



# A DIRECT approach to resource efficiency in the food supply chain

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*Project Partners*



City of Whittlesea



RMIT UNIVERSITY

*Funded by*

Sustainability victoria



AUSTRALIAN INSTITUTE OF PACKAGING

PACKAGING & PROCESSING WEEK  
PROUDLY OWNED AND PRESENTED BY



Australian Packaging and Processing Machinery Association Limited



## What a waste !



- Cost of waste not just waste disposal bill
- Purchase cost of the food itself
- Energy in cooling, freezing, cooking
- Staff time to prepare it, then throw away

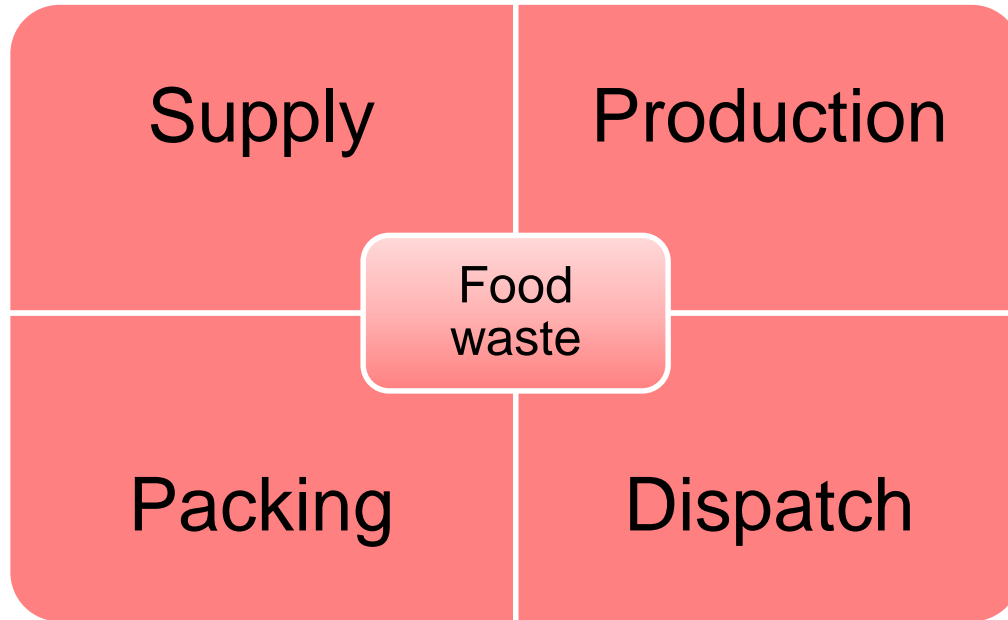
e.g., 180 litre wheelie bin filled with food per week

\$360 per week x 52 weeks

= \$18,720 per year



# Reasons for food waste in food manufacturing



Under or overweight products and trimmings

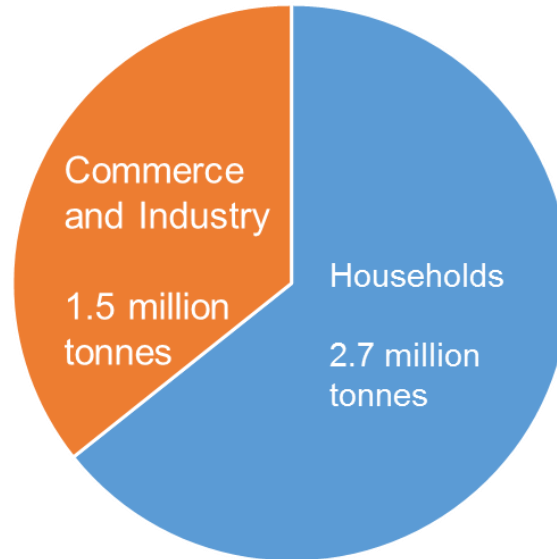
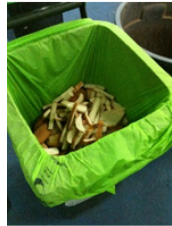
Product spillage through and on conveyors and gutters

Incorrect stacking of products

Last minute order cancellations



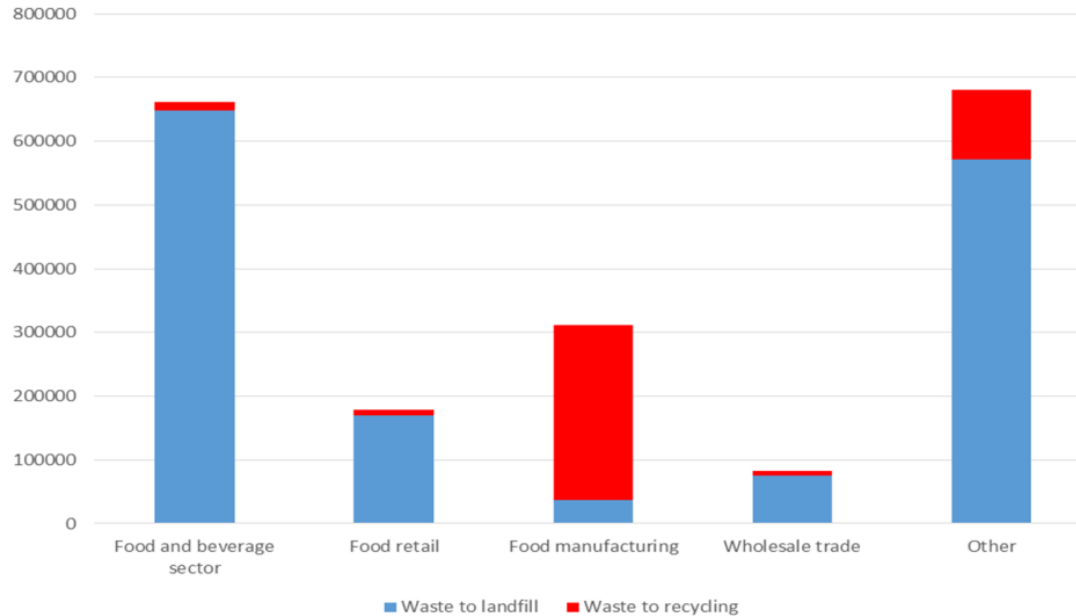
# Sources food waste (AUS)



Excludes food that doesn't reach its intended market and is either donated to charity, sold at a lower market value (e.g., as stock feed) or recycled



# Food waste C&I sector 2012 (AUS)





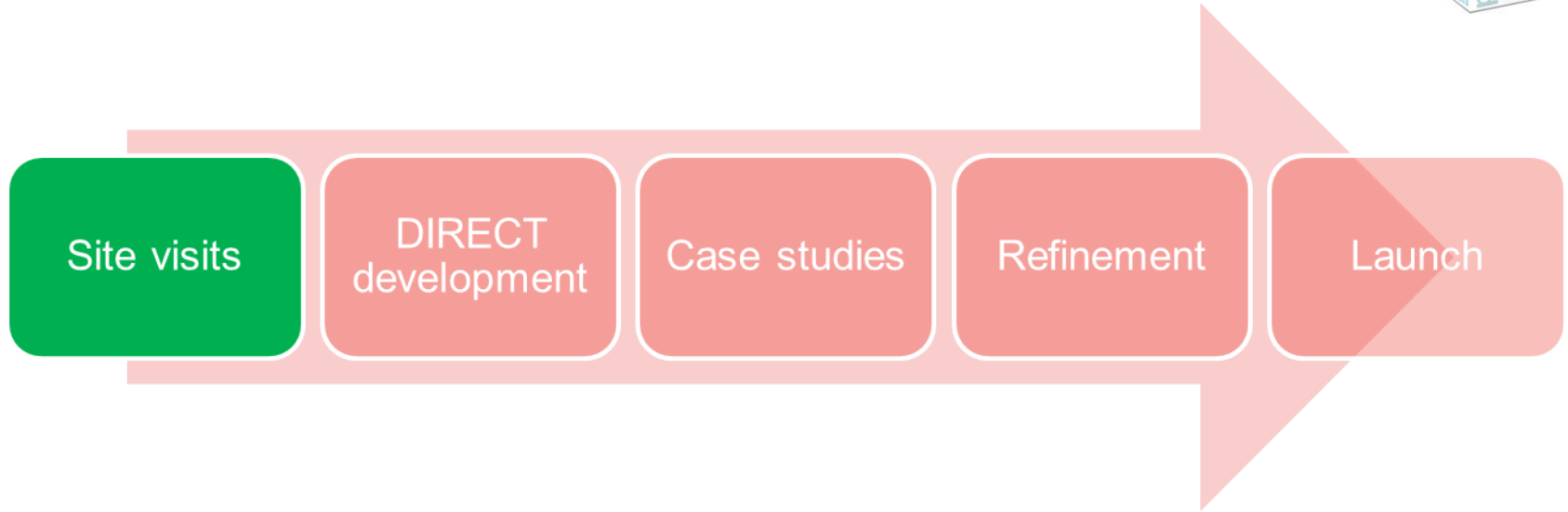
# Development of DIRECT



- July 2012 – June 2014
- City of Whittlesea, Plenty Food Group, Centre for Design & Society RMIT Uni
- Sustainability Victoria Beyond Waste Funded Project
- Assist Plenty Food Group manufacturers to increase resource efficiency

# 2015 NATIONAL TECHNICAL FORUMS

## OPEN INNOVATION & COLLABORATION





# Site visits

20 companies: bakery, confectionary, food processing, pasta and cereals, beverages, fresh fruit and vegetables

Food waste...



Packaging waste...

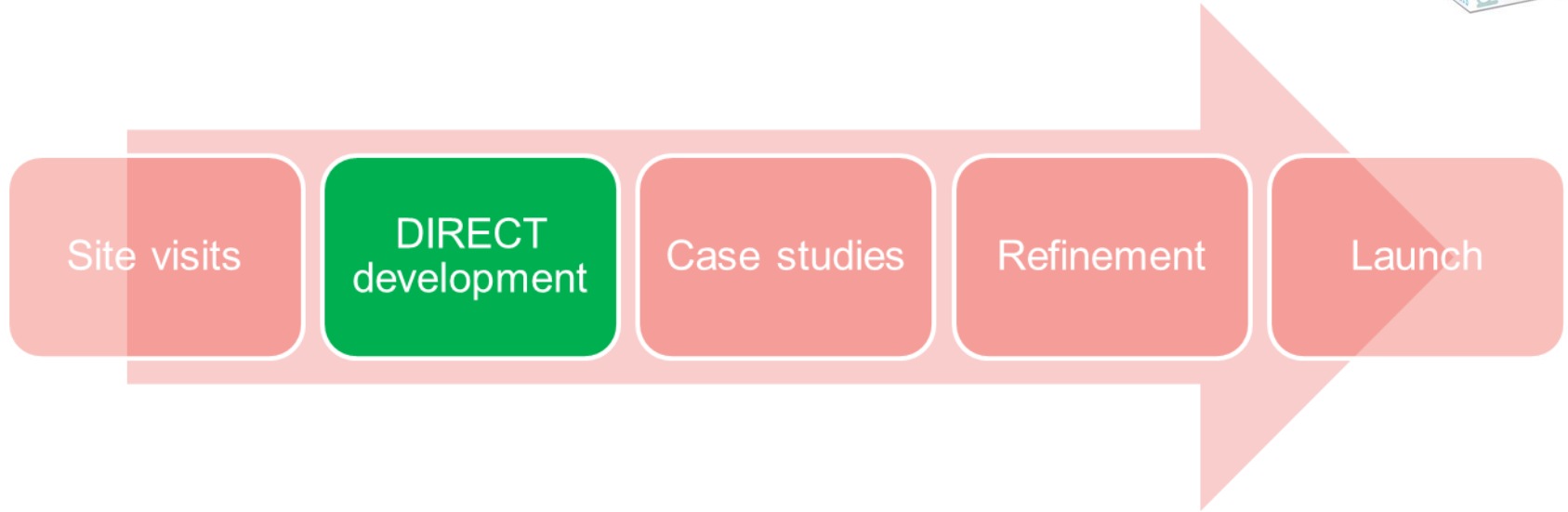






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## OPEN INNOVATION & COLLABORATION

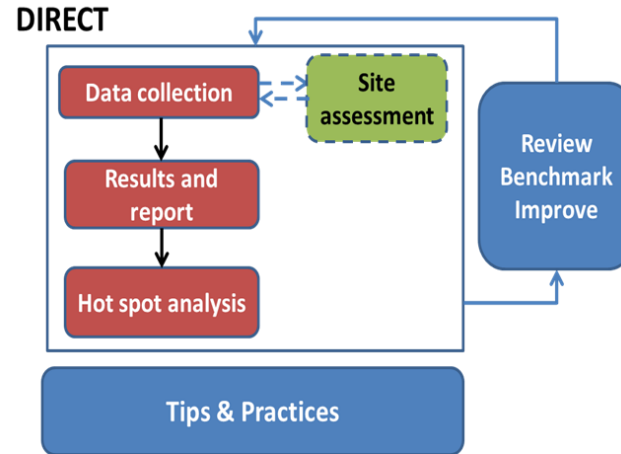




# DIRECT

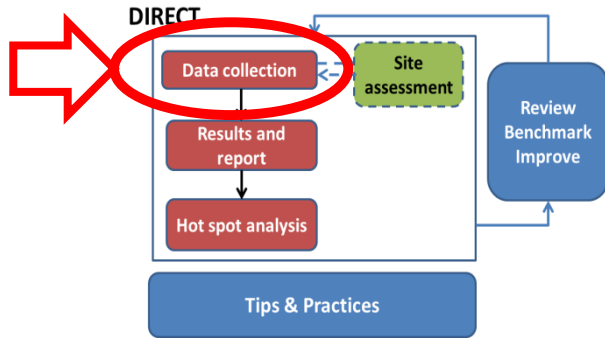
Dynamic Industry Resource Efficiency Calculation Tool

[www.directool.com.au](http://www.directool.com.au)





# DIRECT Calculation Module



INPUTS

OUTPUTS

BUSINESS COSTS



# INPUTS in Calculation Module

- Food ingredients
- Packaging inputs
- Other inputs
- Energy
- Water

Mass per annum (kg)

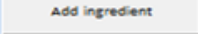

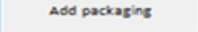

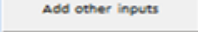

Raw material purchase cost per annum (\$)

Approx. waste per annum (%)

Approx. waste avoidable per annum (%)



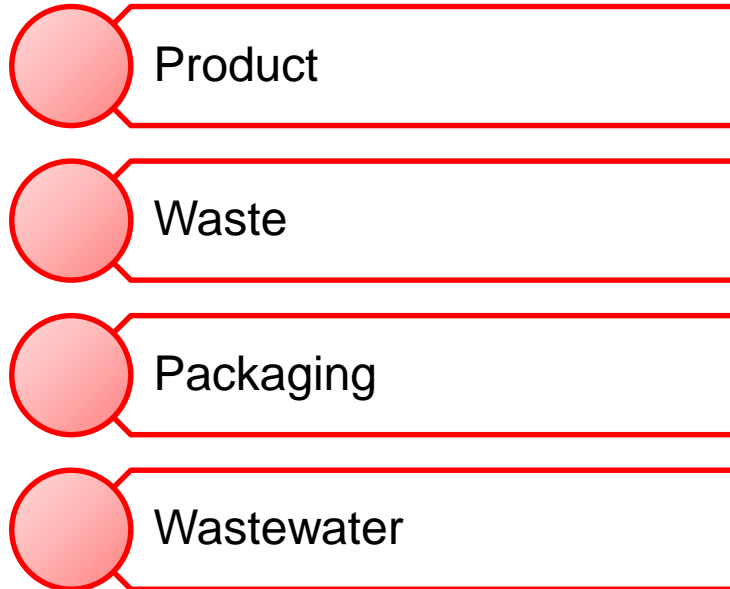
# INPUTS in Calculation Module

| Process Inputs                  | Average mass per annum (kg/year)  | Average raw material purchase costs per annum (\$/year) | Approximate waste p.a. (%) | Proportion of waste generated which is avoidable (%) |
|---------------------------------|---|---|----------------------------|--|
| <i>Food ingredients</i>         |   |   |                            |  |
| Flours, gums spice, etc.        | 40000.00  | \$72,000.00   | 25.0%                      | 10.0%  |
| Green grocery                   | 10000.00  | \$12,727.89   | 25.0%                      | 5.0%   |
| Grocery                         | 15000.00  | \$45,000.00   | 25.0%                      | 5.0%   |
| Meat                            | 5000.00   | \$38,049.82   | 25.0%                      | 5.0%   |
| <i>Packaging inputs</i>         |   |   |                            |  |
| All trays                       | 200   | \$3,875.04  | 5.0%                       | 20.0%  |
| Plastic trays and films         | 200   | \$8,961.84  | 5.0%                       | 10.0%  |
| Plastic films to cover contents | 300   | \$6,984.24  | 5.0%                       | 5.0%   |
| <i>Other inputs</i>             |   |   |                            |  |
| Hand towels                     | 300   | \$1,172.16  | 100.0%                     | 10.0%  |
| Labels                          | 100   | \$8,935.82  | 5.0%                       | 10.0%  |
| Gloves                          | 200.00  | \$382.56  | 5.0%                       | 10.0%  |
| Degreaser and detergent         | 1000  | \$1,764.00  | 100.0%                     | 8.0%   |
| <i>Articulated water inputs</i> |   |   |                            |  |
| Water                           | 250000  | \$1,266.00  | 5.0%                       | 50.0%  |
| <b>Total</b>                    | <b>322300.00</b>  | <b>\$201,119.38</b>                                     | <b>9.7%</b>                | <b>2.4%</b>  |





# OUTPUTS in Calculation Module



Costs per annum (\$)

Income per annum (rebate/revenue \$)

Volume per annum (cubic metre)

Contractor



# OUTPUTS in Calculation Module

| Process Outputs  | Annual costs (\$) | Annual income (rebate or revenue) (\$) | Volume per annum (cubic meter) | Weight per annum (kg) | Contractor | Correct/confirm, and if needed, add some |
|--|-------------------|--|--------------------------------|-----------------------|------------|--|
| <i>Waste outputs</i> <input type="button" value="Add waste"/>  |                   |  |                                |                       |            |  |
| General Waste  | \$3,000.00        | NA                                     | 1.0                            | 258.2                 |            |  |
| <i>Packaging waste outputs</i> <input type="button" value="Add packaging waste"/>  |                   |  |                                |                       |            |  |
| Cardboard and paper (average)  | \$1,000.00        | NA                                     | 75                             | 16342.5               |            |  |
| Other Plastics   | \$200.00          | NA                                     | 1                              | 150.0                 |            |  |
| <i>Wastewater output</i> <input type="button" value="Wastewater discharge ratio"/> 30 % <input type="button" value="▲"/> <input type="button" value="▼"/> Typically this is around 0.9. Please check your water bill, if you know your |                   |  |                                |                       |            |  |
| Wastewater (sew age)   | \$500.00          | NA                                     | NA                             | 225000.00             |            |  |
| <i>Product output</i>  |                   |  |                                |                       |            |  |
| Gross products sold in mass and revenue  | NA                | \$5,000,000.00                         | NA                             | 52500.50              |            |  |
| <b>Total</b>   | <b>\$4,700.00</b> | <b>\$5,000,000.00</b>                  | <b>77</b>                      | <b>294251.17</b>      |            |  |










# BUSINESS COSTS in Calculation Module

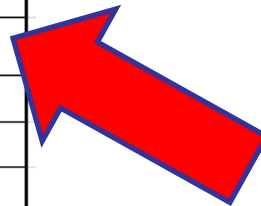
- Facilities
- Rent
- Energy
- Storage including freezing
- Freight
- Waste collection and treatment

Average costs per annum (\$) for overhead processes such as ...



# BUSINESS COSTS in Calculation Module

| Business cost   | Average of cost per annum (\$/year) (or revenue) | Related cost of waste management of this process per annum (\$/year) | Comments |
|---|--|--|----------|
|  <input type="text" value="Add cost"/> |  |  |          |
| Rent  | \$1,000,000.00                                   | \$97,269.62  |          |
| Wages   | \$300,000.00                                     | \$29,180.89  |          |
| Management  | \$200,000.00                                     | \$19,453.92  |          |
| Facilities (ex: rent)   | \$50,000.00                                      | \$4,863.48   |          |
| Electricity   | \$40,000.00                                      | \$3,890.78   |          |
| Gas   | \$25,000.00                                      | \$2,431.74   |          |
| Storage (include freezing or fridge)  | \$20,000.00                                      | \$1,945.39   |          |
| Freight                                | \$3,000.00                                       | \$291.81   |          |
| Waste collection and treatment         | \$4,700.00                                       | \$4,700.00   |          |



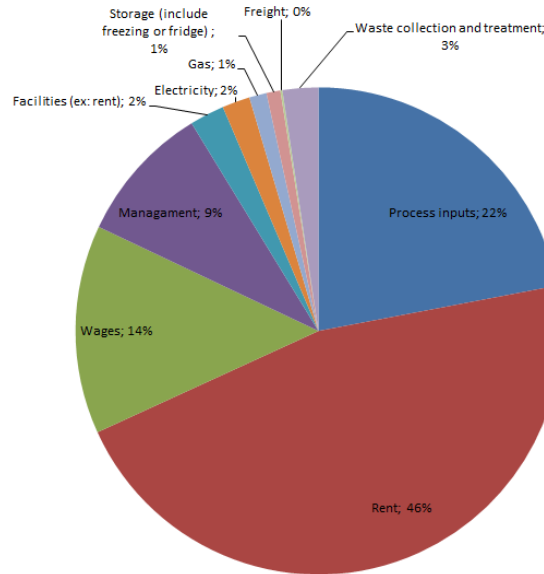
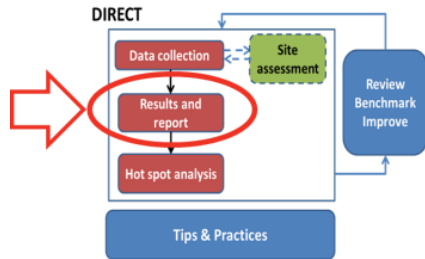
From inputs page,  
Efficiency percentage  
Applied to all business  
Costs (e.g., 9.7%)



From outputs page



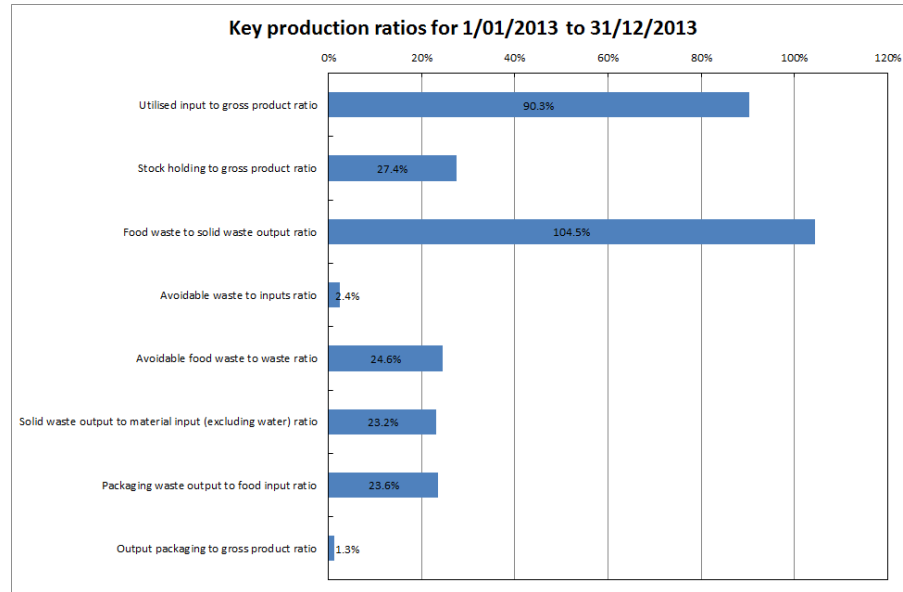
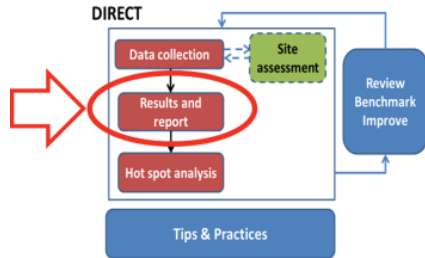
# Results & reporting (Calculation Module)



*Estimated true cost of waste*

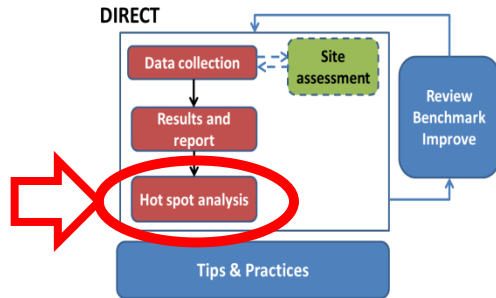


# Results & reporting (Calculation Module)





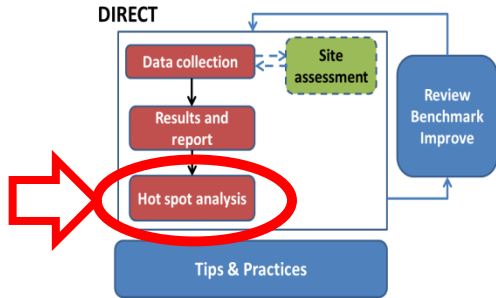
# Hot spot analysis



- Each stage of production life cycle (supply chain of inputs to distribution of finished products and waste mgmt) can be recorded
- Comprising
  - Observation
  - Resources involved
  - Opportunities and success stories
  - Descriptions and illustrations
  - Technologies and material involved



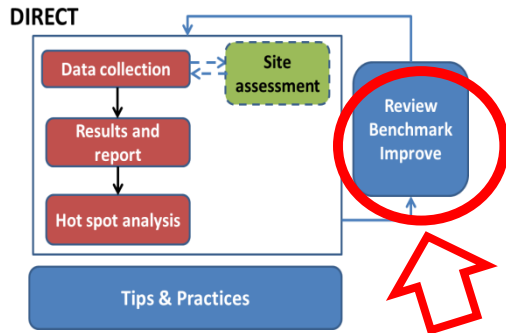
# Opportunities



| Stages                   | Observations we have made during our visit | Resources involved | Opportunities and success stories | Comments etc. | Technologies and material: (comments made during visit) | General examples causing some resources losses may be: | Write your target to increase your resources efficiency |
|--------------------------|--|--------------------|-----------------------------------|---------------|---|--|---|
| Supply                   |  |                    |                                   |               |   |  |   |
| Production               |  |                    |                                   |               |   |  |   |
| Cleaning                 |  |                    |                                   |               |   |  |   |
| Packing                  |  |                    |                                   |               |   |  |   |
| Dispatch                 |  |                    |                                   |               |   |  |   |
| Work in the offices      |  |                    |                                   |               |   |  |   |
| Other (please add below) |  |                    |                                   |               |   |  |   |



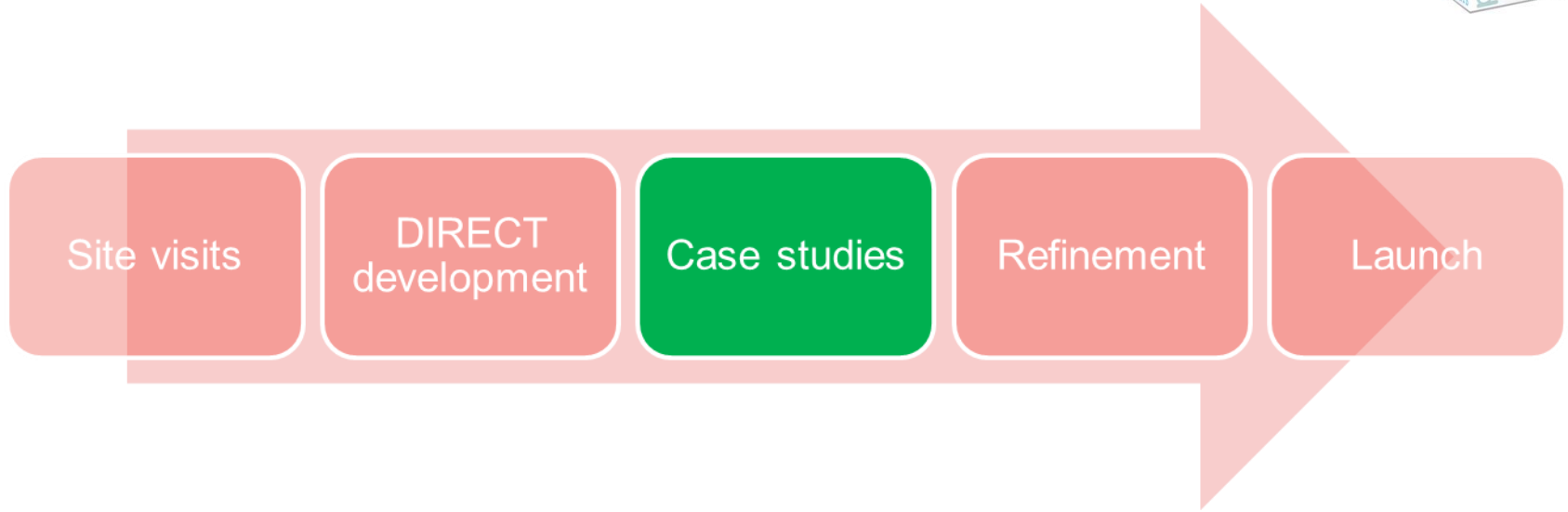
# Review, Benchmark and Improve



- Baseline
  - Review input/output hotspots and true cost of waste / system efficiency ratios
  - Used to benchmark previous / subsequent production years
- Improvements
  - Can be predicted by modifying inputs and outputs and recalculating
  - Can be measured by benchmarking subsequent production years

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## OPEN INNOVATION & COLLABORATION







# Case studies

- November 2013 – March 2014
- Purpose:
  - Real time modelling of company data to judge how DIRECT would be used
  - To determine key gate keepers when using DIRECT
  - To determine key sources of data within companies to enter in DIRECT
  - Feedback on calculation module usability and value to business
  - Co-design of any changes required i.e., extra rations, functionality etc
  - DIRECT online feedback



## Case studies

- Insights
  - Key gate keepers: generally accounts / finance, with interactions with production managers, etc.
  - Key data sources: digital inventory / accounts, paper bills, production floor measurements / estimations of waste, bin audits

*“The development of DIRECT could provide us with the opportunity to involve production managers in using the tool for benchmarking and education, while empowering them to reduce hot spots of waste to potentially incentivise changes’.*

*“Packaging input to gross product ratio would assist in reporting for the Australian Packaging Covenant (APC).”*

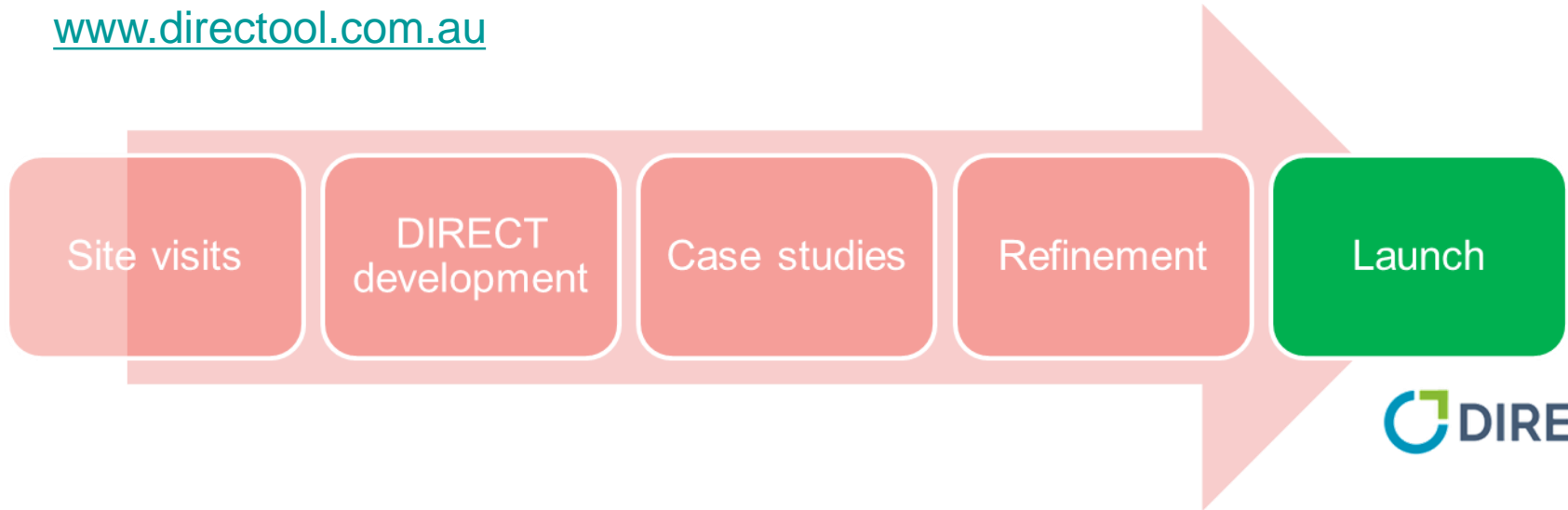
*“Ratios given by DIRECT are good indicators of efficiencies in the food production system.”*

# 2015 NATIONAL TECHNICAL FORUMS

## OPEN INNOVATION & COLLABORATION



- Launched: 26<sup>th</sup> June 2014
- [www.directool.com.au](http://www.directool.com.au)





## Contacts

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