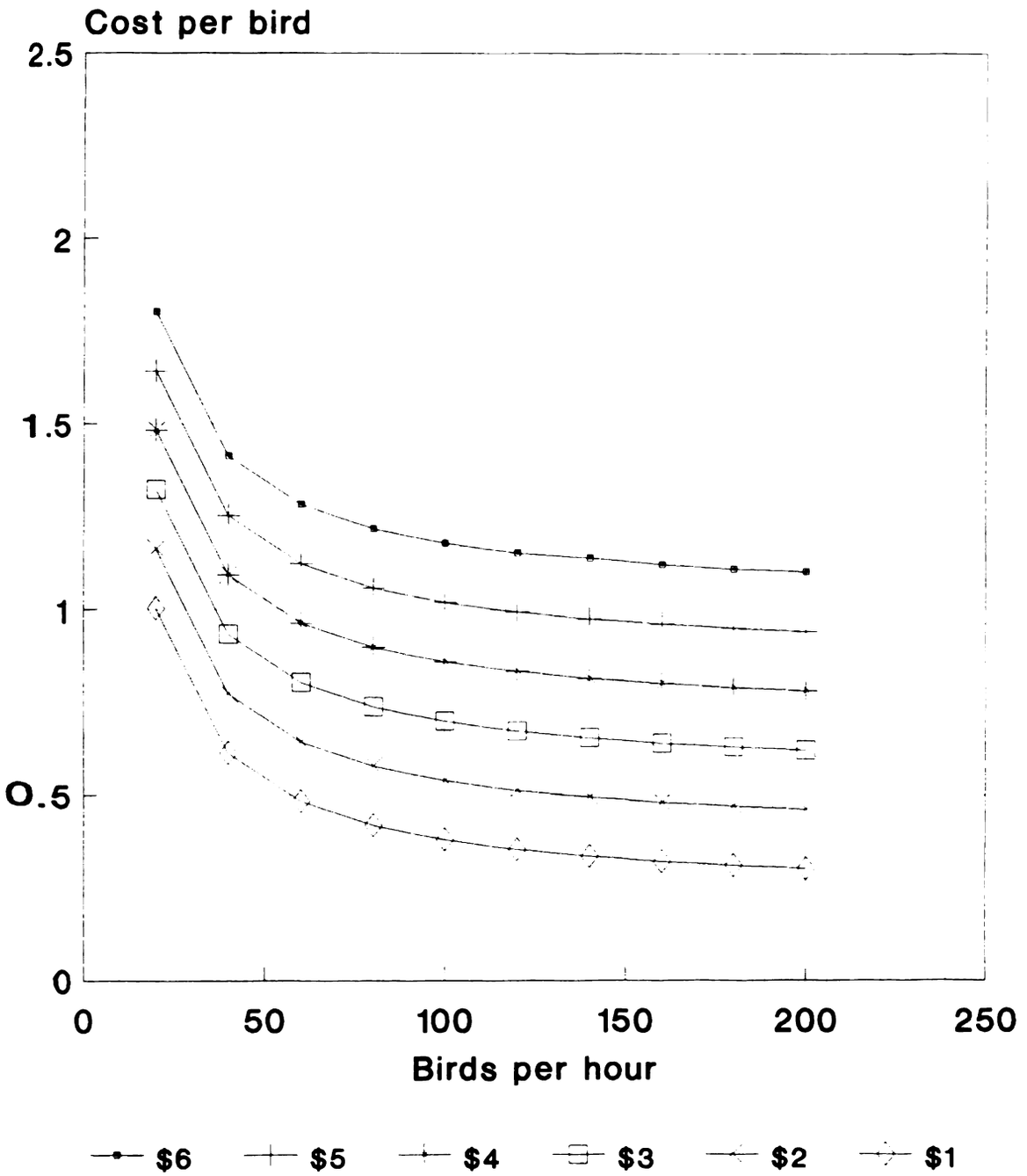


Figure 4.4 Mechanized Processing

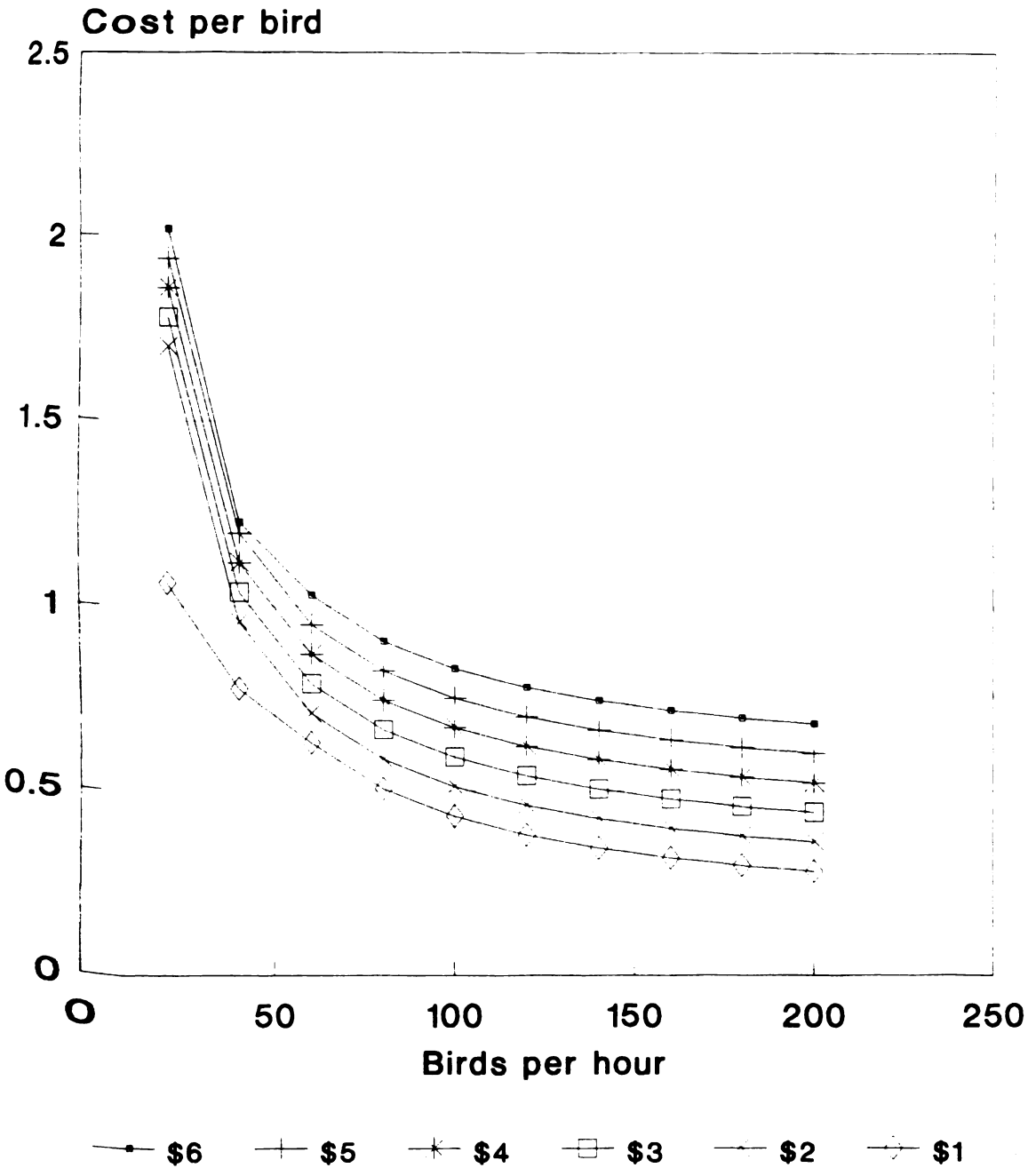
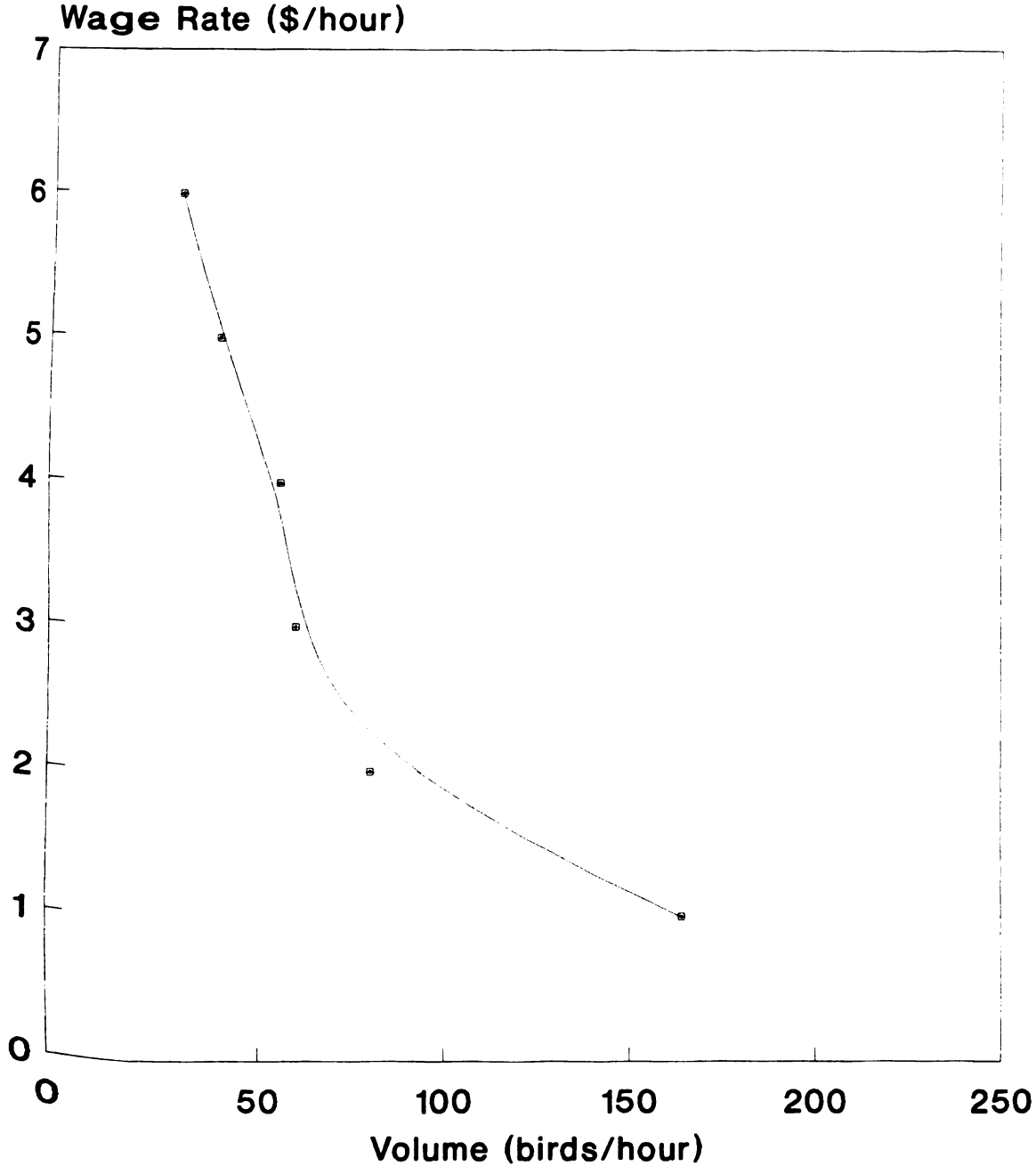


Figure 4.5 Mechanical Transition Threshold



rom the

abor co

ecomes

n highe

ccurs s

echanic

f birds

V. Mech

Ver

involved

processi

o plant

ot more

or a ho

n the

processi

. Pick

Bro

's

go hav

Th

imens

anufac

arly fo

Form the above information it is evident that at a lower labor compensation rate ($1.00 per hour), manual processing becomes economically undesirable beyond 165 birds per hour. At higher wage rates, the substitution of capital for labor occurs sooner. For example, at $6.00 per hour, the mechanical transition threshold occurs when processing about 30 birds per hour.

IV. Mechanized Processing Plants

Very few companies both in North America and Europe are involved in the manufacturing of low-volume poultry processing equipment. Low-volume as defined earlier refers to plants that process not more than 1200 birds per hour (or not more than 2.25 million birds per year when processing for 8 hours per day, 5 days a week, and 50 weeks per year). In the U.S., three manufactures of low-volume poultry processing equipment have been identified. These are: (1) Pickwick Company, (2) Ashly Machine Company, and (3) Brower. These manufacturers except Brower (who bought Kuhl's line of poultry processing equipment, a few years ago) have been operational since the 1930's.

The design of the low-volume processing equipment (dimensions and capacity) is nearly the same between the manufacturers. The technology used is still that of the early forties, with equipment geared to batch processing. In

Europe, the identified manufacturers of low-volume processing equipment are Stork and Linco. These companies are also well known manufacturers of large scale processing equipment. It seems as if low-volume equipment manufacturing is specially designed for marketing in developing countries. The design of their equipment resembles that of large scale processing plants, but they are of reduced scale. Their equipment allows processing activities to be done while the birds are hung on the conveyor line, thus the phrase "in-line" processing. We can categorize low-volume processing plants into two groups based on equipment used: (1) Batch type processing, and (2) In-line processing.

A. Batch Processing

The processing procedure is similar to the one used in the specialized batch processing plant mentioned earlier. The only difference is that in this case mechanized processing equipment is used. The processing activities, equipment and labor required is shown in Tables 4.2 and 4.3. The birds per man-hour output increases for all the plants with Plant D having the highest. The increase of birds per man-hour is by a factor of 0.7 when increasing output from 200 to 350 and from 350 to 500 birds per hour.

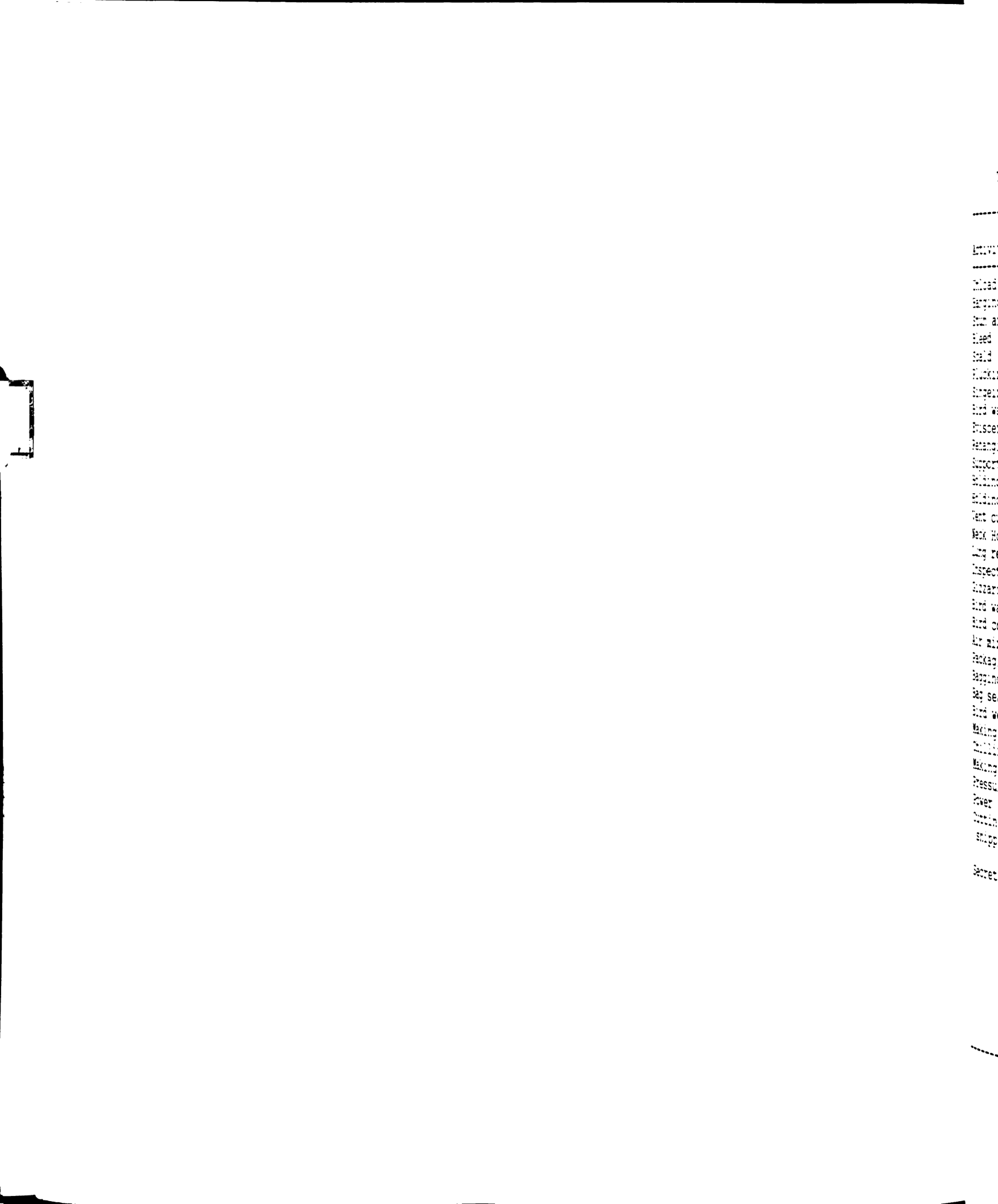


Table: 4.5 Processing Activities, Equipment and Labor Requirement for the Four Processing Plants

Activity	Equipment	Labor Requirement A	B	C	D
Unloading	Unloading Conveyor				
Hanging	Killing Cones/Shackles	1	1	3	6
Stun and Kill	Stun and Kill knife	1	1	1	1
Bleed	Bleeding trough/tunnel				
Scald	Scalder	1	2	2	4
Plucking	Picker	1	2	2	5
Singeing	Singer				
Bird washing	Outside Washing Station				
Eviscerating	Evisceration table	8	13	18	31
Rehanging	Evisceration line				
Supporting	Evisc. line Floor stand				
Holding offal	Offal Cart				
Holding giblet	Giblet pans				
Vent cutting	Vent Cutter				
Neck/Hock cut	Neck and Hock Cutter				
Lung removal	Lung Gun				
Inspection	Inspection station	1	2	2	2
Gizzard cleaning	Gizzard Peeler				
Bird washing	Inside Washing Station				
Bird cooling	Chill Tanks				
Air mixing	Tank Agitator Pump				
Packaging	Packaging Table	2	3	5	8
Bagging	Bird Bagger				
Bag sealing	Bag Clipper				
Bird weighing	Packaging Scales				
Making ice	Ice machine				
Chilling birds	Refrigeration				
Making steam	Boiler				
Pressure	Pumps				
Power supply	Generator				
Cutting, snipping, etc	Loose Hand Equipment: Knives, hand rakes Scissors, etc)				
Secretary, etc	Office Equipment: (chairs, desk, file cabinets computer, typewriter)	1	1	1	1
	Miscellaneous: Finger replacing tool Electric knife sharpener				
	TOTAL	15	25	34	58

B. In-l

Th

process

while t

handlin

concept

not inc

adequat

the pro

Table 4.6 Summary of Labor Requirement

	------- PLANTS --------			
ITEMS	A	B	C	D
Birds/hr. Output	200	350	500	1200
No. of laborers	15	25	34	58
Birds/man-hour	13.3	14.0	14.7	20.7
Marginal Output	15.0	16.7	29.2	

B. In-line Processing

The in-line processing as defined earlier, refers to a processing system where most of the activities are performed while the birds are on the conveyor line. There is less handling of the birds during processing. This is the similar concept used in large plants. The scope of this study does not incorporate the in-line processing because of lack of adequate information on this subject, but Appendix D shows the processing systems of Stork and Linco companies.

: INT

T

poultr

e inv

availa

Three

a ho

f lo

severa

First,

the pl

proces

catego

that m

plant.

a) Ho

T

less t

Most f

active

produc

activi

Chapter 5

Capital Investment for Low-volume Processing Plants.

I. INTRODUCTION

Very often people become tempted to be involved in a poultry business for several reasons. For example, one might be involved because of the rapid turn-over of broilers, or availability of resources and time, or hobby persuasion. Three categories of processors can be identified as: (a) hobby producer/processor, (b) custom processors, and (c) low-volume broiler producer and/or processor). There are several distinguishing features among the three categories. First, the goals of the group. Second, the equipment used in the plant/building, resulting in the number of birds processed per unit time. A brief description of the three categories is provided then followed by pertinent questions that need to be considered before establishing a processing plant.

(a) Hobby Producer or Processor.

This category is constituted of people who are raising less than one hundred birds at a time for home consumption. Most families involved in this category have no commercial motive, or this is not their primary objective. The hobby producer/processor can be regarded as a homesteader. Their activities are seasonal and may be planned to coincide with

ationa

ily. T

process

[illegible]

family

relativ

product

will ha

neighbo

arrange

simples

b. Co

Th

motivat

to rais

process

have a

c. C

Th

for pro

a comme

or by t

process

national holidays such as Thanksgiving and the Fourth of July. To other families, the realization of home grown and processed chicken served at the table brings some kind of fulfillment and pride. There is a tendency that the people (family) who are already involved will influence their relatives and/or neighbors to become involved in poultry production. Usually one family (especially the motivator) will have the capability to process birds raised by neighbors or relatives or friends. The processing activity, arrangement and organization for the hobby processor is the simplest among the three categories.

(b). Commercial Producer or Grower

The commercial producer or grower category is profit motivated. The primary activity of the commercial grower is to raise birds, arrange an agreement with a custom processor, and establish a market. It is very important to have a reliable and dependable custom processing plant.

(c). Custom Processor

This category has low-volume processing plants, used for processing birds at a fee for poultry producers. This is a commercial operation run by the family (both man and wife) or by the wife alone with a few employees. Usually the processors do not raise their own birds. Their processing

activi

handle

geese,

activi

proces

No bir

regula

the in

month.

d). L

T

activi

Severa

enterp

determ

focus

is tha

eight

year.

focus

hereto

activity is seasonal, the plants are not specialized and can handle different species of poultry (broilers, turkeys, geese, and quail). There is a fee charged for the processing activity depending on the type and size of the birds. The processing activity is driven by the availability of birds. No birds, no business! Processors seem to have established regular customers. Very little advertisement is done, and the information about their business is spread by word of mouth.

(d). Low-volume Broiler Producer and/or Processor

This is the most complex of the three categories. The activities range from producing, processing, and marketing. Several approaches or alternatives can be used in such an enterprise (e.g., contracting growers) but this will be determined by the game plan of management. This study will focus on the poultry processing aspects. The assumption made is that birds will be available to enable the plant to run eight hours a day, five days per week, for fifty weeks per year. The analysis of the investment requireiment will focus on the 200, 350, 500 or 1200 birds per hour plants, heretoafter called Plants A, B, C or D, respectively.

II. I

perso

local

alrea

to oth

in la

situa

expens

altern

proces

proces

12,50

respe

plant

exist

III.

other

plant

build

squar

for th

II. INVESTMENT IN LAND

The land investment question will be an issue for a person who does not presently own land for a suitable site. Usually, low-volume processing is done by people who already own land and where the processing activity is added to other farming activities. For this reason the investment in land may be excluded, so this will depend on the given situation. On the other hand, land could be an important and expensive cost, provided the desired land has a high alternative use cost. This results in a large range of land prices.

The minimum land requirement for the different processing plants as stated in Table 2, are 4,000; 5,000; 12,500; or 15,000 sq.ft. for Plants A, B, C or D, respectively. In this study it will be assumed that the plants need a minimum of one acre, and are located on an existing farm. So the investment in land will be zero.

III. INVESTMENT IN BUILDINGS

The FSIS regulation and specifications should be adhered to when building a plant to ensure approval of your plant sketches. This has an implication on the material and building procedures to be followed. The building cost per square foot for different areas of the plant will differ, for this study an average amount will be used for all areas.

The as

on the

tabula

area a

Table

T

Pla
A
B
C
D

T

that o

floor

5.1. I

alloca

relati

increa

decrea

A

increa

to D t

The assumed building cost of $150 per sq.ft. is used. Based on the minimum area requirement for the four plants tabulated in Table 3.1, the cost of the building and floor area and daily production relationship is shown in Table 5.1.

Table 5.1 Estimated Construction Cost for Processing Plants, at $150 per sq.ft.

Plant	Daily Capacity	Floor Area (sq.ft.)	Floor Area per bird Daily Cap.	Building Cost ($)
A	1600	800	0.500	120000
B	2800	1000	0.357	150000
C	4000	1400	0.350	210000
D	9600	3000	0.313	450000

The building cost for Plant D is more than two-fold that of Plant C. A ratio depicting the relationship between floor space and daily processing capacity is shown in Table 5.1. This ratio explains what happens to the floor space allocation as the daily processing capacity is increased in relation to equipment and machinery. As daily output increases from Plant A to D, the floor area per bird ratio decreases. The increase of the ratio is not proportionate.

An explanation of this phenomenon is that when increasing daily processing capacity from Plants A to B or C to D the equipment and machinery are not that different,

mplying
pportio
relation
because
and mach
and dai
used in
space r
same co

IV. IN

I
cost
upon
equip
the l
pick
sourc
feat
of s
comp
and
the
assi
fro

implying that machinery investment does not increase proportionally to output. When moving from Plant B to C, the relationship is different. The floor area per bird increases because more room is needed for introducing larger equipment and machinery. In essence, the ratio on floor area per bird and daily capacity indicate that equipment and machinery used in Plants A and B are not very different in terms of space requirement, which may imply similarities. This is the same concerning Plants C and D.

IV. INVESTMENT IN EQUIPMENT

There are several reasons that make estimating the cost of equipment difficult. First, the cost will depend upon the manufacturer, distributer, or dealer from whom the equipment is purchased. One striking observation concerning the low-volume equipment is that most of the basic equipment (picker, scalder, and eviscerating table) from the different sources are the same in dimension, shape, and other features but have different company tags. Second, the cost of similar pieces of equipment may vary within the same company. For example, the cost will vary between standard and deluxe models of the same piece of equipment. One theoretical possibility to overcome these problem is to assume that comparable equipment for each plant is purchased from the same manufacturer. In this study it is assumed that

the p

equip

T

equip

crushe

of out

the fu

servic

more e

this t

equip

that t

not in

exampl

a). I

b). I

c). S

V. IN

T

employ

5500,

respec

for fu

the processor/investor has complete information about equipment.

The other consideration with equipment purchases, is equipment indivisibility. The same equipment such as ice crushers, and weighing scales, may be used over a wide range of output. This and other equipment may not be utilized to the fullest extent. Yet through necessity of need for the service, or by virtue of this equipment being relatively more efficient than hand labor, it may be desirable to use this type of equipment. That is why there will be some equipment overlap between plants (Table 5.2). Please note that the listed total cost of equipment in Table 5.2 does not include other costs that may be of pertinance, for example:-

(a). Installation charges

(b). Freight charges

(c). Sales tax.

V. INVESTMENT IN FURNITURE

The purchase of furniture for the office, inspector and employee facilities is needed. In this study, estimates of $500, $600, $600 and $800 for Plants A, B, C and D, respectively, were used as representative investment amounts for furniture.

Eqpt

Over
Hill
Run
Hee
Hee
Scal
Rock
Insp
Sing
Jets
Pris
Pris
Pris
Offa
[illegible]
Vent
Neck
Lung
Dizz
Inst
Fall
Tank
Bagg
Pack
Ice
Loos
Misc
Sp
Fl
Pr
El

Table 5.2 Estimated Investment on Batch Processing Equipment

Equipment	Plant A	Plant B	Plant C	Plant D
	dollars			
Overhead Conveyor	-	-	760	760
Killing Cones/Shackles	300	500	1015	1155
Stun and Kill knife	998	998	998	998
Bleeding trough	540	-	-	-
Bleeding tunnel	-	795	2795	2795
Scalder	1160	2021	4080	5370
Picker	1500	3018	7425	7425
Inspection table	533	740	740	740
Singer	41	41	41	82
Outside Washing Station		1495	1495	1495
Evisceration table	490	-	-	-
Evisceration line	-	5595	9950	9950
Evisc. line Floor stand	-	2255	2395	3536
Offal Cart	295	295	295	1180
Giblet pans	116	116	233	350
Vent Cutter			1750	1750
Neck and Hock Cutter			525	525
Lung Gun		350	350	350
Gizzard Peeler		1105	1105	1105
Inside Washing Station		1146	1146	1146
Chill Tanks	600	1899	2160	3240
Tank Agitator Pump	370	370	370	370
Bagging Unit	1180	1780	1780	1780
Packaging Scales	440	440	440	880
Ice machine	9645	9645	9645	9645
Loose Hand Equipment	500	800	1076	1432
Miscellaneous:				
Spare fingers	144	200	288	576
Finger replacing tool	57	57	57	57
Protection clothing	60	220	320	515
Electric knife sharpener	29	29	29	29
TOTAL	18998	35910	52876	59236

II. IN

operat

on an

farm

then,

III.

ident

Table

inves

Year
Buil
Equi
Furn
Tota
Tot.

Data

VI. INVESTMENT IN VEHICLES

Transportation service is a necessity in any business operation. For a processing plant that is to be established on an operating farm, vehicles that are currently at the farm can be used for the processing enterprise. In this case then, the investment cost in vehicles will be zero.

VII. Summary

The total capital investment for establishing the identified low-volume processing plants is summarized in Table 5.3. The resources that were assumed to have zero, an investment cost will not be included in Table 5.3.

Table: 5.3. Summary of Total Investment Requirement for Low-Volume Processing Plants.

	Plant A	Plant B	Plant C	Plant D
Year Prod. Cap. (No.)	375,000	656,250	937,500	2.25mil
Building cost ($)	120,000	150,000	210,000	450,000
Equipment cost ($)	18,998	35,910	52,876	59,236
Furniture cost ($)	500	600	600	800
Total cost ($)	139,498	186,510	263,476	510,036
Tot. cost/day Cap ($)	0.372	0.284	0.281	0.23

The increase in investment requirement (total cost) is dramatic when moving from Plant B to C, an increase of 2.3

times that of Plant B. The main consideration in this regard is what happens to the investment requirement as the plant capacity is increased from one size to the next. This has led to deriving a ratio that considers the daily processing capacity with the total investment cost. Table 5.3 indicate that increased daily processing capacity results in a lower ratio. The implications of these results can be better understood when other processing issues are factored into the equation.

Chapter 6

Plant Processing Cost and Sensitivity Analysis

I. INTRODUCTION

The processing costs to be considered in this study are those that occur in the processing plant, that is in-plant processing costs. These are all costs that are incurred between the procurement of birds and shipping the rtc meat from the processing plant. The in-plant processing cost will be expressed on a cost per bird basis. This expression unit is a helpful common denominator when comparing processing costs of different sized plants (Plant A, B, C or D, in this study).

The approach of this study is that processing costs are made up of the following:

(a) Labor

(b) Administrative costs

(c) Packaging

(d) Utilities

(e) Insurance

(f) Taxes

(g) Depreciation

(h) Interest

(i) Supplies Office

(j) Miscellaneous costs (telephone, postage and fax)

(k) Waste disposal (by-products, sewerage)

The above list of cost items is not exhaustive, but representative of the cost incurred by low-volume processing plants. For example, some plants may budget and incur advertisement and public relations costs. But most low-volume processors do not advertise. The mode of advertisement is by "word of mouth." The philosophy used is simple: as a processor you must do a better job to keep your customers satisfied and loyal. This will make your customers recommend you to other potential customers. The alternative is to advertise, but this may be very expensive and most low-volume processors do not use it. Occasionally processors may use flyers and newspapers for advertisement.

The costs that are incurred by a processing plant can be classified or categorized into:

a) . Overhead or Fixed cost

b) . Variable costs.

II. OVERHEAD COSTS

The terms overhead costs and fixed costs are normally interchangeably used, and this is the case in this study. Fixed costs are costs that are unaffected by volume changes within a plant. Therefore, as output is increased (decreased), the fixed costs are spread over more and more

less

per

are

equip

depre

insu

veh

proc

dura

wear

age,

try

line

calc

init

equ

use

the

Tab

(less and less) units of output. Therefore the fixed cost per unit of output will vary with total output. These costs are associated with investment costs of land, building, equipment, furniture, vehicles and include such costs as depreciation, interest, maintenance and repairs, taxes and insurance. Please note that the investment for land and vehicles are assumed to be zero. This implies that the processor already has invested in land and vehicles.

Depreciation costs

There are three categories that the depreciation of a durable asset can be divided into: (a) depreciation from wear and usage, (b) depreciation over time resulting from age, and (c) depreciation due to obsolescence. In order to try and address the fore mentioned concerns, the Straight Line (SL) Depreciation was be used in this study. The calculation of depreciation for the building uses the initial cost and 15 years of useful life. The useful life of equipment ranged from 1 to 7 years. For the furniture the useful life of 5 years was used. The depreciation cost for the building, equipment and furniture is shown in Table 6.1.

Table 6.1 Depreciation Cost on Building, Equipment and Furniture for Four Processing Plants

ITEMS	PLANTS A	B	C	D
Annual depreciation:	($)	($)	($)	($)
Building	14020	17524	24534	52573
Equipment	6650	10500	14910	16399
Furniture	100	120	120	160
Total depreciation	20770	28144	39564	69132
Per bird depreciation	0.055	0.043	0.042	0.031

The depreciation cost of Plant B and C are nearly the same. Plant B is $0.001 higher in depreciation cost than Plant C. This shows that Plant B is small enough to efficiently use hand labor and some lower cost equipment. On the other hand, Plant B is not large enough to warrant the use of more mechanized equipment that ought to result in lower costs only if larger volumes of birds are processed. This is shown in Plant D (the largest plant) with the depreciation cost of $0.031, which is the lowest among the four plants.

Maintenance and Repairs Costs

The maintenance and the repair operations are two activities that are separate but usually considered as one entity when cost accounting is made. A point of departure or

consid

a fix

situat

to kee

not o

other

direct

cost.

equipm

as pl

the la

the sm

$114

range

respe

Main
Tota
Per

consideration is that maintenance can be either regarded as a fixed or a variable cost depending on the given situation. For example, some maintenance must be performed to keep machinery in working condition even if the plant is not currently operating as is regarded as a fixed cost. The other consideration is when maintenance and repair is a direct result of equipment/machine usage, that is a variable cost. The maintenance and repair cost on the building, equipment and furniture is shown in Table 6.2.

The total maintenance and repairs costs increase as plant output increases. In this study, Plant D which is the largest plant, had the highest ($4126) while Plant A, the smallest, had the lowest maintenance and repairs costs ($1144). On a per bird basis, maintenance and repairs cost ranged from 0.0031 to 0.0018 for Plants A and D, respectively.

Table 6.2 Maintenance and Repairs for the Four Processing Plants

ITEMS	PLANTS A	B	C	D
Maint. & Repairs on:	($)	($)	($)	($)
Building	900	1125	1575	3375
Equipment	238	449	661	741
Furniture	6	8	8	10
Total Maint & Repairs	1144	1582	2244	4126
Per bird Maint & Repairs	0.0031	0.0024	0.0023	0.0018

ne

tha

pe

sno

tta

real

prop

1.01

In
To
Tax and
Tax and

Interest

The interest costs reflect what the money invested in the processing plant would secure if it was invested in other endeavors of approximately equal risk. An interest of 8 percent was used in this study.

Taxes

Normally property tax is considered in this category, since items like social security tax are included in the total labor cost under fringe benefits. The property tax, real and personal is based on the assessed value of property. In this study the tax is going to be assumed as 0.015 of the initial cost (Table 6.3).

Table 6.3 Summary on Property Tax of the the Four Processing Plants

ITEMS	PLANTS A	B	C	D
Initial value of:	($)	($)	($)	($)
Building	120000	150000	210000	450000
Equipment	18998	35910	52876	59256
Furniture	500	600	600	800
Total initial value	139498	186510	263476	510056
Tax on Build., Equip. and Furn. per year	2093	2798	3952	7651
Tax on Build., Equip. and Furn. per bird	0.0056	0.0043	0.0042	0.0034

Insurance

Insurance considerations for a processing plant would be to cover the buildings, equipment and furniture. Normally coverage ensures against property damage (such as fire, wind, etc.). In this study a reasonable estimate of 0.025 of initial cost was used (Table 6.4).

Table 6.4 Summary of Insurance Costs on Building, Equipment and Furniture for the Four Plants

ITEMS	PLANTS A	B	C	D
Initial value of:	($)	($)	($)	($)
Building	120000	150000	210000	450000
Equipment	18998	35910	52876	59256
Furniture	500	600	600	800
Total Investment	139498	186510	263474	510056
Total Insurance cost	3488	4663	6587	12751
Insurance cost per bird	0.0093	0.0071	0.0070	0.0057

III. VARIABLE COSTS

Variable costs vary with plant output. The cost items that are included in this category are: labor, administrative costs, utilities (water, electricity, fuel, and gas), packaging costs, and miscellaneous or secondary

costs (postage, telephone, and fax). The other costs that need to be considered are those dealing with waste and by-product handling. These costs depends on the type of arrangement that the plant personnel has arranged.

Wages and Salaries

The total labor cost is made up of the processing number of laborers employed in a plant. The wage rate for all laborers and a secretary is assumed to be the same at $6.00 per hour (Table 6.5). Administrative costs consist of management and a secretary (or support staff). The salary to allocate to management needs some consideration. The typical situation in a low-volume processing plant is that there is an owner-manager arrangement. Usually the owner-manager allocates more time on an irregular basis in the enterprise than the assumed definition of 8 hours a day, and 5 days a week. The administrative cost per bird for Plants A, B, C or D are 0.064, 0.050, 0.045 or 0.037, respectively.

Cost of Utilities

The cost of utilities include costs for items such as water, electricity, steam, gas. The approach in this study is to specify each item and not group those costs, since grouping does not reflect the requirement of each item.

a) Water

The water requirements in this study were based on a recommendation made in the FSIS regulations that processing one bird will require at least 8 gallons of water (FSIS, 1987). It has been reported that some processing plants are doing much better than this, by using 5 to 6 gallons per bird. The other basic assumption in this study is that water costs $1.50 per 1000 gallons. Based on the above assumptions, the water requirement, as well as the cost of water for each plant can be determined. The annual costs of water is $4500, $7875, $11250 or $27000 for Plants A, B, C or D, respectively (Table 6.5).

b) Electricity

To determine the electricity cost in the processing plants, a reasonable estimate of $0.16 per 100 birds was used. The estimated annual cost electricity for Plants A, B, C or D were $600, $1050, $1500 or $3600, respectively (Table 6.5).

c) Gas

The cost of gas will depend on the source of gas (LP, Natural gas, or Propane) that the equipment is fitted for. For example, some scalders are gas fired and singers use gas.

Cost of Packaging

The cost of packaging supplies are estimated at $0.05 per bird. The total cost for the different plants can be determined based on the daily output. The annual packaging cost for Plants A, B, C or D were $18750, $32813, $46875 or $112500, respectively (Table 6.5).

Miscellaneous costs

There are several other costs that do not fluctuate greatly with output, yet which would not be incurred if there were no output. These include such cost as telephone, postage, office and supplies. An estimate of the secondary costs for Plants A, B, C or D on an annual basis were $4450, $4475, $4500 or $4550, respectively (Table 6.5).

Cost of handling sewerage, waste disposal and processing by-products

A waste water pre-treatment facility is needed in a processing plant to ensure the reduction of effluent (BOD, suspended solids, oil and grease) entering the sewerage system. Usually in a low-volume processing plant an arrangement with a renderer is made for collecting processing by-products. This helps the processor handle the processing by-products, such as blood, feathers, offal and dead birds. This arrangement is made at a certain cost. At

times the renderer may stipulate the type of by-products that will be collected (e.g., blood, offal, but excluding feathers). Costs in this category were not incorporated into this study because of limited availability of information.

IV. PROCESSING COST

The summary of all the costs involved in low-volume poultry processing is shown in Table 6.5. The calculations are based on the following assumptions:

1) Amormotized building cost at $150 per sq.ft., Life = 15 years, Interest rate = 8%.
2) Amortized equipment cost at 8% Interest rate, Life = 1 to 7 years.
3) Amortized furniture cost at 8% Interest rate, Life = 5 years
4) Labor compensation: basic + benefits = $6.00 per
5) Administrative cost based on $30,000 per year for the 500 birds per hour plant and $12,000 per year for secretarial assistance.
6) Water at $1.50 per 1000 gallons.
7) Electricity at $0.16 per 100 birds.
8) Building maintenance and repairs at 0.0075 of initial cost.

Table: 6.5 Summary of Processing Costs

	PLANTS			
	A	B	C	D
Year Production Cap.	375000	656250	937500	2250000
OWNERSHIP COSTS:	---------- DOLLARS ----------			
Building Annual cost	14020	17524	24534	52573
Equipment Annual cost	6650	10500	14910	16399
Furniture Annual cost	125	150	150	200
OPERATING COSTS:				
Labor	180000	300000	396000	696000
Administrative costs	24000	33000	42000	84000
Water	4500	7875	11250	27000
Electricity	600	1050	1500	3600
Building Maint & Rep	900	1125	1575	3375
Equipment Maint & Rep	237	449	661	741
Furniture Maint & Rep	6	8	8	10
Packaging supply	18750	32813	46875	112500
Insurance	3487	4663	6587	12751
Property Tax	2092	2798	3952	7651
Miscellaneous	4450	4475	4500	4550
TOTAL	259817	416430	554502	1021350
Cost/bird	0.6929	0.6346	0.5915	0.4539

9) Equipment maintenance and repairs at 0.0125 of initial cost.

10) Furniture maintenance and repairs at 0.0125 on initial cost.

11) Packaging supply at $0.05 per bird processed.

12) Insurance at 0.025 of initial cost.

13) Property tax at 0.015 of initial cost.

14) Miscellaneous based on $4500 per year for 500 birds per hour plant (for telephone, postage, fax, etc.)

Table 6.5 shows that the cost of processing, on a per bird basis, decreases as the capacity of the plant increases. The annual output of the plants considered range from 375,000 to 2.25 million birds. The increment in plant output between the plants is not proportional. Based on the output, Plant B is 1.75 times larger than Plant A; Plant C is 1.429 times larger than Plant B; and Plant D is 2.40 times larger than Plant C.

The other consideration is the relationship of total capital investment for the plants. The capital requirement of Plant B is 1.362 that of A; Plant C is 1.413 times that of B; and Plant D is 1.936 that of C.

The processing cost per bird is an appropriate measure for comparing the different sized plants. Unit processing costs fall as plant size is increased, if all plants are operating at their designed rates of output.

To determine the contribution of different costs to the unit processing cost, the cost in Table 6.6 were grouped into the following categories:

1) Fixed cost (consisting of depreciation of building, furniture and equipment, management, insurance and tax).
2) Labor cost (included plant laborers and secretary).
3) Utilities (water and electricity)
4) Maintenance and repairs (for building, furniture and equipment)
5) Packaging
6) Miscellaneous (supplies, telephone, postage, stationary, etc.)

Table 6.6 Processing Costs as Percentage of the Total cost for the Four Plants.

ITEMS	----- PLANTS ------ A B C D ----(percentage)----			
Fixed cost	20	15	14	12
Labor cost	69	73	74	72
Utilities	2	2	2	3
Maint. and Rep.	0	0	0	0
Packaging	7	8	8	11
Miscellaneous	2	1	1	0
TOTAL	100	100	100	100

Table 6.6 shows that labor, fixed cost and packaging constitute 96% of the total cost for plants A, B and C, while for plant D those costs constitute 95%. The remaining (utilities, maintenance and repair and miscellaneous) costs are negligible. The fixed cost decreases as the plant size increases.

V. SENSITIVITY ANALYSIS

The estimation of per bird processing cost in Table 6.5 for the different sized plants were based on certain assumptions. The result obtained using those assumptions will be regarded as the base scenario. A sensitivity analysis is used to determine the impact of changing some of the assumptions used in the base scenario on processing costs. In this study, the four factors that are to be considered are:

a) Capacity Utilization: 100, 90, 80, 70, 60, 50, and 40%

b) Labor Cost: $6.00 and $7.00 per hour.

c) Building cost: $140, $150 and $160 per sq.ft.

d) Interest cost: 8% and 12% per annum.

Capacity utilization

The comparison of processing cost per bird for each plant when operating at 100, 90, 80, 70, 60, 50, and 40 percent of plant utilization is presented in Tables 6.7 to 6.12. The results obtained from the 100 percent capacity utilization (the base situation) are shown in Table 6.5.

Table 6.7 Sensitivity Analysis: Capacity Utilization (90 percent)

	PLANTS			
	A	B	C	D
Year Production Cap.	375000	656250	937500	2250000
Year Average Volume	337500	590625	843750	2025000
	DOLLARS			
OWNERSHIP COSTS:	20795	28174	39594	69173
OPERATING COSTS:				
Labor	162000	270000	354000	626400
Administrative costs	24000	33000	42000	84000
Water	4050	7088	10125	24300
Electricity	540	945	1350	3240
Building Maint & Rep	900	1125	1575	3375
Equipment Maint & Rep	237	449	661	741
Furniture Maint & Rep	6	8	8	10
Packaging supply	16875	29531	42186	101250
Insurance	3487	4663	6587	12751
Property Tax	2092	2798	3952	7651
Miscellaneous	4450	4475	4500	4550
TOTAL	239432	382256	506538	937441
Cost/bird	0.7094	0.6472	0.6003	0.4629

Table 6.8 Sensitivity Analysis: Capacity Utilization (80 percent)

	PLANTS			
	A	B	C	D
Year Production Cap.	375000	656250	937500	2250000
Year Average Volume	300000	525000	750000	1800000
	DOLLARS			
OWNERSHIP COSTS:	20795	28174	39594	69173
OPERATING COSTS:				
Labor	144000	240000	316800	556800
Administrative costs	24000	33000	42000	84000
Water	3600	6300	9000	21600
Electricity	480	840	1200	2880
Building Maint & Rep	900	1125	1575	3375
Equipment Maint & Rep	237	449	661	741
Furniture Maint & Rep	6	8	8	10
Packaging supply	15000	26250	37500	90000
Insurance	3487	4663	6587	12751
Property Tax	2092	2798	3952	7651
Miscellaneous	4450	4475	4500	4550
TOTAL	219047	348082	463377	853531
Cost/bird	0.7302	0.6630	0.6178	0.4742

Table 6.9 Sensitivity Analysis: Capacity Utilization (70 percent)

	PLANTS			
	A	B	C	D
Year Production Cap.	375000	656250	937500	2250000
Year Average Volume	262500	459375	656250	1575000
	DOLLARS			
OWNERSHIP COSTS:	20795	28174	39594	69173
OPERATING COSTS:				
Labor	126000	21000	277200	48700
Administrative costs	24000	33000	42000	84000
Water	3150	5513	7875	18900
Electricity	420	735	1050	2520
Building Maint & Rep	900	1125	1575	3375
Equipment Maint & Rep	237	449	661	741
Furniture Maint & Rep	6	8	8	10
Packaging supply	13125	22969	32813	78750
Insurance	3487	4663	6587	12751
Property Tax	2092	2798	3952	7651
Miscellaneous	4450	4475	4500	4550
TOTAL	198664	313909	417815	769421
Cost/bird	0.7568	0.6833	0.6367	0.4886

Table 6.10 Sensitivity Analysis: Capacity Utilization (60 percent)

	PLANTS			
	A	B	C	D
Year Production Cap.	375000	656250	937500	2250000
Year Average Volume	225000	393750	562500	1350000
	DOLLARS			
OWNERSHIP COSTS:	20795	28174	39594	69173
OPERATING COSTS:				
Labor	108000	180000	237600	417600
Administrative costs	24000	33000	42000	84000
Water	2700	4725	6750	16200
Electricity	360	630	900	2160
Building Maint & Rep	900	1125	1575	3375
Equipment Maint & Rep	237	449	661	741
Furniture Maint & Rep	6	8	8	10
Packaging supply	11250	19688	28125	67500
Insurance	3487	4663	6587	12751
Property Tax	2092	2798	3952	7651
Miscellaneous	4450	4475	4500	4550
TOTAL	178277	279735	372252	685711
Cost/bird	0.7924	0.7104	0.6618	0.5079

Table 6.11 Sensitivity Analysis: Capacity Utilization (50 percent)

	PLANTS			
	A	B	C	D
Year Production Cap.	375000	656250	937500	2250000
Year Average Volume	187500	328125	468750	1125000
	DOLLARS			
OWNERSHIP COSTS:	20795	28174	39594	69173
OPERATING COSTS:				
Labor	90000	150000	198000	348000
Administrative costs	24000	33000	42000	84000
Water	2250	3973	5625	13500
Electricity	300	525	750	1800
Building Maint & Rep	900	1125	1575	3375
Equipment Maint & Rep	237	449	661	741
Furniture Maint & Rep	6	8	8	10
Packaging supply	9375	16406	23438	56250
Insurance	3487	4663	6587	12751
Property Tax	2092	2798	3952	7651
Miscellaneous	4450	4475	4500	4550
TOTAL	157892	245560	326689	601801
Cost/bird	0.8421	0.7484	0.6969	0.5349

Table 6.12 Sensitivity Analysis: Capacity Utilization (40 percent)

	PLANTS			
	A	B	C	D
Year Production Cap.	375000	656250	937500	2250000
Year Average Volume	187500	328125	468750	1125000
	DOLLARS			
OWNERSHIP COSTS:	20795	28174	39594	69173
OPERATING COSTS:				
Labor	720001	120000	158400	278400
Administrative costs	24000	33000	42000	84000
Water	1800	3150	4500	10800
Electricity	240	420	600	1440
Building Maint & Rep	900	1125	1575	3375
Equipment Maint & Rep	237	449	661	741
Furniture Maint & Rep	6	8	8	10
Packaging supply	7500	13125	18750	45000
Insurance	3487	4663	6587	12751
Property Tax	2092	2798	3952	7651
Miscellaneous	4450	4475	4500	4550
TOTAL	137509	211386	281127	51891
Cost/bird	0.9167	0.8053	0.749	0.5754

Table 6.13 Summary of Processing Cost per Bird due to Capacity Utilization

Capacity Utilized	PLANT			
	A	B	C	D
	DOLLARS			
100%	0.6929	0.6346	0.5915	0.4539
90%	0.7094	0.6472	0.6032	0.4629
80%	0.7302	0.6630	0.6178	0.4742
70%	0.7568	0.6833	0.6367	0.4886
60%	0.7924	0.7104	0.6618	0.5079
50%	0.8421	0.7484	0.6969	0.5349
40%	0.9167	0.8053	0.7497	0.5754

The above Table show that when processing plants are operating at less than the potential capacity output, the cost of processing a bird increases the most for the smallest plant, while the large plant has the least cost increase as output decreases. The degree of capacity utilization shown in Table 6.14 indicating that a plant not processing at full capacity (70%), if it further reduces the capacity (40%), the unit processing cost increases dramatically, especially as plant size is reduced.

Figure 6.2 Capacity Utilization

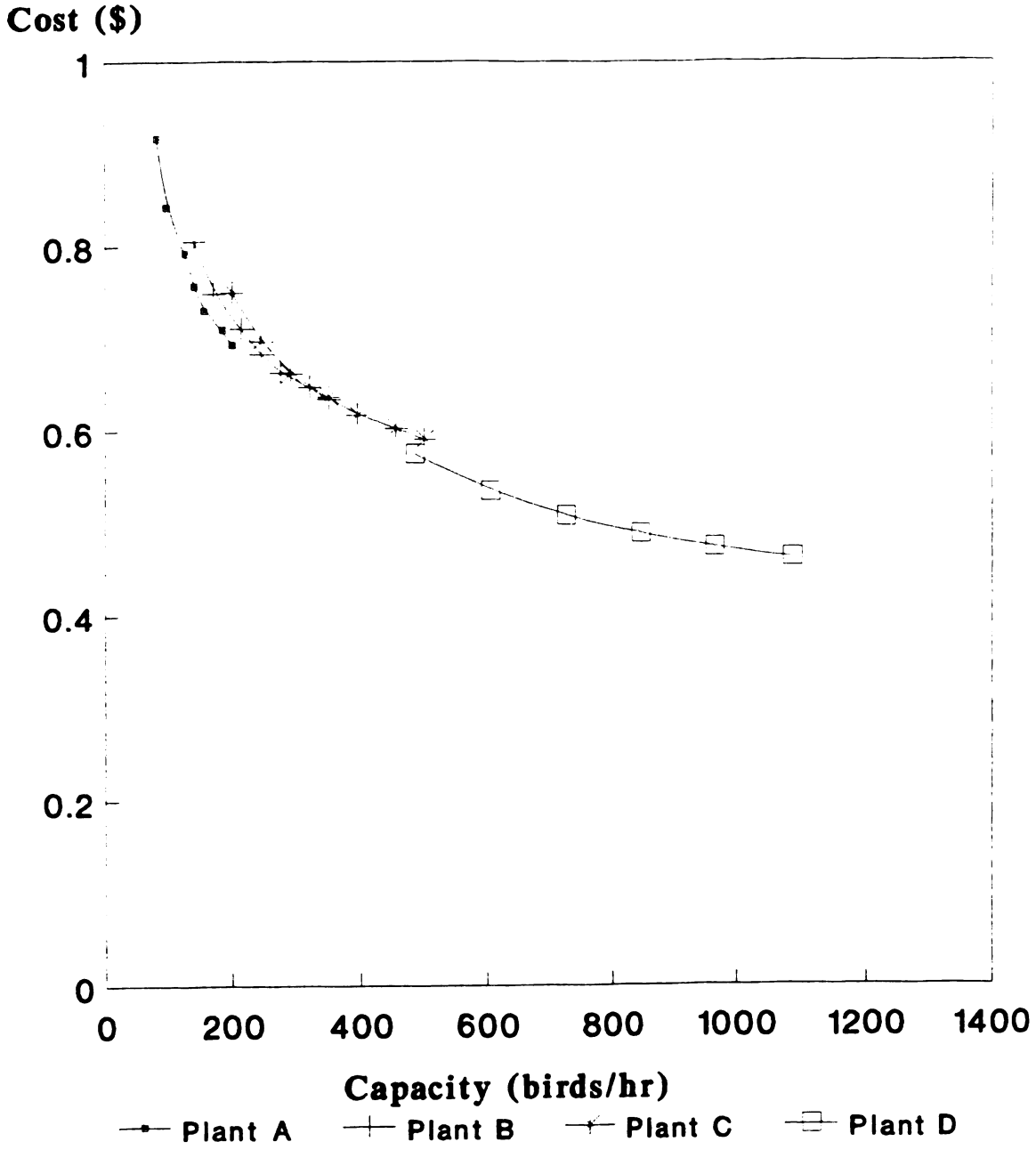


Table 6.14 Summary showing the impact of changing from 100 to 70% and 70 to 40% capacity utilization

Plant	--- Capacity Utilization -- 100%	70%	40%	-- Changes from -- 100-70%	70-40%
A	0.6929	0.7568	0.9167	+0.0639	+0.1599
B	0.6346	0.6833	0.8053	+0.0487	+0.1220
C	0.5915	0.6367	0.7494	+0.0452	+0.1127
D	0.4539	0.4886	0.5754	+0.0347	+0.0868

Labor cost

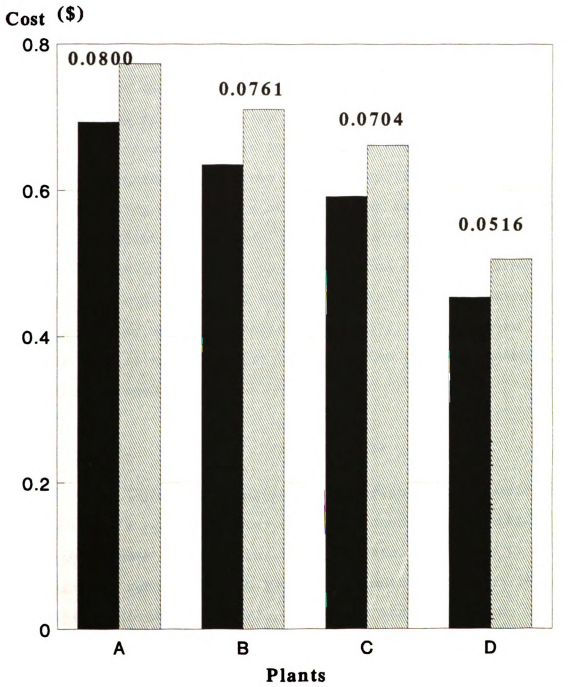
In an integrated poultry enterprise, the processing plant is the highly labor intensive operation when compared to the other production stages. Even though sophisticated equipment is being used, labor (to operate, back-up, clean, maintain and repair) is still needed. Several labor factors (availability, labor cost and reliability) were mentioned in the early discussion as important when considering plant location. The sensitivity analysis on labor costs (salary and wages) will determine the impact it has on the processing cost as it varies from $6.00 (base) to $7.00 per hour (Table 6.15).

The change in labor compensation rate (from $6.00 to $7.00) caused the unit processing cost increase by $0.0800, $0.0761, $0.0704, or $0.0516 for plant A, B, C, or D, respectively.

Table 6.15 Sensitivity Analysis: Increase in Labor Cost (wage rate = $7/hr)

	PLANTS			
	A	B	C	D
Year Production Cap.	375000	656250	937500	2250000
OWNERSHIP COSTS:	---------- DOLLARS ----------			
Building Annual cost	14020	17524	24534	52573
Equipment Annual cost	6650	10500	14910	16399
Furniture Annual cost	125	150	150	200
OPERATING COSTS:				
Labor	210000	350000	462000	812000
Administration costs	24000	33000	42000	27000
Water	4500	7875	11250	27000
Electricity	600	1050	1500	3600
Building Maint & Rep	900	1125	1575	3375
Equipment Maint & Rep	237	449	661	741
Furniture Maint & Rep	6	8	8	10
Packaging supply	18750	32813	46875	112500
Insurance	3487	4663	6587	12751
Property Tax	2092	2798	3952	7651
Miscellaneous	4450	4475	4500	4550
TOTAL	289819	466429	620502	1137351
Cost/bird	0.7729	0.7107	0.6619	0.5055

Figure 6.3 Increase in wage rate by $1.00/hr.



Building cost

Building a processing plant requires adherence to the FSIS regulations, though it is known that some low-volume processors can be exempted. Getting information on building costs from the industry is not a very easy task. This is because the emphasis has long shifted from small sized low-volume processing to large scale processing. Also, according to building contractors it is cheaper per square foot to build a plant larger than that the low-volume processors are contemplating. To grasp the implication of this, three building costs of $140, $150 (base) and $160 were used in sensitivity analyses (Tables 16 and 17). The increase and decrease of building cost per unit area slightly changes the unit processing cost.

Interest rate

The impact of changing the interest rate was determined by using 8 percent (base) and 12 percent (Table 6.18). A four percent increase in interest rate (from 8 to 12 percent) resulted in an increase in unit processing cost by $0.005, $0.0021, $0.0022, or $0.0037 for plant A, B, C, or D, respectively.

Table 6.16 Sensitivity Analysis: Building Cost at $140 per sq.ft.

	PLANTS			
	A	B	C	D
Year Production Cap.	375000	656250	937500	2250000
OWNERSHIP COSTS:	---------- DOLLARS ----------			
Building Annual cost	13085	16356	22899	49068
Equipment Annual cost	6650	10500	14910	16399
Furniture Annual cost	125	150	150	150
OPERATING COSTS:				
Labor	180000	300000	396000	696000
Administrative costs	24000	33000	42000	84000
Water	4500	7875	11250	27000
Electricity	600	1050	1500	3600
Building Maint & Rep	840	1050	1470	3150
Equipment Maint & Rep	237	449	661	741
Furniture Maint & Rep	6	8	8	10
Packaging supply	18750	32813	46875	112500
Insurance	3287	4413	6237	12001
Property Tax	1972	2648	3742	7201
Miscellaneous	4450	4475	4500	4550
TOTAL	258504	414785	552201	1016421
Cost/bird	0.6893	0.6321	0.5890	0.4517

Table 6.17 Sensitivity Analysis: Building Cost at $160 per sq.ft.

	PLANTS			
	A	B	C	D
Year Production Cap.	375000	656250	937500	2250000
OWNERSHIP COSTS:	DOLLARS			
Building Annual cost	14954	18693	26170	56078
Equipment Annual cost	6650	10500	14910	16399
Furniture Annual cost	125	150	150	200
OPERATING COSTS:				
Labor	180000	300000	369000	696000
Administrative costs	24000	33000	42000	84000
Water	4500	7875	11250	27000
Electricity	600	1050	1500	3600
Building Maint & Rep	960	1200	1680	3600
Equipment Maint & Rep	237	449	661	741
Furniture Maint & Rep	6	8	8	10
Packaging supply	18750	32813	46875	112500
Insurance	3687	4913	6937	13501
Property Tax	2212	2948	4162	8101
Miscellaneous	4450	4475	4500	4550
TOTAL	261133	418072	556802	1026281
Cost/bird	0.6964	0.6371	0.5939	0.4561

Figure 6.4 Change in building cost

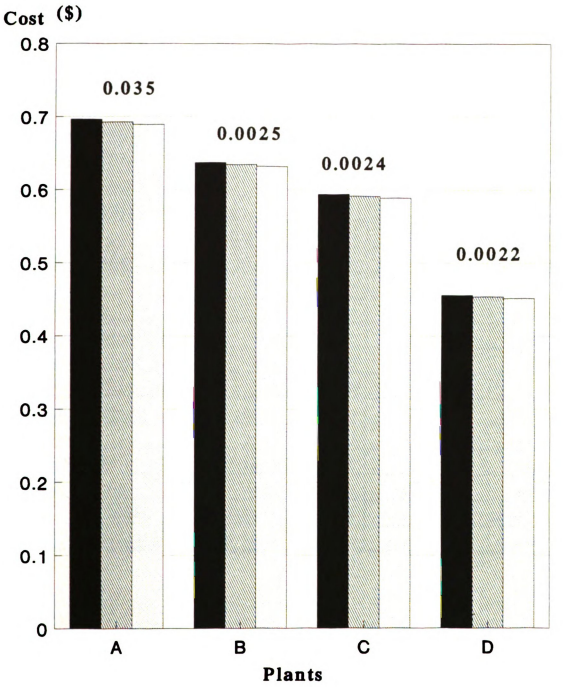
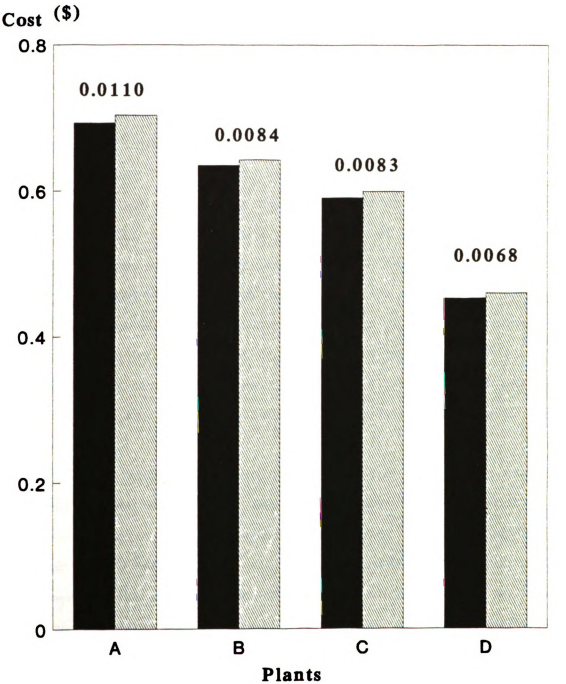


Table 6.18 Sensitivity Analysis: Interest at 12%

	PLANTS			
	A	B	C	D
Year Production Cap.	375000	656250	937500	2250000
OWNERSHIP COSTS:	DOLLARS			
Building Annual cost	17619	22024	30833	66071
Equipment Annual cost	7191	11498	16371	18034
Furniture Annual cost	139	166	166	222
OPERATING COSTS:				
Labor	180000	300000	396000	696000
Administration costs	24000	33000	42000	84000
Water	4500	7875	11250	27000
Electricity	600	1050	1500	3600
Building Maint & Rep	900	1125	1575	3375
Equipment Maint & Rep	237	449	661	741
Furniture Maint & Rep	6	8	8	10
Packaging supply	18750	32813	46875	112500
Insurance	3487	4663	6587	12751
Property Tax	2092	2798	3952	7651
Miscellaneous	4450	4475	4500	4550
TOTAL	263971	421944	562278	1036505
Cost/bird	0.7039	0.6430	0.5998	0.4607

Figure 6.5 Increase interest rate by 4%



Summary

The average per bird processing cost for the model plants A, B, C and D were $0.6929, $0.6346, $0.5915 and $0.4539, respectively. The cost per bird declines as the plant size increases. The basic assumption made ia that plants are operating at full capacity (8 hours a day, 5 days per week and 50 weeks per year). In practice, low-volume plants do not operate at full capacity utilization. In order to infer the impact of not processing at full capacity utilization, sensitivity analyses were made.

The economies associated with plant capacity utilization are demonstrated by higher per bird processing cost, when not operating at full capacity (100%). The processing cost increases the most for the smallest plant, while the large has the least cost increase as output decreases.

When comparing capacity utilization with other factors used in the sensitivity analysis (labor, building cost and interest rate), it is evident that labor had more impact than other factors. The per bird processing cost when labor compensation rate is increased to $7.00 is similar to that when capacity utilization is between 40 and 60 percent. When building cost and interest rate were increased to $160 per sq.ft. and 12 percent, the processing costs were similar to those when plant capacity was between 90 and 100 percent

Chapter 7.

The Computer Application Design

I. INTRODUCTION

The era of computers has dawned, and people are gradually becoming more familiar with using computers in almost all their activities.

One of the other objectives of this study was to transform the research information contained in this thesis into a computerized format. There are several advantages for making this transformation. First, the computerized format can be easily made available to people who need it. From the previous study decisions always had to be made on what and how much to photocopy and send to the enquirer (requester of the study). Using a computerized format will ease this problem by sending this information in a five and quarter floppy disk. The only cost for this transaction would be the purchase of a floppy disk and postage, unlike photocopying 150 pages or so at five to ten cents a page, and then paying postage costs. Second, in the computerized format, changes can be easily be made when necessary, to suit a given situation. For example, equipment prices and other assumptions made in the study can conveniently be altered. Third, the computerized format will allow a processor to

synthesize a processing system. According to this program a low-volume batch processing system can be synthesized. A processor can select equipment combinations to synthesize a processing system of 200, 350, 500, and 1200 birds per hour from equipment manufacturers or dealers. There is compatibility of equipment combinations from the different sources, except for the killing and scalding equipment of Pickwick Company. They use specialized batch shackles and a conveyor system suited for their equipment, which differs from other manufacturers or dealers. After synthesizing the processing system, the program then calculates and displays the capital investment requirement, processing cost per bird, and makes sensitivity analysis. This computerized Low-Volume Poultry Processing Synthesizing System is henceforth going to be referred to as the LVPPSS, as an abbreviation or acronym.

II.SOFTWARE USED

A database of processing equipment was made using dBASE II software of Ashton Tate. The database is comprised of: the Function of equipment, Model of equipment, Power supply, Price information, Specification of the equipment, and manufacturer and or dealer (i.e. source) of the equipment. The information contained in this database was later used in Repertoire.

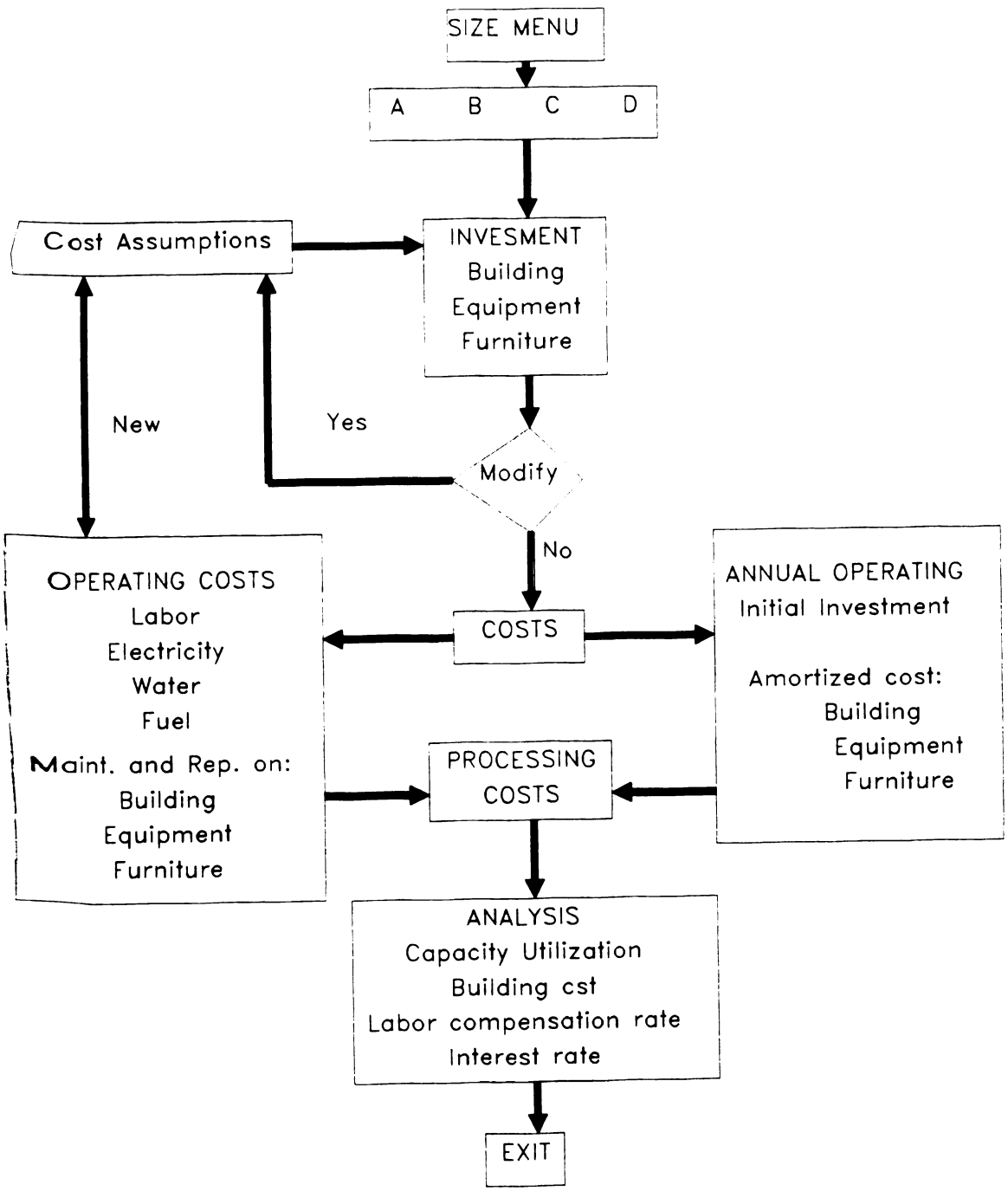
Repertoire, is Polytron Corporation software. It provides an integrated approach for handling screens, text, lists, structured-file, and input analysis. The screen program of Repertoire (DBMSPIM) has a capacity to edit, compile, run and display screens. In this study Repertoire was used in conjunction with dBASE II and Modula-2 programming.

Modula-2 is a powerful software development language, which was introduced by Niklaus Wirth in 1980. Modula-2 provides support for the development of a large software system using object-oriented programming and modern software engineering.

III. Approach

A set of screens showing the chronological output of tables was made using Repertoire. This is a prerequisite for setting out a menu driven program. The screen forms the "skeleton" of what needs to be done by the program, concerning the input, on screen messages, and output. The screens created need to be compiled before they can be displayed. (Appendix C) These screens are depicted in Figure 7.1, showing the most general approach of what the program needs to do, and also capturing the relationships that exist.

Figure 7.1 General Flow Chart



The basic objective of the program is to be able to synthesize a processing system by either selecting the default system (given) or by making ones own selection from the database. The database is organized in a way that four processing systems can be synthesized.

Then Figure 7.2 shows a refined, detailed and a specific relationship of events that the program needs to perform. Using Modula 2, a program was written based on the screens created in Figure 7.1.

Operational Instructions:

The computer application LVPPSS, can be used as an information gathering tool for potential low-volume poultry processors. LVPPSS will provide information on capital investment required, resources needed, processing cost per bird and sensitivity analysis. The LVPPSS program is dynamic, it allows the change of default assumptions to suit prevailing conditions.

The LVPPSS start-up procedure displays a menu providing the following options:

Figure 7.2 Flow Chart of Screens

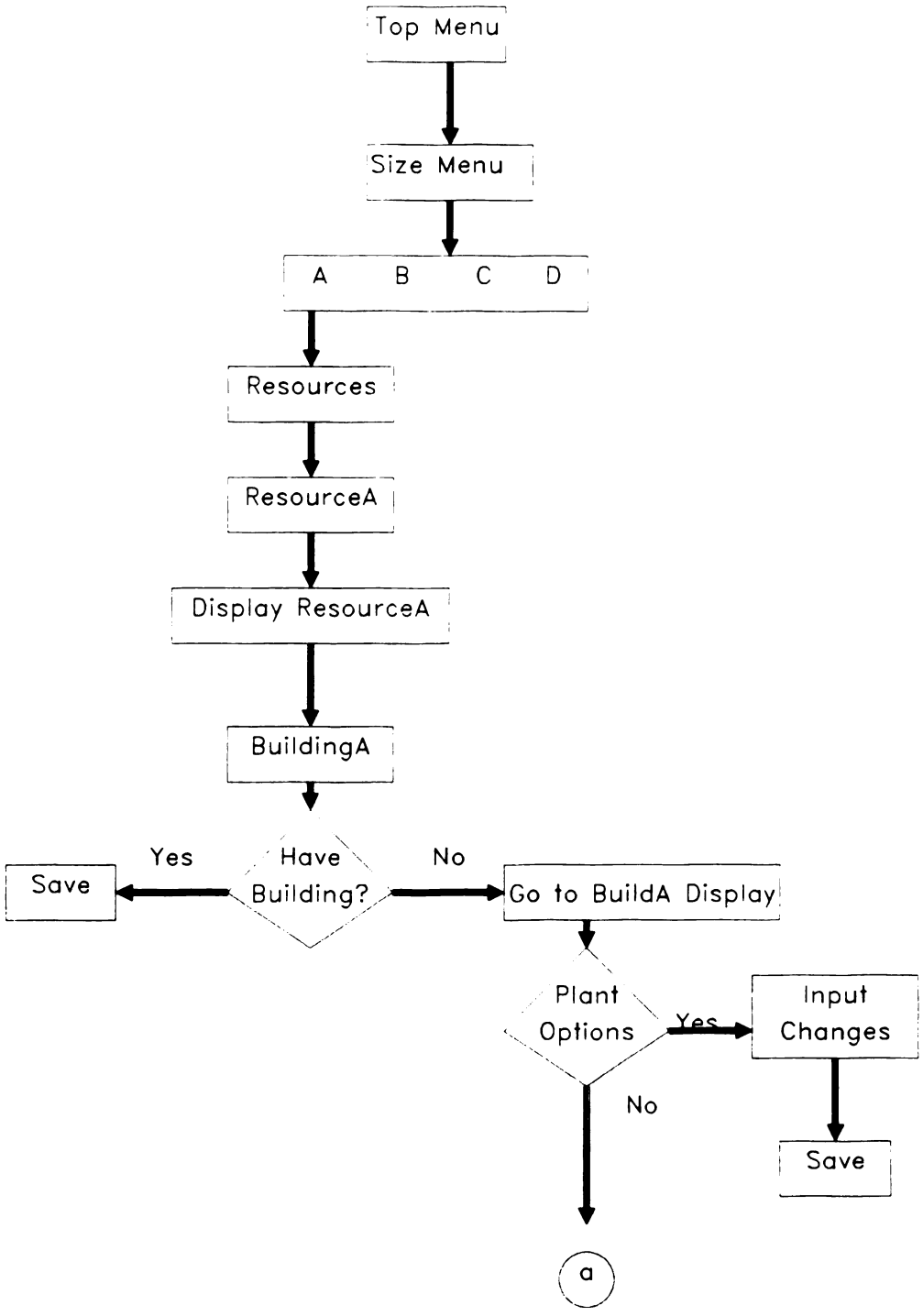


Figure 7.2 Cont.

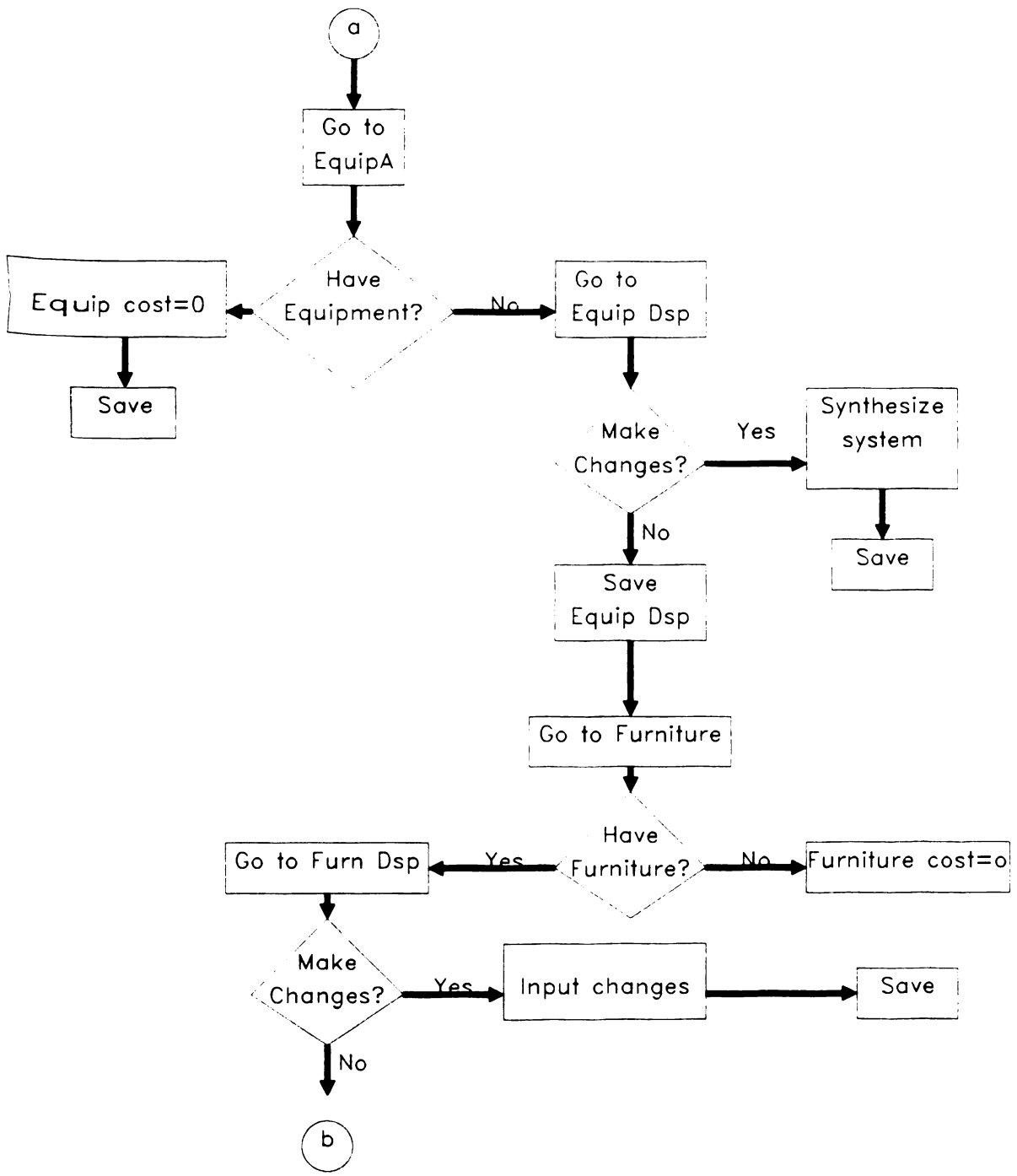
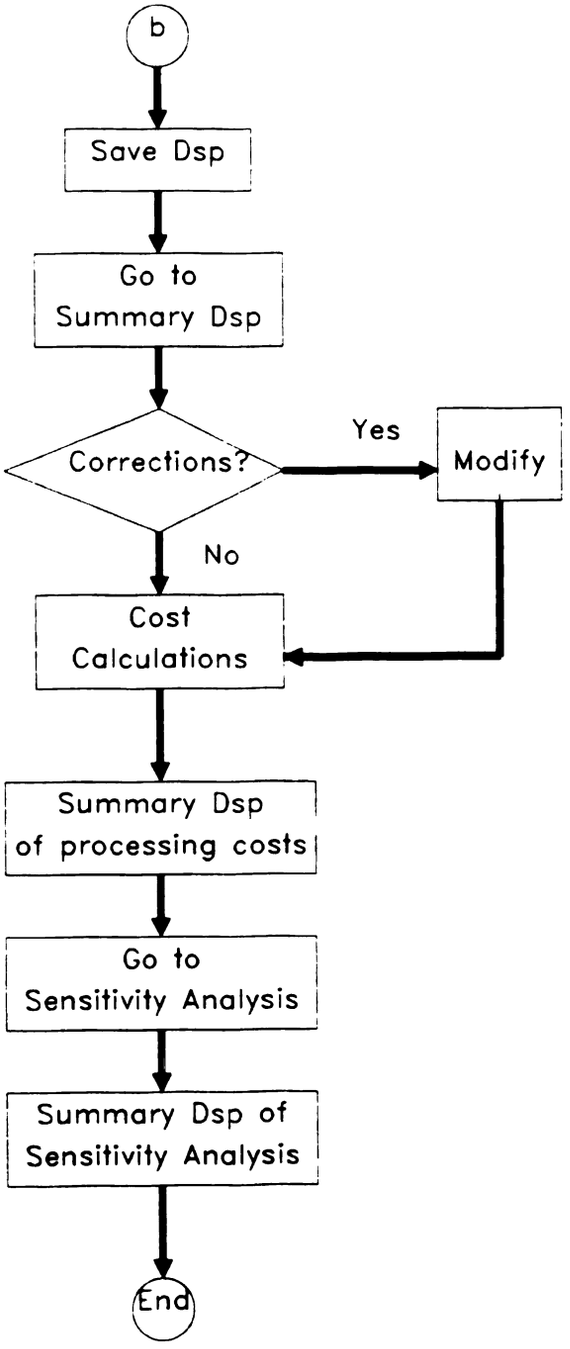


Figure 7.2 (cont.)



1) Size Option

This option provides four plant sizes of 200, 350, 500 or 1200 birds per hour. The potential processor should select a plant size of choice since he/she should have an idea of the plant size that he/she is contemplating to operate.

2) Resource Option

The resource option provides information on resources needed in a processing plant. The resources considered are building, furniture and equipment. A display of default resources is provided, and this may be saved when acceptable to the processor. If not, the processor may select resource dimensions of his/her choice.

The utility of LVPPSS is put into practice when synthesizing a processing system. This is based on selecting processing equipment stored in a database. Information on the types of equipment, model name, price, power requirements, specifications of the equipment, and equipment source (manufacturer and/or dealer) are stored in the database. This information is retrieved when synthesizing a processing system. The summary of selected equipment and the total cost of the equipment is displayed, then saved if modifications are not made.

3) Investment Option

The investment option displays information on the total investment on building, furniture and equipment of a given plant size.

4) Cost Option

The cost option is based on default assumptions. The assumptions are on: labor requirement, labor compensation, capacity utilization, interest rate, cost of utilities, and packaging cost. These assumptions can be modified depending on the given situation. The processing cost per bird is determined by using the cost and information saved in the preceding options. 5) Analysis Option

This provides sensitivity analyses for the purpose of comparing the effects of changing some of the conditioning factors that were assumed. In this study the factors of concern are: capacity utilization (100, 90, 80, 70, 60, 50, and 40%); building cost ($140, $150, and $160); labor cost ($6.00 and $7.00 per hour) and interest rate (10 and 12% per annum).

6 . Output

The output can be written to the screen, or printer, or to the disk in ASCII format.

References

Adams L., 1990. Poultry Inpsction. Meat and Poultry Magazine. Vol. 35. No. 12. December.

Barton T.L., 1986. The Integrated Poultry Industry. Cooperative Extension Service. University of Arkansas, USDA and County Government Cooperating.

Baum E.L., E. Feris, and H.G. Walkup. 1952. Economies of Scale in the Operation of Fryer Processing Plants. Washington Agricultural Experiment Station. Technical Bulletin No. 7.

Brant A.W., J.W. Goble, J.A. Wabeck, and Walters R.E., 1982. Guidelines for Establishing and Operating Broiler Processing Plants. Agricultural Research Service Handbook 581. USDA.

Brower, 1990. World Class Processing Equipment. Catalogue No. Proc14. Iowa. USA

Childs R.E and Walters R.E. 1962. Methods and Equipment for Eviscerating Chickens. USDA Marketing and Research Report. No. 549.

Childs R.E., M.J. Reed and John A. Hamann. 1970. Guidelines for Poultry Processing Plant Layouts. USDA Marketing Research Report No. 878.

Childs R.E. and P.D Rogers. 1958. Methods and Equipment for Ice-Packing Poultry. USDA Marketing Research Report. No. 242.

Clearance E. Harris and Jesse W. Goble. 1972. Planning a Wholesale Poultry Layout in a Multiple-Occupancy Building. USDA Marketing Research Report No. 918.

Crawford Lester. 1988. FSIS Perspective. Broiler Industry. Vol. 51, No. 1. January 1988.

Debertin David L. 1986. Agricultural Production Economics. Macmillan Publishing Company. New York.

Dhladhla Vusumuzi. 1988. Organizational and Economic Fundamentals of Small Scale Broiler Processing Activities. Unpublished Thesis, Michigan State University. East Lansing.

FSIS, 1984. US Inspected Meat and Poultry Packaging Plants: A Guide to Construction and Lay-Out. Handbook 570.

____, 1987. Meat and Poultry Inspection Report. USDA.

Gordy Frank. 1974. Broilers. Chapter 11 in American Poultry History 1823-1973, eds. Oscar Hanke, John L. Skinner and James H. Florea. American Printing and Publishing, Inc. Wisconsin, 1974, pp. 370-433.

Harsh S, L. Connor and G. Schwab. 1981. Managing the Farm Business. Prentice-Hall Inc. Englewood Cliff. New Jersey.

Hebert Lauren Andrew. 1989. The Master Guide for Eliminating Cumulative Trauma Disorders from Workplace: The Neck and Arm Handbook. IMPACC, Inc. Maine.

Henke O. A, J.L Skinner and J.H Florea. 1974. American Poultry History: 1823-1973. American Printing and Publishing, Inc. Madison, Wisconsin.

Huang, Chung and Sukant Misra. 1990. Designing a Data System for Consumer Research. Agribusiness, John Wiley and Sons, Inc., Vol. 6, No. 5, pp. 515-524.

Kushner Gary. 1986. Poultry Inspection in Transition. Poultry Processing. December 1986.

Lazar Virginia. 1991. HACCP: An Overview. Broiler Industry. Vol. 54, No. 9. September.

Lefens Mark. 1986. A New Era: Slaughter Inspection will never be the same. Poultry Processing. December 1986.

Perry R.T. 1989 Technological Developments in Pre-slaughter Handling and Processing. pp. 65-100. In Mead G.C. Processing of Poultry. Elsevier Applied Science. London and New York.

Ridlen S.F. and Hugh S. Johnson. 1970. Locating a Poultry Enterprise. Monthly Poultry Suggestions. University of Illinois at Urban Cooperative Extension Service. Dept of Animal Science. July.

Sheppard C.C and C.J Flegal, 1985. Farming Know-How. Guidelines to Better Family Farming. Cooperative Extension Service. Michigan State University. Extension Bulletin E-1257, January.

Shupe W.L., E.W. Spangler, John A. Hamman and A. Wade Brant. 1973. Guidelines for Turkey Processing Plant Layout. USDA Marketing Research Report No. 1036.

Systat. 1990. The System for Statistics. Systat Inc. Evanston, Illinois.

Rogers George B. and Bardwell Edwin. 1963. Marketing New England Poultry. New England Experiment Station Bulletin No. 476. April.

Tobin, Bernard F and Arthur, Henry B. 1964. Dynamics in the Broiler Industry. Harvard Univ., Graduate School of Business Administration.

USDA 1984. U.S. Inspected Meat and Poultry Packing Plants: A Guide to Construction and Layout. Food and Inspection Service. Agriculture Handbook No. 570.

_____ 1986 Processing Manual

APPENDICES

Appendix A

In-Line Processing Equipment

APPENDIX A - 1

Estimated Investment on In-line Processing Equipment from STORK

KILLING AND PLUCKING:	$
Hanging turntable	20962
Overhead conveyor	37690
Suspension material	1250
Killing shackles	11252
Suspension rods	3630
Automatic stunner	11033
Automatic killer	12653
Bleeding trough	650
Automatic scalder	29063
Condensation canopy	7323
Connecting troughing	900
Automatic plucker/finisher	48150
Automatic head/trachea puller	12203
Automatic singer	2220
Sprayer set	943
Automatic transfer system	77903
Automatic unloading station	6180
Automatic shackle washer	5885
Automatic counter	1888
Horizontal conveyor belt	6983
EVISCERATION LINE:	
Overhead conveyor	50540
Suspension material	1800
Eviscerating shackles	55940
Suspension rods	4400
High pressure pump	2900
Vent cutter/opening machine	61185
Automatic eviscerator	58935
Horizontal slatted belt conveyor	9345
Gizzard harvestor	45435
Automatic gizzard defattener	3798
Gizzard washer/conveyor	6308
Inspection/peeling table	5100
Neck cracker/neck skin slitter	47285
Inside/Outside washer	18810
Final inspection machine	21778
Unloading station	6280
FEATHER AND BLOOD TRANSFER:	
Pump (transfer feather and offal)	9950
Separator (feathes, offal, etc)	10325
Pump	3398
Vacuum installation	23535
Pump installation	11340
Universal grinding machine	3530
Set of PVC transport pipes	19790

Appendix A-1 (cont.)

Estimated Investment on In-line Processing Equipment from STORK

VACUUM TRANSPORT FOR OFFALS:	$
Collecting bin	4010
Vacuum transport system control	14200
Cyclone	4635
Vacuum installation	25395
Crusher	9000
PVC transport pipes	7635
GIBLET PROCESSING:	
Transport trough	3000
Giblet pump	15070
Set of PVC transport pipes	6040
Cleaning system	7430
Giblet chiller	38430
Support frame	3000
Giblet packing machine	80000
PRE-CHILLING LINE	
Screw chiller	45210
Blower	6600
Horizontal conveyor belt	7965
St. St. sliding trough	1625
SORTING AND SUPPORTING:	
Overhead conveyor	42165
Set of suspension material	1500
Grading shackles	12833
Chickway grading station	3620
Chickway shackle jam detector	1173
Chickway weigh station	12058
Chickway electronic control	33433
Chickway release station	4088
Chickway drop sensors	800
Set of cables	795
Epson printer	1833
Collecting bin	2250
Filling chutes	3000
Bag closing devices	1600
Semi-automatic bagger	21300
Air compressor	12740
Packing arrangements	34000
Optical digital weighing scales	14270
TOTAL	

APPENDIX A - 2

Estimated Investment on In-line Processing Equipment from Linco Capacity: 1500 b/hr.

	Dollars	Percent
KILLING AREA	$	%
Water stunner	3972	1.7
Silver link O/H	18079	7.8
Drive units	1635	0.7
Bends, etc.	2854	1.2
Scalder (2 pass)	24673	10.7
Plucker model E2x1/3	29696	12.9
Head puller	467	0.2
Pre EV bird washer	872	0.4
Chain/Shackle washer	1656	0.7
Hock cutter Model B	6281	2.7
Leg unloader	2802	1.2
	92987	48
EVISCERATION		
Transfer chutes & tray	818	0.4
Silver link O/H	8200	3.6
Drive unit	1935	0.8
Bands	1351	0.6
EV trough - 12m	5461	2.4
Giblet troughing - 8m	1971	0.9
OS4 Vent cutter	8715	3.8
Lung removeal system	5517	2.4
Giblet chiller	6439	2.8
Gizzard skinning table	3117	1.3
Giblet packing table	2654	1.1
Loose tools	723	0.3
Shackle washer	1656	0.7
	48558	25
AIR CHILLER / PACKAGING		
Silverling O/H conveyor	33668	14.6
Bends	4106	1.8
Drive ends & Packing table	8888	3.8
Whole bird packing table	4038	1.7
Shrink wrappers	1620	0.7
	52322	27

APPENDIX A-2 (cont.)

Estimated Investment on In-line Processing Equipment from Linco Capacity: 1500 b/hr.

OFFAL GENERAL	$	%
Feather pump	7440	3.2
Feather screen	7110	3.1
Blood/Lung tank	1068	0.5
Heads and feet packing table	704	0.3
High pressure	9690	4.2
S/S wash hand basin	3992	1.7
S/S wash hand basins sterilizer	1052	0.5
Apron Racks	986	0.4
Hose reels	986	0.4
Boot washer	1878	0.8
Comperssor	2135	0.9
	37041	19
Grand Total	230907	100

Appendix B

Copies of Letters Requesting M.S. Thesis

Agro Projects Limited
AGRO-INDUSTRIAL PRODUCTS AND SERVICES

KAMPALA, UGANDA
P.O. Box 2030
Tel. (041) 257131
241134
Telex 62035 AGRO

Date 4th September, 1990

Our ref

Your ref

Allen P. Rahu,
Department of Animal Science/
Agricultural Economics,
Michigan State University,
U.S.A.

Dear Mr. Rahn,

We have come across your article on "Small-scale processing Economics" in the Poultry instructional Magazine of May, 1990.

We are very much interested in the project designs and would very much appreciate if you could send us a standard complete detailed financial analysis of each of the three plant layouts.

It would also be appreciated if you could indicate the sources of the various equipments, buildings and raw materials.

Your anticipated prompt response and co-operation is highly appreciated.

Yours faithfully,

NELSON IIMAH TETE
Executive Director

Agri Contact
Torupvejen 97 - 3390 Hundested - Denmark

R D

Telefon: (+45) 42 32 33 06
Postgiro: 9 10 18 96
Telefax: (+45) 42 32 48 48

Dr. Allen P. Rahn
Dept. of Animal Science / Ag Economics
Michigan State University
East Lansing, MI 48824, USA

Airmail

Torup, July 17th 1990

Dear Allen P. Rahn.

Agri Contact works with transfer of information from research to industry related to agriculture and food production.
We are at present involved in a project concerning new possibilities for food production. The project concerns the possibilities of adding value to products leaving the farm, e.g. by further processing, packaging, labelling etc. on farm or on small scale processing units.
We believe that the technological development (microcomputers, information technology, biotechnology, process equipment etc.) will give the more specialized farms an opportunity to add further value to primary farm products in the future. We also believe, that a decentralized processing like this may increase flexibility and the opportunities to respond quickly to consumer demands.

With great interest I have studied your paper *"Small-Scale Processing Economics"* in Poultry International, May 1990. I certainly would appreciate to learn more about your project and to have your comments to the above mentioned study.

Sincerely yours
Agri Contact

DEPARTMENT OF ANIMAL SCIENCE
FACULTY OF AGRICULTURE
AHMADU BELLO UNIVERSITY, ZARIA NIGERIA

P.M.B. 1044 Zaria Nigeria

Telegrams: Agriscarch Zaria
Telephone: 50571-4 Ext. 4348

Your Ref:.....

Our Ref.....

17th September, 1990

Dr. Allen P. Rahn,
Dept. Animal Science/Agric. Economics,
Michigan State University,
Michigan,
U.S.A.

Dear Dr. Rahn,

I shall be very grateful if you could send me your publication on broiler small-scale processing economics and all other papers of yours.

Yours sincerely,

Dr. N.I. Dim.

HVA-Nederland bv

Michigan State University
attn Department of Animal Science
Agricultural Economics
John A. Hanna Building
EAST LANSING
MI 48824-0001
U.S.A.

Your reference	Our reference	Date
	417/Ter Huurne	October 26, 1990

Dear Sirs,

Please find enclosed our letter of July 24 this year.
Is there any chance that we ever may receive this publication from you?

Please look into this matter.

Thank you very much.

Yours faithfully,

H.V.A.-Nederland B.V.
Economic Statistical Department

Eugénie van Straaten

Enclosure: 1

POULTRY HEALTH SERVICE
Agri-Business Systems

PHS

POULTRY HEALTH SERVICE EXPORT COMPANY
P O BOX 40028
JACKSONVILLE, FLORIDA 32203, U S A
TEL. (904) 786-3224 FAX (904) 786-5227
CABLE "POHESE" TELEX 56-273

July 3, 1990

Allan P. Rahn
Department of Animal Science
~~Agricultural~~ Economics
Michigan State University
Lansing Michigan

Dear Dr. Rahn:

We are interested in receiving a copy of the study on "Small - Scale Proccessing Economics" as described in the May 1990 issue of Poultry International, (by mail or fax).

Thank you for your prompt reply.

Cordially

Lynn Evans
Export Department

E

PRESIDENT'S
E AWARD 1975
E STAR AWARD 1984
EXPORT EXCELLENCE ACHIEVEMENT

Appendix C

Computer Application : Screens

APPENDIX C

Computer Application Screens

```
:TopMenu
  ParentFrame: 0
  Normal Next: Size
  Help:{
    TopHelp}
  Fields:{
    (S) '' Goto Size; prompt
   Lets you examine the various plant sizes.
    (I) '' Goto Investment; prompt
   Lets you determine Capital Investment needed.
    (C) '' Goto Costs; prompt
   Lets you calculate the costs incurred.
    (A) '' Goto Analysis; prompt
   Lets you do Sensitivity Analysis.
    (X) '' Goto 0; prompt
   Close all files and return to DOS.
  }
  Window:{
    EntryBox: ┌┐│ ═╝
    ExitBox: ┌┐│ ═╝
    Position: (1, 1, 80, 3)
  }
  Colors:{
    PointerBar = (black, red) ReverseVideo
    Normal Text = (black, lightgray) Plain
    Border = (red, black) Plain
  }
```

```
     #Size#    #Investment#   #Costs#   #Analysis#   #Exit#
```

```
:Size
  ParentFrame: TopMenu
  Fields:{
    (A) '' Goto ResourceA; prompt
   This plant process 200 birds per hour.
    (B) '' Goto ResourceB; prompt
   This plant process 350 birds per hour.
    (C) '' Goto ResourceC; prompt
   This plant process 500 birds per hour.
    (D) '' Goto ResourceD; prompt
   This plant process 1200 birds per hour.
  }
```

```
  Window:(
  ClearAfter
    Double Box
    Position: (30, 10,  65, 20)
  )
  Colors:(
    PointerBar = (black, red) ReverseVideo
    Normal Text = (black, lightgray) Plain
  )
  Help: (
 Choose an option with the up and down arrow, then
 Press F10)
-------------------------------------------------------------

         Processing Plants
 Highlight your choice and hit <F10>:

        #PlantA#
          #PlantB#
            #PlantC#
              #PlantD#


=============================================================
:ResourceA
   ParentFrame: Size
   NormalNext: BuildingA
   DisplayOnly
   HitAnyKey
   Fields:(
     () 'BUILDING' Real [500..100000]
     () 'FURNITURE' Real [100..10000]
     () 'EQUIPMENT' Real [12000..100000]
   )
   Window:(
   ClearAfter
     Double Box
     Position:( 15, 10, 70, 20 )
   )
   Colors:(
     PointerBar = (black, red) ReverseVideo
     Normal Text = (black, lightgray) Plain
   )
   Help: (
  This minimum requirements are based on the
  synthesized model plant with 200 birds per
  hour capacity)
```

```
------------------------------------------------------------

            PlantA
      Minimum Requirements

    Building (sqft): #   800 #
      Furniture ($): #   500 #
       Equipment($): # 18998 #

============================================================
:ResourceB
    ParentFrame: Size
    NormalNext: BuildingB
    DisplayOnly
    HitAnyKey
    Fields:{
      () 'BUILDING' Real [500..100000]
      () 'FURNITURE' Real [100..10000]
      () 'EQUIPMENT' Real [12000..100000]
    }
    Window:{
    ClearAfter
      Double Box
      Position:( 15, 10, 70, 20 )
    }
    Colors:{
      PointerBar = (black, red) ReverseVideo
      Normal Text = (black, lightgray) Plain
    }
    Help: {
   This minimum requirements are based on the
   synthesized model plant with 350 birds per
   hour capacity}
------------------------------------------------------------
            PlantB
      Minimum Requirements

    Building (sqft): #  1000 #
      Furniture ($): #   600 #
       Equipment($): # 35910 #

============================================================
:ResourceC
    ParentFrame: Size
    NormalNext: BuildingC
    DisplayOnly
    HitAnyKey
    Fields:{
      () 'BUILDING' Real [500..100000]
      () 'FURNITURE' Real [100..10000]
      () 'EQUIPMENT' Real [12000..100000]
    }
```

```
   Window:{
   ClearAfter
     Double Box
     Position:( 15, 10, 70, 20 )
   }
   Colors:{
     PointerBar = (black, red) ReverseVideo
     Normal Text = (black, lightgray) Plain
   }
   Help: {
  This minimum requirements are based on the
  synthesized model plant with 500 birds per
  hour capacity}
-------------------------------------------------------------

            PlantC
     Minimum Requirements

   Building (sqft): #  1400 #
     Furniture ($): #   600 #
      Equipment($): # 52876 #

=============================================================
:ResourceD
   ParentFrame: Size
   NormalNext: BuildingD
   DisplayOnly
   HitAnyKey
   Fields:{
     () 'BUILDING' Real [500..100000]
     () 'FURNITURE' Real [100..10000]
     () 'EQUIPMENT' Real [12000..100000]
   }
   Window:{
   ClearAfter
     Double Box
     Position:( 15, 10, 70, 20 )
   }
   Colors:{
     PointerBar = (black, red) ReverseVideo
     Normal Text = (black, lightgray) Plain
   }
   Help: {
  This minimum requirements are based on the
  synthesized model plant with 1200 birds per
  hour capacity}
```

```
------------------------------------------------------------
            PlantD
     Minimum Requirements

   Building (sqft): #  3000 #
     Furniture ($): #   800 #
      Equipment($): # 59236 #

============================================================
:BuildingA
  ParentFrame: ResourceA
  Fields:{
    (Y) '' GoTo FurnitureA, prompt
   Lets you proceed to select the next resource
    (N) '' GoTo PlantOptA, prompt
   Lets you select the choice Options
  }
  Window:{
  ClearAfter
    Double Box
    Position: ( 30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
  Help: {
 Selecting YES will enable you to proceed
 to another resource, while NO will provide options
 of either selecting the default or own choice}
------------------------------------------------------------


      Do you have a 800 sqft Building?

          Select your Choice <F10>


            #Yes#     #No#

============================================================
:BuildingB
  ParentFrame: ResourceB
  Fields:{
    (Y) '' GoTo FurnitureB, prompt
   Lets you proceed to select the next resource
    (N) '' GoTo PlantOptB, prompt
   Lets you select the choice Options
  }
  Window:{
  ClearAfter
```

```
    Double Box
    Position: ( 30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
  Help: {
 Selecting YES will enable you to proceed
 to another resource, while NO will provide options
 of either selecting the default or own choice}
-------------------------------------------------------------

      Do you have a 1000 sqft Building?

          Select your Choice <F10>


            #Yes#     #No#

=============================================================
:BuildingC
  ParentFrame: ResourceC
  Fields:{
    (Y) '' GoTo FurnitureC, prompt
   Lets you proceed to select the next resource
    (N) '' GoTo PlantOptC, prompt
   Lets you select the choice Options
  }
  Window:{
  ClearAfter
    Double Box
    Position: ( 30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
  Help: {
 Selecting YES will enable you to proceed
 to another resource, while NO will provide options
 of either selecting the default or own choice}
-------------------------------------------------------------


      Do you have a 1400 sqft Building?

          Select your Choice <F10>


            #Yes#     #No#
```

```
============================================================
:BuildingD
  ParentFrame: ResourceD
  Fields:{
    (Y) '' GoTo FurnitureD, prompt
   Lets you proceed to select the next resource
    (N) '' GoTo PlantOptD, prompt
   Lets you select the choice Options
  }
  Window:{
  ClearAfter
    Double Box
    Position: ( 30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
  Help: {
 Selecting YES will enable you to proceed
 to another resource, while NO will provide options
 of either selecting the default or own choice}
------------------------------------------------------------


      Do you have a 3000 sqft Building?

          Select your Choice <F10>


            #Yes#     #No#

============================================================
:FurnitureA
  ParentFrame: BuildingA
  Fields: {
    (Y) '' GoTo DspEquipA, promt

    (N) '' GoTo PlantOptA, prompt
   Lets you see the Options
  }
  Window:{
  ClearAfter
    Double Box
    Position: (  30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
```

```
 Help: {
Selecting YES will enable you to proceed
to another resource, while NO will provide
options of either selecting the default or
own choice.}
------------------------------------------------------------


      Do you have Furniture?

    Select you choice <F10>

        #Yes#     #No#


============================================================
:FurnitureB
  ParentFrame: BuildingB
  Fields: {
    (Y) '' GoTo DspEquipB, promt

    (N) '' GoTo PlantOptB, prompt
   Lets you see the Options
  }
  Window:{
  ClearAfter
    Double Box
    Position: (  30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
  Help: {
Selecting YES will enable you to proceed
to another resource, while NO will provide
options of either selecting the default or
own choice.}
------------------------------------------------------------


      Do you have Furniture?

    Select you choice <F10>

        #Yes#     #No#
```

```
=============================================================
:FurnitureC
  ParentFrame: Building
  Fields: {
    (Y) '' GoTo DspEquipC, promt

    (N) '' GoTo PlantOptC, prompt
   Lets you see the Options
  }
  Window:{
  ClearAfter
    Double Box
    Position: (  30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
  Help: {
 Selecting YES will enable you to proceed
 to another resource, while NO will provide
 options of either selecting the default or
 own choice.}
-------------------------------------------------------------

       Do you have Furniture?

     Select you choice <F10>

         #Yes#     #No#

=============================================================
:FurnitureD
  ParentFrame: BuildingD
  Fields: {
    (Y) '' GoTo DspEquipD, promt

    (N) '' GoTo PlantOptD, prompt
   Lets you see the Options
  }
  Window:{
  ClearAfter
    Double Box
    Position: (  30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
```

```
  Help: {
 Selecting YES will enable you to proceed
 to another resource, while NO will provide
 options of either selecting the default or
 own choice.}
-------------------------------------------------------------


       Do you have Furniture?

     Select you choice <F10>

         #Yes#      #No#


=============================================================
:EquipmentA
  NormalNext: HelpMenu
  ParentFrame: DspEquipA
  Fields:{
    (Y) '' GoTo EquipSum
    (N) '' GoTo PlantOptA
  }
  Window:{
  ClearAfter
    Double Box
    Position: (  30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
-------------------------------------------------------------

   Do you have Processing Equipment?

       Select you choice <F10>

             #Yes#   #No#


=============================================================
:EquipmentB
  NormalNext: HelpMenu
  ParentFrame: DspEquipB
  Fields:{
    (Y) '' GoTo EquipSum
    (N) '' GoTo PlantOptB
  }
  Window:{
```

```
  ClearAfter
    Double Box
    Position: (  30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
-------------------------------------------------------------


   Do you have Processing Equipment?

       Select you choice <F10>

             #Yes#   #No#


=============================================================
:EquipmentC
  NormalNext: HelpMenu
  ParentFrame: DspEquipC
  Fields:{
    (Y) '' GoTo EquipSum
    (N) '' GoTo PlantOptC
  }
  Window:{
  ClearAfter
    Double Box
    Position: (  30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
-------------------------------------------------------------


   Do you have Processing Equipment?

       Select you choice <F10>

             #Yes#   #No#
```

```
==========================================================
:EquipmentD
  NormalNext: HelpMenu
  ParentFrame: DspEquipD
  Fields:{
    (Y) '' GoTo EquipSum
    (N) '' GoTo PlantOptD
  }
  Window:{
  ClearAfter
    Double Box
    Position: (  30, 5, 75, 15 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
----------------------------------------------------------


   Do you have Processing Equipment?

       Select you choice <F10>

             #Yes#    #No#


==========================================================
:DspEquipA
  NormalNext:  EquipmentA
  ParentFrame: FurnitureA
  Fields:{
    () '' String
    () 'SLAUGHTER' String
    () 'HANGING' String
    () 'STUN AND KILL' String
    () 'BLEEDING' String
    () 'SCALDING' String
    () 'PICKING' String
    () 'SINGEING' String
    () 'EVISC LINE' String
    () 'OFFAL CART' String
    () 'TABLES' String
    () 'GIBLET PANS' String
    () 'VENT CUTTING' String
    () 'BIRD OPENING' String
    () 'REMOVE LUNGS' String
    () 'CLEAN GIZZARDS' String
    () 'HOCK CUTTING' String
    () 'ICE MAKING' String
    () 'CHILL TANKS' String
```

```
    () 'TANK AGITATOR' String
    () 'DRAIN TABLES' String
    () 'PACKAGING TABLE'String
    () 'WEIGHING SCALE' String
    () 'BAGGER' String
    () 'BAG CLIPPER' String
    () 'MAKING BOXES' String
    () 'PUSHING CARTS' String
    () 'BOILERS' String
    () 'GENERATORS' String
    () 'SPARE PARTS' String
    () 'TOTAL' String
    () '' String
    () '' String
  }
  Window:{
  ClearAfter
    HeadingLine: 5
    No Box
    Position: (  2, 5, 79, 23 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
```

Synthesized Processing System for PlantA
(200 birds per hour plant)

Activity	Qty	Model	Price	Source
Slaughter:				
HANGING	# 5	SH-5 Shackles	220.00	Pickwick
STUN & KILL	# 1	SKG Stunning Knive	998.00	Pickwick
BLEEDING	# 1	Killing Cabinat	795.00	Pickwick
SCALDING	# 1	SS-30-SS Scalder	2012.00	Ashly
PICKING	# 1	SPJ3 Batch Picker	2995.00	Pickwick
SINGEING	# 1	PS1 Poultry singer	41.00	Pickwick
Evisceration:				
EVISC LINE	# 1	ET4 Evisc. Table	1295.00	Pickwick
OFFAL CART	# 1	OCB2 Offal cart	373.00	Pickwick
GIBLET PANS	# 4	Giblet pans	116.00	Pickwick
TABLES	# -	- -	-	-
VENT CUT	# -	- -	-	-
BIRD OPEN	# -	Knives	-	-
REMOVE LUNG	# -	Hand rake	-	-
CLEAN GIZZARDS	# -			
HOCK CUTTING	# -	Knives		
Chill and Package:				

```
ICE MAKING   # -      - -                  -         -        #
CHILL TANKS # 4    KT-2T Chill tank       720.00   Brower    #
TANK AGITATOR # 1  CTAP-60 Tank agitator   70.00   Brower    #
DRAIN TABLES  # 1 Drain-Packaging table   995.00   Brower    #
PACKAGING TABLE # -          - -             -         -      #
WEIGHING SCALE  # -          - -             -         -      #
BAGGER          # 1  BVS-40 Bagging unit  1780.00  Brower    #
BAG CLIPPER     # -           - -            -         -      #
MAKING BOXES    # -           - -            -         -      #
PUSHING CARTS   # -           - -            -         -      #

                                                   #----------#
                                             TOTAL #          #
       # -------------------------------------------------- #

#----------------------------------------------------------------#
==================================================================
:DspEquipB
  NormalNext:
  ParentFrame:
  Fields:(
    () '' String
    () 'SLAUGHTER' String
    () 'HANGING' String
    () 'STUN AND KILL' String
    () 'BLEEDING' String
    () 'SCALDING' String
    () 'PICKING' String
    () ''String
    () 'SINGEING' String

    () 'EVISC LINE' String
    () 'OFFAL CART' String
    () 'TABLES' String
    () 'GIBLET PANS' String
    () 'VENT CUTTING' String
    () 'BIRD OPENING' String
    () 'REMOVE LUNGS' String
    () 'CLEAN GIZZARDS' String
    () 'HOCK CUTTING' String

    () 'ICE MAKING' String
    () 'CHILL TANKS' String
    () 'TANK AGITATOR' String
    () 'DRAIN TABLES' String
    () 'PACKAGING TABLE'String
    () 'WEIGHING SCALE' String
    () 'BAGGER' String
    () 'BAG CLIPPER' String
    () 'MAKING BOXES' String
    () 'PUSHING CARTS' String
```

```
    () 'BOILERS' String
    () 'GENERATORS' String
    () 'SPARE PARTS' String
    () 'TOTAL' String
    () ''String
  }
  Window:{
    HeadingLine: 5
    No Box
    Position: (  2, 5, 79, 23 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
```

Synthesized Processing System for PlantB
(350 birds per hour plant)

Activity	Qty	Model	Price	Source
Slaughter:				
HANGING	# 6	SH-5 Shackles	300.00	Pickwick
STUN &KILL	# 1	SKG Stunning Knive	998.00	Pickwick
BLEEDING	# 1	Killing Cabinat	795.00	Pickwick
SCALDING	# 1	SS-30-SS Scalder	2012.00	Ashly
PICKING	# 1	SPJ2 Batch Picker	2235.00	Pickwick
	# 1	SPJRT Catch table	495.00	Pickwick
SINGEING	# 1	PS1 Poultry singer	41.00	Pickwick
Evisceration:				
EVISC LINE	# 1	EVO-16 Evisc. line	5595.00	Pickwick
OFFAL CART	# 1	OCB2 Offal cart	373.00	Pickwick
GIBLET PANS	# 4	Giblet pans	116.00	Pickwick
TABLES	# -	- -	-	-
VENT CUTTING	# -	- -	-	-
BIRD OPENING	# -	Knives		
REMOVE LUNGS	# -	Hand rake		
CLEAN GIZZARDS	# -			
HOCK CUTTING	# -	Knives		
Chill and Package:				
ICE MAKING	# -	- -	-	-
CHILL TANKS	# 6	KT-2T Chill tank	1080.00	Brower
TANK AGITATOR	# 1	CTAP-60 Agitator	370.00	Brower
DRAIN TABLES	# 1	Drain-Packaging	995.00	Brower
PACKAGING TABLE	# -	- -	-	-
WEIGHING SCALE	# -	- -	-	-
BAGGER	# 1	BVS-40 Bagger	1780.00	Brower
BAG CLIPPER	# -	- -	-	-

```
   MAKING BOXES     # -     - -            -        -         #
   PUSHING CARTS    # -     - -             -        -        #


                                                  #----------#
                                            TOTAL #          #


       # ---------------------------------------------------- #

===============================================================
:DspEquipC
  NormalNext:
  ParentFrame:
  Fields:{
    () '' String
    () 'SLAUGHTER' String
    () 'HANGING' String
    () ''String
    () 'STUN AND KILL' String
    () 'BLEEDING' String
    () 'SCALDING' String
    () 'PICKING' String
    () ''String
    () 'SINGEING' String

    () 'EVISC LINE' String
    () ''String
    () 'OFFAL CART' String
    () 'TABLES' String
    () 'GIBLET PANS' String
    () 'VENT CUTTING' String
    () 'BIRD OPENING' String
    () 'REMOVE LUNGS' String
    () 'CLEAN GIZZARDS' String
    () 'HOCK CUTTING' String

    () 'ICE MAKING' String
    () 'CHILL TANKS' String
    () 'TANK AGITATOR' String
    () 'DRAIN TABLES' String
    () 'PACKAGING TABLE'String
    () 'WEIGHING SCALE' String
    () 'BAGGER' String
    () 'BAG CLIPPER' String
    () 'MAKING BOXES' String
    () 'PUSHING CARTS' String

    () 'BOILERS' String
    () 'GENERATORS' String
    () 'SPARE PARTS' String
```

```
    () 'TOTAL' String
    () ''String
  }
  Window:{
    HeadingLine: 5
    No Box
    Position: (  2, 5, 79, 23 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
```

Synthesized Processing System for PlantC
(500 birds per hour plant)

Activity	Qty	Model	Price	Source
Slaughter:				
HANGING	1	Dunkmaster conveyor	760.00	Pickwick
	7	SHC16 Shackles	966.00	Pickwick
STUN & KILL	1	SKG Stunning Knive	998.00	Pickwick
BLEEDING	1	Killing Tunnel	2795.00	Pickwick
SCALDING	1	SS-36-SS Scalder	4080.00	Ashly
PICKING	1	JS2A Batch Picker	7425.00	Pickwick
	1	P-60 Insp. Table	740.00	Pickwick
SINGEING	1	PS1 Poultry singer	41.00	Pickwick
Evisceration:				
EVISC LINE	1	EVO-25 Evisc line	7670.00	Pickwick
	1	EVS-25 F. stand	2392.00	Pickwick
OFFAL CART	2	OCB2 Offal cart	746.00	Pickwick
GIBLET PANS	8	Giblet pans	233.00	Pickwick
TABLES	-	- -	-	-
VENT CUTTING	1	Vent cutter	1750.00	Pickwick
BIRD OPENING	-	Knives		
REMOVE LUNGS	1	Jarv lung remover	350.00	Jarvis
CLEAN GIZZARDS	1	Gizzard stand	1105.00	Pickwick
HOCK CUTTING	1	CPE Neck/& Hock	525.00	Pickwick
Chill and Package:				
ICE MAKING	-	- -	-	-
CHILL TANKS	4	K3694 Chill tank	1960.00	Brower
TANK AGITATOR	1	CTAP-60 Agitator	370.00	Brower
DRAIN TABLES	1	Drain-table	995.00	Pickwick
PACKAGING TABLE	-	- -	-	-
WEIGHING SCALE	-	- -	-	-
BAGGER	1	BVS-40 Baggier	1780.00	Brower
BAG CLIPPER	-	- -	-	-
MAKING BOXES	-	- -	-	-

```
   PUSHING CARTS   # -    - -           -         -       #

                                                #---------#
                                          TOTAL #         #

    # ---------------------------------------------------- #

================================================================
:DspEquipD
  NormalNext:
  ParentFrame:
  Fields:(
    () '' String
    () 'SLAUGHTER' String
    () 'HANGING' String
    () ''String
    () 'STUN AND KILL' String
    () 'BLEEDING' String
    () 'SCALDING' String
    () 'PICKING' String
    () ''String
    () 'SINGEING' String
    () 'EVISC LINE' String
    () ''String
    () 'OFFAL CART' String
    () 'TABLES' String
    () 'GIBLET PANS' String
    () 'VENT CUTTING' String
    () 'BIRD OPENING' String
    () 'REMOVE LUNGS' String
    () 'CLEAN GIZZARDS' String
    () 'Bird washing' String
    () ''String
    () 'HOCK CUTTING' String

    () 'ICE MAKING' String
    () 'CHILL TANKS' String
    () 'TANK AGITATOR' String
    () 'DRAIN TABLES' String
    () 'PACKAGING TABLE'String
    () 'WEIGHING SCALE' String
    () 'BAGGER' String
    () 'BAG CLIPPER' String
    () 'MAKING BOXES' String
    () 'PUSHING CARTS' String

    () 'BOILERS' String
    () 'GENERATORS' String
    () 'SPARE PARTS' String
    () 'TOTAL' String
    () ''String
```

```
  }
  Window:{
    HeadingLine: 5
    No Box
    Position: (  2, 5, 79, 23 )
  }
  Colors:{
    Normal Text = ( blue, lightgray ) plain
    Border = (green, lightgray) plain
  }
```

Synthesized Processing System for PlantD
(1200 birds per hour plant)

Activity	Qty	Model	Price	Source
Slaughter:				
HANGING	# 1	Dunkmaster conveyor	760.00	Pickwick
	# 7	SHC20 Shackles	1085.00	Pickwick
STUN & KILL	# 1	SKG Stunning Knive	998.00	Pickwick
BLEEDING	# 1	Killing Tunnel	2795.00	Pickwick
SCALDING	# 1	SS-48-SS Scalder	5370.00	Ashly
PICKING	# 1	JS2A Batch Picker	7425.00	Pickwick
	# 1	P-60 Inspec. Table	740.00	Pickwick
SINGEING	# 2	PS1 Poultry singer	83.00	Pickwick
Evisceration:				
EVISC LINE	# 1	EVO-37 Evisc. line	9950.00	Pickwick
	# 1	EVS-37 Floor stand	3536.00	Pickwick
OFFAL CART	# 1	OCB4 Offal cart	998.00	Pickwick
GIBLET PANS	# 12	Giblet pans	350.00	Pickwick
TABLES	# -	- -	-	-
VENT CUTTING	# 1	Vent cutter	1750.00	Jarvis
BIRD OPENING	# -	Knives		
REMOVE LUNGS	# 1	Lung gun	350.00	Jarvis
CLEAN GIZZARDS	# 1	Gizzard stand	1105.00	Pickwick
BIRD WASHING	# 1	BWI washing	1460.00	Pickwick
	# 2	BWO washing	3630.00	Pickwick
HOCK CUTTING	# 1	CPE Neck/Hockr	525.00	Pickwick
Chill and Package:				
ICE MAKING	# -	- -	-	-
CHILL TANKS	# 6	K3694 Chill tank	2940.00	Brower
TANK AGITATOR	# 1	CTAP-60 Agitator	370.00	Brower
DRAIN TABLES	# 2	Drain- table	1990.00	Pickwick
PACKAGING TABLE	# -	- -	-	-
WEIGHING SCALE	# -	- -	-	-
BAGGER	# 1	BVS-40 Bagger	1780.00	Brower
BAG CLIPPER	# -	- -	-	-
MAKING BOXES	# -	- -	-	-

```
PUSHING CARTS    # -   - -                    -         -        #


                                                      #---------#
                                               TOTAL #         #


         # -------------------------------------------------- #
================================================================
:PlantOptA
  ParentFrame: FurnitureA
  Fields:{
    (B) '' GoTo BuildAltA, prompt
   Lets you see Building Options
    (F) '' GoTo FurniAltA, prompt
   Lets you see Furniture Options
    (S) '' GoTo EquipKil, prompt
   Lets you see Equipment Options
  }
  Window:{
  ClearAfter
    Double Box
    Position: ( 30, 5, 70, 20  )
  }
  Colors: {
    NormalText = ( lightgray, blue ) plain
    Border = (green, blue) plain
  }
---------------------------------------------------------------


     Do you want to make any changes?


      Highlight your choice <F10>

           #Building#
           #Furniture#
           #Synthesize systems#
===============================================================
:BuildAltA
   ParentFrame: PlantOptA
   Fields:{
     (D) 'Default Value' Real [500..100000]

     (C) 'Own Choice' Real [500..100000]
   }
   Window:{
   ClearAfter
```

```
    Double Box
    Position: (25, 5, 75, 15)
  }
  Colors:{
     NormalText = (lightgray, blue) plain
     Border = (green, blue) plain
  }
-----------------------------------------------------------------

        Highlight Resources to be Altered

        DEFAULT VALUE (sqft):#       800 #
     ENTER YOUR CHOICE (sqft):#           #

=================================================================
:FurniAltA
  NormalNext: EquipKil
  ParentFrame: PlantOptA
  Fields:{
    (D) 'Default Value' Real [100..100000]
    (C) 'Own Choice' Real [100..100000]
  }
  Window:{
  ClearAfter
    Double Box
    Position: (35, 10, 75, 20)
  }
  Colors:{
     NormalText = (lightgray, blue) plain
     Border = (green, blue) plain
  }
-----------------------------------------------------------------


  Enter DOLLAR AMOUNT of Furnisher

       DEFAULT VALUE ($):#     500 #
    ENTER YOUR CHOICE ($):#         #
=================================================================
:PlantOptB
  ParentFrame: FurnitureB
  Fields:{
    (B) '' GoTo BuildAltB, prompt
   Lets you see Building Options
    (F) '' GoTo FurniAltB, prompt
   Lets you see Furniture Options
    (S) '' GoTo EquipKil, prompt
   Lets you see Equipment Options
  }
  Window:{
```

```
  ClearAfter
    Double Box
    Position: ( 30, 5, 70, 20  )
  }
  Colors: {
    NormalText = ( lightgray, blue ) plain
    Border = (green, blue) plain
}
------------------------------------------------------------

     Do you want to make any changes?

      Highlight your choice <F10>

           #Building#
           #Furniture#
           #Synthesize systems#

============================================================
:BuildAltB
   ParentFrame: PlantOptB
   Fields:{
     (D) 'Default Value' Real [500..100000]

     (C) 'Own Choice' Real [500..100000]
   }
   Window:{
   ClearAfter
     Double Box
     Position: (25, 5, 75, 15)
   }
   Colors:{
      NormalText = (lightgray, blue) plain
      Border = (green, blue) plain
   }
------------------------------------------------------------


          Highlight Resources to be Altered

          DEFAULT VALUE (sqft):#      1000 #
      ENTER YOUR CHOICE (sqft):#           #

============================================================
:FurniAltB
   NormalNext: EquipKil
   ParentFrame: PlantOptB
   Fields:{
     (D) 'Default Value' Real [100..100000]
     (C) 'Own Choice' Real [100..100000]
   }
```

```
   Window:{
   ClearAfter
     Double Box
     Position: (35, 10, 75, 20)
   }
   Colors:{
      NormalText = (lightgray, blue) plain
      Border = (green, blue) plain
   }
-------------------------------------------------------------


   Enter DOLLAR AMOUNT of Furniture

        DEFAULT VALUE ($):#     600 #
    ENTER YOUR CHOICE ($):#         #
=============================================================
:PlantOptC
  ParentFrame: FurnitureC
  Fields:{
    (B) '' GoTo BuildAltC, prompt
   Lets you see Building Options
    (F) '' GoTo FurniAltC, prompt
   Lets you see Furniture Options
    (S) '' GoTo EquipKil, prompt
   Lets you see Equipment Options
  }
  Window:{
  ClearAfter
    Double Box
    Position: ( 30, 5, 70, 20  )
  }
  Colors: {
    NormalText = ( lightgray, blue ) plain
    Border = (green, blue) plain
  }
-------------------------------------------------------


     Do you want to make any changes?

      Highlight your choice <F10>

           #Building#
           #Furniture#
           #Synthesize systems#
=============================================================
```

```
:BuildAltC
   ParentFrame: PlantOptC
   Fields:{
     (D) 'Default Value' Real [500..100000]

     (C) 'Own Choice' Real [500..100000]
   }
   Window:{
   ClearAfter
     Double Box
     Position: (25, 5, 75, 15)
   }
   Colors:{
      NormalText = (lightgray, blue) plain
      Border = (green, blue) plain
   }
-------------------------------------------------------------


          Highlight Resources to be Altered

          DEFAULT VALUE (sqft):#      1400 #
      ENTER YOUR CHOICE (sqft):#           #

=============================================================
:FurniAltC
   NormalNext: EquipKil
   ParentFrame: PlantOptC
   Fields:{
     (D) 'Default Value' Real [100..100000]
     (C) 'Own Choice' Real [100..100000]
   }
   Window:{
   ClearAfter
     Double Box
     Position: (35, 10, 75, 20)
   }
   Colors:{
      NormalText = (lightgray, blue) plain
      Border = (green, blue) plain
   }
-----------------------------------------------------------


   Enter DOLLAR AMOUNT of Furniture

        DEFAULT VALUE ($):#     600 #
    ENTER YOUR CHOICE ($):#         #

===========================================================
```

```
:PlantOptD
  ParentFrame: FurnitureD
  Fields:{
    (B) '' GoTo BuildAltD, prompt
   Lets you see Building Options
    (F) '' GoTo FurniAltD, prompt
   Lets you see Furniture Options
    (S) '' GoTo EquipKil, prompt
   Lets you see Equipment Options
  }
  Window:{
  ClearAfter
    Double Box
    Position: ( 30, 5, 70, 20  )
  }
  Colors: {
    NormalText = ( lightgray, blue ) plain
    Border = (green, blue) plain
  }
-------------------------------------------------------
     Do you want to make any changes?

      Highlight your choice <F10>

           #Building#
           #Furniture#
           #Synthesize systems#

=======================================================
:BuildAltD
   ParentFrame: PlantOptD
   Fields:{
     (D) 'Default Value' Real [500..100000]

     (C) 'Own Choice' Real [500..100000]
   }
   Window:{
   ClearAfter
     Double Box
     Position: (25, 5, 75, 15)
   }
   Colors:{
      NormalText = (lightgray, blue) plain
      Border = (green, blue) plain
   }
-------------------------------------------------------

          Highlight Resources to be Altered

          DEFAULT VALUE (sqft):#      3000 #
      ENTER YOUR CHOICE (sqft):#           #
```

```
=========================================================
:FurniAltD
   NormalNext: EquipKil
   ParentFrame: PlantOptD
   Fields:{
     (D) 'Default Value' Real [100..100000]
     (C) 'Own Choice' Real [100..100000]
   }
   Window:{
   ClearAfter
     Double Box
     Position: (35, 10, 75, 20)
   }
   Colors:{
      NormalText = (lightgray, blue) plain
      Border = (green, blue) plain
   }
---------------------------------------------------------


   Enter DOLLAR AMOUNT of Furniture

        DEFAULT VALUE ($):#     800 #
    ENTER YOUR CHOICE ($):#         #

=========================================================
:HelpMenu
  NormalNext: EquipKil
  DisplayOnly
  Window:{
    EntryBox: ┌┐│‖└┘
    ExitBox: ┌┐│‖└┘
    Position:(1, 20, 80, 23)
  }
  Colors:{
    PointerBar = (black, red) ReverseVideo
    Normal Text = (black, lightgray) Plain
    Border = (red, black) Plain
  }
-----------------------------------------------------------

 F1:   F2:  F3:  F4:   F5:   F6:   F7:    F8:    F9:    F10:
 HELP EXIT KILL SCALD PICK  EVISC CHILL  PACK  PRINT   SUBMIT
=========================================================
:EquipKil
   Normal Next: EquipEvisc
   Fields:{
      () '' Group 8
      (1) '1' Choice
      (2) '2' Choice
      (3) '3' Choice
```

(4) '4' Choice
(5) '5' Choice
(6) '6' Choice
(7) '7' Choice
(8) '8' Choice
() '' Group 8
(1) '1' Choice
(2) '2' Choice
(3) '3' Choice
(4) '4' Choice
(5) '5' Choice
(6) '6' Choice
(7) '7' Choice
(8) '8' Choice
() '' Group 8
(1) '1' Choice
(2) '2' Choice
(3) '3' Choice
(4) '4' Choice
(5) '5' Choice
(6) '6' Choice
(7) '7' Choice
(8) '8' Choice
() '' Group 8
(1) '1' Choice
(2) '2' Choice
(3) '3' Choice
(4) '4' Choice
(5) '5' Choice
(6) '6' Choice
(7) '7' Choice
(8) '8' Choice
() '' Group 8
(1) '1' Choice
(2) '2' Choice
(3) '3' Choice
(4) '4' Choice
(5) '5' Choice
(6) '6' Choice
(7) '7' Choice
(8) '8' Choice
() '' Group 8
(1) '1' Choice
(2) '2' Choice
(3) '3' Choice
(4) '4' Choice
(5) '5' Choice
(6) '6' Choice
(7) '7' Choice
(8) '8' Choice

```
      () '' Group 8
      (1) '1' Choice
      (2) '2' Choice
      (3) '3' Choice
      (4) '4' Choice
      (5) '5' Choice
      (6) '6' Choice
      (7) '7' Choice
      (8) '8' Choice
      () '' String
   }
   Window:{
   ClearAfter
     HeadingLine: 5
     No Box
     Position: (1, 4, 80, 22)
   }
   Colors:{
     PointerBar = (black, red) ReverseVideo
     Normal Text = (black, lightgray) Plain
     Border = (red, black) Plain
   }
   Help: {
     Use the Function Keys to get information on the types of
     equipment, pricing, manufacturers, etc. }
-------------------------------------------------------------

                  Synthesizing Processing System

 Slaughter:                          Choices:

   HANGING        # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   STUN AND KILL  # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   BLEEDING       # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   SCALDING       # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   SCALDING       # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   PICKING        # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   SINGEING       # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #


   #-------------------------------------------------------------#
```

```
============================================================================
:EquipEvisc
   Normal Next: EquipChill
   ParentFrame: EquipKil
   Fields:{
      () '' Group 8
      (1) '1' Choice
      (2) '2' Choice
      (3) '3' Choice
      (4) '4' Choice
      (5) '5' Choice
      (6) '6' Choice
      (7) '7' Choice
      (8) '8' Choice
      () '' Group 8
      (1) '1' Choice
      (2) '2' Choice
      (3) '3' Choice
      (4) '4' Choice
      (5) '5' Choice
      (6) '6' Choice
      (7) '7' Choice
      (8) '8' Choice
      () '' Group 8
      (1) '1' Choice
      (2) '2' Choice
      (3) '3' Choice
      (4) '4' Choice
      (5) '5' Choice
      (6) '6' Choice
      (7) '7' Choice
      (8) '8' Choice
      () '' Group 8
      (1) '1' Choice
      (2) '2' Choice
      (3) '3' Choice
      (4) '4' Choice
      (5) '5' Choice
      (6) '6' Choice
      (7) '7' Choice
      (8) '8' Choice
      () '' Group 8
      (1) '1' Choice
      (2) '2' Choice
      (3) '3' Choice
      (4) '4' Choice
      (5) '5' Choice
      (6) '6' Choice
      (7) '7' Choice
      (8) '8' Choice
```

```
    () '' Group 8
    (1) '1' Choice
    (2) '2' Choice
    (3) '3' Choice
    (4) '4' Choice
    (5) '5' Choice
    (6) '6' Choice
    (7) '7' Choice
    (8) '8' Choice
    () '' Group 8
    (1) '1' Choice
    (2) '2' Choice
    (3) '3' Choice
    (4) '4' Choice
    (5) '5' Choice
    (6) '6' Choice
    (7) '7' Choice
    (8) '8' Choice
    () '' Group 8
    (1) '1' Choice
    (2) '2' Choice
    (3) '3' Choice
    (4) '4' Choice
    (5) '5' Choice
    (6) '6' Choice
    (7) '7' Choice
    (8) '8' Choice
    () '' Group 8
    (1) '1' Choice
    (2) '2' Choice
    (3) '3' Choice
    (4) '4' Choice
    (5) '5' Choice
    (6) '6' Choice
    (7) '7' Choice
    (8) '8' Choice
    () '' String
}
Window:{
ClearAfter
  HeadingLine: 5
  No Box
  Position: (1, 4, 80, 22)
}
Colors:{
  PointerBar = (black, red) ReverseVideo
  Normal Text = (black, lightgray) Plain
  Border = (red, black) Plain
}
```

```
   Help: {
     Use the Function Keys to get information on the types of
     equipment, pricing, manufacturers, etc. }
-------------------------------------------------------------
                    Synthesizing Processing System

 Evisceration:

   EVISC LINE     # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   OFFAL CART     # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   GIBLET PANS    # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   TABLES         # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   VENT CUTTING   # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   BIRD OPENING   # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   REMOVE LUNGS   # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   CLEAN GIZZARDS# 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   HOCK CUTTING   # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #


   #-----------------------------------------------------------#
=================================================================
:EquipChill
   Normal Next: EquipSum
   ParentFrame: EquipEvisc
   Fields: {
      () '' Group 8
      (1) '1' Choice
      (2) '2' Choice
      (3) '3' Choice
      (4) '4' Choice
      (5) '5' Choice
      (6) '6' Choice
      (7) '7' Choice
      (8) '8' Choice
      () '' Group 8
      (1) '1' Choice
      (2) '2' Choice
      (3) '3' Choice
      (4) '4' Choice
      (5) '5' Choice
      (6) '6' Choice
```

(7) '7' Choice
(8) '8' Choice
() '' Group 8
(1) '1' Choice
(2) '2' Choice
(3) '3' Choice
(4) '4' Choice
(5) '5' Choice
(6) '6' Choice
(7) '7' Choice
(8) '8' Choice
() '' Group 8
(1) '1' Choice
(2) '2' Choice
(3) '3' Choice
(4) '4' Choice
(5) '5' Choice
(6) '6' Choice
(7) '7' Choice
(8) '8' Choice
() '' Group 8
(1) '1' Choice
(2) '2' Choice
(3) '3' Choice
(4) '4' Choice
(5) '5' Choice
(6) '6' Choice
(7) '7' Choice
(8) '8' Choice
() '' Group 8
(1) '1' Choice
(2) '2' Choice
(3) '3' Choice
(4) '4' Choice
(5) '5' Choice
(6) '6' Choice
(7) '7' Choice
(8) '8' Choice
() '' Group 8
(1) '1' Choice
(2) '2' Choice
(3) '3' Choice
(4) '4' Choice
(5) '5' Choice
(6) '6' Choice
(7) '7' Choice
(8) '8' Choice
() '' Group 8
(1) '1' Choice
(2) '2' Choice
(3) '3' Choice

```
    (4) '4' Choice
    (5) '5' Choice
    (6) '6' Choice
    (7) '7' Choice
    (8) '8' Choice
    () '' Group 8
    (1) '1' Choice
    (2) '2' Choice
    (3) '3' Choice
    (4) '4' Choice
    (5) '5' Choice
    (6) '6' Choice
    (7) '7' Choice
    (8) '8' Choice
    () '' Group 8
    (1) '1' Choice
    (2) '2' Choice
    (3) '3' Choice
    (4) '4' Choice
    (5) '5' Choice
    (6) '6' Choice
    (7) '7' Choice
    (8) '8' Choice
    () '' Group 8
    (1) '1' Choice
    (2) '2' Choice
    (3) '3' Choice
    (4) '4' Choice
    (5) '5' Choice
    (6) '6' Choice
    (7) '7' Choice
    (8) '8' Choice
    () '' Group 8
    (1) '1' Choice
    (2) '2' Choice
    (3) '3' Choice
    (4) '4' Choice
    (5) '5' Choice
    (6) '6' Choice
    (7) '7' Choice
    (8) '8' Choice
    () ''String
}
Window:{
ClearAfter
  HeadingLine: 5
  No Box
  Position: (1, 4, 80, 22)
}
```

```
   Colors:{
     PointerBar = (black, red) ReverseVideo
     Normal Text = (black, lightgray) Plain
     Border = (red, black) Plain
   }
   Help: {
     Use the Function Keys to get information on the types of
     equipment, pricing, manufacturers, etc. }
-------------------------------------------------------------
                  Synthesizing Processing System


 Chill and Package:                CHOICES:

   ICE MAKING     # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   CHILL TANKS    # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   TANK AGITATOR # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   DRAIN TABLES   # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   PACKAGING TABL # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   WEIGHING SCALE # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   BAGGER          # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   BAG CLIPPER     # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   PUSHING CARTS   # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   BOILERS        # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   GENERATORS     # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #

   SPARE PARTS    # 1 # # 2 # # 3 # # 4 # # 5 # # 6 # # 7 # # 8 #


#-------------------------------------------------------------#

=============================================================


:HelpMenuX
  NormalNext: EquipKil
  DisplayOnly
  Window:{
}
```

```
---------------------------------------------------------------

===============================================================
:EquipSum
  Normal Next: Costs
  ParentFrame: EquipChill
  DisplayOnly
  HitAnyKey
  Fields: {
    () ''String
    () 'SLAUGHTER' String
    () 'HANGING' String
    () 'STUN AND KILL' String
    () 'BLEEDING' String
    () 'SCALDING' String
    () 'PICKING' String
    () 'SINGEING' String
    () 'EVISC LINE' String
    () 'OFFAL CART' String
    () 'TABLES' String
    () 'GIBLET PANS' String
    () 'VENT CUTTING' String
    () 'BIRD OPENING' String
    () 'REMOVE LUNGS' String
    () 'CLEAN GIZZARDS' String
    () 'BIRD WASHING' String
    () 'HOCK CUTTING' String
    () 'ICE MAKING' String
    () 'CHILL TANKS' String
    () 'TANK AGITATOR' String
    () 'DRAIN TABLES' String
    () 'PACKAGING TABLE' String
    () 'WEIGHING SCALE' String
    () 'BAGGER' String
    () 'BAG CLIPPER' String
    () 'MAKING BOXES' String
    () 'PUSHING CARTS' String
    () 'BOILERS' String
    () 'GENERATORS' String
    () 'SPARE PARTS' String
    () ''String
    () 'TOTAL' String
    () '' String
    () '' String
  }
  Window:{
  ClearAfter
    HeadingLine: 5
    Position: (3, 3, 80, 23)
  }
```

```
  Colors:{
     NormalText = (lightgray, blue) plain
     Border = (green, blue) plain
   }
```

Summary of Equipment Selected

Plant Size:

Activity	Model	Qty	Price	Source
RECEIVING				
HANGING				
STUN AND KILL				
BLEEDING				
SCALDING				
PICKING				
SINGEING				
EVISC LINE				
OFFAL CART				
SINGEING				
TABLES				
GIBLET PANS				
VENT CUTTING				
BIRD OPENING				
REMOVE LUNGS				
CLEAN GIZZARDS				
BIRD WASHING				
HOCK CUTTING				
ICE MAKING				
CHILL TANKS				
TANK AGITATOR				
DRAIN TABLES				
PACKAGING TABLE				
WEIGHING SCALE				
BAGGER				
BAG CLIPPER				
MAKING BOXES				
PUSHING CARTS				
BOILERS				
GENERATORS				
(SPARE PARTS)				
			TOTAL	

```
=============================================================
:Investment
   ParentFrame: TopMenu
   DisplayOnly
   HitAnyKey
   Fields:{
     (B) 'Building' Real [500..100000]
     (F) 'Furniture' Real [100..1000]
     (E) 'Equipment' Real [500..100000]
     (T) 'Total nvestment' [500..1000000]
   }
   Window:{
   ClearAfter
     Double Box
     Position: ( 30, 5, 70, 15)
   }
   Colors:{
     PointerBar = (black, red) ReverseVideo
     NormalText = (black, lightgray) Plain
   }
-------------------------------------------------------------

            INVESTMENT REQUIREMENT

  Investment in Buildings ($):#           #
  Investment in Furniture ($):#           #
  Investment in Equipment ($):#           #

         TOTAL INVESTMENT ($):#           #

=============================================================
:Costs
   ParentFrame: TopMenu
   Fields:{
     (O) '' Goto Ownership; prompt
    Lets you determine Annual Ownership.
     (C) '' Goto Operating; prompt
    Lets you determine Operating Costs.
     (A) '' GoTo CostAsmpt; prompt
    Lets you modify cost assumptions.
 }
 Window:{
 ClearAfter
   Double Box
   Position:  (25, 5, 70, 15)
 }
 Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
 }
-------------------------------------------------------------
```

```
        PROCESSING COSTS

      Highlight your choice
        and hit <F10>

       #Annual Ownership#
         #Operating Costs#
           #Cost Assumptions#

=============================================================
:Ownership
   ParentFrame: Costs
   Fields:{
     (A) '' Goto OwnershipA; prompt
    Lets you determine Annual Ownership for PlantA
     (B) '' Goto OwnershipB; prompt
    Lets you determine Annual Ownership for PlantB
     (C) '' Goto OwnershipC; prompt
    Lets you determine Annual Ownership for PlantC
     (D) '' Goto OwnershipD; prompt
    Lets you determine Annual Ownership for PlantD
 }
 Window:{
   ClearAfter
     Double Box
     Position:  (15, 10, 70, 20)
 }
 Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
 }
-------------------------------------------------------------

            OWNERSHIP CATEGORIES
       Select your choice and hit <F10>

            #OwnershipA#
                #OwnershipB#
                    #OwnershipC#
                        #OwnershipD#

=============================================================
:OwnershipA
   NormalNext: Operating
   ParentFrame: Ownership
   DisplayOnly
   HitAnyKey
   Fields:{
     ( ) 'Plant' Real [100000..1000000]
     ( ) 'Equipment' Real [1000..200000]
     ( ) 'Furniture' Real [100..100000]
```

```
 }
 Window:{
 ClearAfter
   Double Box
   Position:  (15, 10, 70, 20)
 }
 Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
 }
-------------------------------------------------------------


             Annual Ownership Costs for PlantA

                Plant Annual Cost #             #
            Equipment Annual Cost #             #
            Furniture Annual Cost #             #

=============================================================
:OwnershipB
   NormalNext: Operating
   ParentFrame: Ownership
   DisplayOnly
   HitAnyKey
   Fields:{
     ( ) 'Plant' Real [100000..1000000]
     ( ) 'Equipment' Real [1000..200000]
     ( ) 'Furniture' Real [100..100000]
 }
 Window:{
 ClearAfter
   Double Box
   Position:  (15, 10, 70, 20)
 }
 Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
 }
-------------------------------------------------------------

             Annual Ownership Costs for PlantB

                Plant Annual Cost #             #
            Equipment Annual Cost #             #
            Furniture Annual Cost #             #

=============================================================
```

```
:OwnershipC
   NormalNext: Operating
   ParentFrame: Ownership
   DisplayOnly
   HitAnyKey
   Fields:{
     ( ) 'Plant' Real [100000..1000000]
     ( ) 'Equipment' Real [1000..200000]
     ( ) 'Furniture' Real [100..100000]
 }
 Window:{
 ClearAfter
   Double Box
   Position:  (15, 10, 70, 20)
 }
 Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
 }
-------------------------------------------------------------


             Annual Ownership Costs for PlantC

                Plant Annual Cost #            #
             Equipment Annual Cost #           #
             Furniture Annual Cost #           #

=============================================================
:OwnershipD
   NormalNext: Operating
   ParentFrame: Ownership
   DisplayOnly
   HitAnyKey
   Fields:{
     ( ) 'Plant' Real [100000..1000000]
     ( ) 'Equipment' Real [1000..200000]
     ( ) 'Furniture' Real [100..100000]
 }
 Window:{
 ClearAfter
   Double Box
   Position:  (15, 10, 70, 20)
 }
 Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
 }
```

```
------------------------------------------------------------


              Annual Ownership Costs for PlantD

                 Plant Annual Cost #             #
              Equipment Annual Cost #            #
              Furniture Annual Cost #            #

============================================================
:Operating
   ParentFrame: Costs
   Fields:{
     (A) '' Goto OperatingA; prompt
    Lets you determine Operating Costs for PlantA
     (B) '' Goto OperatingB; prompt
    Lets you determine Operating Costs for PlantB
     (C) '' Goto OperatingC; prompt
    Lets you determine Operating Costs for PlantC
     (D) '' Goto OperatingD; prompt
    Lets you determine Operating Costs for PlantD
 }
 Window:{
 ClearAfter
   Double Box
   Position:  (15, 10, 70, 20)
 }
 Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
 }
------------------------------------------------------------

             Annual Operating Costs
        Select your choice and hit <F10>

             #OperatingA#
                #OperatingB#
                   #OperatingC#
                      #OperatingD#
============================================================
:OperatingA
   NormalNext: CostAsmptA
   ParentFrame: Operating
   DisplayOnly
   Fields:{
     ( ) 'Labor' Real [1..100000000]
     ( ) 'Electricity' Real [1..100000000]
     ( ) 'Water' Real [1..1000000000]
     ( ) 'Plant maint. and repairs' Real [1..1000000000]
```

```
    ( ) 'Equipment maint. and repairs' Real[1..1000000000]
    ( ) 'Furniture maint. and repairs' [1..1000000000]
    ( ) 'Insurance' Real [1..1000000000]
    ( ) 'Taxes' Real [1..1000000000]
    ( ) 'Packaging' Real [1..1000000000]
  }
  Window:{
  ClearAfter
    Double Box
    Position:  (15, 5, 70, 20)
  }
  Colors:{
    PointerBar = (black, red) ReverseVideo
    Normal Text = (black, lightgray) Plain
  }
-------------------------------------------------------


            Annual Processing Costs for PlantA
            Highlight your choice and hit <F10>

                          Labor #       #
                    Electricity #       #
                          Water #       #
       Plant Maint.and Repairs #       #
  Equipment Maint. and Repairs #       #
  Furniture Maint. and Repairs #       #
                     Insurance #       #
                         Taxes #       #
                     Packaging #       #

=======================================================
:OperatingB
  NormalNext: CostAsmptB
  ParentFrame: Operating
  DisplayOnly
  Fields:{
    ( ) 'Labor' Real [1..100000000]
    ( ) 'Electricity' Real [1..100000000]
    ( ) 'Water' Real [1..1000000000]
    ( ) 'Plant maint. and repairs' Real [1..1000000000]
    ( ) 'Equipment maint. and repairs' Real[1..1000000000]
    ( ) 'Furniture maint. and repairs' [1..1000000000]
    ( ) 'Insurance' Real [1..1000000000]
    ( ) 'Taxes' Real [1..1000000000]
    ( ) 'Packaging' Real [1..1000000000]
  }
  Window:{
  ClearAfter
    Double Box
    Position:  (15, 5, 70, 20)
```

```
   }
   Colors:{
     PointerBar = (black, red) ReverseVideo
     Normal Text = (black, lightgray) Plain
   }
-------------------------------------------------


            Annual Processing Costs for PlantB
            Highlight your choice and hit <F10>

                         Labor #       #
                   Electricity #       #
                         Water #       #
       Plant Maint.and Repairs #       #
  Equipment Maint. and Repairs #       #
  Furniture Maint. and Repairs #       #
                     Insurance #       #
                         Taxes #       #
                     Packaging #       #

=================================================
:OperatingC
   NormalNext: CostAsmptC
   ParentFrame: Operating
   DisplayOnly
   Fields:{
     ( ) 'Labor' Real [1..100000000]
     ( ) 'Electricity' Real [1..100000000]
     ( ) 'Water' Real [1..1000000000]
     ( ) 'Plant maint. and repairs' Real [1..1000000000]
     ( ) 'Equipment maint. and repairs' Real[1..1000000000]
     ( ) 'Furniture maint. and repairs' [1..1000000000]
     ( ) 'Insurance' Real [1..1000000000]
     ( ) 'Taxes' Real [1..1000000000]
     ( ) 'Packaging' Real [1..1000000000]
   }
   Window:{
   ClearAfter
     Double Box
     Position:  (15, 5, 70, 20)
   }
   Colors:{
     PointerBar = (black, red) ReverseVideo
     Normal Text = (black, lightgray) Plain
   }
```

```
------------------------------------------------------------
            Annual Processing Costs for PlantC
            Highlight your choice and hit <F10>
                        Labor #       #
                  Electricity #       #
                        Water #       #
       Plant Maint.and Repairs #       #
  Equipment Maint. and Repairs #       #
  Furniture Maint. and Repairs #       #
                    Insurance #       #
                        Taxes #       #
                    Packaging #       #
============================================================
:OperatingD
   NormalNext: CostAsmptD
   ParentFrame: Operating
   DisplayOnly
   Fields:{
     ( ) 'Labor' Real [1..100000000]
     ( ) 'Electricity' Real [1..100000000]
     ( ) 'Water' Real [1..1000000000]
     ( ) 'Plant maint. and repairs' Real [1..1000000000]
     ( ) 'Equipment maint. and repairs' Real[1..1000000000]
     ( ) 'Furniture maint. and repairs' [1..1000000000]
     ( ) 'Insurance' Real [1..1000000000]
     ( ) 'Taxes' Real [1..1000000000]
     ( ) 'Packaging' Real [1..1000000000]
   }
   Window:{
   ClearAfter
     Double Box
     Position:  (15, 5, 70, 20)
   }
   Colors:{
     PointerBar = (black, red) ReverseVideo
     Normal Text = (black, lightgray) Plain
   }
------------------------------------------------------------
            Annual Processing Costs for PlantD
            Highlight your choice and hit <F10>
                        Labor #       #
                  Electricity #       #
                        Water #       #
       Plant Maint.and Repairs #       #
  Equipment Maint. and Repairs #       #
  Furniture Maint. and Repairs #       #
                    Insurance #       #
                        Taxes #       #
                    Packaging #       #

============================================================
```

```
:CostAsmptA
   ParentFrame: Costs
   Fields:{
     () 'Day' Real [0..10]
     () 'Year' Real [1..250]
     () 'Capacity' Real [1..100]
     () 'Building' Real [0..200]
     () 'Wages' Real [0..10]
     () 'Labor' Real [1..100]
     () 'Interest Rate' Real [1..20]
     () 'Building maint and repairs'Real [0..10]
     () 'Equipment maint and repairs' Real [0..10]
     () 'Insurance' Real [0..10]
     () 'Taxes' Real [0..10]
     () 'Electricity' Real [0..10]
     () 'Water' Real [0..10]
     () 'Packaging'Real [0..10]
   }
   Window:{
   ClearAfter
     Double Box
     Position:  (15, 4, 70, 23)
   }
   Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
   }
```

COST ASSUMPTIONS

Day (hours/day)	#	8 #
Year (days/year)	#	250 #
Capacity utilization (%)	#	100 #
Building ($/sqft.)	#	150 #
Wage Rate ($/hr.)	#	6 #
Laborers (Number)	#	15 #
Interest Rate (%)	#	8 #
Building maint and repairs (% of initial cost)	#	0.0075#
Equipment maint and repairs (% of initial cost)	#	0.0125#
Insurance (% of initial cost)	#	0.0250#
Taxes (% of initial cost)	#	0.0150#
Electricity ($/100 bidrs)	#	0.16 #
Water ($/1000 gal)	#	1.50 #
Packaging ($/bird processed)	#	0.05 #

==========

```
:CostAsmptB
   ParentFrame: Costs
   Fields:{
     () 'Day' Real [0..10]
     () 'Year' Real [1..250]
     () 'Capacity' Real [1..100]
     () 'Building' Real [0..200]
     () 'Wages' Real [0..10]
     () 'Labor' Real [1..100]
     () 'Interest Rate' Real [1..20]
     () 'Building maint and repairs'Real [0..10]
     () 'Equipment maint and repairs' Real [0..10]
     () 'Insurance' Real [0..10]
     () 'Taxes' Real [0..10]
     () 'Electricity' Real [0..10]
     () 'Water' Real [0..10]
     () 'Packaging'Real [0..10]
   }
   Window:{
   ClearAfter
     Double Box
     Position:  (15, 4, 70, 23)
   }
   Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
   }
```

COST ASSUMPTIONS

Day (hours/day)	#	8 #
Year (days/year)	#	250 #
Capacity utilization (%)	#	100 #
Building ($/sqft.)	#	150 #
Wage Rate ($/hr.)	#	6 #
Laborers (Number)	#	25 #
Interest Rate (%)	#	8 #
Building maint and repairs (% of initial cost)	#	0.0075#
Equipment maint and repairs (% of initial cost)	#	0.0125#
Insurance (% of initial cost)	#	0.0250#
Taxes (% of initial cost)	#	0.0150#
Electricity ($/100 bidrs)	#	0.16 #
Water ($/1000 gal)	#	1.50 #
Packaging ($/bird processed)	#	0.05 #

==========

```
:CostAsmptC
   ParentFrame: Costs
   Fields:{
     () 'Day' Real [0..10]
     () 'Year' Real [1..250]
     () 'Capacity' Real [1..100]
     () 'Building' Real [0..200]
     () 'Wages' Real [0..10]
     () 'Labor' Real [1..100]
     () 'Interest Rate' Real [1..20]
     () 'Building maint and repairs'Real [0..10]
     () 'Equipment maint and repairs' Real [0..10]
     () 'Insurance' Real [0..10]
     () 'Taxes' Real [0..10]
     () 'Electricity' Real [0..10]
     () 'Water' Real [0..10]
     () 'Packaging'Real [0..10]
   }
   Window:{
   ClearAfter
     Double Box
     Position:  (15, 4, 70, 23)
   }
   Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
   }
```

COST ASSUMPTIONS

Day (hours/day)	#	8 #
Year (days/year)	#	250 #
Capacity utilization (%)	#	100 #
Building ($/sqft.)	#	150 #
Wage Rate ($/hr.)	#	6 #
Laborers (Number)	#	35 #
Interest Rate (%)	#	8 #
Building maint and repairs (% of initial cost)	#	0.0075#
Equipment maint and repairs (% of initial cost)	#	0.0125#
Insurance (% of initial cost)	#	0.0250#
Taxes (% of initial cost)	#	0.0150#
Electricity ($/100 bidrs)	#	0.16 #
Water ($/1000 gal)	#	1.50 #
Packaging ($/bird processed)	#	0.05 #

==========

```
:CostAsmptD
   ParentFrame: Costs
   Fields:{
     () 'Day' Real [0..10]
     () 'Year' Real [1..250]
     () 'Capacity' Real [1..100]
     () 'Building' Real [0..200]
     () 'Wages' Real [0..10]
     () 'Labor' Real [1..100]
     () 'Interest Rate' Real [1..20]
     () 'Building maint and repairs'Real [0..10]
     () 'Equipment maint and repairs' Real [0..10]
     () 'Insurance' Real [0..10]
     () 'Taxes' Real [0..10]
     () 'Electricity' Real [0..10]
     () 'Water' Real [0..10]
     () 'Packaging'Real [0..10]
   }
   Window:{
   ClearAfter
     Double Box
     Position:  (15, 4, 70, 23)
   }
   Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
   }
```

COST ASSUMPTIONS

Day (hours/day)	#	8 #
Year (days/year)	#	250 #
Capacity utilization (%)	#	100 #
Building ($/sqft.)	#	150 #
Wage Rate ($/hr.)	#	6 #
Laborers (Number)	#	58 #
Interest Rate (%)	#	8 #
Building maint and repairs (% of initial cost)	#	0.0075#
Equipment maint and repairs (% of initial cost)	#	0.0125#
Insurance (% of initial cost)	#	0.0250#
Taxes (% of initial cost)	#	0.0150#
Electricity ($/100 bidrs)	#	0.16 #
Water ($/1000 gal)	#	1.50 #
Packaging ($/bird processed)	#	0.05 #

==========

```
:Analysis
   ParentFrame: TopMenu
   Fields:{
     (C) '' Goto SensCapa; prompt
    Lets you display effect of Capacity Utilization
     (W) '' Goto SensWage; prompt
    Lets you display effect of Wage diffences
     (B) '' Goto SensBuild; prompt
    Lets you display effect of different Building Costs
     (I) '' Goto SensInt; prompt
    Lets you display effect of different Interst Rates
   }
   Window:{
   ClearAfter
     Double Box
     Position:  (15, 10, 70, 25)
   }
   Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
   }
-----------------------------------------------------

               Sensitivity Analysis

        Highlight your choice and hit <F10>

             #Capacity#
                 #Wages#
                    #Building#
                        #Interest#

=====================================================


:SensCapa
   ParentFrame: Analysis
   NormalNext: SensWage
   DisplayOnly
   HitAnyKey
   Fields:{
 }
 Window:{
 ClearAfter
   Double Box
   Position:  (15, 5, 70, 20)
 }
 Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
 }
```

```
-------------------------------------------------------
                SENSITIVITY ANALYSIS:
                 Capaciy Utilization

              Plant          Daily        Cost per
            Utilization    Capacity        Bird
            ------------------------------------
               100%
                90%
                80%
                70%
                60%
                50%
                40%
             ----------------------------------

=======================================================
:SensWage
   ParentFrame: SensCapa
   NormalNext: SensBuild
   DisplayOnly
   HitAnyKey
   Fields:{
   }
   Window:{
   ClearAfter
     Double Box
     Position:  (25, 5, 70, 20)
   }
   Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
   }
-------------------------------------------------------

                SENSITIVITY ANALYSIS:
                 Labor Compensation

                Wages        Cost per
                               bird
               ($/hr.)         ($)
               ------------------
                $6.00
                $7.00
               -----------------
=======================================================
:SensBuild
   ParentFrame: SensWage
   NormalNext:
   DisplayOnly
   HitAnyKey
```

```
   Fields:{
   }
   Window:{
   ClearAfter
     Double Box
     Position:  (10, 5, 70, 20)
   }
   Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
   }
-------------------------------------------------------

                SENSITIVITY ANALYSIS:
                    Building Cost

        Plant    ------Processing Cost per bird------
        size     @ $140/sqft  @ $150/sqft  @ $160/sqft
       ---------------------------------------------


        ---------------------------------------------
=========================================================
:SensInt
   ParentFrame: SensBuild
   NormalNext: TopMenu
   DisplayOnly
   HitAnyKey
   Fields:{
   }
   Window:{
   ClearAfter
     Double Box
     Position:  (15, 5, 70, 20)
   }
   Colors:{
   PointerBar = (black, red) ReverseVideo
   Normal Text = (black, lightgray) Plain
   }
-----------------------------------------------


            SENSITIVITY ANALYSIS:
               Interest Rate

        Plant    Processing Cost per bird
        size       @ 8%          @ 12%
        ----     -----------  -----------


        -------------------------------
```

Appendix D

List of Equipment Manufacturers

Appendix D

Small Scale Poultry Processing Equipment Vendors

A. "BATCH TYPE" PROCESSING EQUIPMENT

1. **Ashly Machine**
   901 N. Carver Street
   P.O Box 2
   Greensburg
   Indiana
   47240
   USA
   Phone: (812) 663-2180
   FAX 812 663-5405

2. **Brower**
   P.O Box 2000
   Houghton
   Iowa
   USA
   Phone: (319) 469-4141
   Toll Free 800 553-1917
   FAX 319 469-4402

3. **Pickwick**
   1870 McCloud Place N.E
   Cedar Rapids
   Iowa
   USA
   Phone (319) 393-7443
   Toll Free 800 397-9797
   Fax 319 393-7456

B. "IN-LINE" PROCESSING EQUIPMENT

4. **Linco**
   DK-8280
   Trige
   Denmark
   Phone (06) 231455
   Telex 68143
   Telefax (06) 231444
   Cable LINDHOLSTCO

5. Stork PMT B.V
   Handelstraat 3
   P.O Box 118
   5830 AC Boxmeer
   Holland
   Phone (31) 8855-86111
   Telex 37376
   Fax (31) 8855-86222