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# Prioritizing Requirements: Practical Tips for Time-Constrained Projects

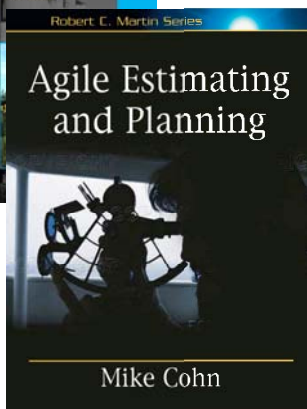
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MARCH 3-7, 2008, SANTA CLARA, CA


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## Mike Cohn - background



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## Non-financial techniques

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## Choosing your approach

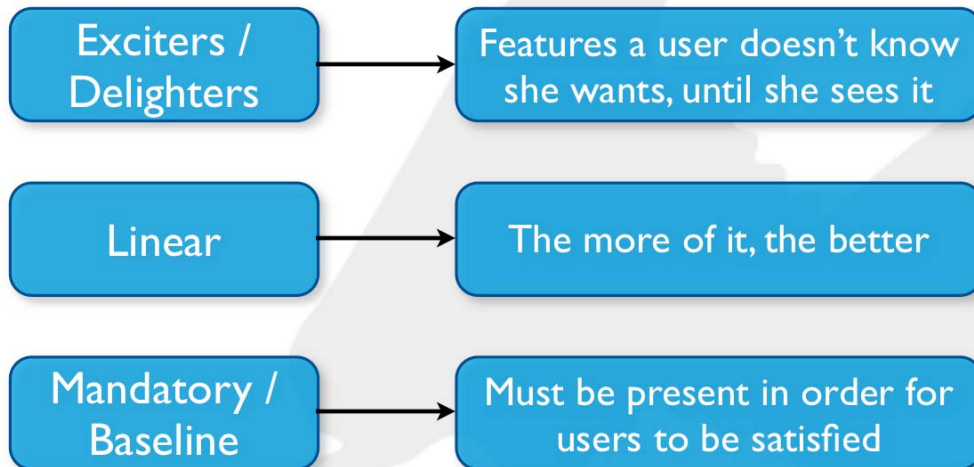
	Expert Opinion	User Interview
Kano analysis	✓	✓
Theme screening	✓	
Theme scoring	✓	
Relative weighting	✓	

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# Kano analysis

## Three types of features

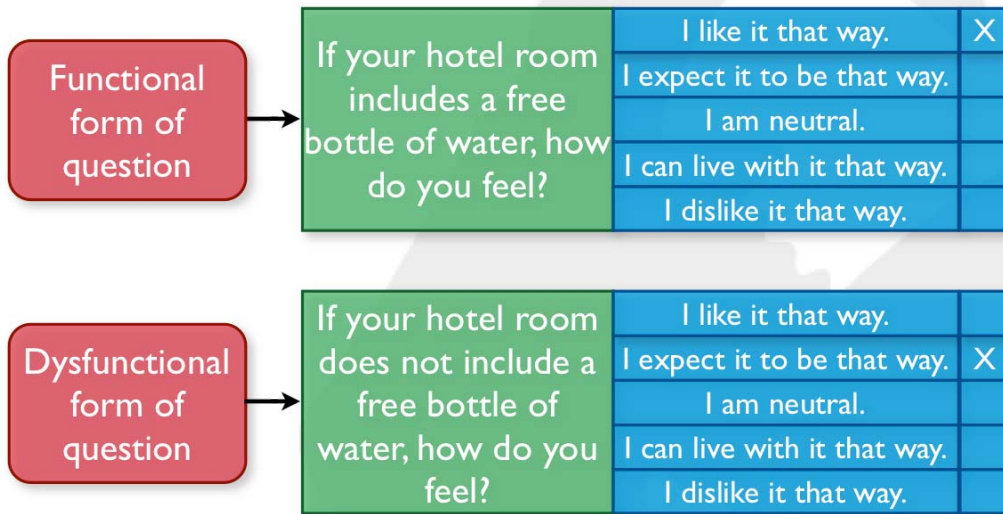


# Surveying users

- To assess whether a feature is baseline, linear, or exciting we can:
  - Sometimes guess
  - Or survey a small set of users (20-30)
- We ask two questions
  - A functional question
    - How do you feel if a feature is present?
  - And a dysfunctional question
    - How do you feel if that feature is absent?



# Functional and dysfunctional forms



# Categorizing an answer pair

		Dysfunctional Question				
		Like	Expect	Neutral	Live with	Dislike
Functional Question	Like	Q	E	E	E	L
	Expect	R	I	I	I	M
	Neutral	R	I	I	I	M
	Live with	R	I	I	I	M
	Dislike	R	R	R	R	Q

- M Mandatory
- L Linear
- E Exciter
- Q Questionable
- R Reverse
- I Indifferent



# Aggregating results

Theme	Exciter	Linear	Mandatory	Indifferent	Reverse	Questionable
Apply formatting themes	3	11	31	1	3	2
Automate report execution	4	22	20	4	1	0
Export reports to PowerPoint	21	9	14	5	1	1



## What to include

- All of the baseline features
  - By definition, these must be present
- Some amount of linear features
- But leaving room for at least a few excitors



# Theme screening

- Identify 5-9 (approximately) selection criteria for what is important in the next release
- Select a baseline theme
  - Likely to be included in the next release
  - Understood by most team members
- Assess each candidate theme relative to the baseline theme



## Theme screening: an example

Selection Criteria	Themes							
	Theme A	Theme B	Theme C	Baseline Theme	Theme E	Theme F	Theme G	
Importance to existing customers	+	+	-	0	-	+	0	
Competitiveness with ABC Corp.	+	-	0	0	0	0	0	
Starts us integrating product lines	+	0	0	0	+	-	+	
Generates revenue in Q2	0	0	0	0	+	0	+	
+ = better than	Net score	3	0	-1	0	1	0	2
0 = same as	Rank	1	4	5	4	3	4	2
- = worse than	Continue?	Y	N	N	Y	Y	N	Y



# Theme scoring

- Like theme screening but selection criteria are weighted
- Need to select a baseline theme for each criteria
- Avoids compression of a category
- Each theme is assessed against the baseline for each selection criteria

Much worse than reference	1
Worse than reference	2
Same as reference	3
Better than reference	4
Much better than reference	5



# Theme scoring: an example

Selection Criteria	Weight	Theme A		Theme B		Theme C	
		Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Importance to existing cust.	.25	3	0.75	1	0.25	4	1.00
Competitive. with ABC	.10	2	0.20	3	0.30	3	0.30
Starts us integrating...	.15	3	0.45	4	0.60	4	0.60
Generates Q2 revenue	.50	5	2.50	2	1.00	3	1.50
Net score		3.90		2.15		3.40	
Rank		1		3		2	
Continue?		Yes		No		Yes	



# Relative weighting

- Assess the impact of having a story/theme from 1-9
- Assess impact of NOT having it from 1-9
- Calculate the value of each story or theme relative to the entire product backlog
  - This gives you the relative value of that story or theme
- Estimate the cost of each story theme
- Calculate the cost of each story or theme relative to the entire product backlog
  - This gives the relative cost of that story or theme
- Priority is given by (Relative Value ÷ Relative Cost)



## Relative weighting: an example

		Relative Benefit	Relative Penalty	Total Value	Value Percent	Estimate	Cost Percent	Priority
Themes	More investment choices	8	6	14	40	64	44	91
	Portfolio rebalancing	9	2	11	31	40	27	115
	Comply with new law	1	9	10	29	42	29	100
Total				35	100	146	100	

$$\text{Total Value} = \text{Relative Benefit} + \text{Relative Penalty}$$

$$\text{Value Percent} = \text{Total Value} / \sum (\text{Total Value})$$

$$\text{Cost Percent} = \text{Estimate} / \sum (\text{Estimate})$$





# An example with weights

		Weight →						
		2	1					
		Relative Benefit	Relative Penalty	Total Value	Value Percent	Estimate	Cost Percent	Priority
Themes	More investment choices	8	6	22	41	64	44	93
	Portfolio rebalancing	9	2	20	38	40	27	141
	Comply with new law	1	9	11	21	42	29	72
Total				53	100	146	100	



Financial techniques



# Three factors to consider

- All financial decisions involve three elements
  - How much?
  - How long?
  - At what interest rate?
- If you're buying a house:
  - It's a \$220,000 loan
  - For 30 years
  - At 7% per year



# Which project would you prefer?

Year	Project A		Project B	
	Investment	Return	Investment	Return
0	\$1,000		\$1,000	
1		\$200		\$3,000
2		\$300		\$500
3		\$500		\$300
4		\$3,000		\$200
5		\$0		\$0

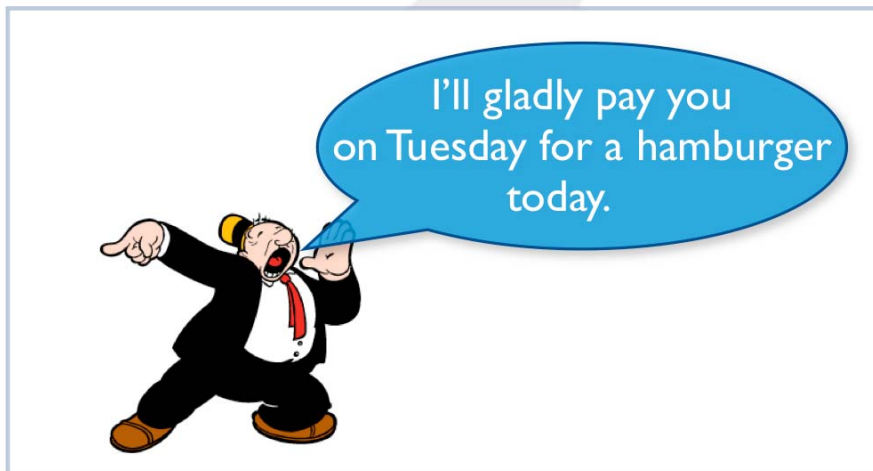


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# The time-value of money

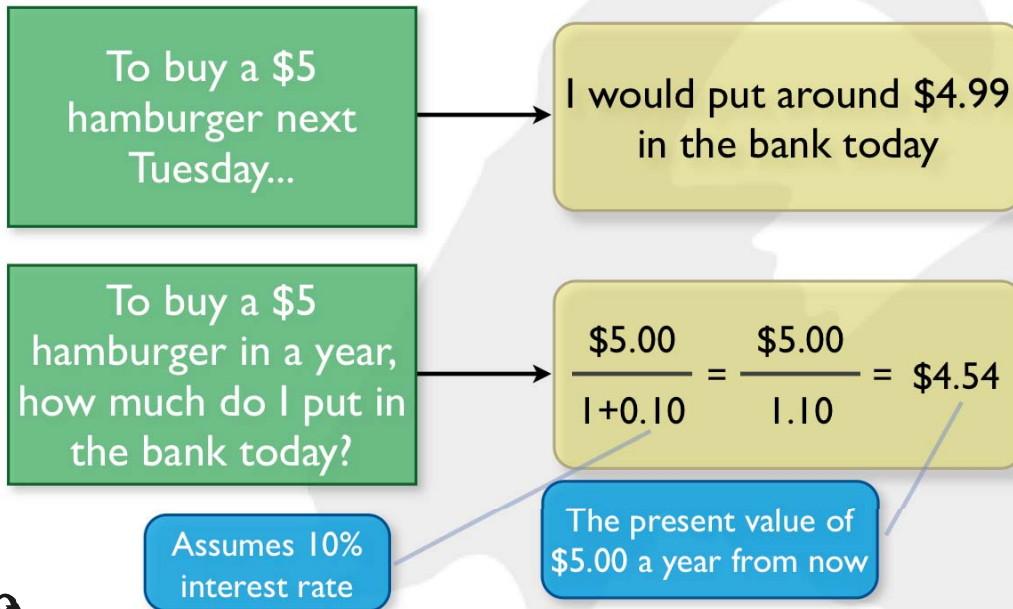
- A dollar today is worth more than a dollar a year from now



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# Calculating the value of future dollars



# Present value of one future amount

$$\text{Present Value} = \frac{\text{Future Value}}{1 + \text{interest rate}}$$

An example:  $\frac{\$5.00}{1+0.10} = \$4.54$

Generalizing

$$PV = \frac{FV}{(1+i)^t}$$

Simplifying

$$PV = FV(1+i)^{-t}$$



# Net present value (NPV)

- The present value of a stream of cash flows
- Measures the return on a theme or project as an amount of money

$$NPV(i) = \sum_{t=0}^n F_t(1+i)^{-t}$$



## NPV example

- Assuming 12% annual discount rate (3% / quarter)

Quarter	Cash flow	$(1+i)^{-t}$	Discounted Cash Flow	Running Total
0	-200	1.000	-200	-200
1	-600	0.971	-583	-783
2	100	0.943	94	-689
3	300	0.915	275	-414
4	500	0.888	444	30



# Discount rate sensitivity

- NPV is highly sensitive to the chosen discount rate

Quarter	Cash flow	Discounted Cash Flow (3%)	Discounted Cash Flow (6%)
0	-200	-200	-200
1	-600	-583	-783
2	100	94	-689
3	300	275	-414
4	500	444	30
Total	100	30	-29

Do the project under these conditions

But not under these



# Comparing NPVs

- Highest NPV brings the most present-value dollars to the company

Theme	NPV
Scalability	\$2,100
Gift registry	\$1,253
Ad hoc reporting	\$78
Pay by invoice	\$38

Comparing NPVs can be misleading. What if:

- "Pay by invoice" requires a \$5 investment
- "Scalability" requires \$50,000?





## Return as a percentage

- Rather than expressing returns in dollars, we'd like to express return as a percentage
  - Allows for direct comparisons
- NPV = how much money a project will return
- ROI = how quickly an investment will grow



## Internal rate of return (IRR) and ROI

- IRR = Internal Rate of Return
  - Often called Return On Investment (ROI)
- The interest rate at which NPV is 0

$$0 = PV(i^*) = \sum_{t=0}^n F_t (1+i)^{-t}$$



## Remember this table?

Quarter	Cash flow	Discounted Cash Flow (3%)	Discounted Cash Flow (6%)
0	-200	-200	-200
1	-600	-583	-783
2	100	94	-689
3	300	275	-414
4	500	444	30
Total	100	30	-29

- IRR gives us the discount rate at which we don't care whether or not we do the project
  - We don't make \$30; we don't lose \$29; we break even





# How to calculate ROI or IRR

- Use Excel's irr function

+irr({-200, -600, 100, 300, 500})

An investment made on the first day of the project

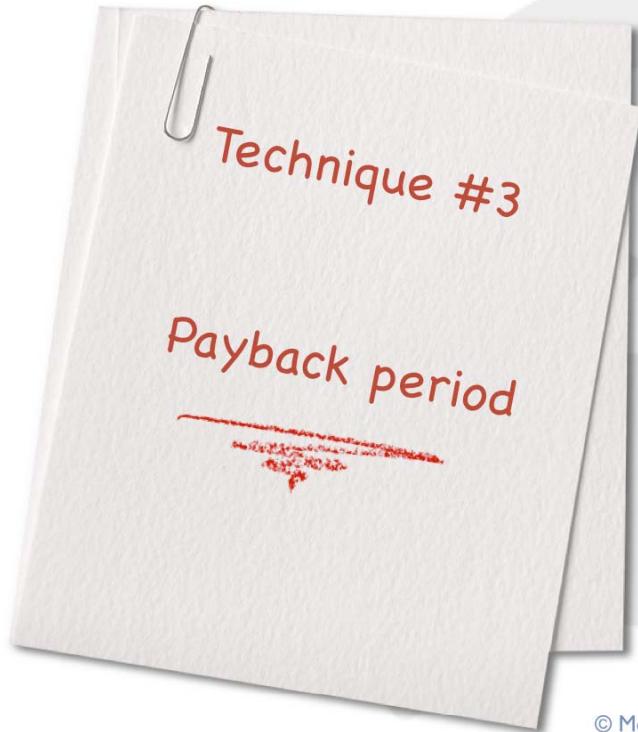
Cash flows for remainder of project (4 quarters)



# Advantages and disadvantages

- Advantages
  - You don't need to guess at a discount rate like with NPV
  - Can be used to directly compare projects
- Disadvantages
  - Calculation is hard to do by hand (but easy in Excel); may lead to numbers being distrusted
  - Cannot use in all circumstances
    - e.g., once cash flow turns positive, it stays positive





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## Payback period

- The amount of time before an initial investment is paid back
- I loan you \$5. You pay me back \$1/week. The payback period is 5 weeks.

Quarter	Cash Flow	Running Total
0	-200	-200
1	-200	-400
2	100	-300
3	300	0
4	500	500

Payback period is 3 quarters.

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# Advantages and disadvantages

- Advantages
  - Calculation is very easy
  - Measures the duration of financial risk
    - Longer payback period = greater risk
- Disadvantages
  - Doesn't consider the time-value of money
  - Doesn't measure profitability at all



# Discounted payback period

- Discount future cash flows and determine when the investment is paid back

Quarter	Cash Flow	$(1+i)^{-t}$ $i=3\%$	Discounted Cash Flow	Running Total
0	-200	1.000	-200	-200
1	-200	0.971	-194	-394
2	100	0.943	94	-300
3	300	0.915	275	-25
4	500	0.888	444	419

Discounted payback period = 4 quarters



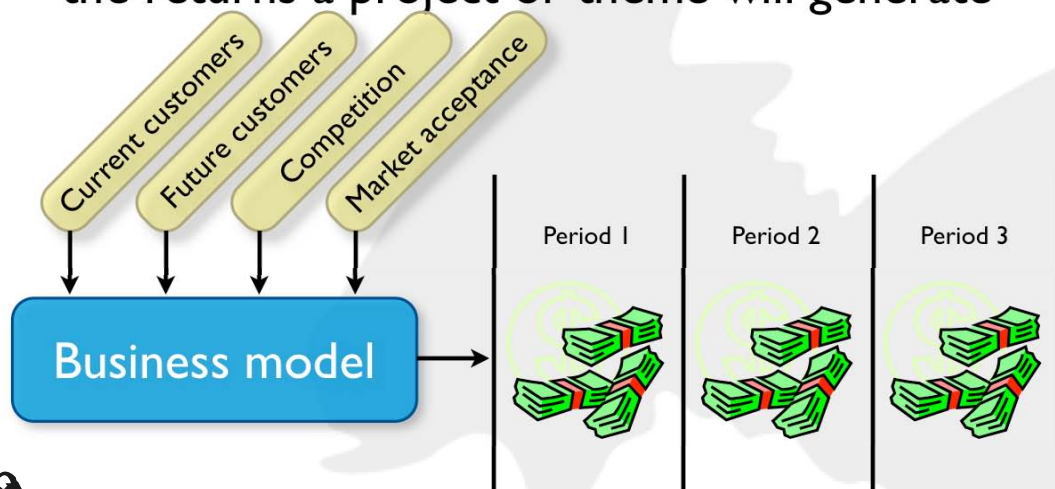
# Financial analysis recap

- Net Present Value (NPV)
  - Sum of discounted future cash flows
  - Expresses return as an amount of money
- Return on Investment (ROI) / Internal Rate of Return
  - The interest rate at which  $NPV = 0$ 
    - That is, at which you'd be indifferent to the investment
  - Expresses return as a percentage
- Discounted payback period
  - Amount of time before discounted returns equal the investment
  - Expresses return as an amount of time



# You need a business model

- These formulas assume you have a model of the returns a project or theme will generate



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# A relatively simple way to model

- Consider your revenue sources and group them
- These four often work well:
  1. New revenue
  2. Incremental revenue
  3. Retained revenue
  4. Operation efficiency



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# New revenue

- Money we'll make selling products or services to new customers
- The first thing most people think of when they think of the return on a project

• In addition to selling books, Amazon decides to sell music CDs.



# Incremental revenue

- Sometimes worth distinguishing from new revenue
- Typically comes because new product or service:
  - Encourages existing customers to buy or license more
  - Includes optional, add-on modules that are sold separately
  - Includes features that justify a higher price
  - Encourages use of consulting services

• An eCommerce site decides to offer gift wrapping for \$5 per box.



# Retained revenue

- Revenue you'll lose if the project is not performed
- Revenue you'll *lose* is different from revenue you *won't get*
- Customers who will stay with you who otherwise would leave

- We're losing customers because our eCommerce site doesn't offer gift wrapping.
- Our competitors have added features we don't have



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# Operational efficiency

- Most applicable for internally used software
  - But also a factor on commercial products
- Anything that takes a long time
  - Or will take a long time as the company grows
- Anything that improves accuracy or reduces rework

- An eCommerce site with third-party sellers. It takes 2 hours of manual time to add each seller.
- Our commercial software has usability issues, we get a lot of tech support calls.
- We spend 16 hours training new employees how to use our internal software



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# An example: WebPayroll

- Offers web-based payroll system to small companies
- Calculates payroll taxes, prints checks, etc.
- We tell customers they need to enter payroll data 3 days before they want checks
- Our goal: Next-day service
  - Enter data by 5pm, we print checks and overnight them to the company



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# Facts about WebPayroll

- Average customer – pays \$400/year in fees
- Overnight delivery will appeal to smaller customers, paying an average of \$200/year
- We think we'll make another \$100/year per customer that uses the over night service
- Average new customer is then worth \$300/year (\$200+\$100), or \$75/quarter
- New feature will take four months to deliver



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# WebPayroll: new revenue

- Sales says 50 new customers/quarter this year; 100 next year

Quarter	New Customers	Revenue per Customer	New Revenue
1	0	\$0	\$0
2	50	\$50	\$2,500
3	50	\$75	\$3,750
4	50	\$75	\$3,750
5	100	\$75	\$7,500
6	100	\$75	\$7,500
7	100	\$75	\$7,500
8	100	\$75	\$7,500



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# WebPayroll: incremental revenue

- We estimate we'll sign up 100 existing members per quarter until we have 400

Quarter	Customers	Revenue per Customer	Incremental Revenue
1	0	\$0	\$0
2	100	\$16	\$1,600
3	200	\$25	\$5,000
4	300	\$25	\$7,500
5	400	\$25	\$7,500
6	400	\$25	\$10,000
7	400	\$25	\$10,000
8	400	\$25	\$10,000



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# WebPayroll: retained revenue

- Sales say we'll retain 10 customers per quarter

Quarter	Retained Customers	Total Retained	Revenue per Customer	Retained Revenue
1	10	10	\$100	\$1,000
2	10	20	\$100	\$2,000
3	10	30	\$100	\$3,000
4	10	40	\$100	\$4,000
5	10	50	\$100	\$5,000
6	10	60	\$100	\$6,000
7	10	70	\$100	\$7,000
8	10	80	\$100	\$8,000



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# Operational efficiency

- We can avoid hiring a new payroll clerk a year from now at a fully burdened labor cost of \$30,000/year.

Quarter	Payroll Clerks Not Needed	Fully Burdened Labor Cost	Operational Efficiencies
1	0	\$0	\$0
2	0	\$0	\$0
3	0	\$0	\$0
4	0	\$0	\$0
5	1	\$7,500	\$7,500
6	1	\$7,500	\$7,500
7	1	\$7,500	\$7,500
8	1	\$7,500	\$7,500



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# All the numbers for WebPayroll

Q	Dev Cost	New Revenue	Incr. Revenue	Retained Revenue	Oper. Efficiency	Net Cash Flow
1	-\$90,000	\$0	\$0	\$1,000	\$0	-\$89,000
2	-\$30,000	\$2,500	\$1,600	\$2,000	\$0	-\$23,900
3		\$3,750	\$5,000	\$3,000	\$0	\$11,750
4		\$3,750	\$7,500	\$4,000	\$0	\$15,250
5		\$7,500	\$7,500	\$5,000	\$7,500	\$27,500
6		\$7,500	\$10,000	\$6,000	\$7,500	\$31,000
7		\$7,500	\$10,000	\$7,000	\$7,500	\$32,000
8		\$7,500	\$10,000	\$8,000	\$7,500	\$33,000



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# WebPayroll - NPV

Quarter	Net Cash Flow	$(1+i)^{-t}$	Present Value
1	-\$89,000	0.971	-\$86,419
2	-\$23,900	0.943	-\$22,538
3	\$11,750	0.915	\$10,751
4	\$15,250	0.888	\$13,542
5	\$27,500	0.863	\$23,733
6	\$31,000	0.837	\$25,947
7	\$32,000	0.813	\$26,016
8	\$33,000	0.789	\$26,037
NPV (12%) =			\$43,106



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# WebPayroll - ROI

	A
1	0
2	-\$89,000
3	-\$23,900
4	\$11,750
5	\$15,250
6	\$27,500
7	\$31,000
8	\$32,000
9	\$33,000

+irr(A1:A9, .10)

6%



# WebPayroll - Payback Period

Quarter	Net Cash Flow	Running Total
1	-\$89,000	-\$89,000
2	-\$23,900	-\$112,900
3	\$11,750	-\$101,150
4	\$15,250	-\$85,900
5	\$27,500	-\$58,400
6	\$31,000	-\$27,400
7	\$32,000	\$4,600
8	\$33,000	\$37,600

Payback period = 7 quarters



## WebPayroll - Discounted Payback Period

Quarter	Net Cash Flow	$(1+i)^{-t}$ 3%	Present Value	Running Total
1	-\$89,000	0.971	-\$86,419	-\$86,419
2	-\$23,900	0.943	-\$22,538	-\$108,957
3	\$11,750	0.915	\$10,751	-\$98,206
4	\$15,250	0.888	\$13,542	-\$84,664
5	\$27,500	0.863	\$23,733	-\$60,931
6	\$31,000	0.837	\$25,947	-\$34,984
7	\$32,000	0.813	\$26,016	-\$8,968
8	\$33,000	0.789	\$26,037	\$17,069

Discounted payback period = 8 quarters

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## Comparison matrix

	Cost	NPV	IRR	D. Payback (Quarters)
Theme A	\$150	\$448	133%	2
Theme B	\$192	\$940	172%	4
Theme C	\$540	\$883	89%	2
Theme D	\$288	\$443	76%	4
Theme E	\$330	\$191	48%	2
Theme F	\$474	\$331	56%	4
Theme G	\$540	\$2,519	139%	5
Theme H	\$300	\$1,023	146%	2
Theme I	\$90	\$747	221%	1
Theme J	\$180	\$182	65%	2
Theme K	\$450	(\$104)	5%	NA

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# Upcoming public classes

Date	What	Where
April 8-9 April 10	Certified ScrumMaster Agile Estimating and Planning	Dallas
May 12-13	Certified Scrum Product Owner	Denver
June 3-4 June 5	Certified ScrumMaster Agile Estimating and Planning	Washington, DC (Reston)
July 29-30 July 31	Certified ScrumMaster Agile Estimating and Planning	La Jolla, CA
Other classes in London, Oslo and Stockholm if you're up for a longer trip.		

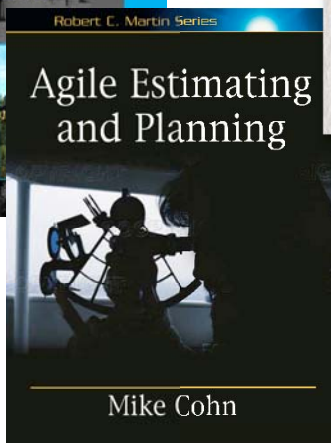
Information and registration at  
[www.mountangoatsoftware.com](http://www.mountangoatsoftware.com)



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