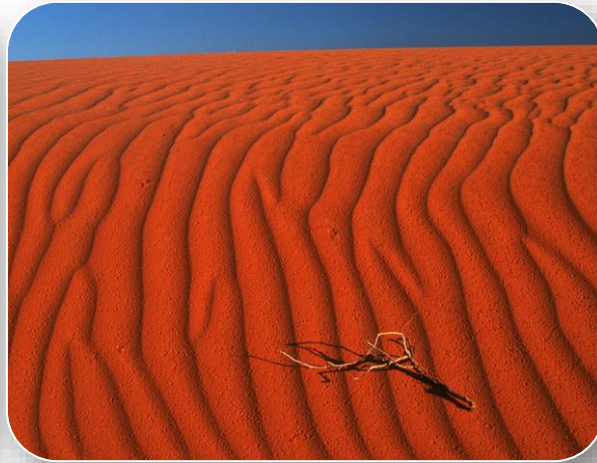


# Metrics that engage leadership attention

Nicholas Fisher



University of Sydney & ValueMetrics Australia



# Acknowledgement



Thank you to Professor Matilde Bine,  
incoming President of ISBIS,  
for her hospitality and for  
the opportunity to talk to a European audience.



# Overview

# Sub-text

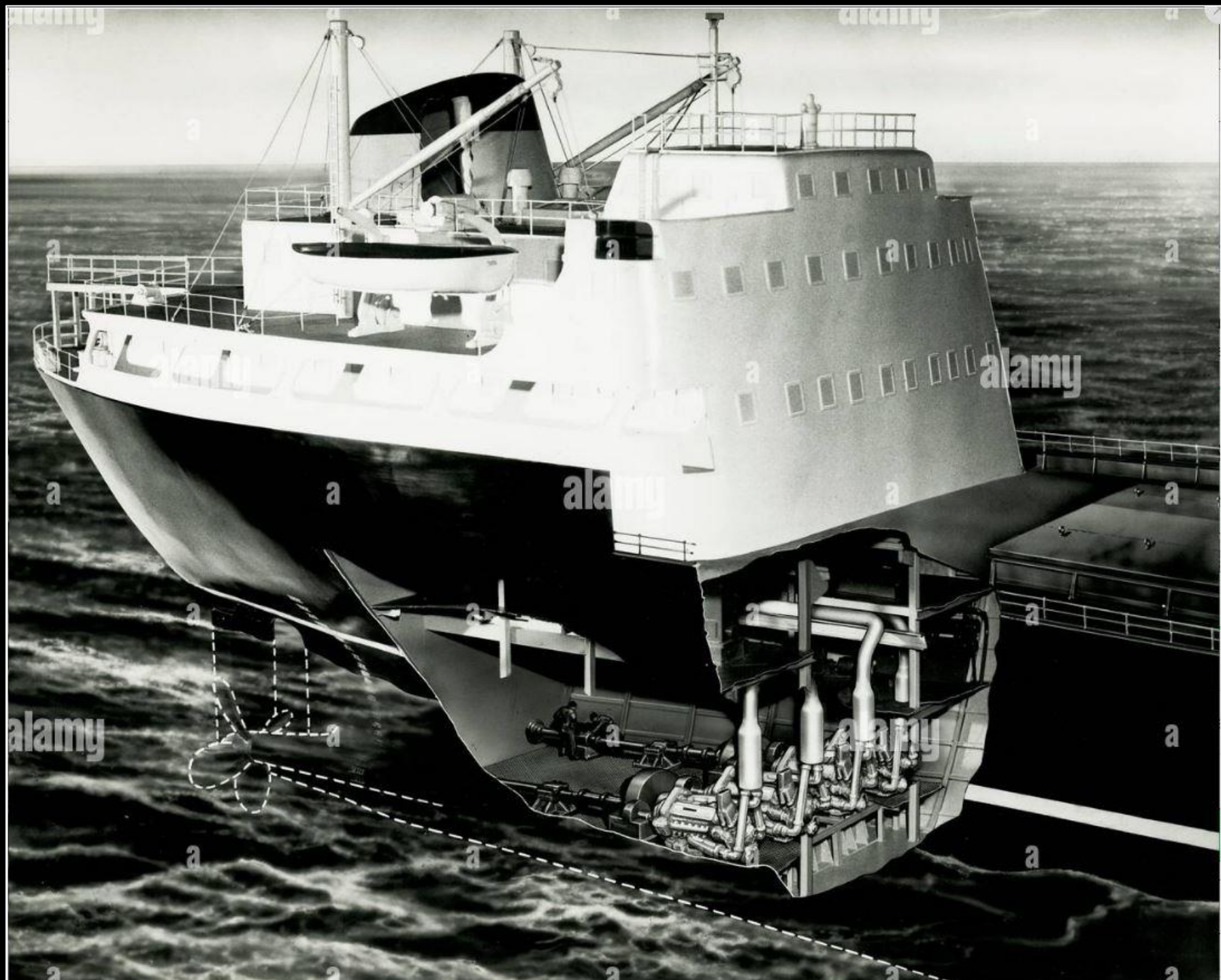
1. Background
2. Measuring relationships
3. Managing Safety Culture

## Beware of

- Likert scales
- Factor analysis
- Playing in other people's back yards

# Back to 1991 – 1993 ...

- Leading a CSIRO Australia research program mainly carrying out R&D in Quality Improvement.
- We needed to be able to demonstrate the value of our work to clients.
- However, all our work was very **operational**: engine room processes and metrics important to the engine room ...



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- However, all our work was very operational: engine room processes and metrics important to the engine room.
- Unfortunately, if you want to influence the direction of the ship, you need to be on the bridge with the captain.
- Separately from this, we had adopted Quality Management as the way we did things ([Deming Lecture 2019](#)).

An assessment against a best practice Quality Management framework revealed that our worst category was:

*How we used data and information for how we did things.*

- This raised the question: *Which metrics should we use?*





# Back to 1991 – 1993 ...

- Here's the same issue, coming from two entirely different directions: I needed
  - metrics to engage the attention of senior leadership in companies, that demonstrated in terms **meaningful to them** the benefit of our work in the engine room; and
  - top-level metrics relating to my own management issues.
- *So, what sorts of metrics should be engaging the ongoing attention of the leadership of an enterprise?*
- *In other words, what sorts of metrics should be in the monthly Board and Senior leadership reports?*

# The state of leadership reports in 1993



- In the early 1990s, no-one appeared to have paid any serious attention to this question, at least as far as publishing suggestions, or addressing the issue in MBA programs.
  - Existing top-level reports tended to be confined to financial metrics, and a few others such as *Market share* or *Staff turnover*, or violation of statutory requirements.
- 
- 

# My research project (1993 – 2013)

- Identify a set of metrics that will help answer three ongoing questions for leadership:
  - How are we going now?
  - Where are we heading?
  - Where do we need to focus attention?
- After a lot of luck, and a lot of wise counsel (see Deming Lecture), I managed to build a performance measurement system for an enterprise based on a stakeholder view of life ...
- ... and it produced the following answer to these questions:

# To identify leadership metrics ...

... focus the resources of the enterprise on making it a

*Worthwhile investment*

... which means that it is

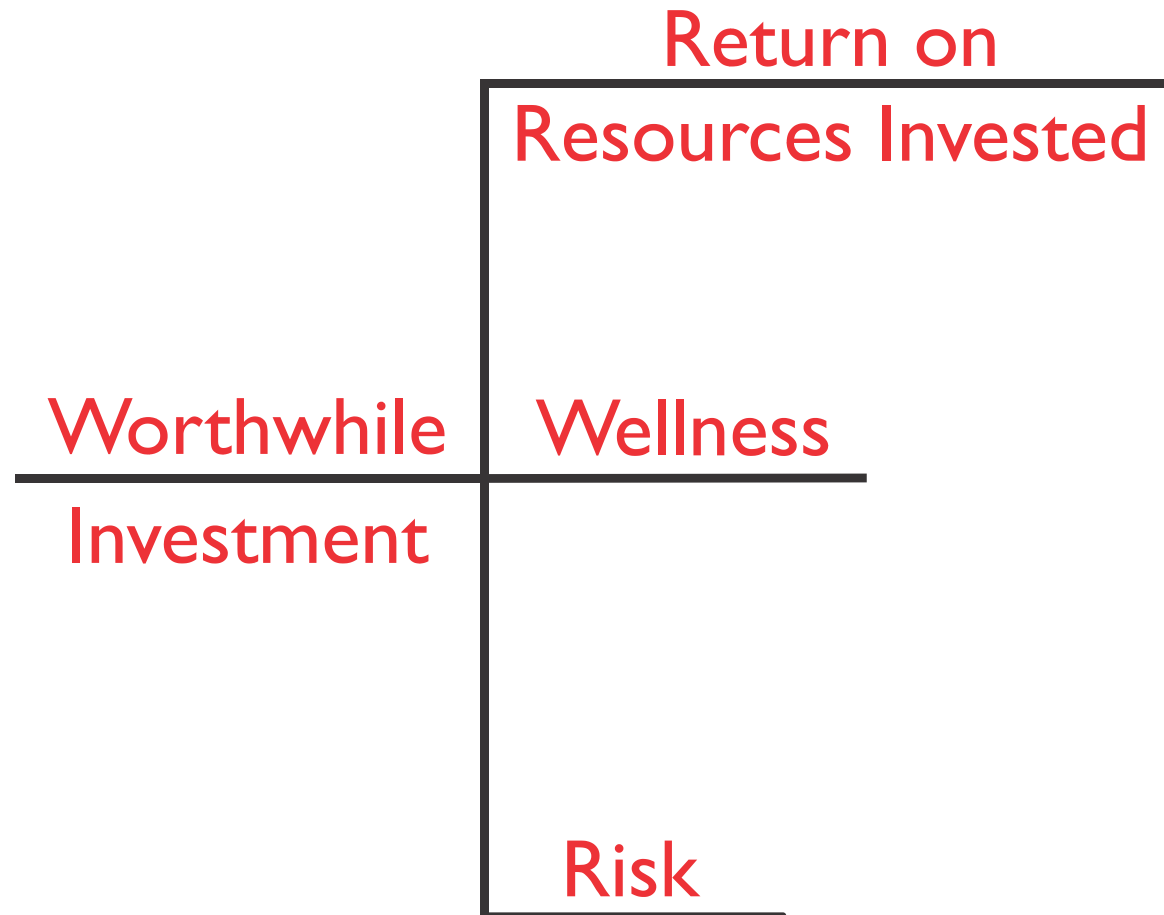
- a better investment for the **Owners** (e.g. shareholders) than they can get elsewhere

In other words, it represents

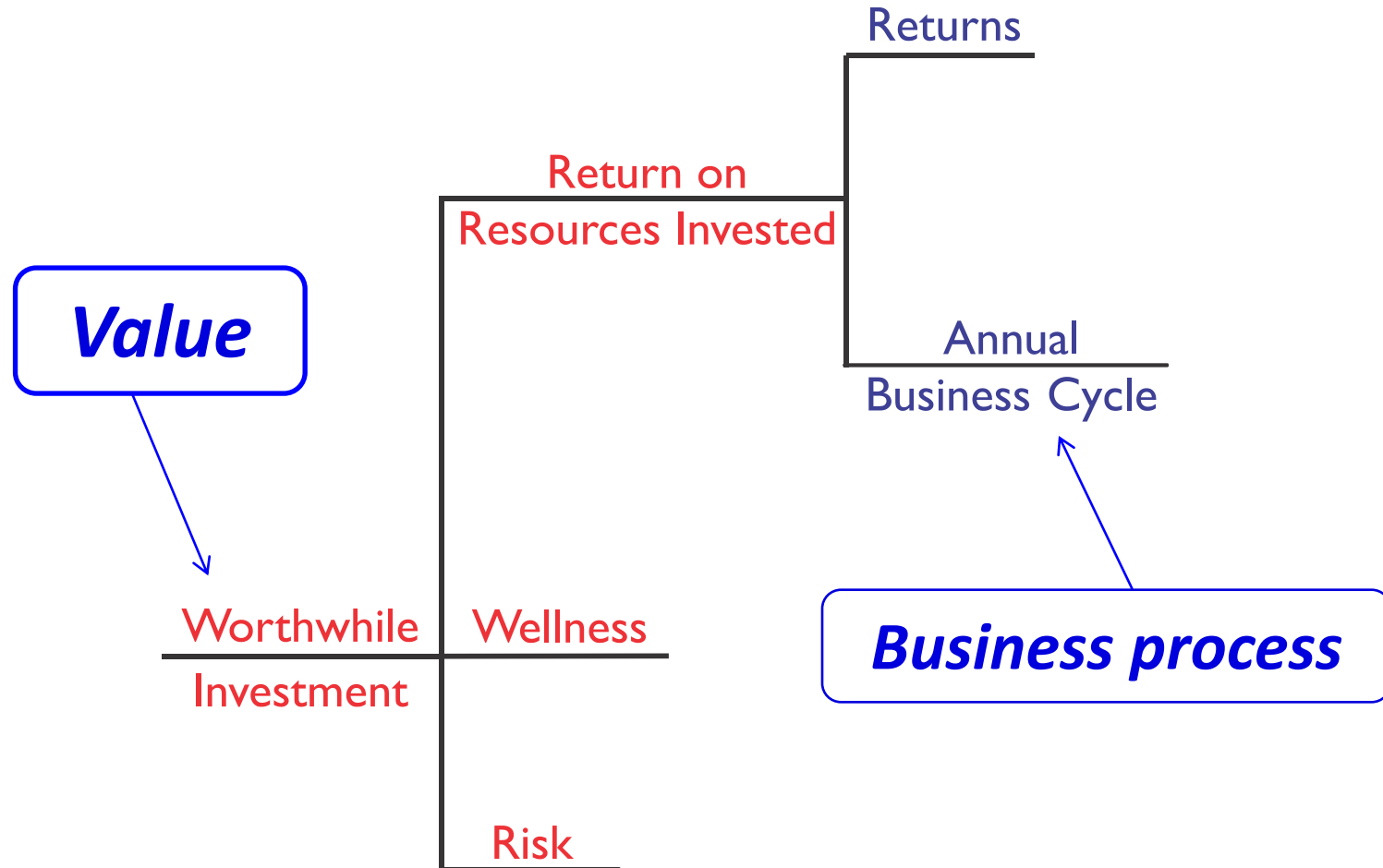
- superior *Relative Value Added* for the Owners

To do this, model *Worthwhile investment* in terms of its principal Drivers and their attributes, in what I call an **Owner Value Tree** ...

# Owner Value Tree

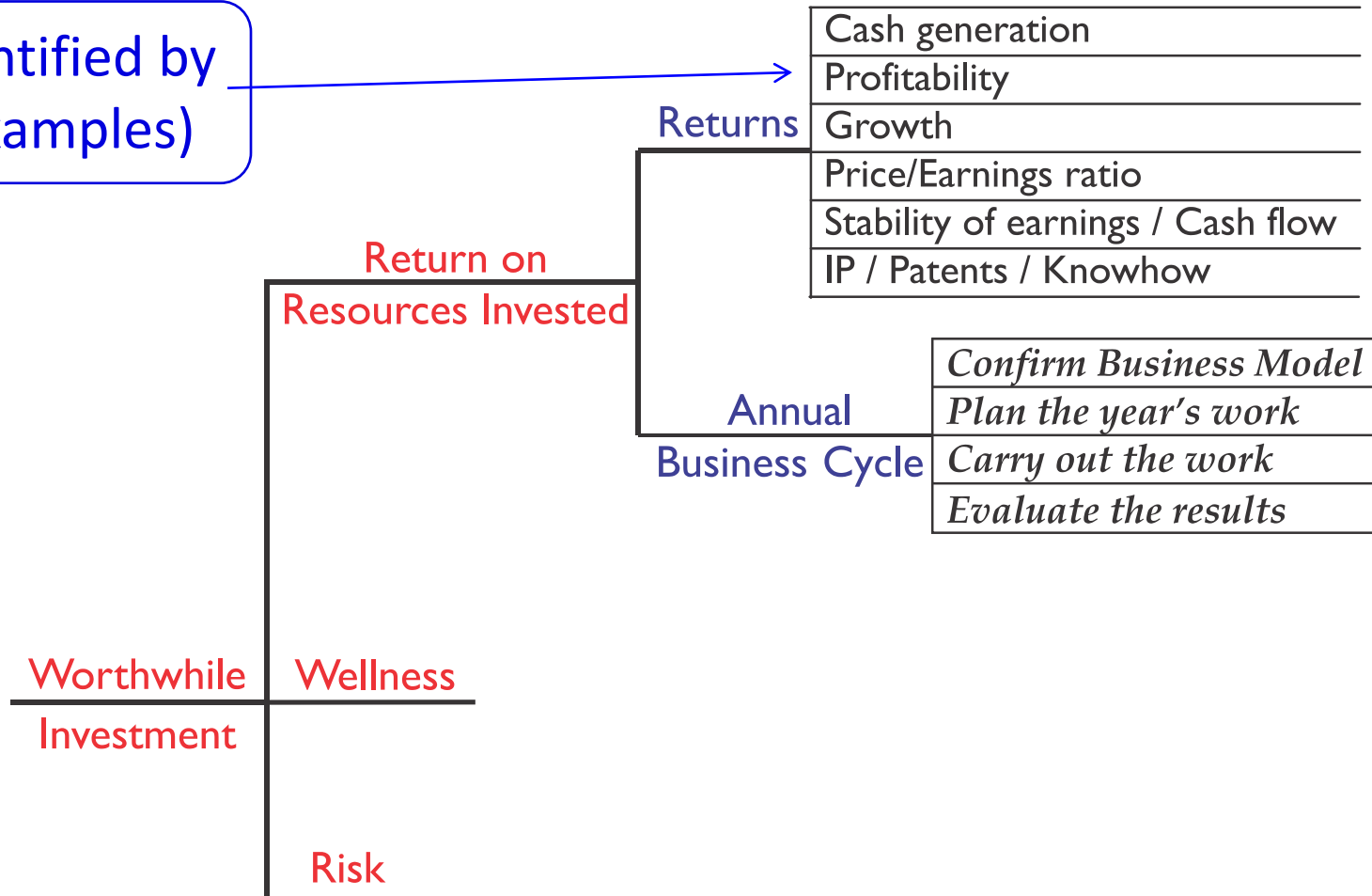


# Owner Value Tree

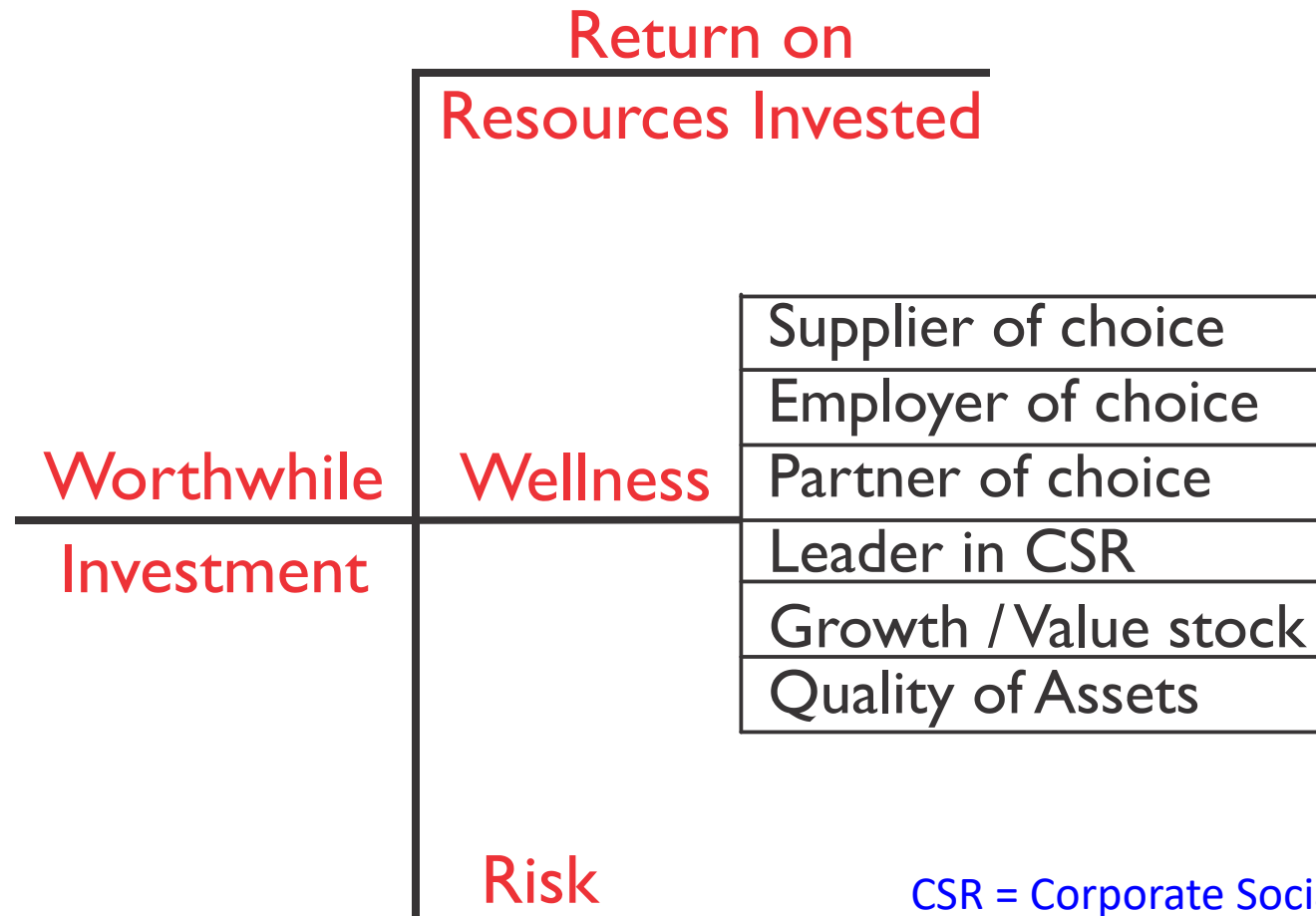


# Owner Value Tree

Attributes identified by the Board (examples)



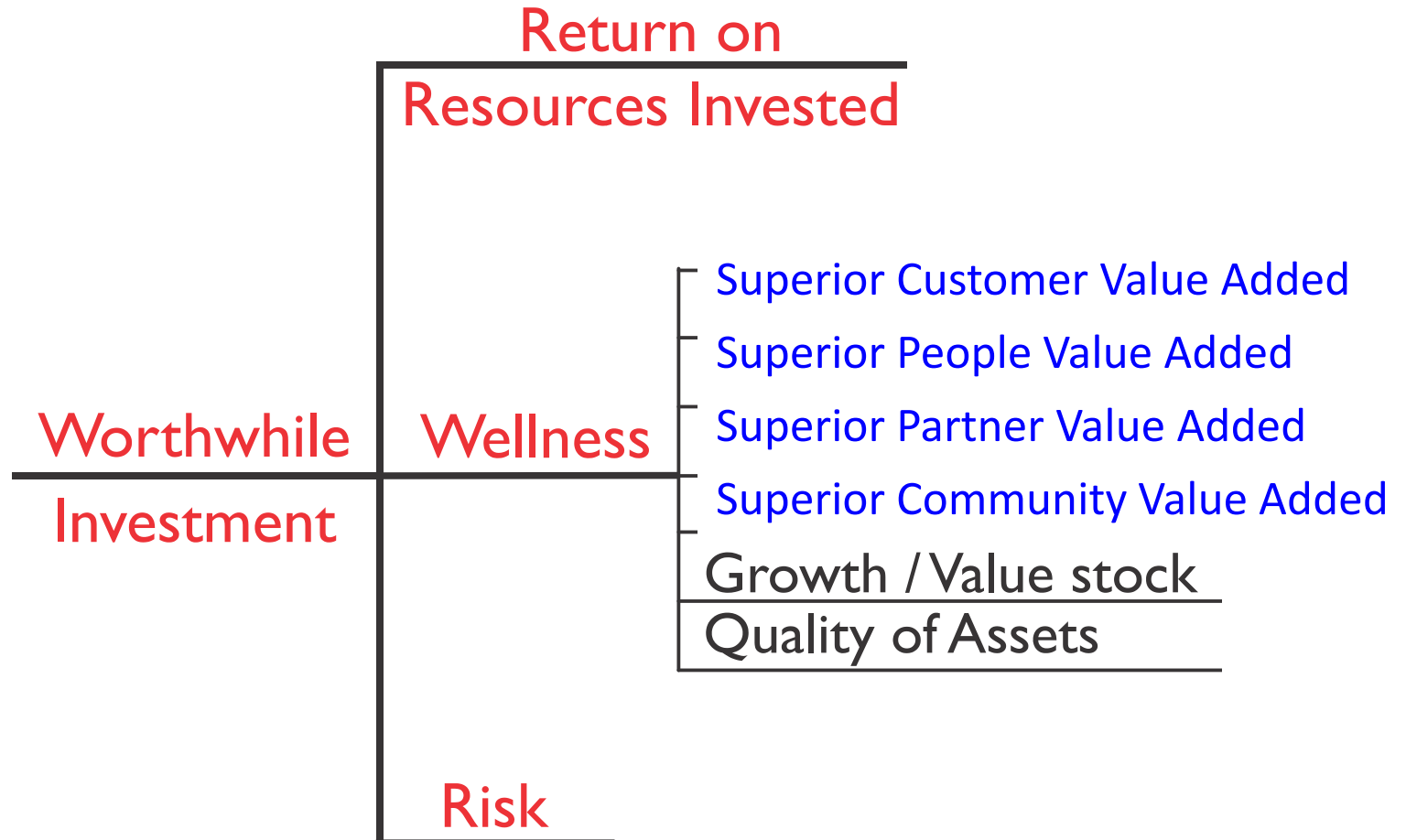
# Owner Value Tree



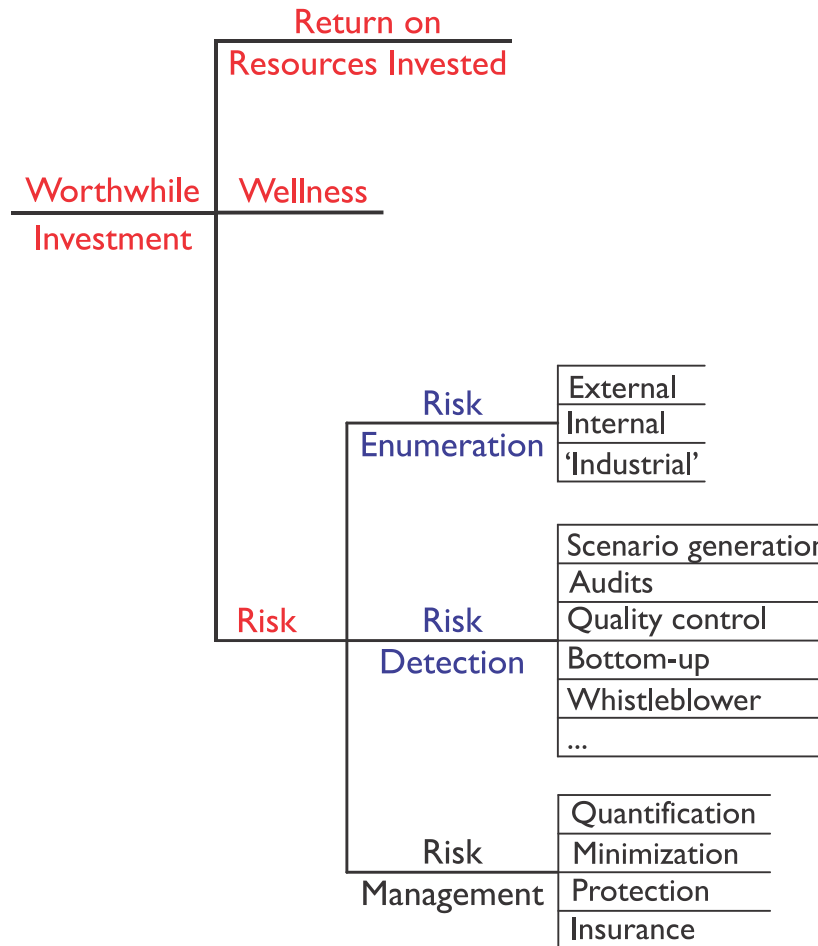
CSR = Corporate Social Responsibility



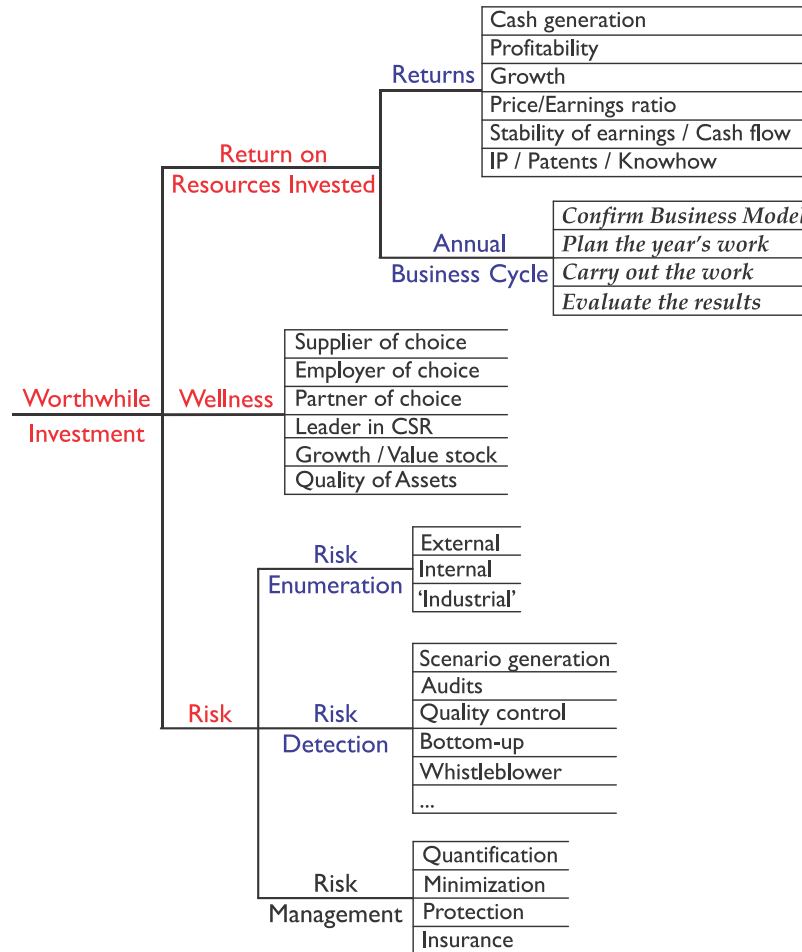
# Owner Value Tree



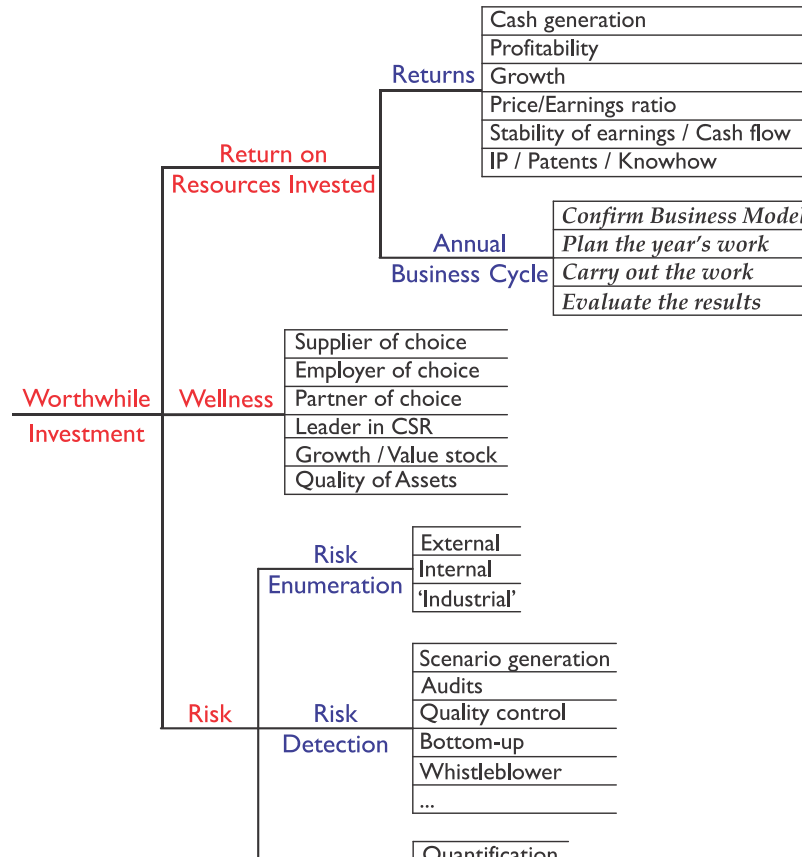
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# Owner Value Tree

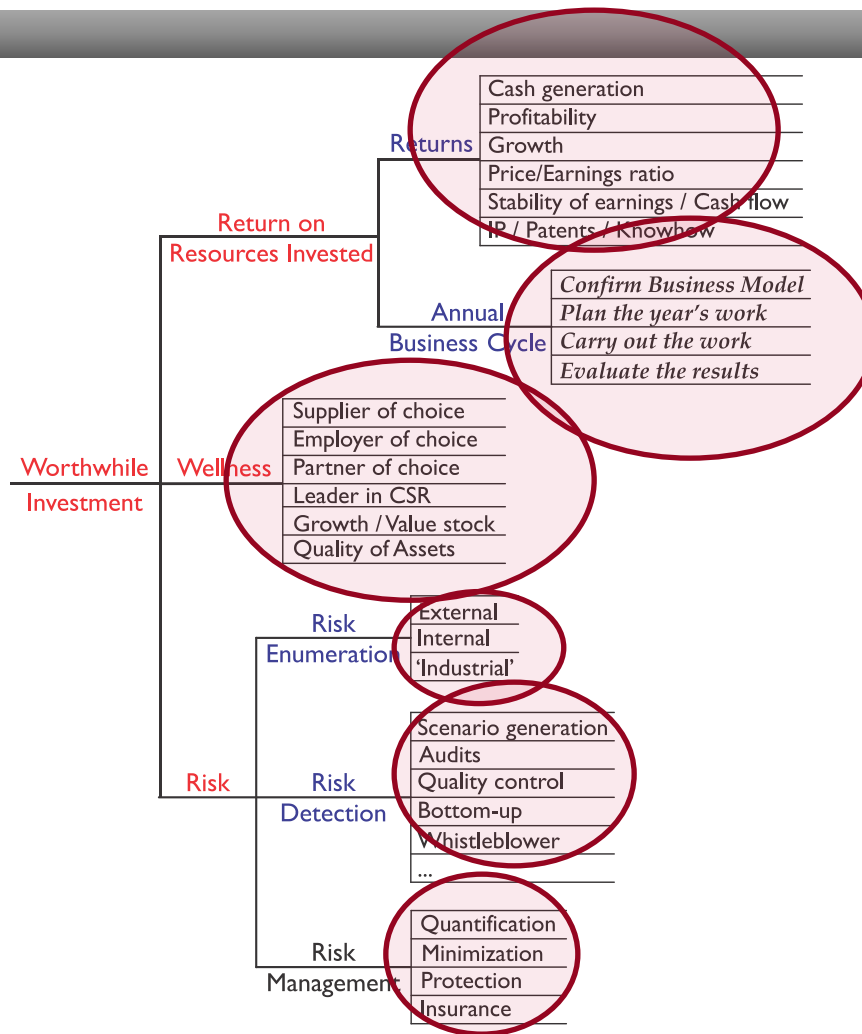


# What is the Owner Value tree telling us?



*It is answering the question ...*

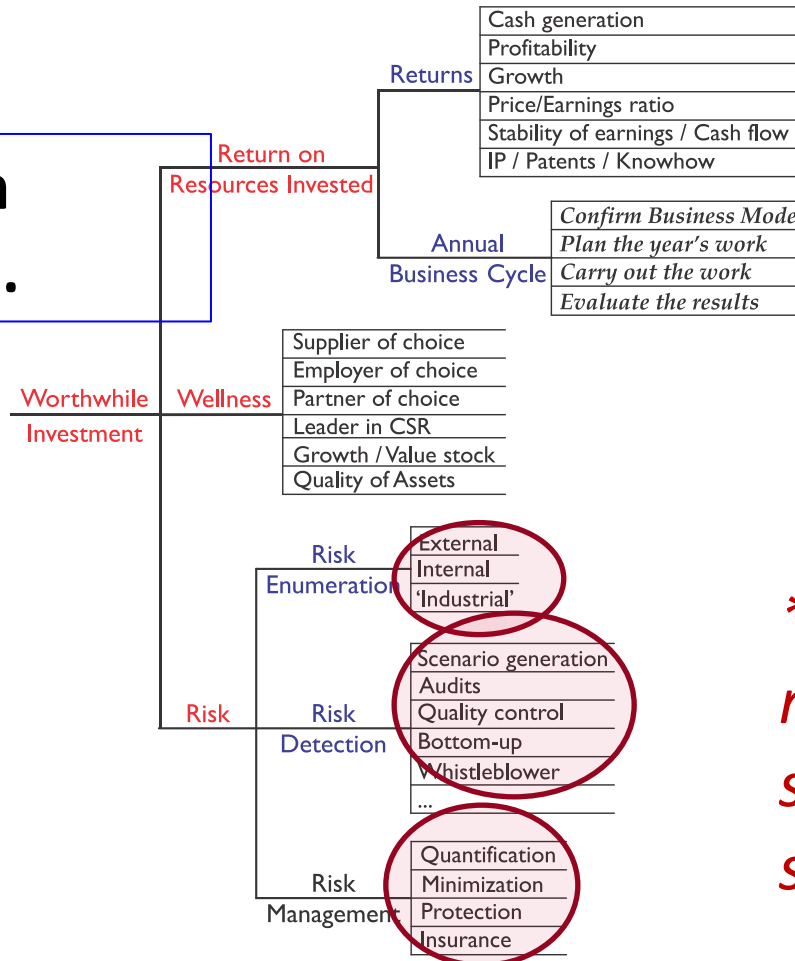
# ... where should monthly reports focus?



*Lead and lag indicators are needed for each of these.*

# Example: an important risk to manage\* ...

... regulatory risk in relation to Safety ...

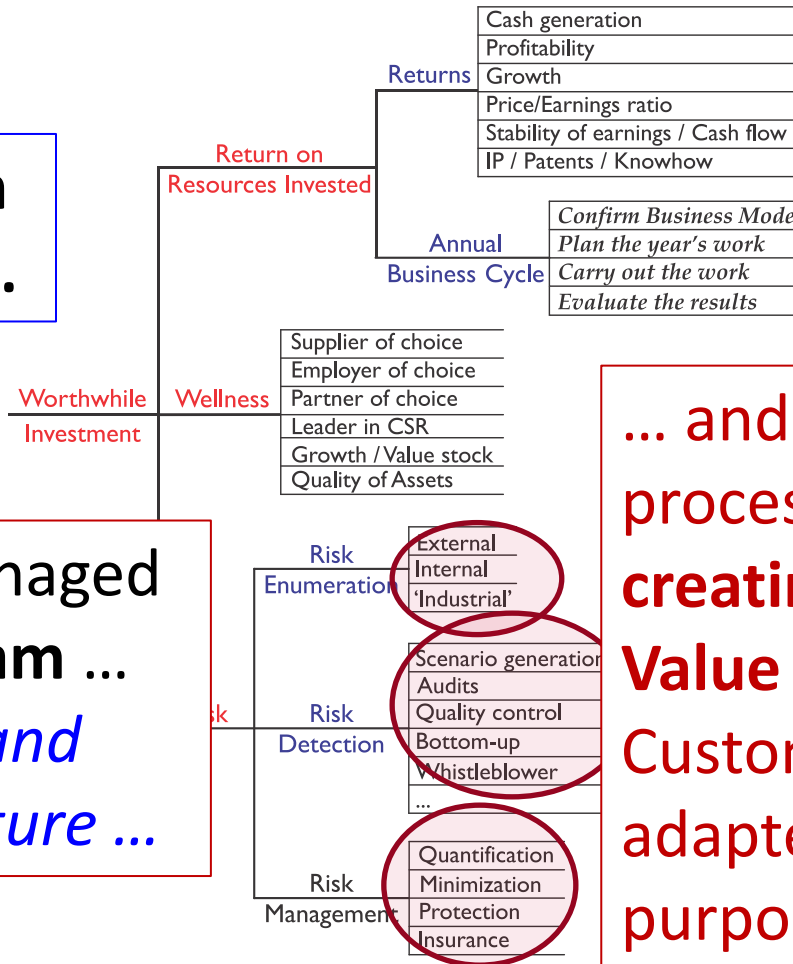


*\* So that Board members and senior executives stay out of prison!*

# An important risk to manage ...

... regulatory risk in relation to Safety ...

... which is best managed by working upstream ...  
*measure, monitor and improve Safety Culture ...*



... and the improvement process we have used for **creating and adding Value** for Owners, Customers, ... is readily adapted for just this purpose.

# Two-minute intro to *Managing (Customer) Value*\*

1. In its simplest form, **Customer Value** is defined as a trade-off between
  - Satisfaction with **Quality of Product or Service**
  - and
  - Satisfaction with **Price Paid**
2. Elaborate **Quality** and **Price** in terms of their *drivers* and *attributes*, to get a **Customer Value Tree** [... see next slides]
3. The critical quantity is *Relative Value*, or *Customer Value Added (CVA)*:

$$CVA = \frac{\text{Value of your offering}}{\text{average Value of your competitors' offerings}}$$

\* Originally developed by AT&T in 1986 (Kordupleski 2003), and since adapted for other stakeholders (Fisher 2113)



# One-minute intro to (Customer) Value Management

1. In its simplest form, *Customer Value* is defined as a trade-off between

- Satisfaction with *Quality of Product or Service*

and

- *Price*

2. Elements

to

3. The

(C

Example: Factory producing industrial chemicals

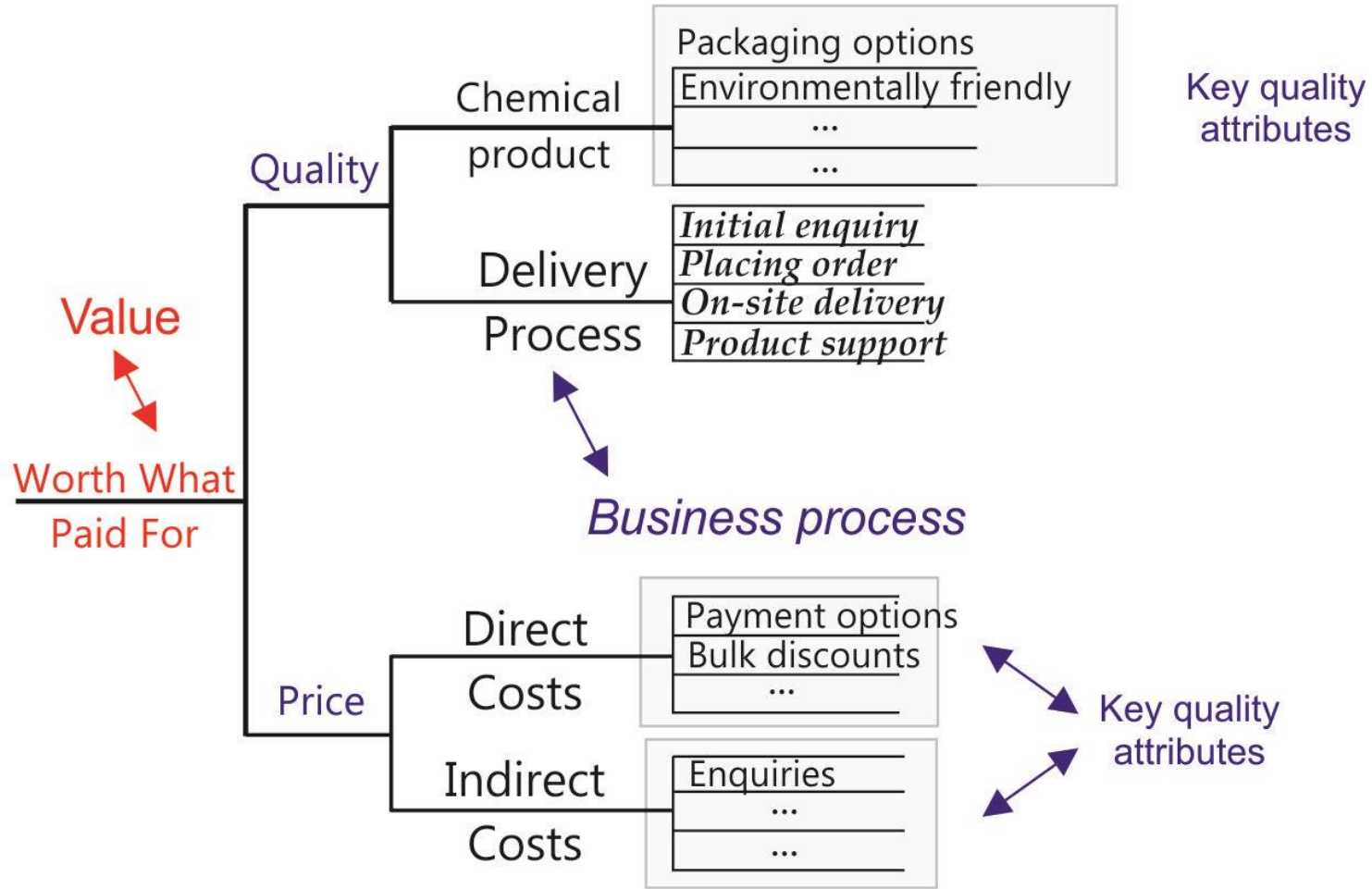
What might the concept of **Value** mean to someone purchasing these products?

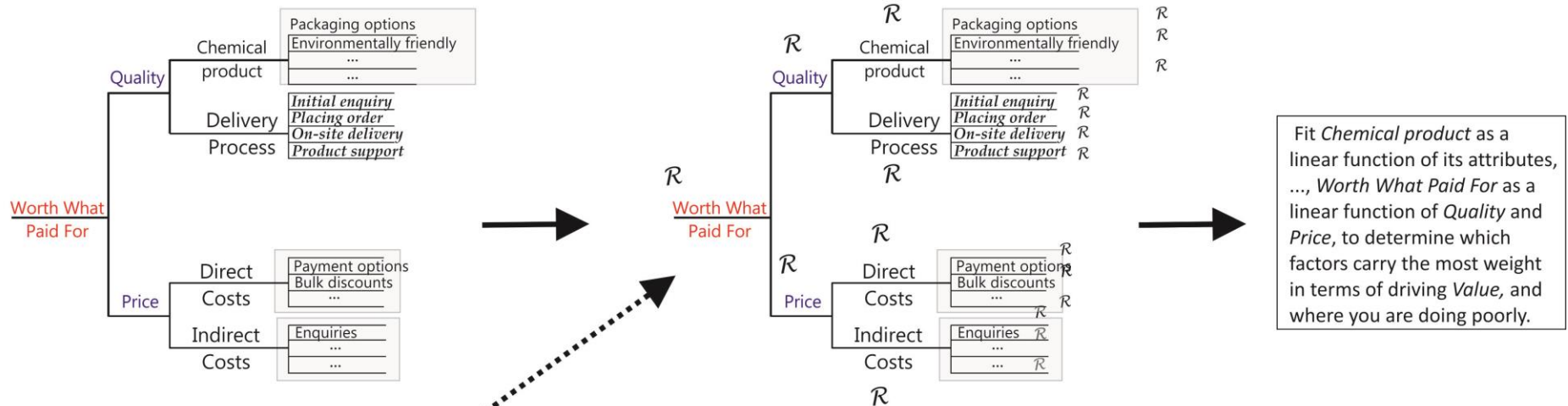
*attributes,*

*Added*

$$CVA = \frac{\text{Value of your offering}}{\text{average Value of your competitors' offerings}}$$

# Example: Chemical Plant Value tree





(a) Develop a Customer Value tree by elaborating the concept of Value in terms of its drivers and their attributes, and the steps in the business process. Shaded sets of attributes are obtained from focus groups.

(b) Collect ratings data  $\mathcal{R}$  by surveying decision-makers:  
*On a scale of 1 to 10, please rate Company X on Packaging options, ...*  
*All things considered, please rate the overall Value.*  
*Please rate your willingness to re-purchase from this company.*

(c) Statistical analysis, checking that all model fits are adequate.

(f) fix the problems, communicate that you have done so, and re-survey.

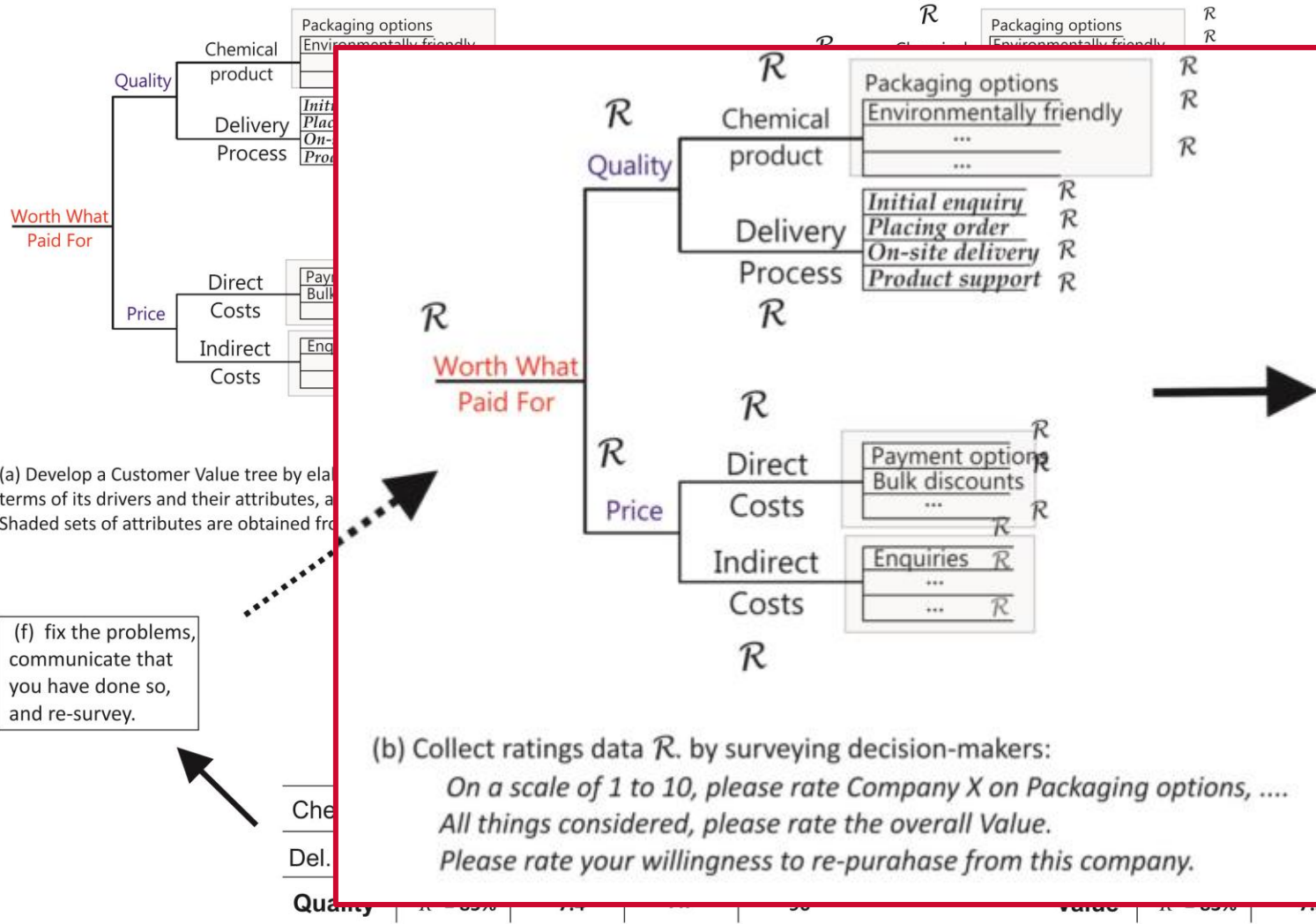
	Impact weight (%)	Your rating	Competitor rating	Relative rating (%)
Chemical	30	7.7	7.8	99
Del. proc.	55	6.8	7.2	94
<b>Quality</b>	$R^2 = 85\%$	7.4	7.7	96

	Impact weight (%)	Your rating	Competitor rating	Relative rating (%)
Quality	51	7.4	7.7	96
Price	32	6.9	6.8	101
<b>Value</b>	$R^2 = 83\%$	7.3	7.5	97

(e) Here, the focus needs to be on Delivery Process. Continue down through the tables to identify where the problem lies. See Kordupleski (2003) or Fisher (2013, 2019a) for greater elaboration.

(d) Top level profile. The Value of  $R^2$  suggests a good model fit, so that no important factor has been overlooked. Focus attention on the driver that carries significant rate and where you are rated relatively poorly. In this case, it is Quality. Drill down to look more closely at Quality ...

# Value Management Process



Fit *Chemical product* as a linear function of its attributes, ..., *Worth What Paid For* as a linear function of *Quality* and *Price*, to determine which factors carry the most weight in terms of driving *Value*, and where you are doing poorly.

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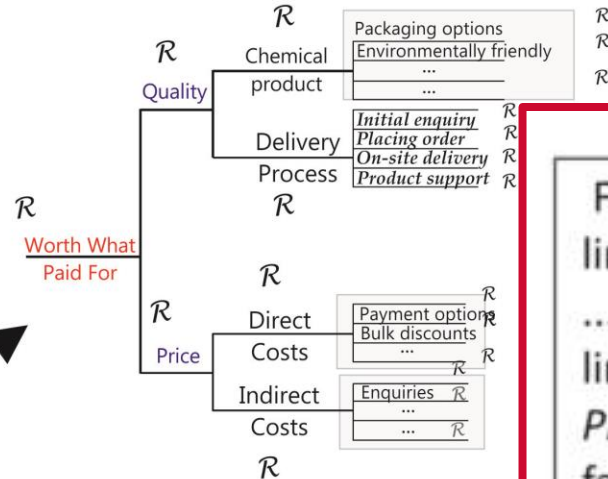
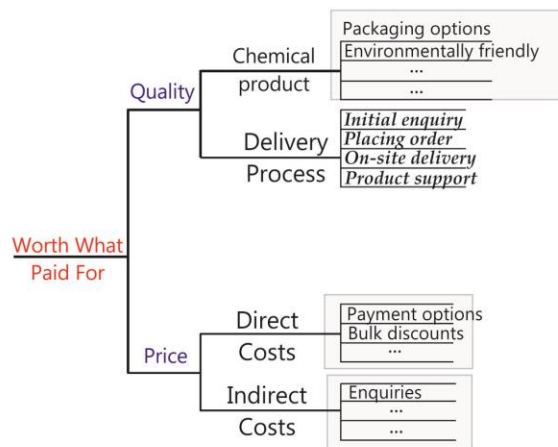
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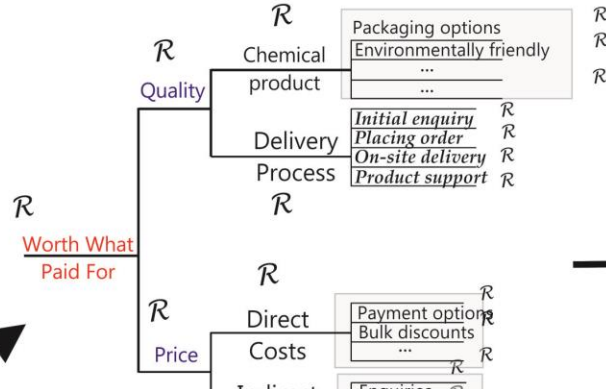
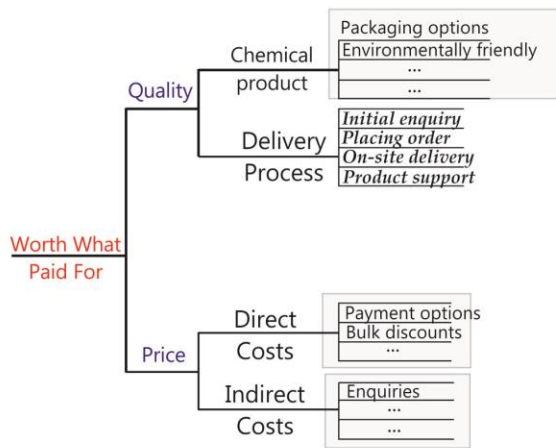
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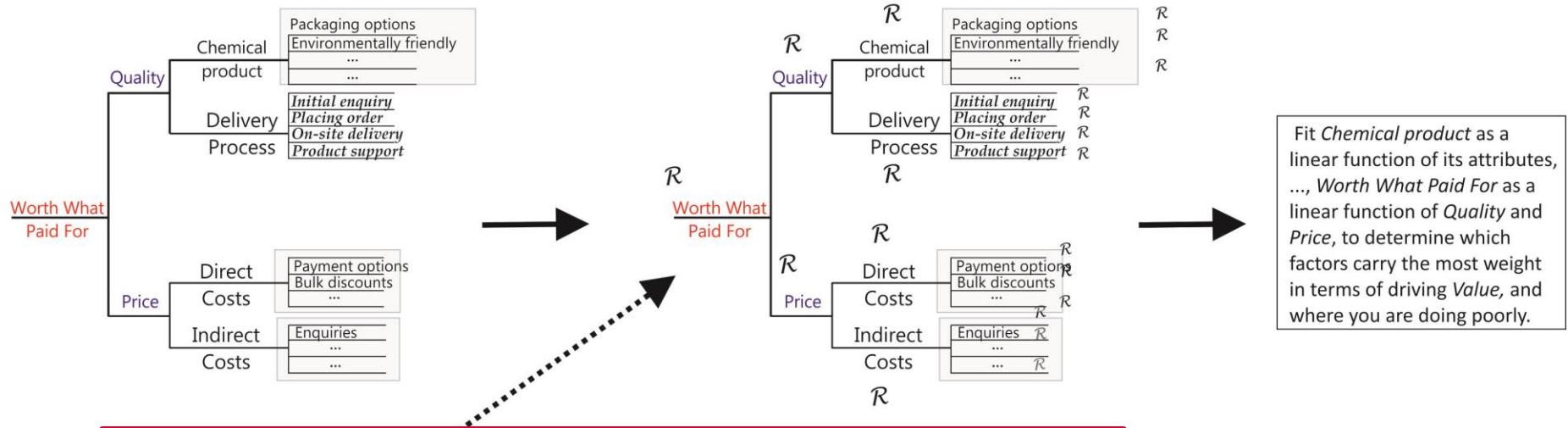
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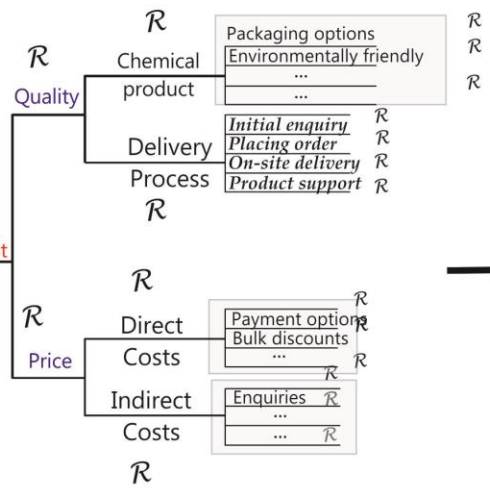
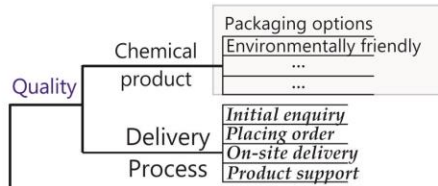
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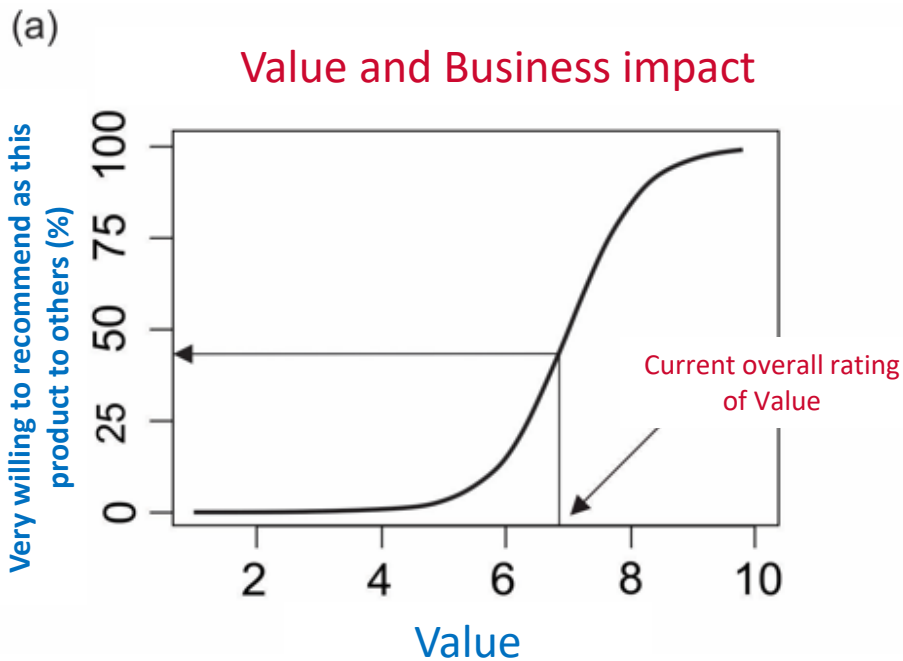
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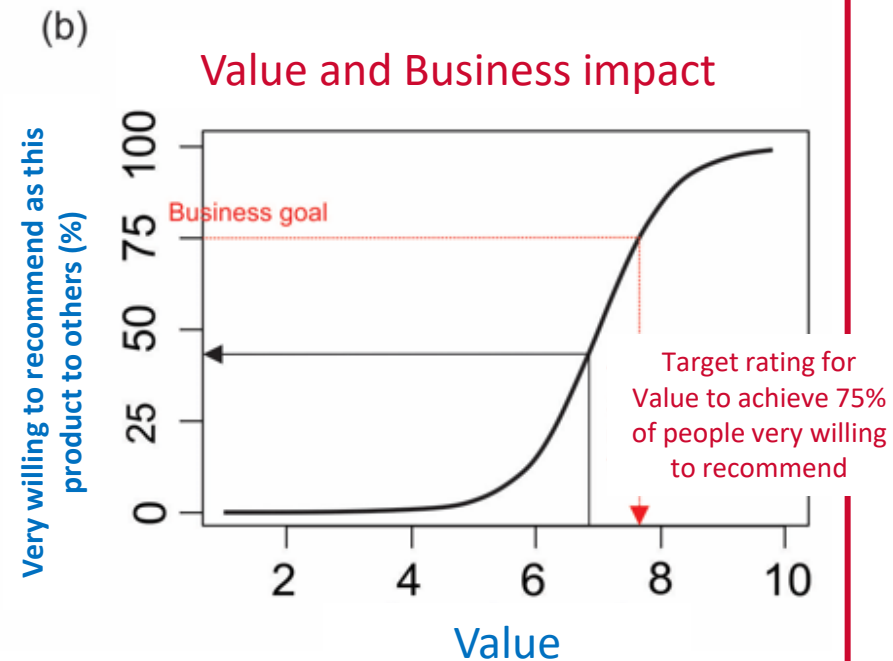
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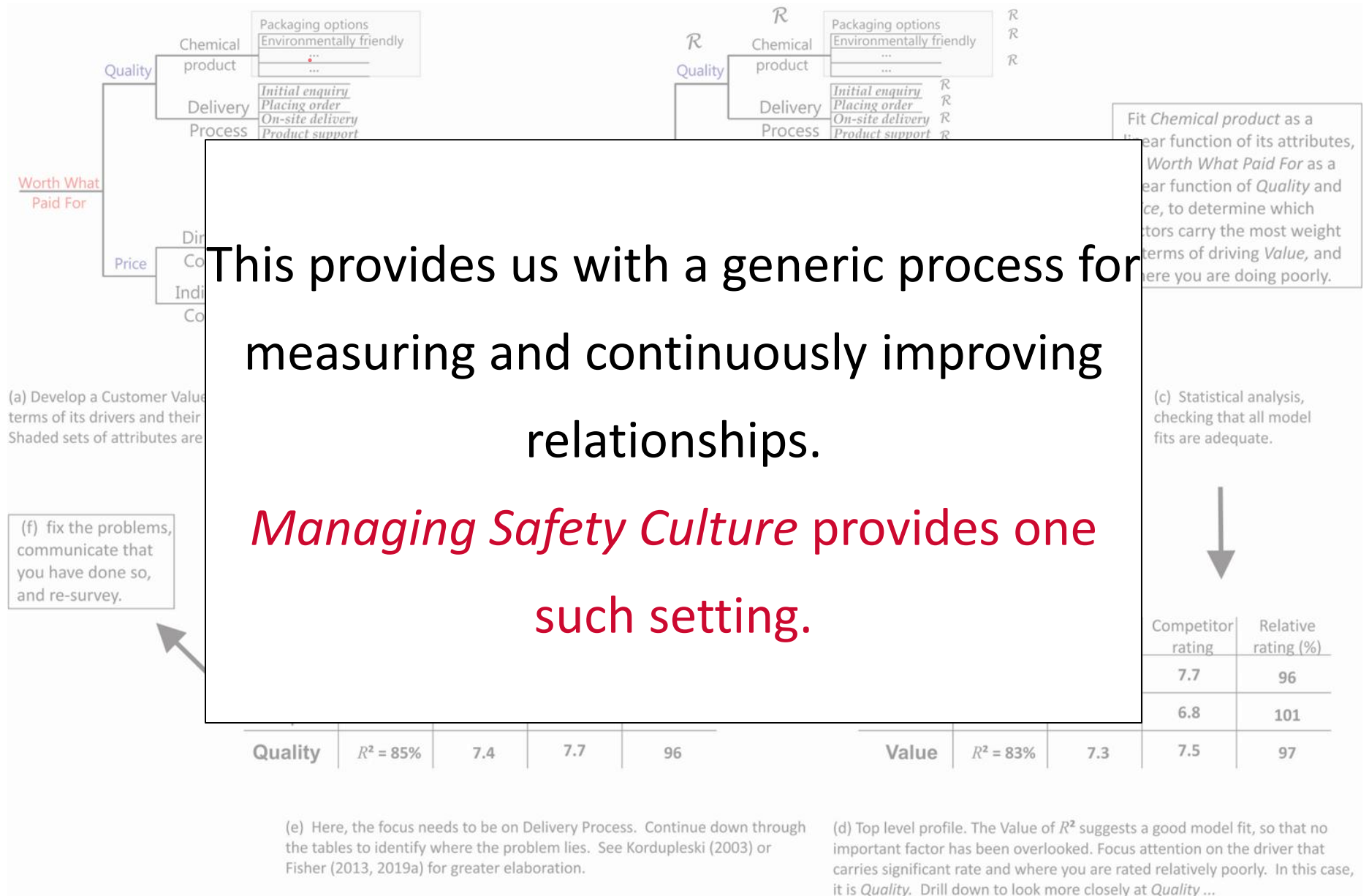
... not forgetting the all-important link to higher-level business drivers ...



Fisher (2013, 2019a) for greater elaboration.



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# Culture and Safety Culture

- Culture means:

*The way we do things around here*

and Safety Culture is a very important sub-set:

*The way we go about working safely around here*

- Culture and Safety Culture are intrinsically concerned with **Relationships**.

***And they matter ...***

... because almost every formal inquiry into massive safety disasters around the world concludes that **organisational culture** is a significant to major causal factor.

# The usual way to “improve” Safety

- Much of the work to “assure” Safety is focused on collecting safety statistics – deaths, time lost to injuries, damage to equipment, near misses ... *which is all too late!*

If you saw a manufacturing line producing car engines, with Quality being “assured” by collecting data on number of components missing, number of units that didn’t work, number of damaged units, ... you’d start to wonder why Shewhart put in all that effort 90 years ago!

- The preventative effort to assure a safe workplace needs to go on **upstream, by creating and sustaining a strong *Safety Culture*.**
- So we need to capture perception data on an ongoing basis to manage this.

# Desiderata for market research processes

- Statistically sound, ensuring that no attributes of the product or services that are important to the customer have been omitted from the survey.
- Obtain timely feedback
- A means of linking survey results to higher-level business drivers.
- Actionable Board and senior executive reports, including the ability to drill down.
- Find out what to fix, and in what order
- Comparable and useful benchmarking metrics.

## Desiderata for ~~market research~~ processes

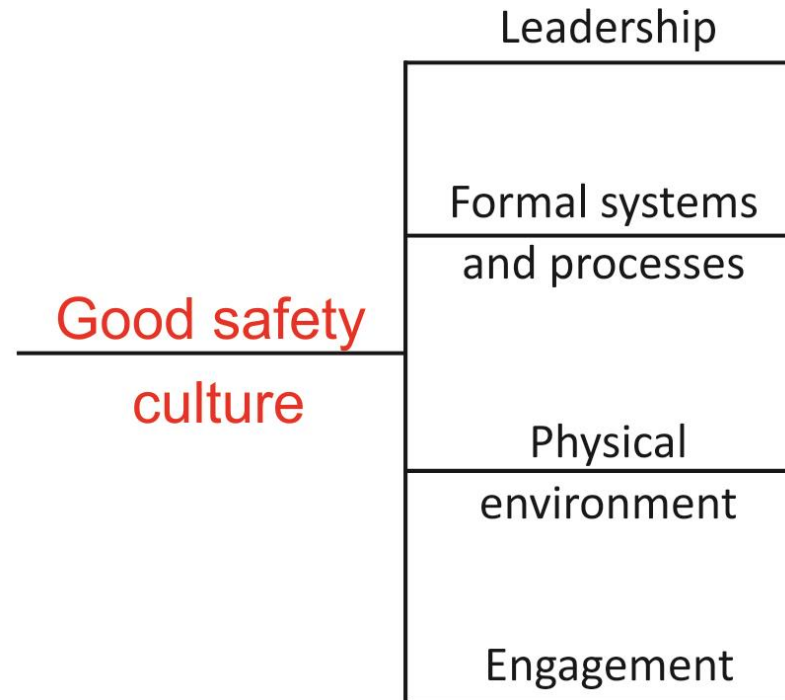
- Statistically sound, ensuring that no attributes of safety culture that are important to people have been omitted from the survey.
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- **Actionable Board and senior executive reports, including the ability to drill down.**
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# Implications for survey design

- Ask the right questions – **no essential factor omitted**
- Find a way of benchmarking the results
- Survey sufficiently often that you get timely data
- Ensure that the resulting data are actionable
- Make the survey user-friendly – not too long or complex – to get a reasonable response rate and accurate responses
- Relate overall survey metric to higher-level business drivers
  - Willingness to recommend this as a safe place to work ...
  - ...

# How does the generic process apply here?

- The starting point is to identify the main drivers of Good Safety Culture and build a tree-structured model:





# Now elaborate each of these Drivers, e.g.

## Leadership

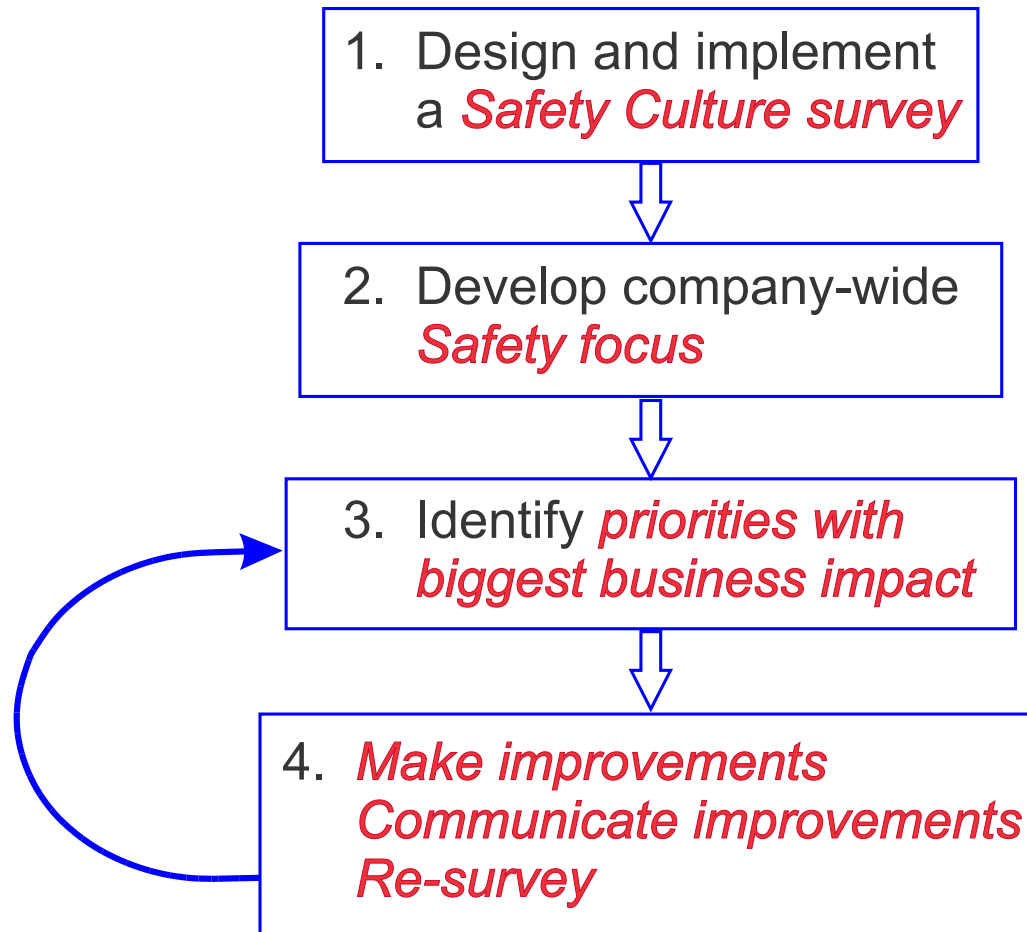
Senior leadership	Supporting safety improvement initiatives
	Leading by example
	Taking accountability for decisions made
Intermediate leadership	Decision-making style
	Clear, effective communication of safety messages
	Celebrating success with safety performance & initiatives
Immediate supervisor	Supporting safety improvement initiatives
	Leading by example
	Taking accountability for decisions made
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# Now elaborate each of these Drivers, e.g.

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	Decision-making style
	Clear, effective communication of safety messages
	Celebrating success with safety performance & initiatives

# ... and deploy a basic improvement cycle



# Comparison with current practice

- There is a vast array of methods to conduct perception surveys relating to Culture, Safety culture, Risk culture, ... *and many stem from a single source.*
- **These methods** dominate the market, and are in widespread use for benchmarking purposes.
- And most of them are fundamentally flawed, because their progenitor, the **Safety Awareness Questionnaire (SAQ)**, was designed with fundamental flaws ...

# The origins of SAQ

- Early 1980's, a laboratory at University of Texas investigated safety-related attitudes in commercial aviation pilots using the Cockpit Management Attitudes Questionnaire (CMAQ: Helmreich, 1984).
- A survey based on an initial list of 120 items **assembled by experts** was conducted (5-point Likert scale), and Factor Analysis used to shrink this list to around 60.
- Safety culture survey instrument derived, with 6 factors\*:

*Teamwork Climate*

*Perceptions of Management*

*Working Conditions*

*Safety Climate*

*Job Satisfaction*

*Stress Recognition*

\* Sexton, John B, Robert L Helmreich, Torsten B Neilands, Kathy Rowan, Keryn Vella, James Boyden, Peter R Roberts & Eric J Thomas (2006), "The Safety Attitudes Questionnaire: psychometric properties, benchmarking data, and emerging research". BMC Health Services Research, 8 April 2006, 6 –44.

# Current usage of SAQ

- In wide-spread use world-wide, particularly in health services sector, but also financial, risk, ... .
- Overall averages for the six factors (*Teamwork Climate, Safety Climate, Perceptions of Management, Job Satisfaction, Working Conditions, and Stress Recognition*) **provide basis for benchmarking**.
- Sexton *et al.* – **Reliability assessment:**
  - Composite scale reliability for the SAQ was assessed via Raykov's  $\rho$  coefficient. The  $r$  value for the SAQ in this sample was .90, indicating strong reliability of the SAQ .
  - Also, the same survey was run in a few more places and yielded similar results, thereby “validating” the survey instrument!!!

# Current usage of SAQ

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sector, b
  - Overall a  
*Perceptions of Management, Job Satisfaction, Working Conditions, and Stress Recognition*) provide basis for benchmarking.
  - Sexton e  
    - Comp  
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- Health services  
e, *Safety Climate,*  
To find out, let's revisit our desiderata for a good safety culture survey ...  
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## Desiderata for ~~market research~~ processes

- Statistically sound, ensuring that no attributes of safety culture that are important to people have been omitted from the survey.
- Obtain timely feedback
- A means of linking survey results to higher-level business drivers.
- **Actionable Board and senior executive reports, including the ability to drill down.**
- Find out what to fix, and in what order
- Comparable and useful benchmarking metrics.



# Evaluation of SAQ against desiderata

- NO!** Statistically sound, ensuring that no attributes of safety culture that are important to people have been omitted from the survey.
- NO!** Obtain timely feedback
- NO!** A means of linking survey results to higher-level business drivers.
- NO!** Actionable Board and senior executive reports, including the ability to drill down.
- NO!** Find out what to fix, and in what order
- NO!** Comparable and useful benchmarking metrics.

# Experience with SAQ: a case study

Client: an area health service agency with SAQ history:

- We requested permission to add some questions

Permission was granted, subject to

(a) usual SAQ analysis being reproduced in usual report format  
**to make benchmarking possible against previous results;**

and

(b) no extra cost to client

# Experience with SAQ: a case study

Client: an area health service client with SAQ history:

- We requested permission to add some questions
- We ran focus groups asking people what was important to them about Safety Culture
  - Identified a number of other items of prospective importance
- Re-designed survey into a tree structure, with overall **Good Safety Culture** as focus for survey
  - Replaced 5-point Likert scale with 10-point performance rating scale rather than the Likert agreement scale
  - Re-positioned items such as *Willingness to recommend as a safe place to work* as Business impact questions (i.e. outcomes)

# Aside: What's wrong with the Likert scale?

- In perception surveys, it is desirable that respondents rate the performance of the enterprise.
- With the Likert scale, requests are presented in such a way that respondents rate their agreement or disagreement with a particular statement that may or may not reflect their views about company performance.

*Please rate your agreement with the following statements, from Strongly disagree to Strongly agree:*

	Strongly disagree				Strongly agree
<i>Safety managers have authority and status in this organisation</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>...</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

# Aside: What's wrong with the Likert scale?

- In perception surveys, it is desirable that respondents rate the performance of safety managers in a way that is useful.

- With the Likert scale, respondents rate safety managers in a way that is useless. The Safety managers may well have "authority and status in this organisation" but how well is it exercised? Or are they just highly-paid people who give orders?

Please rate your agreement with the following statements, from Strongly disagree to Strongly agree:

Safety managers have authority and status in this organisation

...

Strongly disagree

Strongly agree

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

# Results from case study

## Outcomes of this approach:

1. Many of the existing items [attributes] were of little importance in terms of influencing people's overall perception of *Good Safety Culture*. **There was little or no evidence of change from the previous SAQ study.**
2. The additional items identified in the focus groups carried significant weight in terms of influencing *Good Safety Culture* ... **and were rated poorly!**
3. **Without** the additional items, we get a poor model fit:

# Results of basic SAQ survey

<b>Factor</b>	<b>W (%)</b>	<b>Rating</b>
Teamwork climate	0	7.2
Safety climate	18	7.4
Job satisfaction	5	7.5
Stress recognition	4	6.2
Perception of management	17	6.2
Working conditions	21	6.9
<b>Good Safety Culture</b>	<b><math>R^2 = 66\%</math></b>	<b>6.7</b>

# Results from case study

## Outcomes of this approach:

1. Many of the existing items [attributes] were of little importance in terms of influencing people's overall perception of *Good Safety Culture*. There was little or no evidence of change from the previous SAQ study.
2. The additional items identified in the focus groups carried significant weight in terms of influencing *Good Safety Culture* ... and were rated poorly!
3. Without the additional items, we get a poor model fit.
4. Including the extra Attributes identified through the Focus Group work provided greater explanatory power for each of these factors:



# Change with the extra Attributes

<b>Factor</b>	Variation explained by all Attributes	Variation explained by Focus Group Attributes
Teamwork climate	<b>76%</b>	<b>42%</b>
Safety climate	<b>84%</b>	<b>69%</b>
Job satisfaction	<b>56%</b>	<b>36%</b>
Stress recognition	<b>71%</b>	<b>66%</b>
Perception of management	<b>78%</b>	<b>14%</b>
Working conditions	<b>67%</b>	<b>33%</b>

# Comment on SAQ

- This suggests a fundamental flaw in the process of developing an SAQ-type instrument ... *a reliance on experts to decide what's important to people rather than checking with the target populations to see what they actually think\**.
- And this instrument and its myriad derivatives are in current and very widespread use, for many different purposes, all around the world, not least because of its perceived “value” for benchmarking purposes!

\* Recall W Edwards Deming's comment: “Why ask the customer what he wants? What would he know?”

# Case study – *Coda*

The client demanded that

- a report simply updating previous SAQ reports be provided, *with all mention of the additional work suppressed*
- a separate confidential report describing the additional findings be supplied to just one person [and then, apparently, shelved]

# Comparison with current practice

- There is a vast array of methods to conduct perception surveys relating to Culture, Safety culture, Risk culture, ... and many stem from a single source.
- These methods dominate the market, and are in widespread use for benchmarking purposes.
- And most of them are all fundamentally flawed, because their progenitor was designed with fundamental flaws.
- There are other non-SAQ-based approaches in fairly widespread use, so it is of interest to present a summary evaluation against our criteria for good practice.

## Criterion

Approach	Criterion						
	Timely actionable data	Identifies improvement priorities	Links to business drivers & outcomes	Statistically valid: nothing important omitted	Not burdensome	Benchmarking	Supports Due Diligence
<i>DOGS</i>	✗	✗	✗	✗	✗	✓	✗
<i>OCAI</i>	?	?	✗	✗	?	✓	✗
<i>OCI</i>	?	✓	✗	✗	?	✓	✗
<i>OCP</i>	?	?	✗	✗	?	✓	✗
<i>SAQ</i>	✗	✗	✗	✗	?	✓	✗
<i>DuPont</i>	✗	✗	✗	?	?	✓	✗
<i>SCI</i>	✓	✗	✗	?	?	✓	✗
<i>SCT</i>	✓	✗	✗	✗	?	✓	✗
<b>SCIP</b>	✓	✓	✓	✓	✓	✓	✓

# Revisiting the Overview Sub-text

## Beware of

1. Background
  - Likert scales
2. Measuring relationships
  - Factor analysis
3. Managing Safety Culture
  - Playing in other people's back yards

## Closing remarks – 1 (“Playing in other people’s back yards” – J W Tukey)

- This research was not well-received by the academic discipline that “owns” issues relating to Culture.
- From my perspective (as a statistical scientist), when it comes to **measuring relationships**, two different sets of capabilities are needed:
  - a. **skills, knowledge and knowhow relating to the relevant Social Science discipline**; and
  - b. **statistical skills plus statistical thinking**
- And in my experience (as a statistical scientist), the latter component of item (b) **is generally not possessed** by people with psychometrics or other social science backgrounds, in particular as it relates to **process thinking**, which is essential to continuous improvement.

# Closing remarks – 2

- The issue of “Measuring (and managing) relationships” crops up in a wide variety of settings.
- We have mentioned just two –
  - relationships between an enterprise and its stakeholders (*e.g.* Fisher 2013)
  - workplace culture and safety culture (*e.g.* Fisher *et al.* 2021)– however there are many others, *e.g.*
  - constructing a World University Rating System (*e.g.* Fisher 2022)
  - Strategic planning (*e.g.* Fisher 2018)
  - measuring Trust (a bewildering variety of contexts)
  - ...
- Feel free to join in! – but if you have a lot of problems with journal editors, don’t take it personally! They fear the unknown (fearless statisticians introducing the rigour of statistical thinking into their discipline).



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