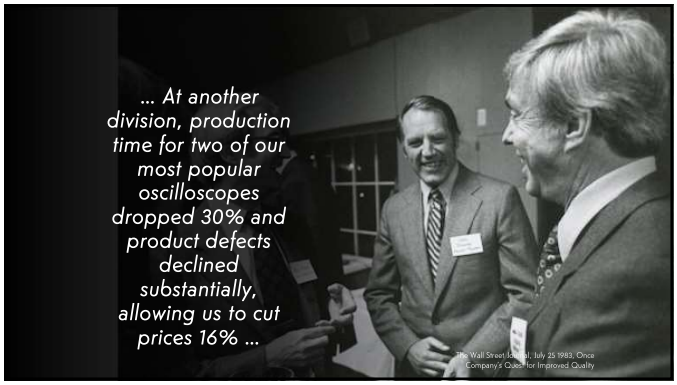
RELIABILITY VALUE MAP

1

2

3



4

5

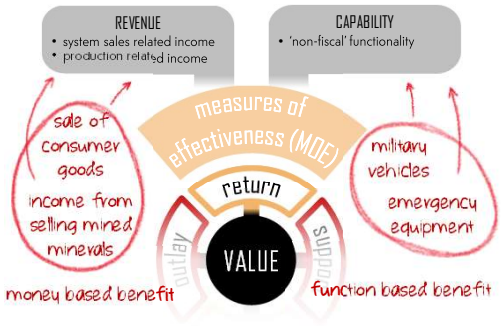
what are the ways you establish the reliability value proposition?

... start with the creation of a reliability, availability and maintainability value map

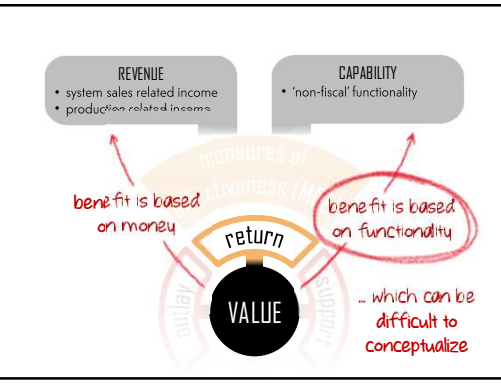
6


return
support
asset
outlay
VALUE

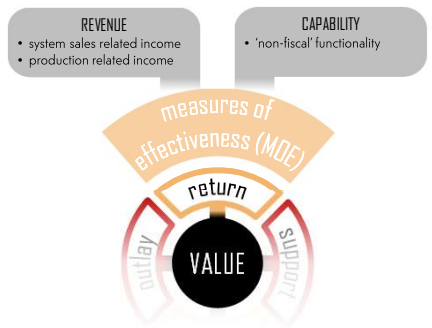
7


REVENUE
• system sales related income
• production related income
CAPABILITY
• 'non-fiscal' functionality
measures of effectiveness (MOE)
sale of consumer goods
income from selling mined minerals
military vehicles
emergency equipment
return
VALUE
outlay
support
money based benefit
function based benefit

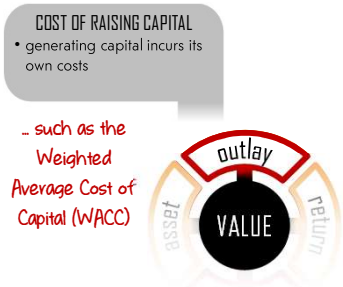
8


REVENUE
• system sales related income
CAPABILITY
• 'non-fiscal' functionality
benefit is based on money
benefit is based on functionality
return
VALUE
... which can be difficult to conceptualize

9



10



11

weighted average cost of capital/ (WACC)

noun

is the ongoing fee a company pays creditors, shareholders and owners for the capital they provide.

.. this is market-based – if security holders believe they are not being paid enough for their capital they invest their money elsewhere

12

.. a characteristic of management decision making

COST OF RAISING CAPITAL
- generating capital incurs its own costs

OPPORTUNITY COST
- what are the 'missed benefits' of spending money on something else?

.. such as the Weighted Average Cost of Capital (WACC)

13

opportunity cost/
[op-er-tyoo-ni-tee kost]

noun

is the loss of potential gain from other alternatives when one alternative is chosen.

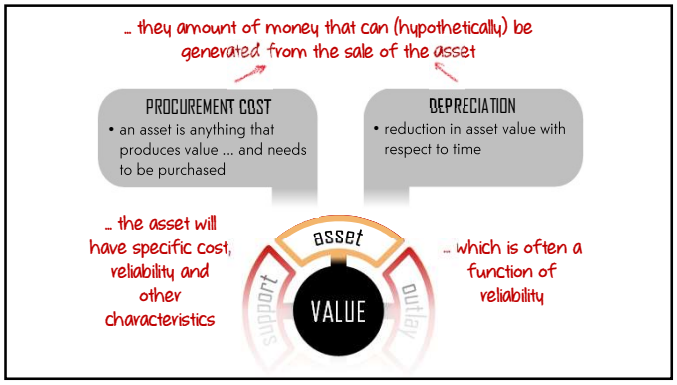
New Oxford American Dictionary, 3rd Edition (http://www.oxforddictionaries.com/us/definition/american_english/opportunity-cost?q=opportunity+cost) retrieved 4th June 2016

14

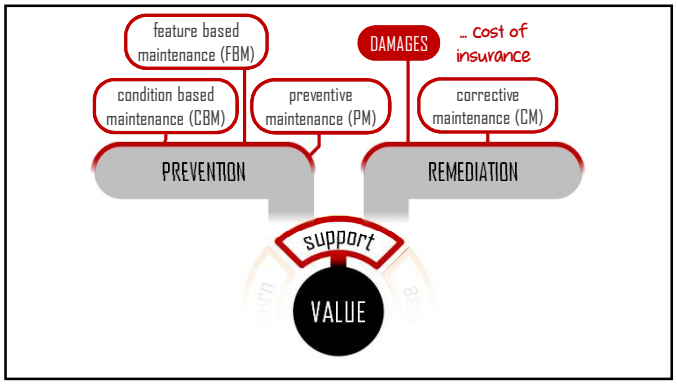
COST OF RAISING CAPITAL
- generating capital incurs its own costs

OPPORTUNITY COST
- what are the 'missed benefits' of spending money on something else?

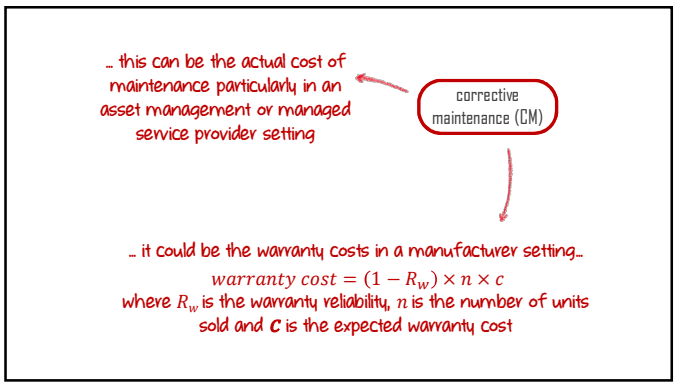
15


.. they amount of money that can (hypothetically) be generated from the sale of the asset
PROCUREMENT COST
• an asset is anything that produces value ... and needs to be purchased
DEPRECIATION
• reduction in asset value with respect to time
.. the asset will have specific cost, reliability and other characteristics
asset
support
outlay
VALUE
.. which is often a function of reliability

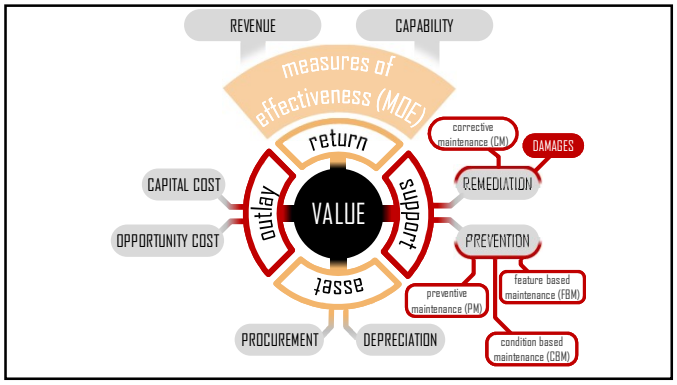
16


feature based maintenance (FBM)
DAMAGES
.. cost of insurance
condition based maintenance (CBM)
preventive maintenance (PM)
corrective maintenance (CM)
PREVENTION
REMEDIATION
support
VALUE

17


.. this can be the actual cost of maintenance particularly in an asset management or managed service provider setting
corrective maintenance (CM)
.. it could be the warranty costs in a manufacturer setting..
$warranty\ cost = (1 - R_w) \times n \times c$
where R_w is the warranty reliability, n is the number of units sold and c is the expected warranty cost

18

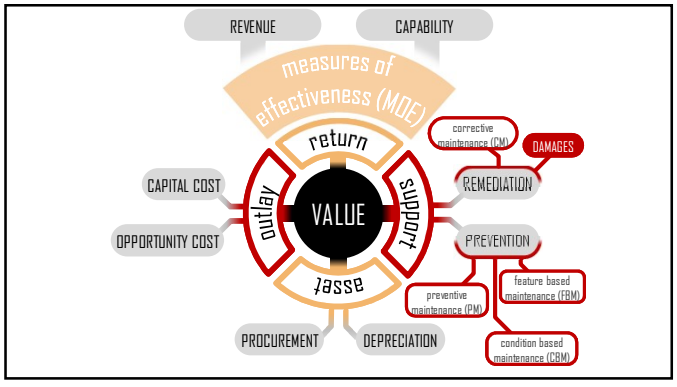


19

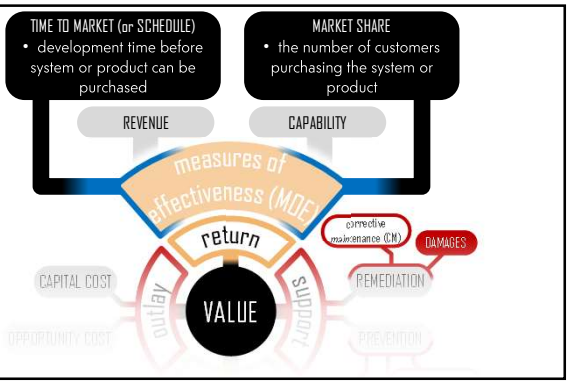
these value elements are what we call 'hard'

... they are based on relatively 'certain' characteristics and parameters

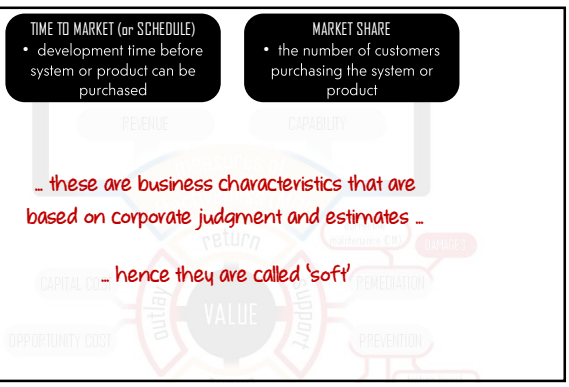
20



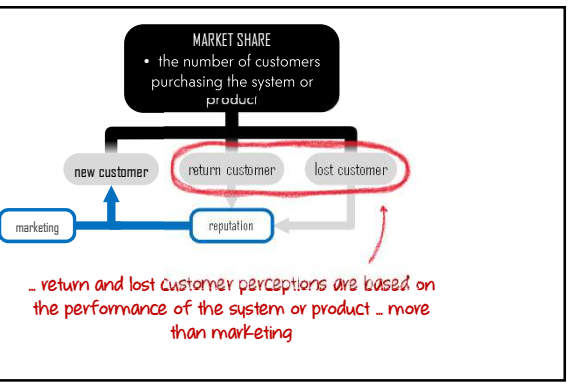
21


TIME TO MARKET (or SCHEDULE)
• development time before system or product can be purchased
MARKET SHARE
• the number of customers purchasing the system or product
REVENUE
CAPABILITY
measures of effectiveness (MOE)
return
corrective maintenance (CM)
DAMAGES
CAPITAL COST
REMEDIATION
outlay
support
VALUE
OPPORTUNITY COST
PREVENTION

22

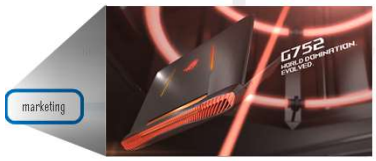

TIME TO MARKET (or SCHEDULE)
• development time before system or product can be purchased
MARKET SHARE
• the number of customers purchasing the system or product
… these are business characteristics that are based on corporate judgment and estimates …
… hence they are called 'soft'
VALUE

23


MARKET SHARE
• the number of customers purchasing the system or product
new customer
return customer
lost customer
marketing
reputation
… return and lost customer perceptions are based on the performance of the system or product … more than marketing

24

MARKET SHARE
- the number of customers purchasing the system or product



25

MARKET SHARE
- the number of customers purchasing the system or product

new customer | return customer | lost customer

which one would you buy?

reputation

26

TIME TO MARKET (or SCHEDULE)
- development time before system or product can be purchased

REVENUE | CAPABILITY | reputation | marketing

measures of effectiveness (MOE)

MARKET SHARE

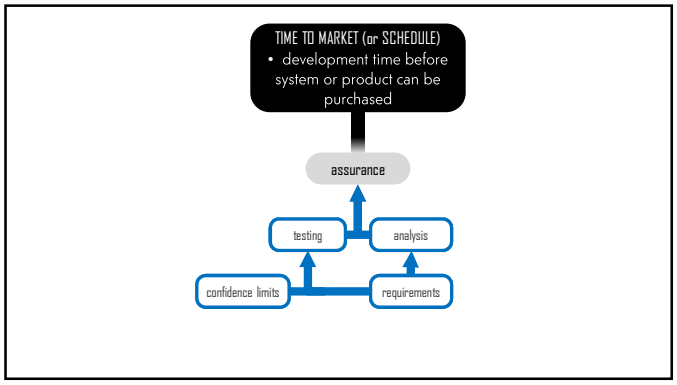
return

VALUE

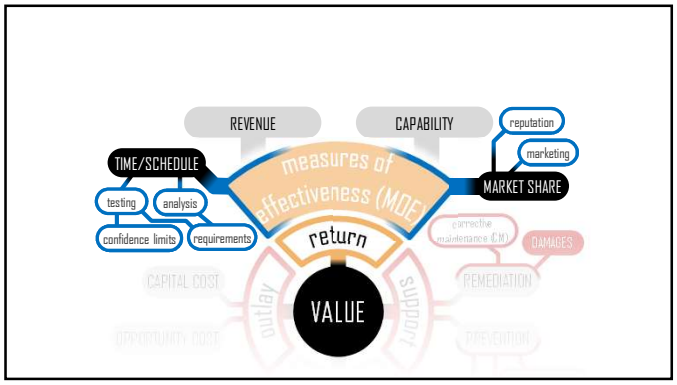
corrective maintenance (CM) | DAMAGES | REMEDIATION | PREVENTION

CAPITAL COST | OPPORTUNITY COST | outlay | support

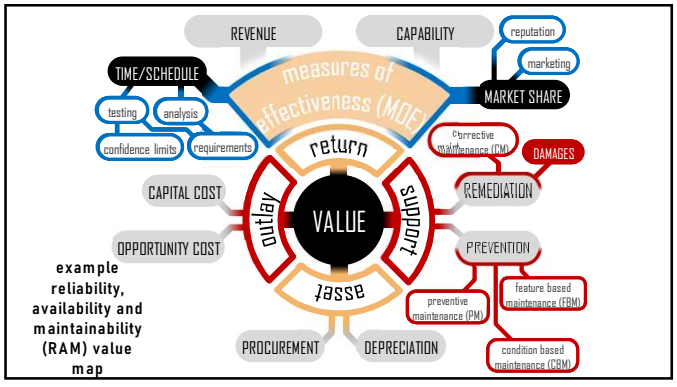
27


TIME TO MARKET (or SCHEDULE)
• development time before system or product can be purchased
assurance
testing
analysis
confidence limits
requirements

28


REVENUE
CAPABILITY
reputation
marketing
TIME/SCHEDULE
MARKET SHARE
measures of effectiveness (MOE)
testing
analysis
confidence limits
requirements
return
corrective maintenance (CM)
DAMAGES
CAPITAL COST
REMEDIATION
outlay
support
VALUE
OPPORTUNITY COST
PREVENTION

29

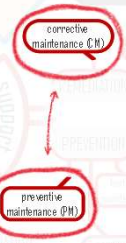

REVENUE
CAPABILITY
reputation
marketing
TIME/SCHEDULE
MARKET SHARE
measures of effectiveness (MOE)
testing
analysis
confidence limits
requirements
return
corrective maintenance (CM)
DAMAGES
CAPITAL COST
REMEDIATION
outlay
support
VALUE
OPPORTUNITY COST
PREVENTION
asset
feature based maintenance (FBM)
preventive maintenance (PM)
condition based maintenance (CBM)
PROCUREMENT
DEPRECIATION
example reliability, availability and maintainability (RAM) value map

30

... but we must not forget that some elements are linked ... and are not independent

31

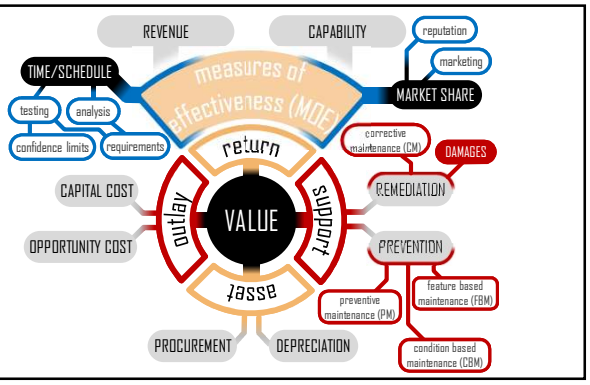
... for example, preventive maintenance is conducted because of and to influence corrective maintenance



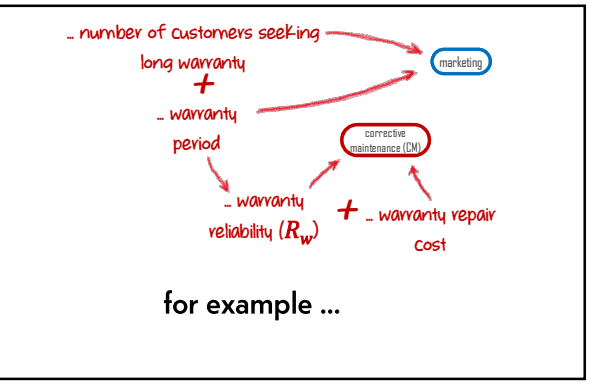
32

you then ascribe costs for each value map element based on specific reliability characteristics.

33



34



for example ...

35

EXAMPLE

Calculating Warranty Costs ...

A manufacturer of electronic goods expects to sell 10 000 wireless modem routers ...

... each wireless modem router has a 2 year warranty (based on market expectations)

... warranty repair involves unit replacement at cost of $ 125

what are the expected warranty costs?

36

EXAMPLE

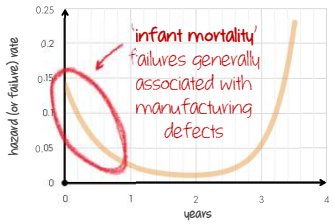
The company has undertaken some analysis and testing
...

... and determined the hazard or failure rate of the wireless modem router

.. the hazard or failure rate is the expected number of failures per unit time .. such as failures per year

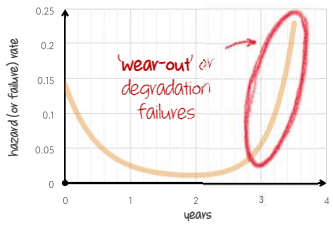
37

EXAMPLE



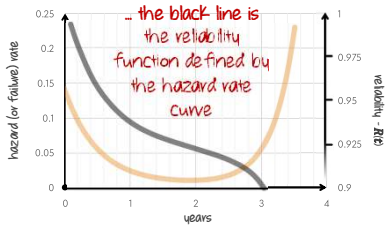
38

EXAMPLE



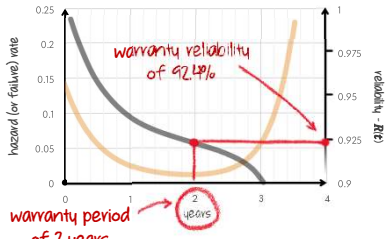
39

EXAMPLE



40

EXAMPLE



41

EXAMPLE

That means that 7.6 per cent of all wireless modem routers will fail during the warranty period ...

$$warranty\ cost = (1 - R_w) \times n \times c$$

where R_w is the warranty reliability, n is the number of units sold and c is the expected warranty cost ...

$$= (1 - 0.924) \times 10\,000 \times \$\,125$$

$$= \$95\,000$$

42

EXAMPLE

In this example, the reliability value function is ...

$$V = -[(1 - R_w) \times n \times c]$$

noting that the negative sign relates how value is 'maximized' when warranty costs are 'minimized.

43

EXAMPLE

... the key reliability **metric** or characteristic is the warranty reliability, R_w.

44

... where are resources on warranty performance and value?

... there are many websites such as www.warrantyweek.com

WARRANTY WEEK
The Newsletter for Warranty Management Professionals

45

EXAMPLE

US Average warranty Costs and Accrual Rates

Thirteenth Annual Product Warranty Report, Warranty Week, 24th March 2016 [retrieved 15th June 2016 http://www.warrantyweek.com/archive/ww20160324.html

46

warranty cost/
[wawr-uh n-tee kost]

noun

is the cost incurred for the agreed repair or replacement of products, goods or systems sold.

47

warranty accrual/
[wawr-uh n-tee uh-kroo-uh l]

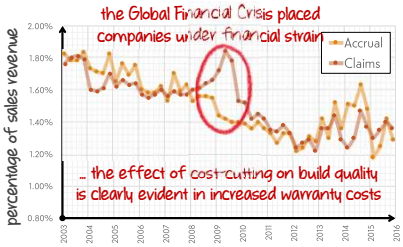
noun

is the capital set aside at time of sale to mitigate warranty liable associated with the expected warranty cost.

48

EXAMPLE

US Average warranty Costs and Accrual Rates

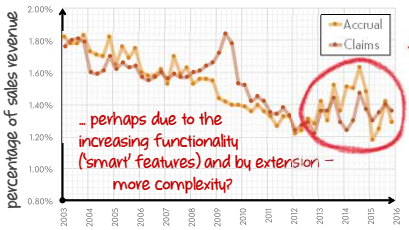


Thirteenth Annual Product Warranty Report, Warranty Week, 24th March 2016 [retrieved 15th June 2016 http://www.warrantyweek.com/archive/ww20160324.html

49

EXAMPLE

US Average warranty Costs and Accrual Rates



Thirteenth Annual Product Warranty Report, Warranty Week, 24th March 2016 [retrieved 15th June 2016 http://www.warrantyweek.com/archive/ww20160324.html

50

EXAMPLE

US Average warranty Costs and Accrual Rates

... these figures appear 'low' – but they are based on sales revenue.

for typical profit margins of 5 to 10 per cent, 1 to 2 per cent of revenue dedicated to warranty is a major cost driver

Thirteenth Annual Product Warranty Report, Warranty Week, 24th March 2016 [retrieved 15th June 2016 http://www.warrantyweek.com/archive/ww20160324.html

51

EXAMPLE

US Average warranty Costs and Accrual Rates

percentage of sales revenue

... also – these are 'average' percentages across multiple industries ...

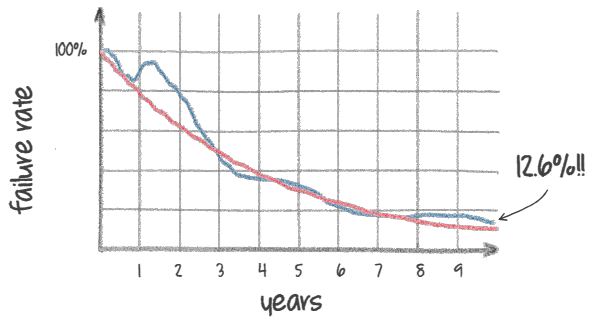
'satisfactory' warranty percentages can range from 1 to 10 per cent (the computer industry is around 5 per cent)

Thirteenth Annual Product Warranty Report, Warranty Week, 24th March 2016 [retrieved 15th June 2016 http://www.warrantyweek.com/archive/ww20160324.html

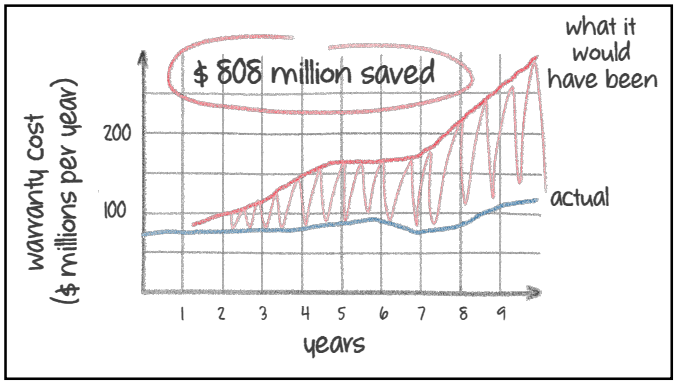
52

... just to reinforce the importance of warranty ...

53



54

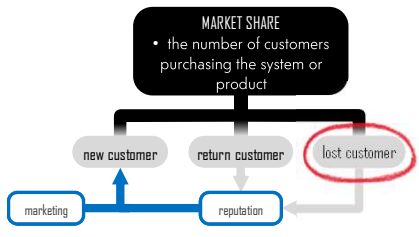


55

so how do we incorporate 'reputational' characteristics into value?

... start with 'lost customers'

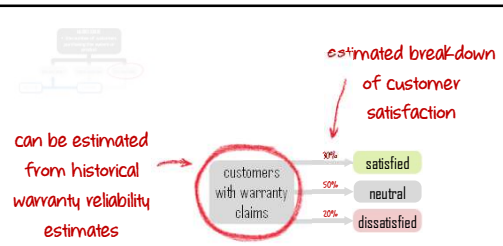
56



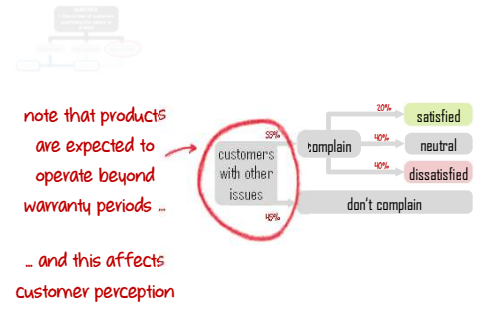
57

… here is one way – of many …

58



59



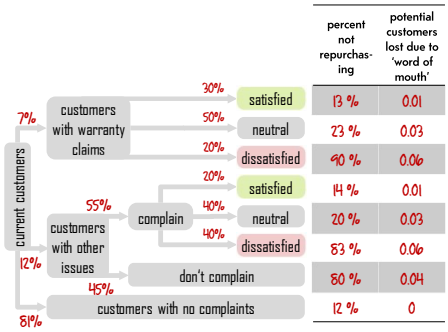
60

customers with no complaints

.. note that a fraction of customers with no complaints will not repurchase an organization's product ..

.. this is referred to as 'natural attrition'

61



	percent not repurchas-ing	potential customers lost due to 'word of mouth'
satisfied	13 %	0.01
neutral	23 %	0.03
dissatisfied	90 %	0.06
satisfied	14 %	0.01
neutral	20 %	0.03
dissatisfied	83 %	0.06
don't complain	80 %	0.04
customers with no complaints	12 %	0

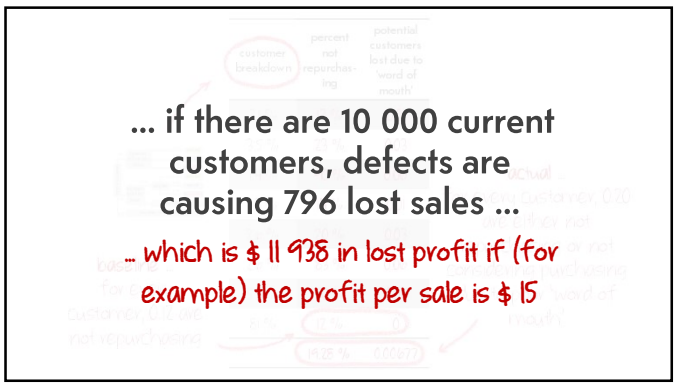
62

customer breakdown	percent not repurchas-ing	potential customers lost due to 'word of mouth'
2.1 %	13 %	0.01
3.5 %	23 %	0.03
1.4 %	90 %	0.06
1.3 %	14 %	0.01
2.6 %	20 %	0.03
2.6 %	83 %	0.06
5.4 %	80 %	0.04
81 %	12 %	0
	19.28 %	0.00677

baseline .. for every customer, 0.12 are not repurchasing

actual .. for every customer, 0.20 are either not repurchasing or not considering purchasing due to poor 'word of mouth'

63



... if there are 10 000 current customers, defects are causing 796 lost sales ...

... which is $ 11 938 in lost profit if (for example) the profit per sale is $ 15

64

... but these are just estimates - how do we reduce the uncertainty?

... start with conducting sensitivity analysis

65

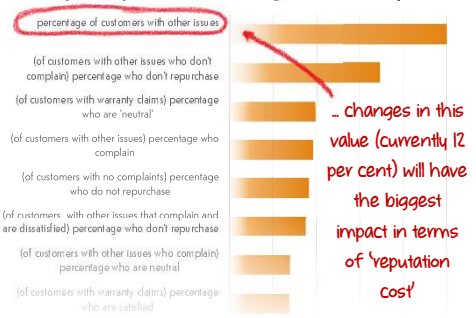
sensitivity analysis/
[sen-si-tiv-i-tee uh-nal-uh-sis]

noun

is the study of how the uncertainty in the output of a model or system is influenced by uncertainty in its inputs.

66

Sensitivity Analysis – Cost of Organization 'Reputation'



67

... this means that (for example) surveys can target the finding the percentage of 'customers with other issues'

... and it also means that (as it stands) reducing this percentage will have the biggest positive benefit on reputation cost

68

OBSERVATION

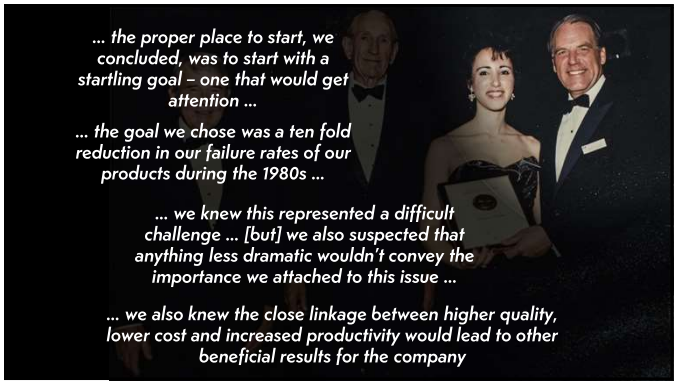
soft cost drivers are equally important ...

... if not easy to calculate.

... so where do we 'stop' analysis – in terms of trying to model reliability value?

... typically, after you have made your business case (which starts on 'hard cost drivers')

69



70

OBSERVATION

you stop analysis when ...

you have all the **information you need** to adequately enable a decision ...

... and there is no **organizational benefit** in creating a better understanding of reliability value.

... but what happens when we need to take into more performance characteristics than reliability metrics?

... for example – how do we compare the **value** of expensive but reliable systems to inexpensive but faulty ones?

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OBSERVATION

What do you do if you present 'soft' figures that are uncertain estimates ... and someone challenges you or tells you that you are wrong?

... such as warranty estimates, number of lost customers, the effect of the loss of each customer et cetera.

There is one technique that usually (but not always) works ...

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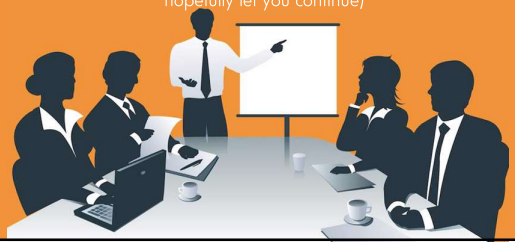
Be prepared for this … and then ask them to provide their estimates. They will either …

(1) Improve your calculations with better estimates … or

(2) Demonstrate that they have no idea themselves (and hopefully let you continue)



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