TEKNOLOGISK
INSTITUT

inVALUABLE

Innovation Fund Denmark

TEKNOLOGISK INSTITUT

inVALUABLE

Work package 3
Automation

Innovation Fund Denmark

Specifications and return of investment (ROI) for an automated production of insects

EAAP 2019

Ghent

TEKNOLOGISK
INSTITUT

Overview

- The team
- The problem
- The insects
- An production overview – flow of a production
- The proceses
  - Manual
  - Automated
- Automization level
  - Production capacity
- ROI of an Automized production unit

The Team

Jens Fynbo, CEO
Danish Insect Automation ApS, jf@d-ia.dk

Jonas Lembcke Andersen, Specialist
Danish Technological Institute, jlan@dti.dk

Mikkel Ebbesen, head of insect production
Ausumgaard I/S, mikkel@ausumgaard.dk

The Problem or target

We need a common framework for automization in the insect industry!!

In the comming years we will see two different types of business models:

1. Upscaling a manual production (small scale ongoing businesses), to a automized or semi-automized production.
2. Huge investments in turn key highly (fully) automized production plants

It is our hope with this presentation that we will have an more open discussion of optimizing the production of insects, and especcialy where a coorporative setup will add value.

The Insects

Overview – EU legislation

1. Black Soldier Fly (*Hermatia illucens)*
2. Common Housefly (*Musca domestica*)
3. Yellow Mealworm (*Tenebrio molitor*)
4. Lesser Mealworm (*Alphitobius diaperinus*)
5. House cricket (*Acheta domesticus)*
6. Banded cricket (*Gryllodes sigillatus*)
7. Field Cricket (*Gryllus assimilis*)

Criterias

- m^3/kg
- Full cycle nature of the insect (handling - especially reproduction)
- Production focused on Feed or Food – consumer acceptance - direct or indirect use

- Feed Conversion Ratio (FCR),
- Water consumption
- Green hous gas (CO_2,CH_4, N_2O)

Volume needed – full life cycle

1. ~~House cricket (*Acheta domesticus)*~~
2. ~~Banded cricket (*Gryllodes sigillatus*)~~
3. ~~Field Cricket (*Gryllus assimilis*)~~
4. Black Soldier Fly (*Hermatia illucens)*
5. Common Housefly (*Musca domestica*)
6. Yellow Mealworm (*Tenebrio molitor*)
7. Lesser Mealworm (*Alphitobius diaperinus*)

Criterias

- ~~m^3/kg~~
- Full life cycle – handling (especially reproduction)
- Production focused on Feed or Food – consumer acceptance - direct or indirect use

Other criterias

- Feed Conversion Ratio (FCR),
- Water consumption
- Green hous gas (CO_2,CH_4, N_2O)

Full life cycle – handling

1. ~~Black Soldier Fly (*Hermatia illucens)*~~
2. ~~Common Housefly (*Musca domestica*)~~
3. Yellow Mealworm (*Tenebrio molitor*)
4. Lesser Mealworm (*Alphitobius diaperinus*)

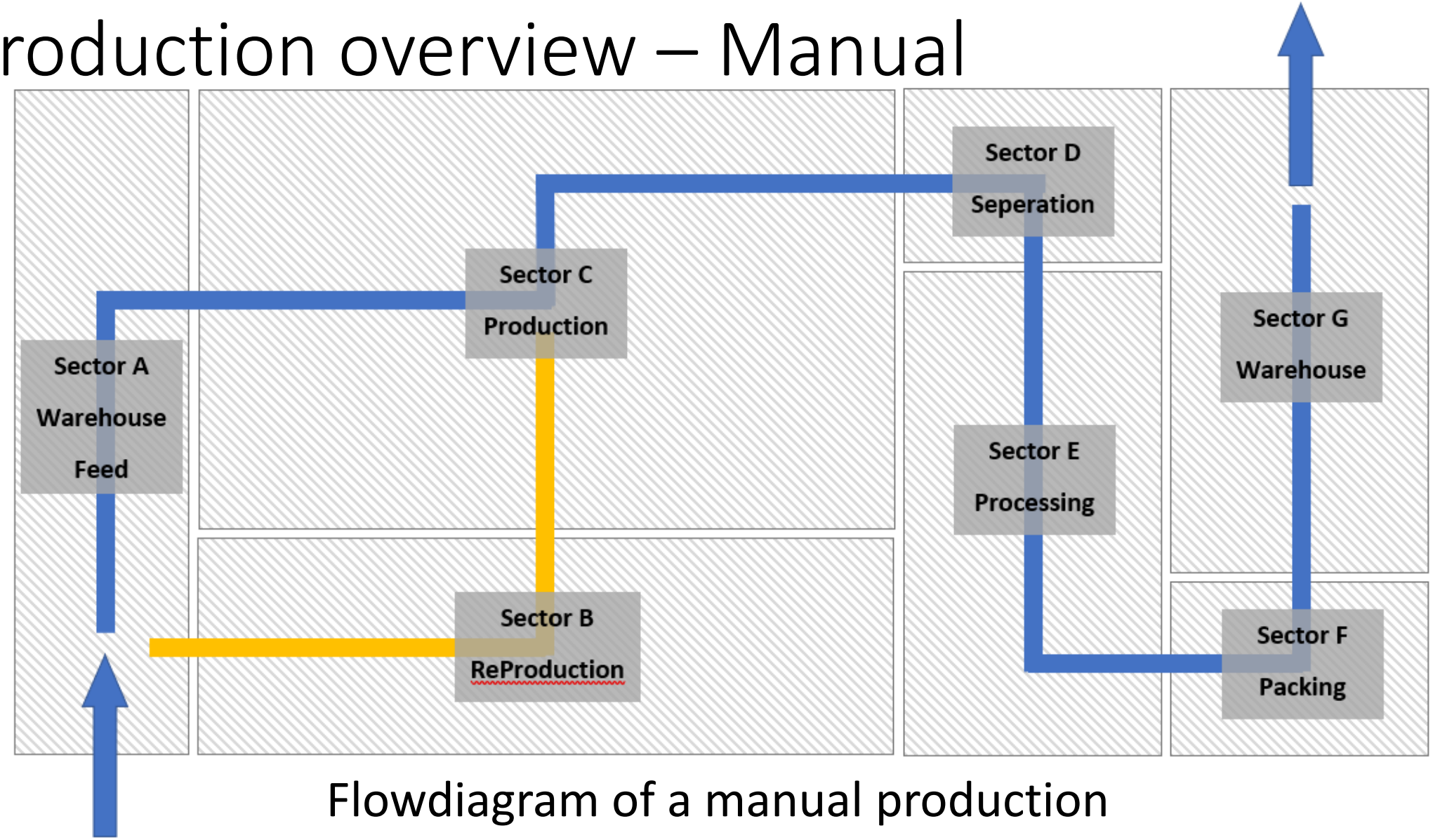
No future selection is needed - yellow and lesser are produced in the same way today – in boxes.

The mealworm has a higher consumer acceptance if used for food

ROI

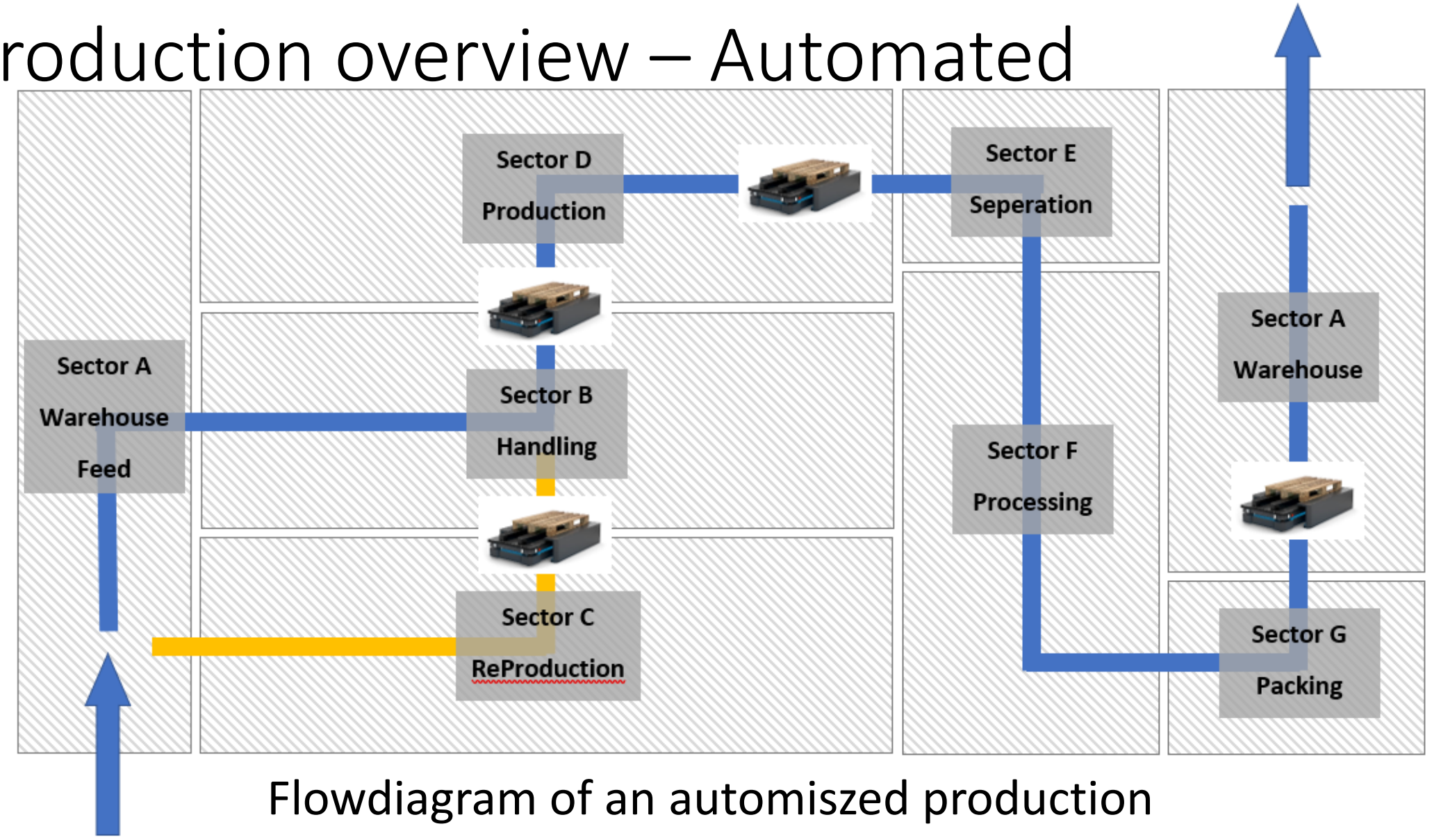
- Manual production flow - proces description
- Automized production flow - proces description
- Equipment needed
  - CapEx
  - OpEx
  - ROI

Production overview – Manual



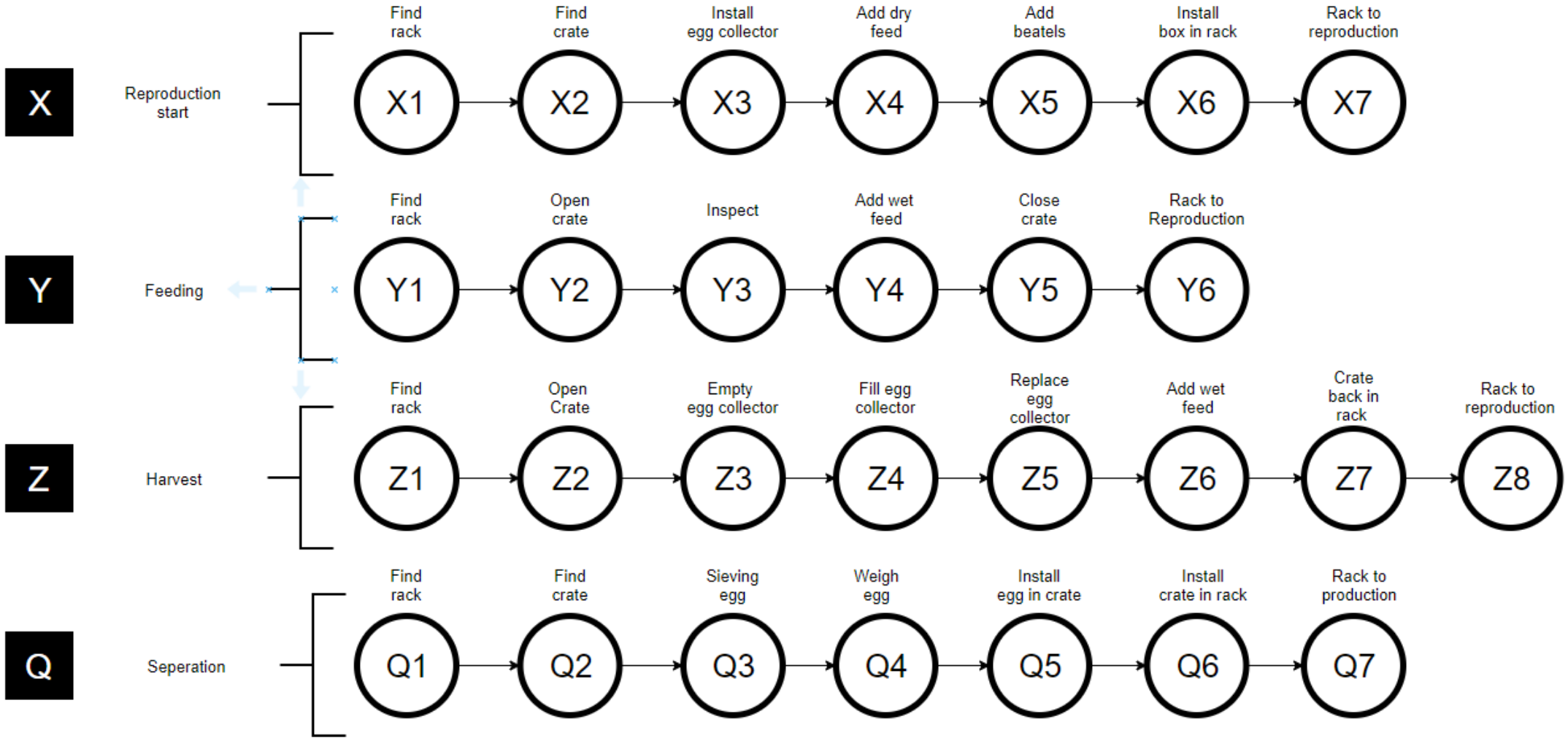
Flowdiagram of a manual production

Production overview – Automated



Flowdiagram of an automiszed production

The Proceses – reproduction



Manual

Operations – reproduction

X	Description of operations Start Reproduction Crate		Sector C Reproduction
Operations	Op. nr.	Description	Estimated time
	X1	Go find rack	60s
	X2	Find crates 400x600	60s
	X3	Install TI eggcollector in 400x600 Crate	5s
	X4	Add dry feed to egg collector	10s
	X5	Add 200g beatles to the crate	15s
	X6	Install crate in rack	5s
	X7	Move rack to reproduction area	120s
	Extra info		
	Rack and boxes are arrange nearby. The beatles in a separat box. Each reproduction crate must be loaded with 200g approx. 1700 beatles		

Manual

Equipment needed – automized production

- Building incl. heat and ventilation systems
- Boxes
- Pallets
- Egg collectors
- Destacker
- Convoyers
- Crate washer
- Feeding system (central)
- Silos
- Fridge
- Light (extra)
- MIR 500
- Electric Stacker

ROI of an automized production

CapEx	Stable incl. ventilation heating/cooling		2.000	693.333	€
	Boxes	600x400	19947	159.579	€
		300x200	19947	79.789	€
	Pallets	helpalle	237	9.474	€
		halvpalle	227	4.547	€
	Egg collectors		100	4.000	€
	Machines				
	Stacker/destacker		2	26.667	€
	Conveyors		25	33.333	€
	Crate washer		1	33.333	€
	Feeding system		1	66.667	€
	Silos		2	26.667	€
	Cooling facility		2	40.000	€
	Light (extra)		250	6.667	€
	MIR500		4	138.667	€
	Electric stacker		2	13.333	€
CapEx				1.336.056	€
ROI				1,3	year

OpEx	Feed			0,77	€/kg
	Water (cleaning)	5	m3/day	0,03	€/kg
	Heating/Cooling	1,12	kWh/m2/day	0,60	€/kg
	Light	38,85	kWh/day	0,01	€/kg
	Ventilation	1,12	kWh/m2/day	0,60	€/kg
	Power for machinery	1,68	kWh/m2/day	0,90	€/kg
	Insurance	365,00	days	0,01	€/kg
	Salary	4	persons	0,58	€/kg
	Systematic maintenance			0,35	€/kg
	Sum			3,9	€/kg
OpEx				1.406.796	€/year
Turnover				2.433.333	€/year
Profit				1.026.538	€/year