

Justifying Your Automation Project



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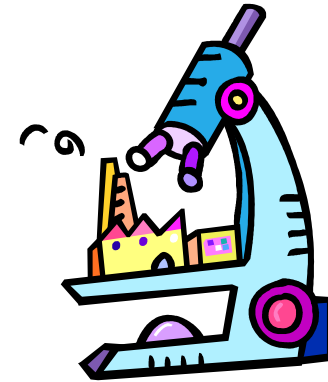
- ◆ **Non-profit research and development consortium**
- ◆ **Shreveport, LA**

The Louisiana Center for Manufacturing Sciences will research, develop, and implement technological innovations to advance manufacturing and information sciences.



Topics – Justifying Your Automation Project

- ◆ Starting with the business need in mind
- ◆ Understanding what justification is
- ◆ Fundamentals of justification
- ◆ Justification opportunities for packaging systems
- ◆ Plug-and-Pack™ - aiding justification

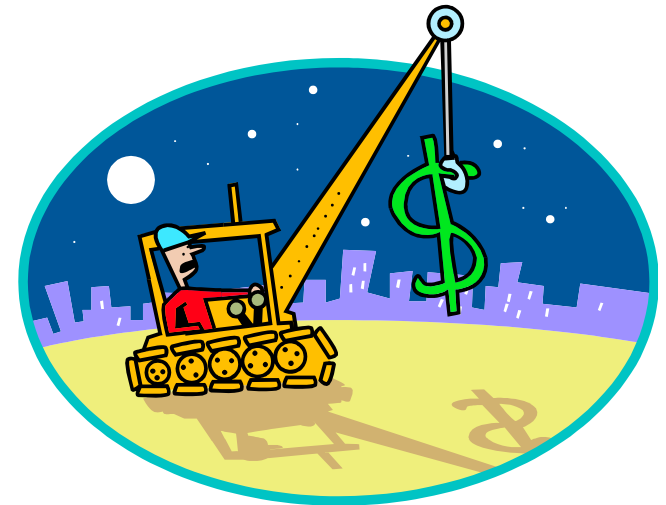


Plug and Pack™
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Justification

- ◆ **Translating the language of engineering to the language of finance**
 - Remember: finance sets the rules
- ◆ **Justification is technology independent**
 - Buildings
 - Packaging systems
 - Computer systems
 - Instrumentation & automation
- ◆ **Applies to various scopes**
 - Entire project
 - Portion of a project
 - Evaluating competing quotes



Justification is built on *Business Need*

- ◆ **Understand the business**
 - Selling ice cream
- ◆ **Describe the business need**
 - Sell more ice cream
- ◆ **Ask probing questions**
 - How do you sell ice cream?
 - ▶ From a bicycle cart
 - What limits the amount of ice cream you sell?
 - ▶ I have to keep going home to fill the cart
 - ▶ I can't go very far from home
 - ▶ I have to do it all myself

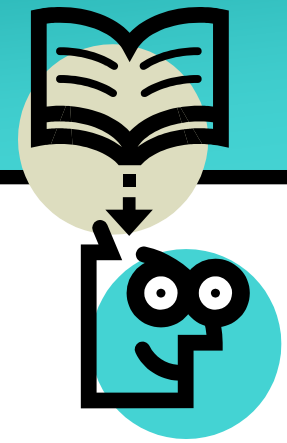


Justification is built on *Business Need*

- ◆ **Benchmark with other leading ice cream salespeople**
 - **The International Ice Cream Sales Association**
 - ▶ Some have stores
 - ▶ Some use carts
 - ▶ Some use trucks
- ◆ **Make a business proposal**
 - **Buy an ice cream truck!**



Fundamentals of Justification



- ◆ **Identify the base case**
- ◆ **Identify alternatives to the base case**
- ◆ **Determine cash flows associated with the alternatives vs. the base case**
- ◆ **Use company's financial rules to evaluate the cash flow alternatives**
 - **Payback period**
 - **Net present value**
 - **Rate of return**
 - **Hurdle rate**



Fundamentals - Simplifying Assumptions

◆ Ignore depreciation

- Vary by type of investment
- Vary by country

◆ Ignore taxes

- Vary by business structure
- Vary by company's overall profitability
- Vary by state / country

◆ Cash flows analyzed by year

- Not by month or quarter



Fundamentals- Base Case and Alternatives

◆ Base Case

- The circumstances that exist if you don't do what you are trying to justify.
- Sell ice cream from a bicycle cart.



◆ Alternatives to Base Case

- 1) Trade the bicycle cart on a truck
- 2) Keep the cart, hire an assistant and buy an ice cream truck



Fundamentals – Cash Flow Impact

◆ Continue to use the cart – Base Case

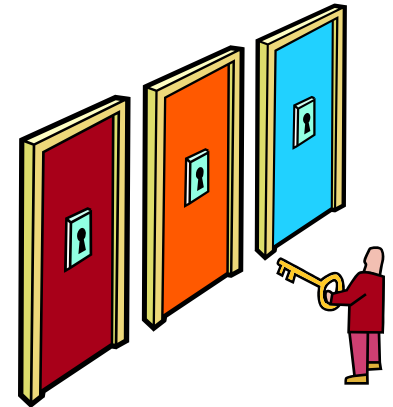
- Sell \$2000 per month: June, July & August
- Sell \$500 per month remainder of year
- Margin 50%

◆ Trade cart on truck – Alternative 1

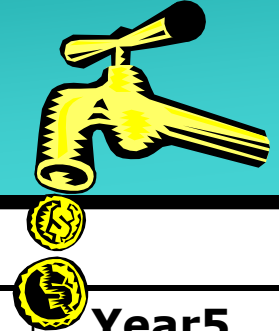
- \$26,500 less \$1500 trade in: delivered end of August
- Sell \$6000 per month: June, July & August
- Sell \$1000 per month rest of year
- Margin 50% reduced by maintenance and fuel costs of \$4000

◆ Buy truck, keep cart, hire employee – Alternative 2

- As above without trading cart
- Employee June, July & Aug. only
- Margin on cart sales reduced by wages of \$800 per month



Fundamentals – Cash Flows



	Year 1	Year 2	Year 3	Year 4	Year5
Cart	\$0				\$0
Sales	\$10,500	\$10,500	\$10,500	\$10,500	\$10,500
Income	\$5,250	\$5,250	\$5,250	\$5,250	\$5,250
Truck	(\$25,000)				\$5000
Sales	\$12,500	\$33,000	\$33,000	\$33,000	\$33,000
Income	\$6,250	\$16,500	\$16,500	\$16,500	\$16,500
Truck Expense	(\$604)	(\$4,000)	(\$4,000)	(\$4,000)	(\$4,000)
Truck & Cart	(\$26,500)				\$5,000
Sales	\$12,500	\$39,000	\$39,000	\$39,000	\$39,000
Income	\$6,250	\$19,500	\$19,500	\$19,500	\$19,500
Truck Expense	(\$604)	(\$4,000)	(\$4,000)	(\$4,000)	(\$4,000)
Wages	\$0	(\$2,400)	(\$2,400)	(\$2,400)	(\$2,400)



Fundamentals - Change in Cash Flows

	Capital Investment	Year 1 Income	Years 2 - 5
Cart	\$0	\$0	\$0
Truck	\$25,000	\$396	\$7,250
Truck & Cart	\$26,500	\$396	\$7,850

- ◆ Which is the better alternative?
- ◆ Is either alternative justified?



Fundamentals – Payback Period

- ◆ **The number of years required to return the original investment.**
 - **Some companies set a maximum allowable period**
 - **The faster the payback, the better the investment**

Truck – Alternative 1

Invest \$25,000

Get back \$396 in first 4 months

Get back \$7250 per year after that

Payback is 3.7 years

Truck & cart – Alternative 2

Invest \$26,500

Get back \$396 in first 4 months

Get back \$7850 per year after that

Payback is 3.7 years



Fundamentals – Net Present Value

NPV

- ◆ **The present value of all future cash flows discounted at the cost of capital, minus the cost of the investment.**
 - **Discounted means that a future cash flow is worth less to me (discounted) than a present cash flow.**

$$PV = \frac{FV}{(1 + R)^N}$$

FV = future value

R = rate per period

PV = present value

N = number of periods

- **\$100 received 3 years from now at 8% cost of capital is the same as receiving \$79.38 today.**

$$\$79.38 = \frac{\$100}{(1 + .08)^3}$$



Fundamentals – Net Present Value

NPV

- ◆ **The present value of all future cash flows discounted at the cost of capital, minus the cost of the investment.**
 - Discounted means that a future cash flow is worth less to me (discounted) than a present cash flow.
 - **Cost of capital**
 - ▶ For an individual, your borrowing rate
 - ▶ For a corporation, a weighted combination of the cost of debt (long term debt and leases, after tax) and the cost of equity (preferred and common stock)
 - **All future cash flows means that the PV's are summed over some time horizon, often 5 or 10 years.**
 - **Subtract the cost of the initial investment**

$$NPV = \sum_{n=0}^N \frac{FV_n}{(1+R)^n} - Investment$$

**N=number of years
to be analyzed**



Fundamentals – Net Present Value

NPV

- ◆ **The greater the NPV, the better the investment.**
- ◆ **NPV's $> \$0$ MAY be justified.**



Fundamentals – Net Present Value

NPV



	Capital Investment	Year 1 Income	Years 2 - 5	Payback (yrs)
Cart	\$0	\$0	\$0	
Truck	\$25,000	\$396	\$7,250	3.7
Truck & Cart	\$26,500	\$396	\$7,850	3.7

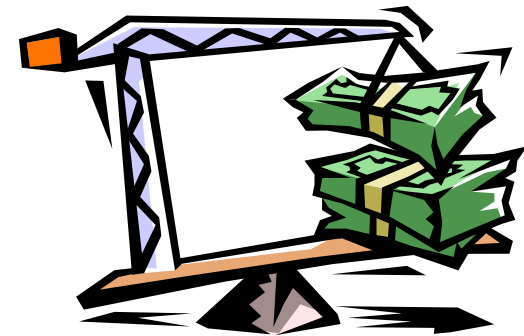
$$NPV = \sum_{n=0}^N \frac{FV_n}{(1+R)^n} - Investment$$

	NPV @ 6%	NPV @ 9%	NPV @ 16%
Cart	\$0	\$0	\$0
Truck	\$489	(\$1,024)	(\$3,722)
Truck & Cart	\$1035	(\$617)	(\$3,567)



Fundamentals – NPV Analysis

- ◆ **An entrepreneur, with good credit, in good economic times, might justify this investment.**
- ◆ **A public corporation probably could not justify the same investment.**
 - Higher cost of capital
- ◆ **What “financial engineering” could we do?**
 - Speed up truck delivery by 3 months
 - Assume resale value of truck at end of 5 years



Fundamentals – Back to the Well

	Original NPV at 9% C of C	NPV with early delivery	NPV with salvage value	NPV with both
Cart	\$0	\$0	\$0	\$0
Truck	(\$1,024)	\$4,811	\$2,226	\$8,061
Truck & Cart	(\$617)	\$5,769	\$2,633	\$9,018



Fundamentals – Back to the well.



- ◆ **3 month earlier delivery adds significant cash flow in year 1**
 - Major impact on NPV
 - Adds attractiveness to alternative 2
- ◆ **Assuming a salvage value of \$5000 adds positive cash flow in year 5**
 - Could be enough impact on NPV to turn a bad investment into a good investment
- ◆ **Both together, make a compelling case**
 - Even with a cost of capital over 20%
- ◆ **Justification would improve, even if we had to spend more money up-front:**
 - To reduce delivery
 - To improve the lifetime / salvage value of the truck



Fundamentals – Rate of Return

◆ Internal Rate of Return (IRR)

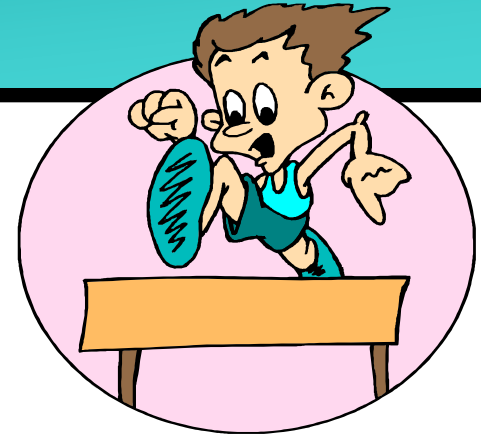
- The interest rate that equates the present value of the future cash flows to the investment outlay. The IRR assumes that cash flows can be reinvested at a rate equal to the IRR.

◆ Terminal Rate of Return (TRR)

- The interest rate that equates the cost of the initial investment to the accumulated future value of the cash flows, reinvested at the cost of capital or the hurdle rate.



Fundamentals – Hurdle Rate



- ◆ **The minimum rate of return to justify an investment**
 - **Cost of capital**
 - ▶ Long term debt
 - ▶ Cost of equity
 - **Risk premium**
 - ▶ Track record of group asking for money
 - ▶ Type of investment
 - ▶ Allowance for overruns
 - **Other factors**
 - ▶ Working capital requirements
 - ▶ Increment to compensate for other necessary investments (roofs)



Fundamentals – Internal Rate of Return (IRR)

	IRR of Original Proposal	IRR with early delivery	IRR with salvage value	IRR with both
Cart	0	0	0	
Truck	7%	22%	13%	28%
Truck & Cart	8%	23%	14%	29%



◆ If the hurdle rate is:

- 9% cost of capital
- 2% risk premium
- 5% other
- 16% total

◆ Then we can justify

- 4 of the 8 options
- We **must** have early delivery of the truck
- ? Is 1% worth the hassles of an employee?



Justification Opportunities - Packaging

◆ Generate Positive Cash Flows

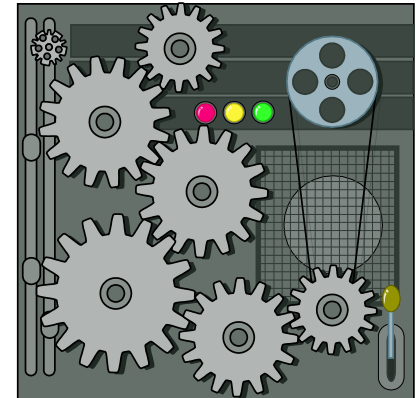
- Machine Speed
- Efficiency
- Material Loss
- MTBF
- Downtime
- Changeover time
- Reconfiguration time
- Footprint
- Delivery lead time
- Commissioning time



Justification Opportunities - Packaging

◆ Machine Speed

- **Same amount of product with fewer machines**
 - ▶ Fewer operators / unit
 - ▶ Less maintenance / unit
 - ▶ Greater % of production at risk from downtime
 - ▶ Potentially lower capital
- **More product with same # of machines**
 - ▶ More sales revenue
 - ▶ Faster response to orders / market
 - ▶ Less operating cost / unit
 - ▶ Less overtime cost



Justification Opportunities - Packaging

◆ Efficiency

- Products out / products out
- More products successfully packaged
- Increased output
- Decreased rework

◆ Material Loss

- Less product waste
- Less packaging material waste



Justification Opportunities - Packaging

◆ Mean time between failure

- How often a machine fails

◆ Downtime

- How long it takes to repair X number of failures

◆ In combination

- Higher availability
- Lower maintenance cost / unit
- More units / shift
- Fewer shifts / sales volume
- Faster response to orders



Justification Opportunities - Packaging

◆ Changeover time

- Refers to back and forth conversions among products
- Increase packaging capability / unit of time
- Decrease non-productive labor / unit of time
- Increase total production volumes
- Reduce waste and rework
- Responsiveness to orders yields more sales
- May reduce initial capital costs



◆ Reconfiguration time

- Refers to reuse of equipment for new purposes
- Higher salvage value
- Lower risk / hurdle rates
- Lower future capital costs



Justification Opportunities - Packaging

◆ Footprint

- Reduce capital cost of building / mezzanines
- May allow reduction in # of operators

◆ Delivery Lead time

- Reduce lost sales
- Increase sales in initial period
- Reduce time to realization of positive cash flows
- Accelerate depreciation across entire project
- Make or loose market vs. competitors



◆ Commissioning Time

- As above
- Reduced startup expense in initial period



Plug-and-Pack™ - Aiding Justification

◆ OPW Mission / Vision - 2000

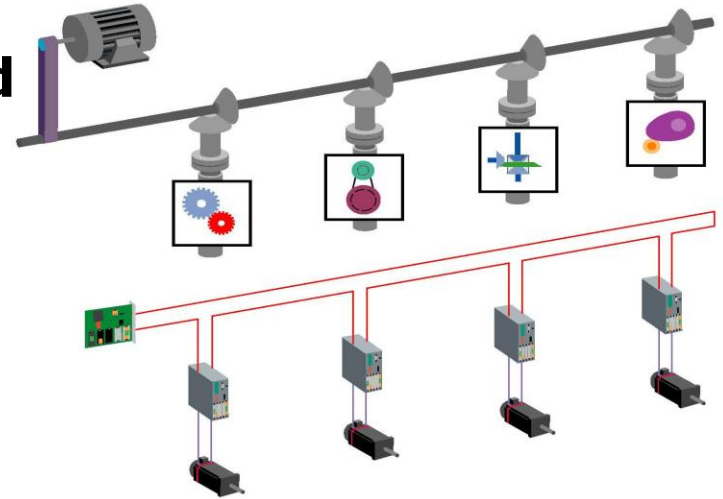
- Enhance the value of packaging machines by promoting the use of digital motion control and OMAC guidelines for open control architectures.
- Over a three year horizon, foresee potential improvements approaching 50% for
 - ▶ Product throughput
 - ▶ Material loss
 - ▶ Machine reconfiguration / overhaul time
 - ▶ Mean time between failure
 - ▶ Machine downtime
 - ▶ Product changeover time
 - ▶ Machine / system footprint
 - ▶ Delivery lead time
 - ▶ Startup time



Plug-and-Pack™ - Aiding Justification

◆ Vision has been largely accomplished

- **Third Generation Packaging Machinery**
 - ▶ Mechatronic design
- **Additional benefits identified**
 - ▶ Validation costs
 - ▶ Integration costs
 - ▶ Performance monitoring
- **Penetration relatively low**
 - ▶ End users
 - ▶ Machine builders
- **New and greater opportunities remain**
 - ▶ Proven technology
 - ▶ Standards
 - ▶ New technology



Plug-and-Pack™ - Aiding Justification

◆ Updated Mission / Vision - 2003

- **Maximize the business value of packaging machinery by developing guidelines that lead to the most appropriate application of advanced automation technology**
- **Become the leading advocacy group for packaging machine control technology and integration, leveraging standards and OMAC guidelines to enhance the business operations of end users, machine builders and technology providers.**



Plug-and-Pack™ Aiding Justification

- ◆ **Improving machines and systems**
 - **Providing guidelines / applying standards**
 - ▶ *PackSoft, PackConnect, PackML*
- ◆ **Providing education**
 - ▶ *PackLearn*
- ◆ **Illuminating benefits / successes**
 - ▶ *PackAdvantage*
- ◆ **Demonstrating future potential**
 - **2004 Demonstration project**



Summary: Justifying Your Automation Project

- ◆ **Identify your business needs**
- ◆ **Participate with industry leaders**
 - **OMAC for packaging**
 - **ISA for instrumentation and automation systems**
 - **Others for your area of interest**
- ◆ **Benchmark to find opportunities**
- ◆ **Learn and apply the fundamentals of justification**
 - **Identify the base case**
 - **Develop alternatives to meet business needs**
 - **Identify the cash flows**
 - **Use your company's specific financial rules to evaluate alternatives**



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