Sustainability Without Compromise
Revealing & Solving Lean Contradictions

Darrell Mann
98% of ‘innovation’ attempts fail
Innovation Performance

Apple

Y = 0.0112x + 0.0852  R = 0.0073

“crackpot rigour”
Some of our clients from the last 17 yrs:
Greater Operational Excellence = Worse Change Capability

Someone Already Solved Your Problem. They’re Outside Your Silo.
Where Change Failures Happen – Service Sector

- Wrong Problem
- Wrong Coordination
- Wrong Logistics
- Wrong Channel
- Wrong Solution
Innovation... Most Difficult Game In The World?

Customer Need

More Ideal Solution

Ability of an Organisation to successfully exploit the solution
What is a WOW solution?

When was the last time something made you go ‘wow!’?
Why Do Some Things Succeed and others fail?
The Dynamics of ‘Wow’

1) We notice things that are different

2) We work out what jobs they do

3) We assess whether they are better

Value = \frac{\text{perceived benefits}}{\text{perceived costs & harms}}
Every concrete object has abstract value, is timeless in the dream parallel.

--- Hilda Doolittle ---
The Direction Of Success Is Clear…

Perfect

Today

Achieve the BENEFITS with zero cost or harm
The Direction Of Success Is Clear…

Today

Astroturf

Lawnmower

Grass-seed

Perfect

‘grass cuts itself’
(or ‘stops growing’)

Achieve the BENEFITS
with zero cost or harm

…so are the winners
Sustainability…

$$\text{IDEALITY} = \text{PERCEIVED} \left\{ \frac{\text{BENEFITS}}{\text{COST} + \text{HARM}} \right\}$$
Sustainability… The Good News

\[ \text{IDEALITY} = \frac{\text{PERCEIVED BENEFITS}}{\text{COST} + \text{HARM}} \]

‘Harm’ reduces over the long run.

Things become more sustainable.
Sustainability… The Bad News

IDEALITY = PERCEIVED \[\frac{\text{BENEFITS}}{\text{COST} + \text{HARM}}\]

given the choice between benefits, cost or harm, sadly, ‘harm’ usually takes third place.
Sustainability… The Solution

given the choice between benefits, cost or harm, sadly, ‘harm’ usually takes third place.

I want all the Benefits
AND
none of the Cost
AND
none of the Harm
Sustainability… *(Not) The Solution*

**WHAT ARE YOU WORKING ON?**

TRYING TO FIX THE PROBLEMS I CREATED WHEN I TRIED TO FIX THE PROBLEMS I CREATED WHEN...
Two Different ‘PERFECT’s’

Elimination of all waste
Only value-add activities remain
The perfect CAR

‘All the benefits, zero cost, zero harm’
Customer wants the function
Perfect MOBILITY
Lean & S-Curves

% total waste eliminated

TIME

Phase I

II

III

Usually less than 10% of total potential
Phase II – Lean With Consequences

...needs a fundamentally different mindset and toolkit... beyond Lean
Two And Three…

…two ways to innovate:

1) New Function / deliver Function new way
2) Solve a Contradiction

…three ways to generate:

1) FUNCTION database
2) CONTRADICTION database
3) EVOLUTION POTENTIAL database
Sustainability Focused Patents
Sustainability Focused Patents

25,000 patents with declared ‘sustainability’ goal
Sustainability Focused Patents

United States (US patents)
Italy (IT patents)
United Kingdom (GB patents)
Japan (JP patents)
Canada (CA patents)
Germany (DE patents)
China (CN patents)
Netherlands (NL patents)
France (FR patents)
Switzerland (CH patents)
Australia (AU patents)
Sweden (SE patents)
Spain (ES patents)
Others (Others patents)

3M INNOVATIVE PROPERTIES CO, ABB TECHNOLOGY AG, ARKEMA FRANCE, ASAHI GLASS CO LTD, AUSIMONT SPA, BAKER HUGHES INC, BOEING CO, CHEVRON USA INC, DOW CHEMICAL CO, DOW GLOBAL TECHNOLOGIES LLC, DSM IP ASSETS BV, DU PONT, E INK CORP, EASTMAN CHEM CO, EASTMAN KODAK CO, ECOLAB INC, ENI SPA, FORD GLOBAL TECH LLC, FUJIFILM CORP, GEN ELECTRIC, HALLIBURTON ENERGY SERV INC, HENKEL KGAA, HEWLETT PACKARD DEVELOPMENT CO, HITACHI LTD, HONEYWELL INT INC, IBM, JOHNSON MATTHEY PLC, KHASHOGGI E IND, MICROSOFT CORP, MINNESOTA MINING & MFG, OCCIDENTAL OIL SHALE INC, PIONEER HI BREED INT, PROCTER & GAMBLE, QUALCOMM INC, RICOH KK, ROHM & HAAS, ROLLS ROYCE PLC, SABIC INNOVATIVE PLASTICS IP, SCHLUMBERGER TECHNOLOGY CORP, SEIKO EPSON CORP, SHELL OIL CO, SHINETSU CHEMICAL CO, TOSHIBA KK, UNILEVER NV, UNIV CALIFORNIA, UOP LLC.
Sustainability Focused Patents – Problem Focus

Increase
- concentration (1469)
- cost (1250)
- degree (775)
- difficult (1413)
- effective (1310)
- efficiency (1989)
- efficient (1778)
- energy (986)
- expensive (904)
- flexibility (777)
- heat (701)
- level (1426)
- material (769)
- performance (1021)
- period (810)
- power (709)
- pressure (1634)
- rate (1043)
- resistance (885)
- surface area (767)
- temperature (3229)
- time (1191)
- volume (914)
- water (2067)
- yield (873)

Decrease
- agent (1054)
- amount (717)
- cost (2448)
- damage (923)
- diameter (538)
- emission (558)
- energy (950)
- environmental impact (4191)
- expensive (1010)
- heat (691)
- material (1082)
- need (1772)
- particle (669)
- power (628)
- pressure (1667)
- problem (964)
- risk (554)
- size (658)
- temperature (1118)
- time (1258)
- viscosity (602)
- volume (685)
- waste (593)
- water (1865)
- weight (567)

Change or stabilize
- agent (338)
- combustion (74)
- component (58)
- composition (90)
- condition (76)
- data (71)
- database (68)
- device (71)
- dispersion (62)
- emulsion (97)
- fluid (71)
- liquid (62)
- material (78)
- mixture (108)
- pH (299)
- position (75)
- pressure (267)
- reaction (87)
- reaction mixture (78)
- reaction temperature (95)
- reactor (70)
- solution (83)
- system (154)
- temperature (873)
- water (73)
Remove Water from glass

Without touching the glass
Knowledge from all fields

How many ways do you know to move a liquid?
Other Means of Delivering The ‘Heat Solid’ Function

Radio frequency heating

Function: Heats
State: Solid

It is a process of heating materials through the application of radio waves of high frequency—heating uses electro-magnetic fields with wavelengths of 7.4 to 44.2 metres. This technology is u

Radio frequency source

Solid to be heated

Waves

Search Function:

Heats
Solid ● Liquid ● Gas ● Field GO

Search Found 20 Results

► Air Impingement
► Combustion
► Condensation Heating
► Conduction
► Convection
► Eddy Current
► Exothermic Reactions
► Induction heating
► Infra red Heating
► Laser
► Light wave heating
► Microwave Radiation
► Peltier Effect
► Phase Changes
► Radiation
► Radio frequency heating
► Shunt Effect
► Solar Energy
► Strain Heating
► Ultrasonic Heating

www.systematic-innovation.com
Case Studies: Acid/Sour Gas

A good problem…

Diverse Inventory of Undeveloped Opportunities

- LNG: 15
- Deepwater: 8
- Tight Gas: 3
- Arctic: 5
- Acid/Sour Gas: 6
- Conventional: 1
- Heavy Oil/Oil Sands: 12
Case Studies: Acid/Sour Gas

A not so good solution…

Shell: 480m and 600 kilotons deadweight

Oct 2009: Shell awarded a contract to a consortium of France’s Technip SA and Korea’s Samsung Heavy Industries Co. to build the floating LNG ship and has an option to order nine more over the next 15 years
Case Studies: Acid/Sour Gas

Some gas-fields contain 70% CO$_2$ and H$_2$S. The whole lot is brought to the surface and the CO$_2$ and H$_2$S are then removed to give methane…

Q. Why not separate the CO$_2$ & H$_2$S at source?

…Because the problem has always been solved by chemists
How Would A Non-Chemist Solve The Problem?

1) re-formulate the problem: it’s not CO2 and CH4 its ‘separate gas with density 44 from gas with density 16’
2) Go find people who have solved this density-difference separation problem:

3) Adapt this solution to the specific problem (which in this case means installing a device within the well, separating the useful methane at source and leaving the unwanted CO2 where it is)

OUTCOME: $50M reduced to <100K capital cost
100+M tonnes of CO₂ reduction p.a.
**Question:** How do you re-design a leaking flange joint?
Leaking Flange

We wish to eliminate leaks....

...but we also want to reduce maintenance effort.

strategies used by others who already solved this problem
Inventive Principle 17 ‘Another Dimension’

A. If an object contains or moves in a straight line, consider use of dimensions or movement outside the line.

B. If an object contains or moves in a plane, consider use of dimensions or movement outside the current plane.

C. Use a multi-storey arrangement of objects instead of a single-storey arrangement.

D. Tilt or re-orient the object, lay it on its side.

E. Use 'another side' of a given area.
FLUID-TIGHT JOINT WITH INCLINED FLANGE FACE
US Patent: 5230540, Lewis et al

50% reduction in number of bolts
Time For A Jump?
Time For A Jump?

Our Age of Anxiety is, in great part, the result of trying to do today's job with yesterday's tools and yesterday's concepts.

Marshall McLuhan

Find The Contradictions; Solve Them
Innovation... Most Difficult Game In The World?

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