National Innovation Robotics Competition - Seminars

Economic Justification for Industrial Robotic Systems

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Economic Justification for Robotic Systems

- Benefits of Robotic Automation
- Current Operating costs
- Costing a Robotic System
- Financial analysis
  - Payback period, return on investment
  - Consideration of depreciation, government taxes etc
  - More complex analysis methods
- Finance Options

Benefits of Robotic Automation

- Why use Industrial Robots?
  - Decreasing labour costs
  - Optimal use of raw materials
  - Improve cycle times
  - Increase productivity
  - Flexibility of equipment (ie. Reprogrammable)
- Results in $$$ Savings for the company!

Current Operating costs

- Cost of an typical employee on a factory floor for one year is based on:
  - Yearly wages
  - Cost of annual leave, sick leave
  - Cost of OHS, insurance
  - Cost of office/floor space, stationary, equipment
- On Average the annual cost to a company of one factory worker completing 5 shifts a week is 50K per person (+/- 5K)
  - ~ 1.4 x annual wage
  - Can vary from company to company

Cost of a Robotic System

- Cost of Initial Capital Investment includes:
  - Robot/s price
  - Peripheral equipment – safety barriers, sensors, plc's , HMI's, safety systems
  - Engineering costs – programming, installation, commissioning
  - Project management costs
- Price varies based on complexity, number of robots involved, quality etc
- For a 1 Robot complete system cost can vary between 150K to 600K
  - ~ Average cost of a 1 Robot system approximately 250K
- Ongoing maintenance
  - 500 – 3K per year

Financial analysis

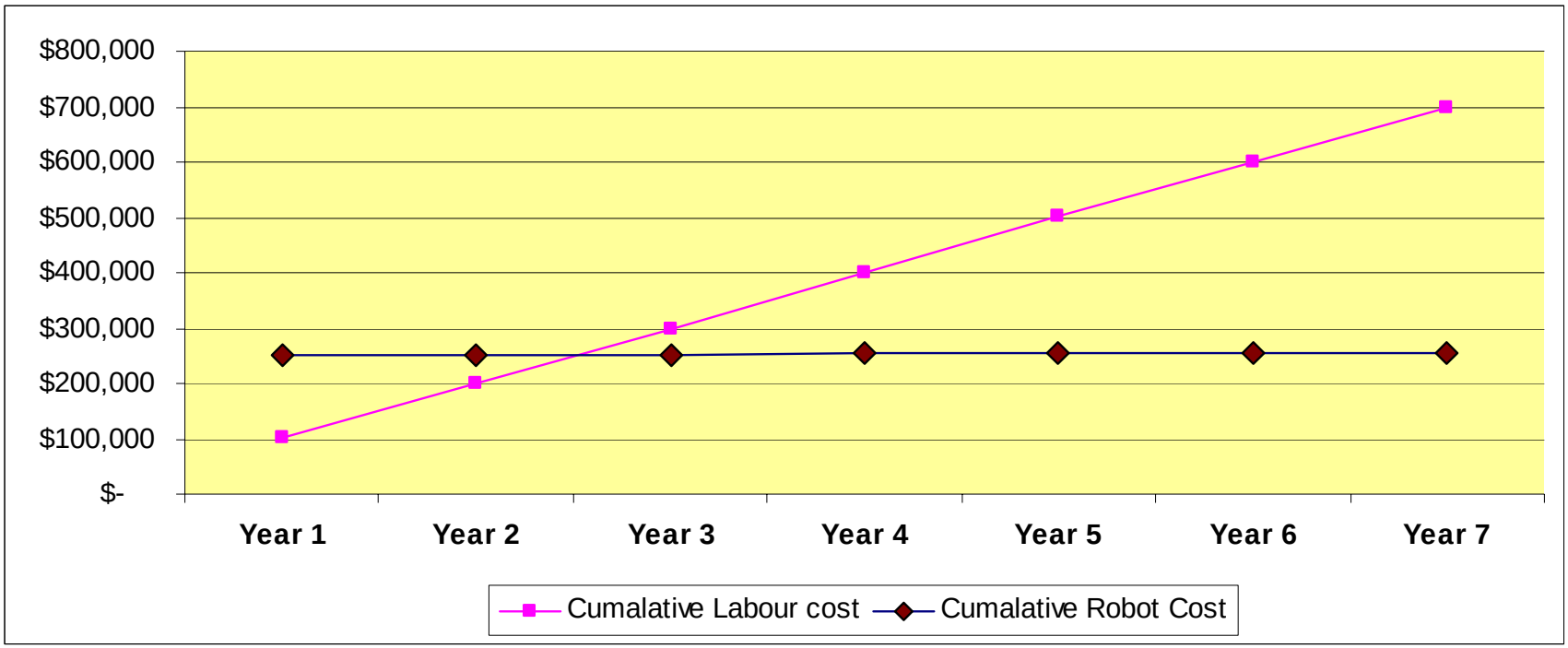
- Factors to consider:
  - Taxes – flat rate of 30% in Australia regulated by the ATO
  - Depreciation – assets with finite times loose value over time
  - Inflation – a rise in prices with respect to purchasing power over time
  - Ongoing maintenance etc
  - Time value of money
- Complexity of analysis
  - Case-by-case basis

A Simple Analysis

- 2 operators, 2 shifts Vs 1 Robot Cell

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Labour cost	100000	100000	100000	100000	100000	100000	100000
Cumulative Labour cost	100000	200000	300000	400000	500000	600000	700000
Robot cost	250000	1000	1000	1000	1000	1000	1000
Cumulative Robot Cost	250000	251000	252000	253000	254000	255000	256000
Annual savings (Robot cost – labour cost)	-150000	99000	99000	99000	99000	99000	99000
				Total savings over 7 years			**444000**

A Simple Analysis



Annual Savings

- Factors to consider for a more in-depth analysis

  - Accessories cost
  - Maintenance costs
  - Training costs
  - Spare parts
  - Installation costs
  - Production line modifications
  - Energy costs
  - Reduced reject rates
  - Savings in raw material
  - Environmental and OHS savings
  - Safety & health program savings
  - Increased productivity
  - New facilities construction

Payback period

- Payback period is the number of years required to recover initial investment

$$\text{Payback Period} = \frac{\text{Total Investment}}{\text{Total yearly savings}}$$

- This can be interpreted in various ways and can take into account different economic effects

Calculating Payback Period

- Select a time period over which to perform the analysis
- In this formula we take into account:
  - Depreciation :
  - Company tax rates :
  - Maintenance costs :

$$\text{Payback Period} = \frac{\text{Total Investment}}{\text{savings} - (\text{savings} * \text{TR}) + (\text{DP} * \text{TR}) - \text{Maintenance costs}}$$

$$\text{where TR} = \text{Tax rate (\%)}$$

$$\text{DP} = \text{Total depreciation (\$)}$$

Return on Investment

- Return on Investment provides an indication of the percentage rate of return on an investment
- Provides a means to compare attractiveness of one business investment to another
- A rough return on investment (ROI) can be calculated as:

$$\text{ROI} = \frac{\text{Annual Savings}}{\text{Cost}} \times 100\%$$

$$= \frac{1}{\text{Payback Period}} \times 100\%$$

Limitations

- Some limitations in the analysis presented so far:
  - Does not consider inflation
  - Does not consider Time value of money
  - Payback period data does not factor in saving beyond break-even point
  - Does not consider all savings
- For a more complex analysis
  - Cost-benefit analysis
  - ROI calculations factoring in time value of money
  - ROI calculations over a designated period of time
  - Cash flow method

Finance Options

- There are various ways a company might consider in making a capital equipment investment
  - Outright purchase
  - Bank Loan
  - Leasing
- Finance option may be based on
  - potential tax savings,
  - other investments available to the company
  - availability of cash

A Detailed example

- Factors to consider for a more in-depth analysis
  - Accessories cost
  - Maintenance costs
  - Training costs
  - Spare parts
  - Installation costs
  - Production line modifications
  - Energy costs
  - Reduced reject rates
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