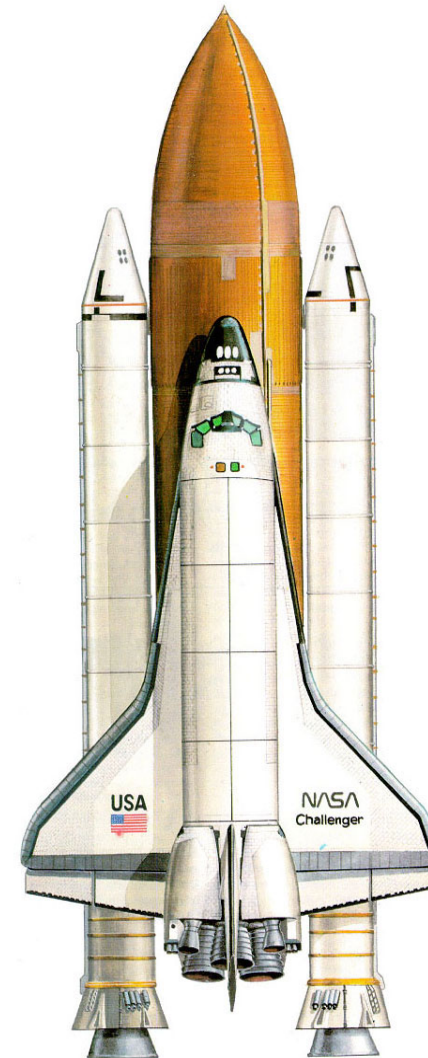
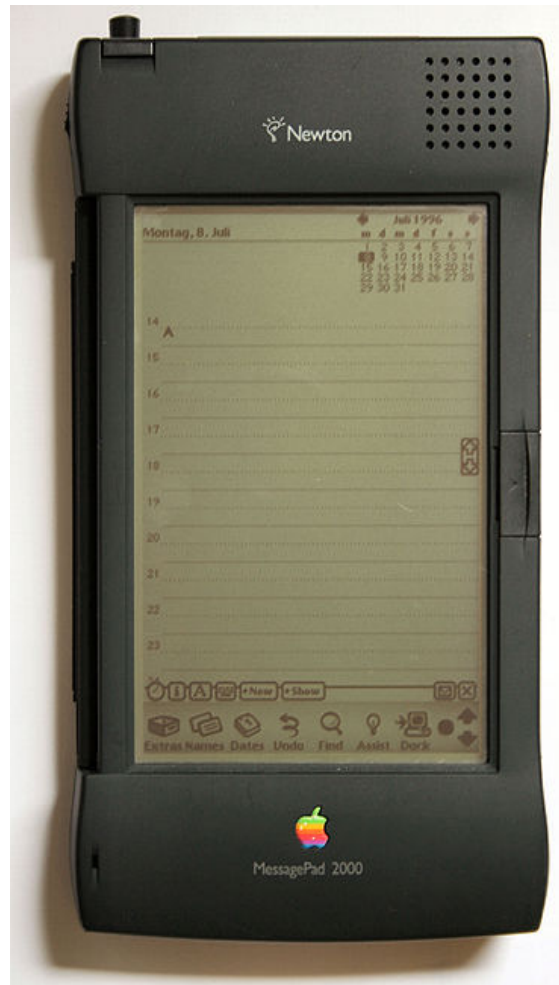




Combination of Contradictions Based approach and Logistic Curves models for Strategic Technological Forecasting

Dmitry KUCHARAVY, SeeCore Project
Strasbourg, FRANCE, dk.seecore@gmail.com

what do they have in common?



restless question...

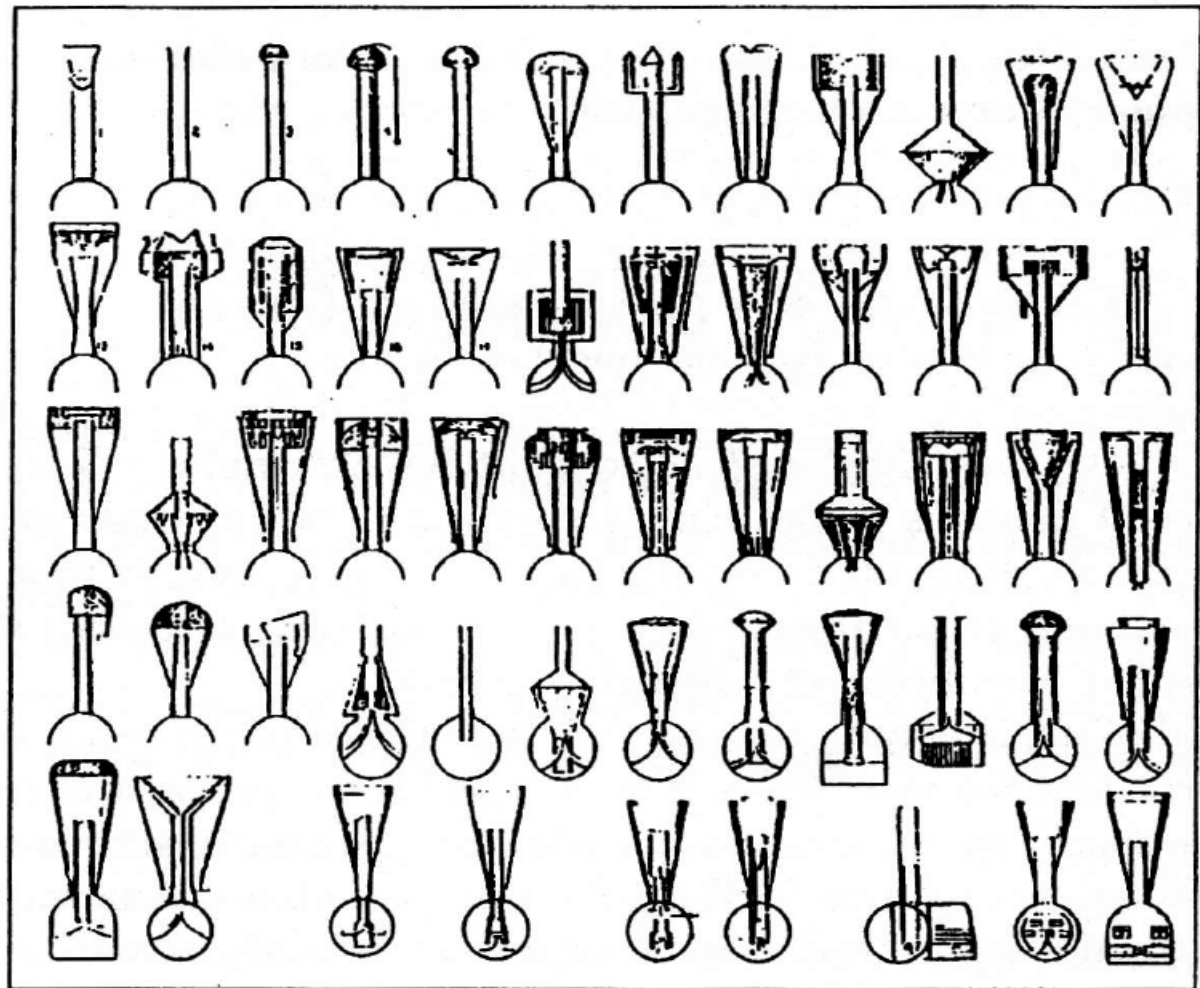
*...The righter we do the wrong thing,
the wronger we become...*

Russel Ackoff (2003)

what is a reason that so many patented *inventions* have not appeared as *innovation*?

Some examples out of a thousand patented 'smoke-spark arresters' for wood-burning steam locomotives in the USA (19th century).

Source: Basalla, G. The Evolution of Technology, p. 136. Copyright © 1988



* Source: Grubler, A. Technology and Global Change. (International Institute of Applied System Analysis, Cambridge, 2003), p.452 ISBN 0 521 54332 0.

two earthquakes

Haiti, January 2010



On 10 February the Haitian government reported the death toll to have reached 230,000*
An investigation by Radio Netherlands has questioned the official death toll, reporting an estimate of 92,000 deaths as being a more realistic figure.**

* "Haiti quake death toll rises to 230,000". BBC News. 10 February 2010.

** Melissen, Hans Jaap (23 February 2010). "Haiti quake death toll well under 100,000". Radio Netherlands Worldwide. Retrieved 28 February 2010.

Chile, February 2010

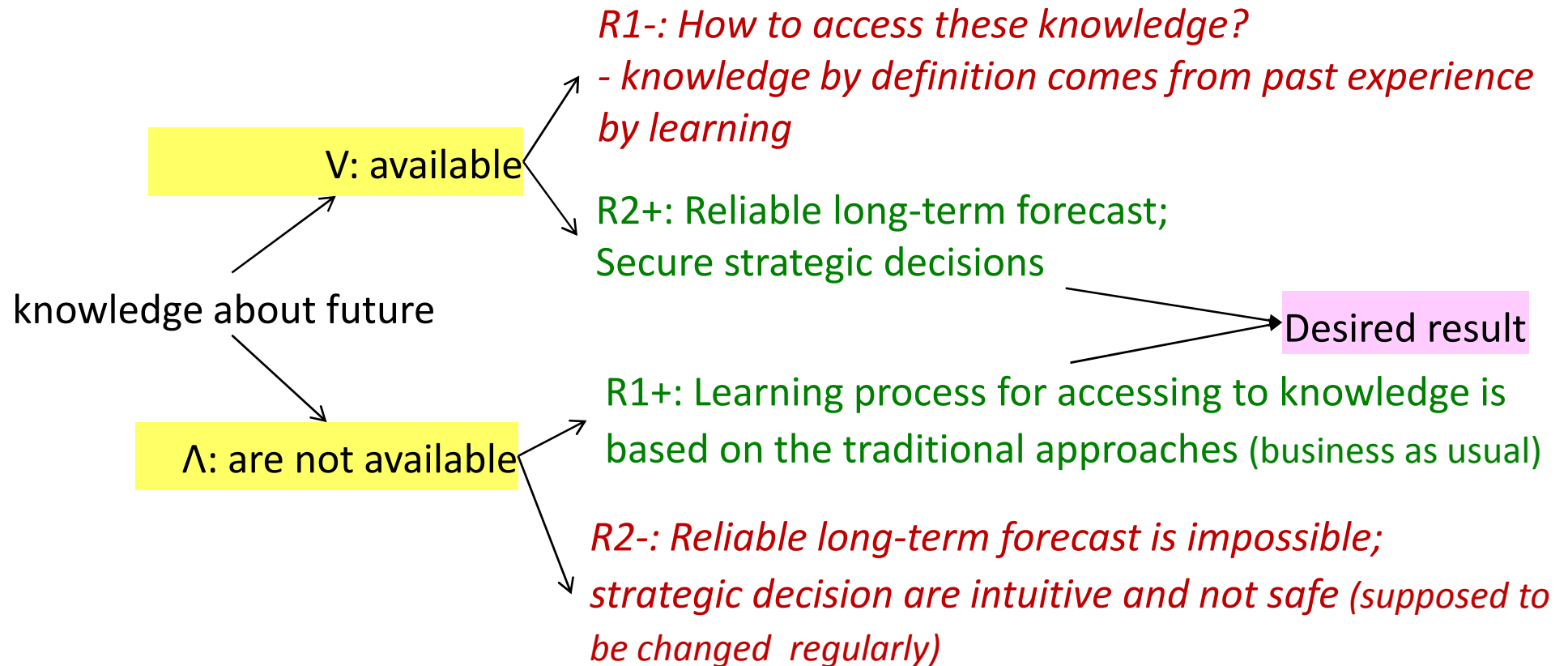
This was the strongest earthquake affecting Chile since the magnitude 9.5 1960 Valdivia earthquake (the most energetic earthquake ever measured in the world).
...as the **seventh strongest earthquake** ever measured, **five hundred times more forceful** than the 7.0 Mw earthquake in Haiti in January of 2010.



The latest death toll as of April 7, 2010 is **486 victims*****

*** Gobierno aumenta a 486 los fallecidos por terremoto y posterior tsunami http://www.latercera.com/contenido/680_240084_9.shtml

why is it difficult to forecast?



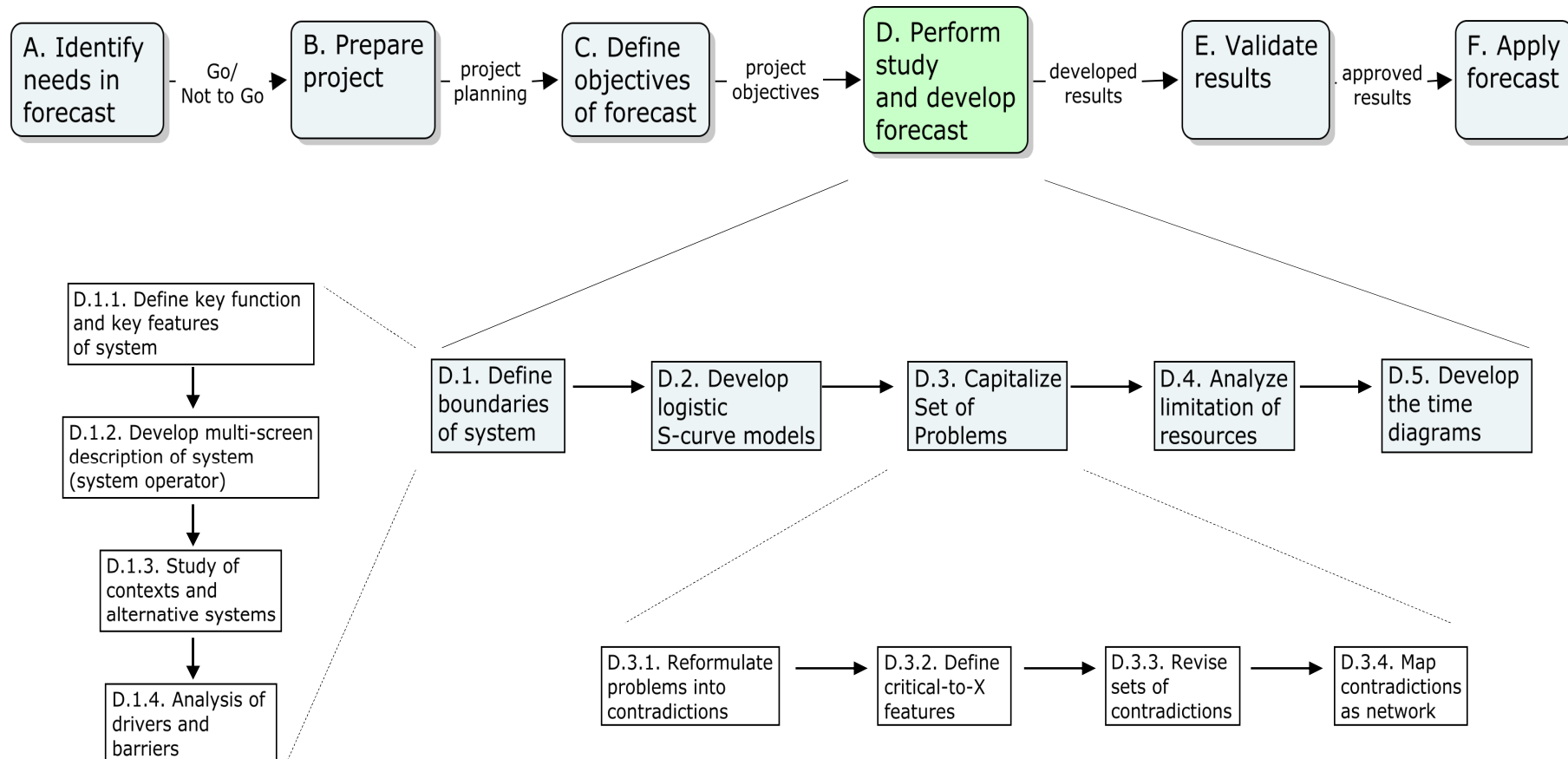
what is suggested?

***Problems are more important
than solutions.
Solutions can become obsolete when
problems remain.***

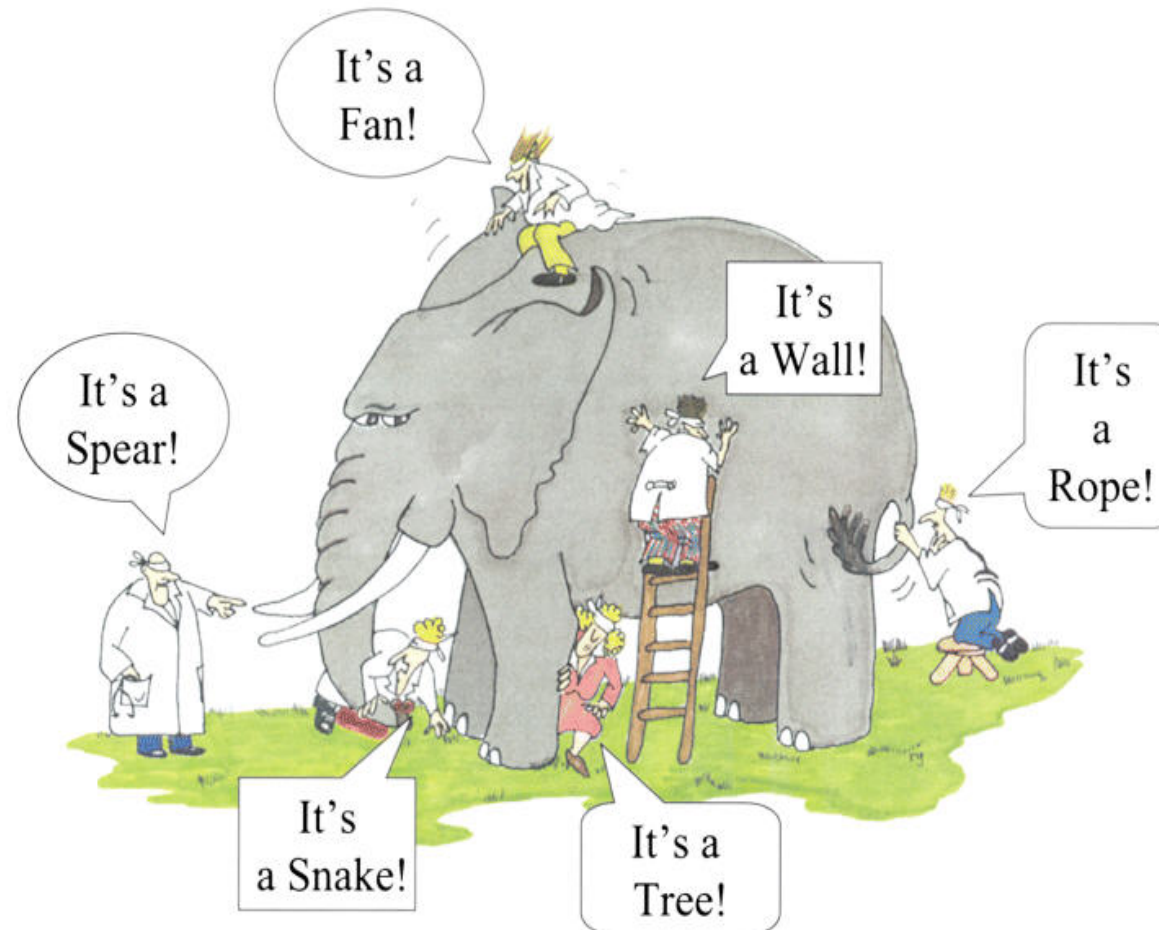
– attributed to Niels Bohr

Researching Future methodology (RFm)

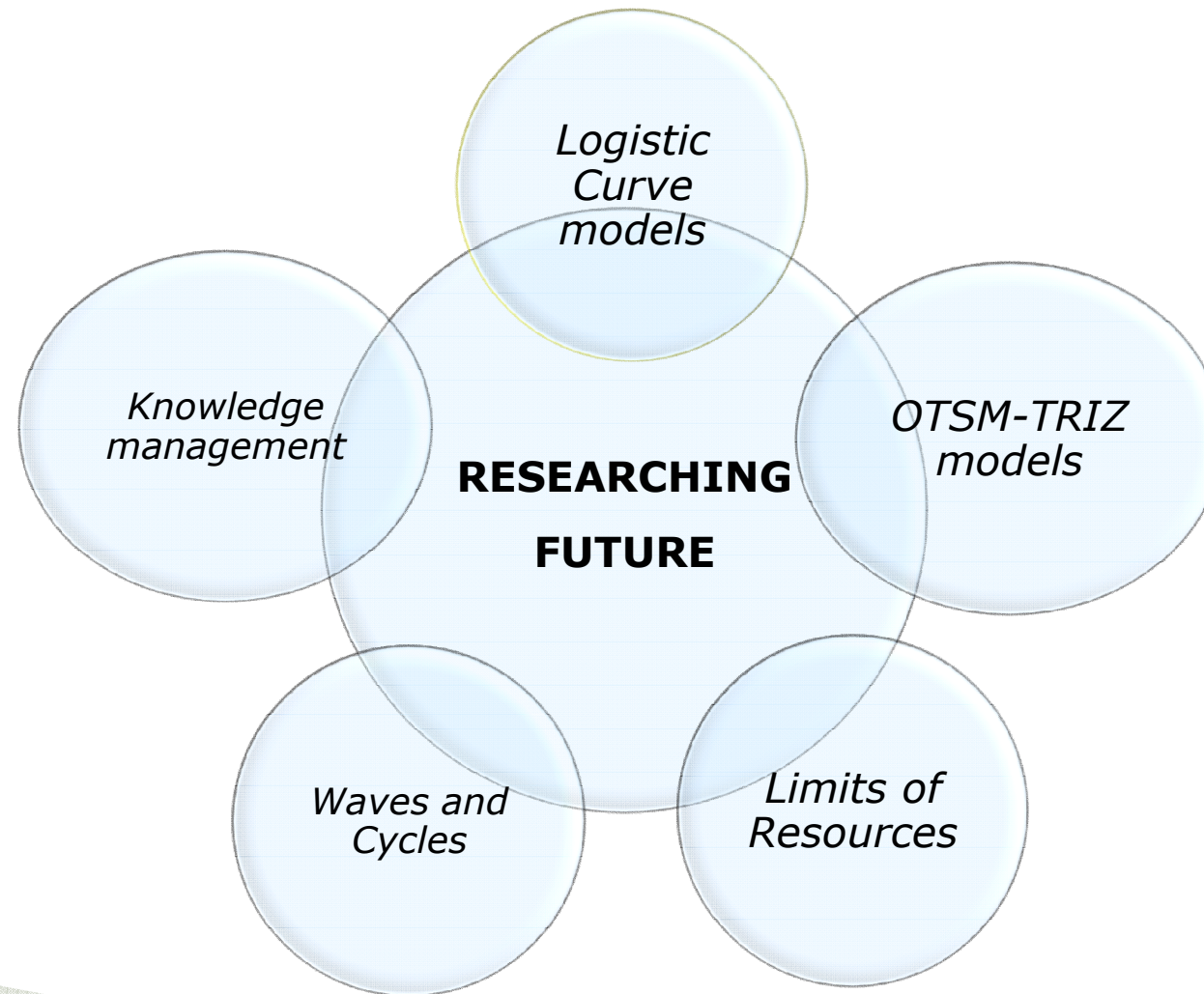
main function: <facilitate> <the collective production of knowledge> (about future)



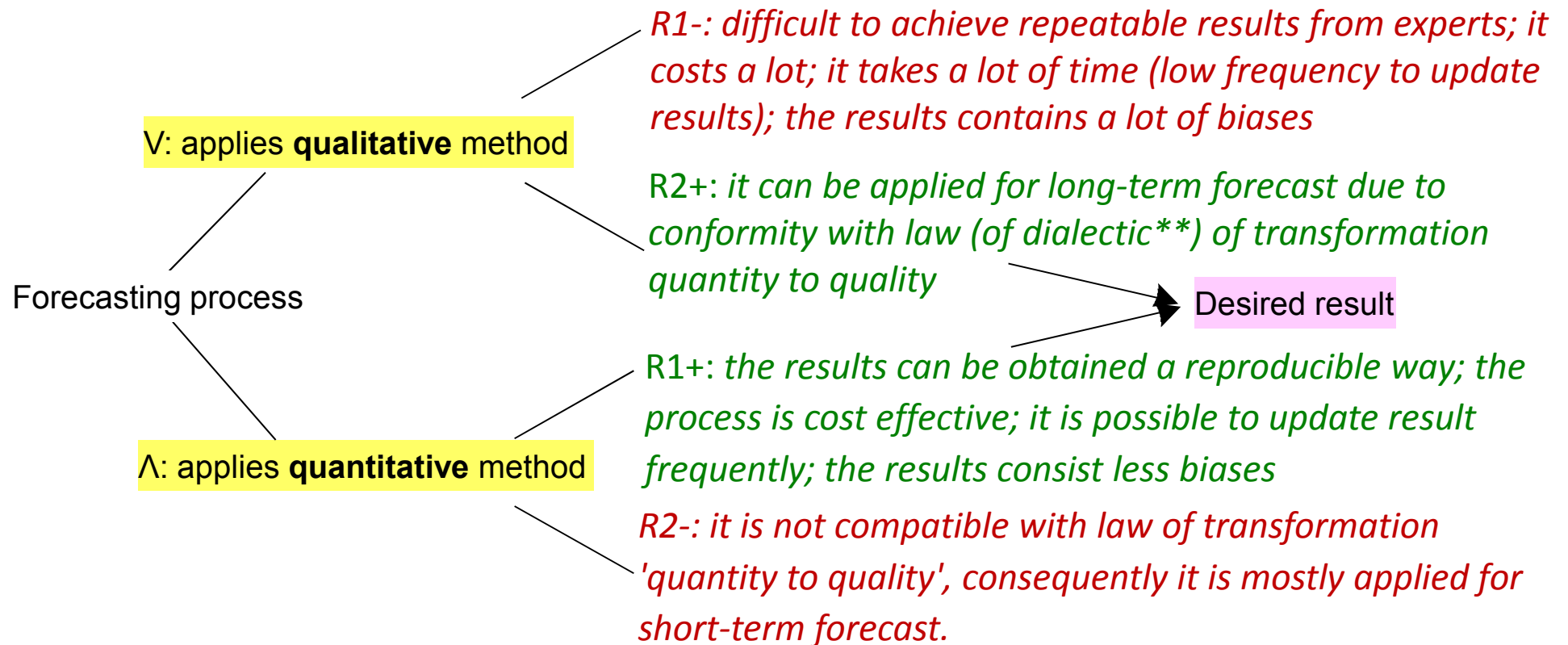
why collective production of knowledge should be facilitated?



Researching Future methodology (RFm)



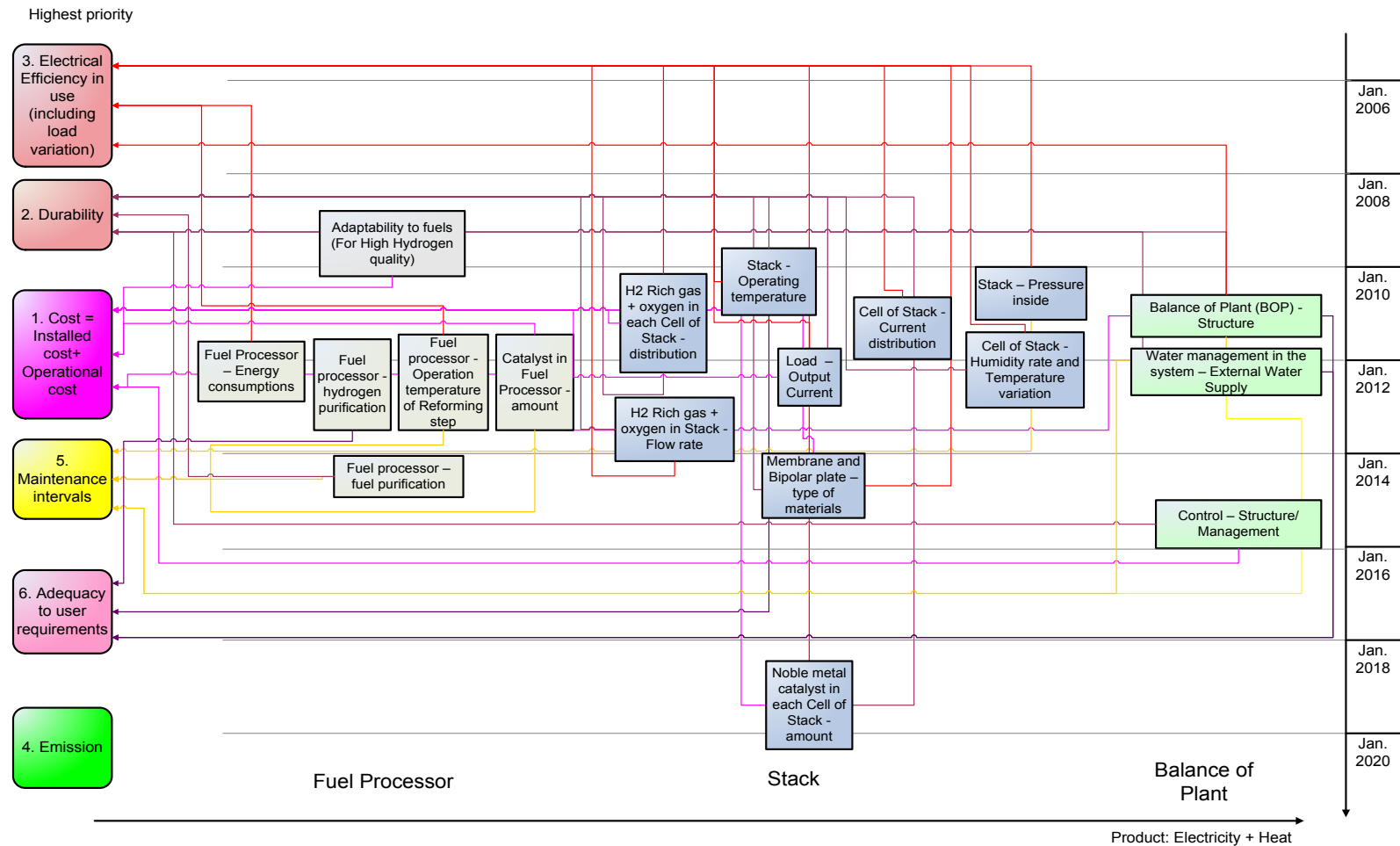
the problem of a method for exploratory LONG-TERM forecast



** The law of transformation of quantity into quality: "For our purpose, we could express this by saying that in nature, in a manner exactly fixed for each individual case, **qualitative changes can only occur by the quantitative addition** or subtraction of matter or motion (so-called energy)." [Engels' Dialectic of Nature. II. Dialectics. 1883]

network of contradiction as a roadmap

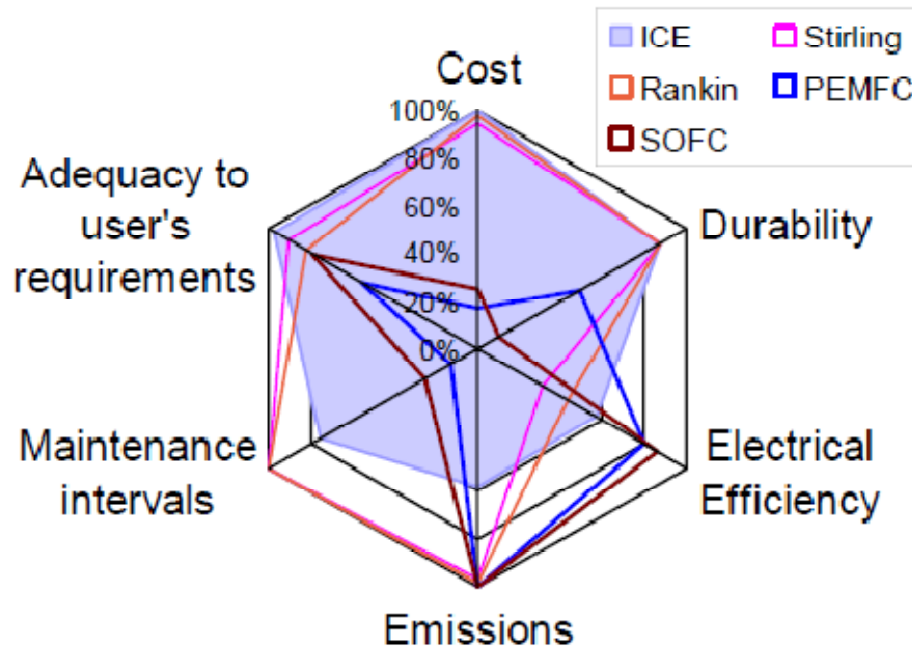
Source: Information provided courtesy of EIFER, Karlsruhe [Gautier, L. et al., 2005]



features of future

Source: Information provided courtesy of EIFER, Karlsruhe [Gautier, L. et al., 2005]

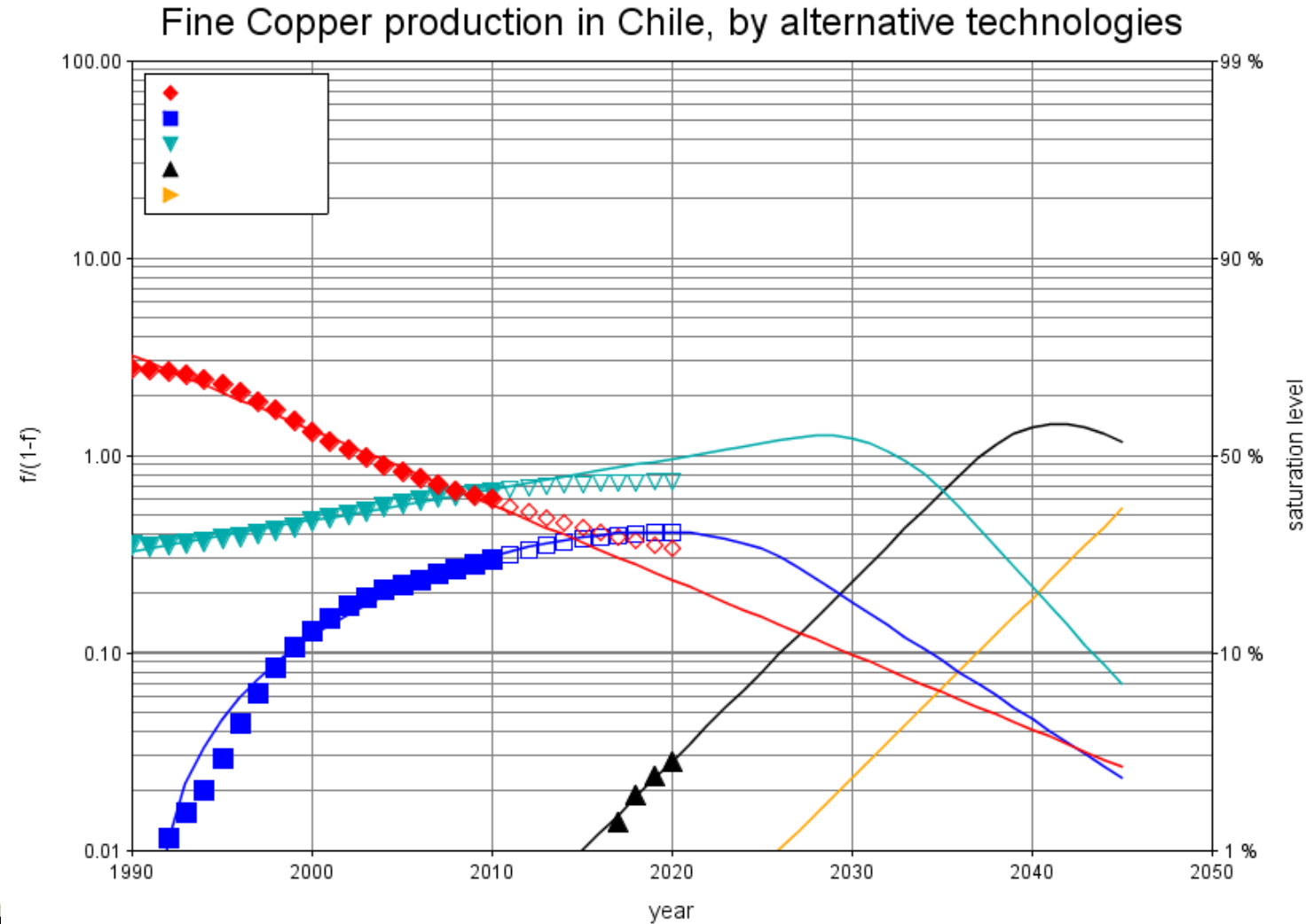
Critical-to-Market features: Stationary Fuel Cell



	PEMFC			SOFC		
	actual	market target	performance	actual	market target	performance
1. Cost:	77%	100%		25%	100%	
1.1 Installed Cost/NO, EUR/kW	15000	4000	27%	10000	4000	40%
Impedance: High						
1.2 Operational cost, EUR/kWh	0.3	0.02	7%	0.2	0.02	10%
Impedance: High						
2. Durability:	49%	100%		10%	100%	
2.1 Durability in operating conditions, years	2	1.5	13%	2	1.5	13%
Impedance: High						
2.2 Cycling ability, number of stops per year	125	125	100%	10	125	8%
Impedance: High						
2.3 Start up time, min	90	1.5	17%	240	1.5	6%
Impedance: Moderate						
3. Energy Efficiency, %	85%	100%		93%	100%	
3.1 Electrical efficiency, %	28%	35%	80%	38%	35%	85%
3.2 Thermal efficiency, %	59%	65%	91%	55%	50%	100%
3.3 Ratio Electrical power / Thermal Power	0.51	0.04		0.04	0.04	
4. Emissions:	100%	100%		100%	100%	
4.1 Substances, ppm	40		100%	CO < 5ppm	100%	
Impedance: High				NOx < 0.4 ppm	100%	
4.2 Noise, dB	0		100%	0		100%
Impedance: High						
5. Maintenance Interval, h	1000	8000	13%	2000	8000	25%
Impedance: Moderate						
6. Adequacy to user requirements:	56%	100%		79%	100%	
6.1 min. temperature return, °C	50	90	83%	500	70	100%
Impedance: High						
6.2 min. flow temperature, °C	70	80	88%	900	90	100%
Impedance: Moderate						
6.3 IRR, h	1.2x10 ³	1.7 x 10 ³		0.35 x 10 ³	0.3x10 ³	
Impedance: Moderate						
6.4 weight, kg	2.17	0.25	12%	0.48	0.25	52%
Impedance: Moderate						
Average for technology: 59% 100% 40% 100%						

logistic substitution model

Source: 2011, Forecasting the parameters of the technological dynamics of a technological core area of Chilean mining industry (BHP Billiton)



We fail more often because we solve the wrong problem than because we get the wrong solution to the right problem.

Russell Ackoff

THANK YOU!

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www.trizminsk.org



About 20 years of experience for inventive problem solving using OTSM-TRIZ methods as engineer, researcher, consultant, and instructor

1998-2001: professional TRIZ consultant & instructor at LG-Production and Research Centre (LG-PRC, Pyeongtaek, S.Korea);

2001 - 2012 : research engineer, instructor, adviser and consultant for inventive problem solving methods based on OTSM-TRIZ at LGECO, INSA Strasbourg, France.

2003 - : restart of research for method of Reliable Technological Forecasting – Researching Future

- Project_1 (2004 – 2005) Technological forecasting of Fuel Cells for small stationary applications
- Project_2 (2005-2006) Technological forecast of Distributed Generation (DG)
- 4 days course (2008) Vinci, Italy
- 3 days course (2010) Istanbul, Archelik, Turkey
- Project_3 (2011 – 2012) Forecasting the parameters of the technological dynamics of a technological core area of Chilean mining industry (BHP Billiton)
- Project_4 (2013) Express Forecast of technology substitution for beverage packaging, Italy
- Project_5 (2012-) external consultant for FOrecast and Roadmapping for MANufacturing Technologies (FORMAT) project

2013 - : freelance researcher, consultant, coach, and educator