

SEMICON 2014

Roadmaps to develop CRM substitutes

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This project is funded by
the European Union

'Tale of two strategies'*or two Roberts



"If the world's population grows faster than the planet's ability to produce food and other necessities...at a certain point it will lead to a sudden population collapse."

T Robert Malthus



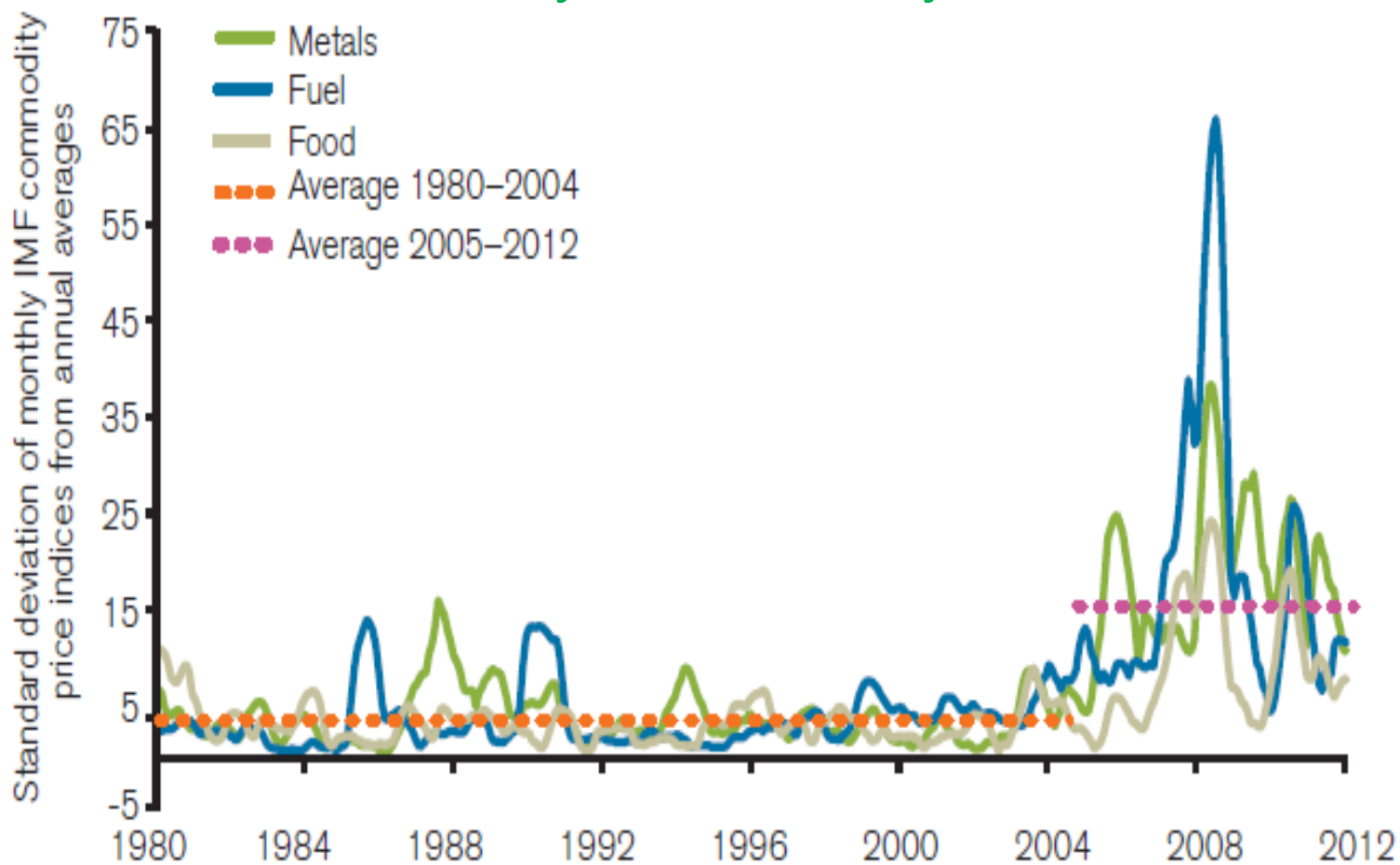
"If it is easy to substitute other factors for natural resources, then there is in principle no 'problem.'
The world can, in effect, get along without natural resources, so exhaustion is just an event, not a catastrophe."

Robert Solow

"Duelling theories breed inaction.
..... the easiest course is to wait"



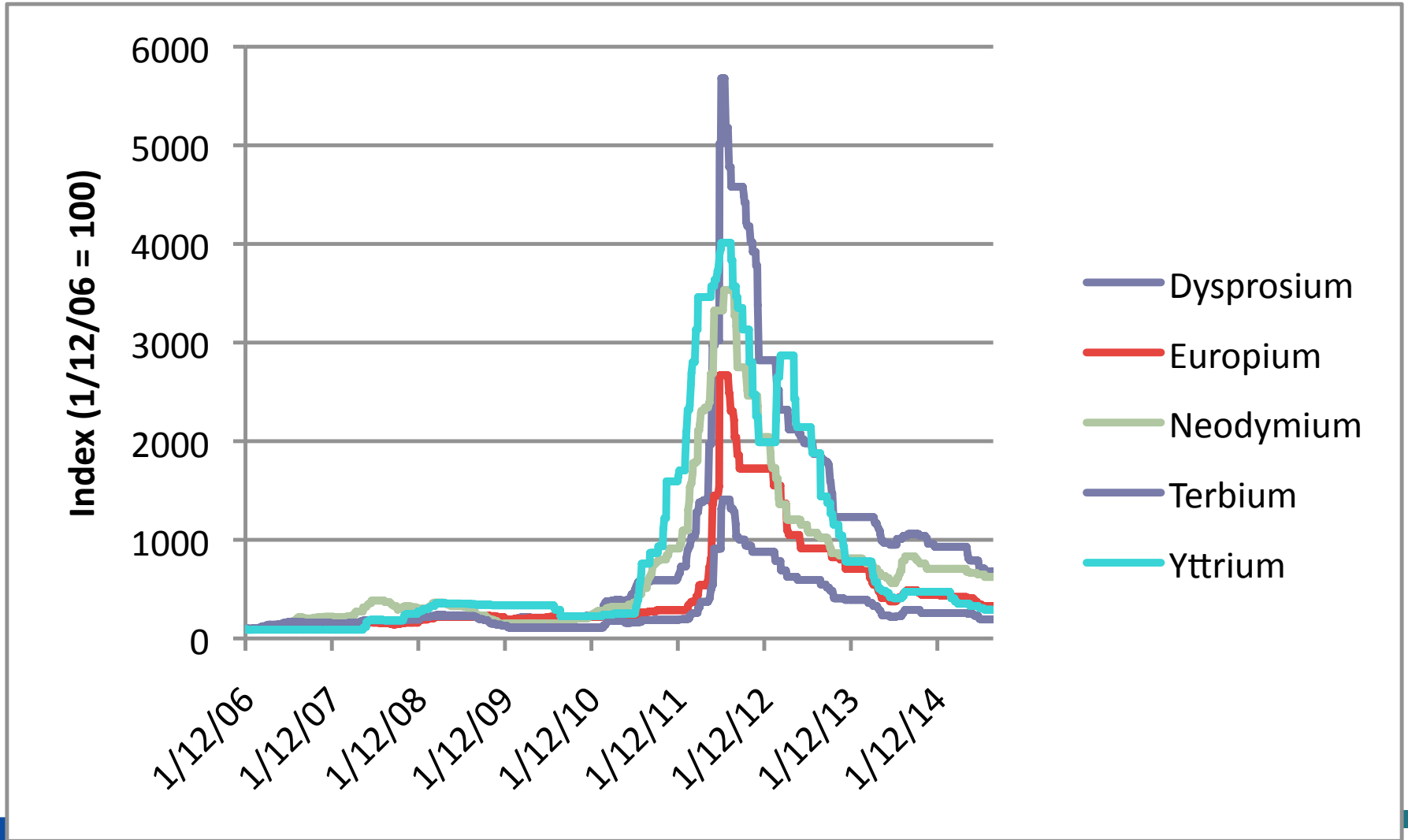
Volatility in commodity markets



Lee B, et al, Resources Futures, Chatham House (The Royal Institute of International Affairs), 2012, p59



Indexed rare-earth oxide prices, (6 January 2006 – 4 September 2014)



Source: metal-pages.com
Roderick G. Eggert

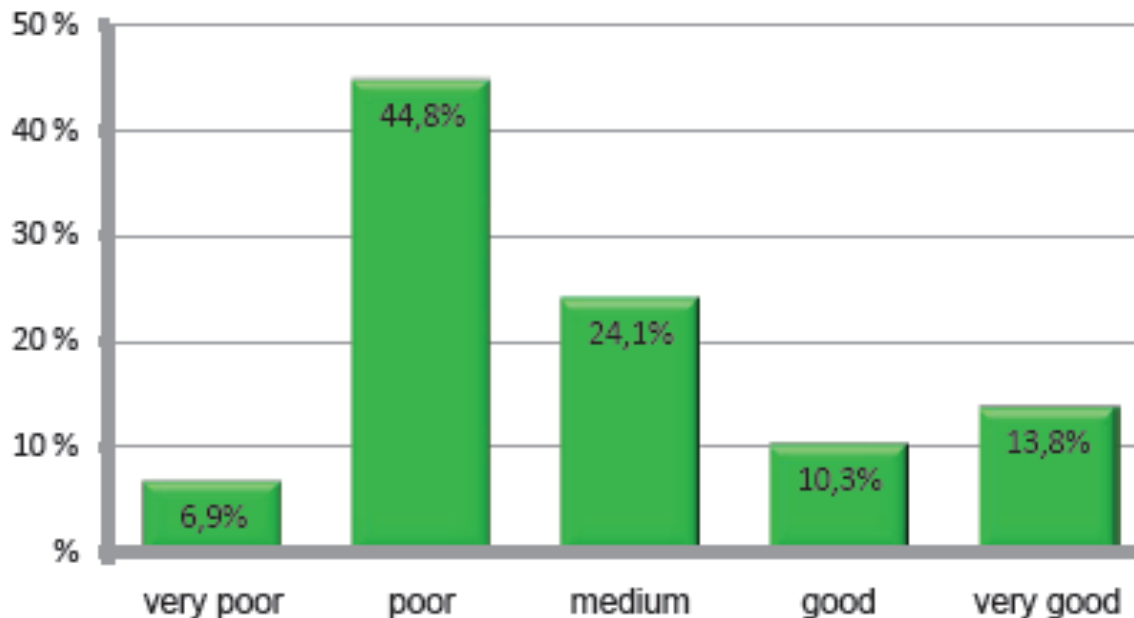
Mining – Yes, but...

- Mountain Pass (USA) and Mount Weld (Australia) will overcome their technical challenges & enjoy some degree of success
 - Important for other projects in the short term
- What of the other '400'?
 - Most are or will be 'back on the shelf' until the next boom
 - Most require demand growth, reversal of demand destruction
 - All are affected by what happens in China, Bayan Obo
 - Perhaps 5-6 will come into production by 2020

- Roderick G. Eggert Professor, Colorado School of Mines
 - Deputy Director, Critical Materials Institute
 - reggert@mines.edu

How well are developments followed?

“We all keep our eyes and ears open, but still on an ad hoc basis. Whenever there is something new happening the information is shared with everybody in the company.”

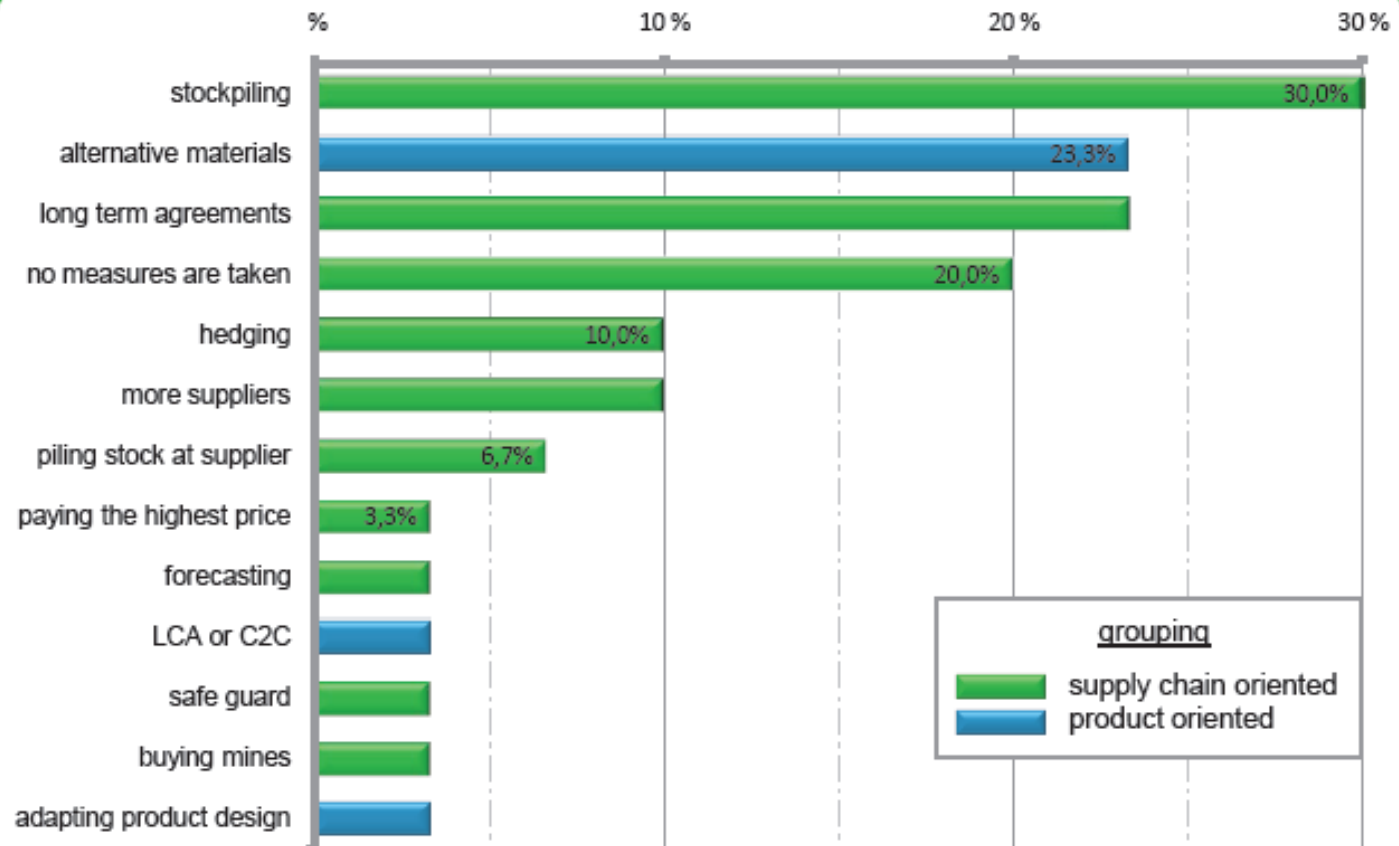


Peck &
Moerland, 2013

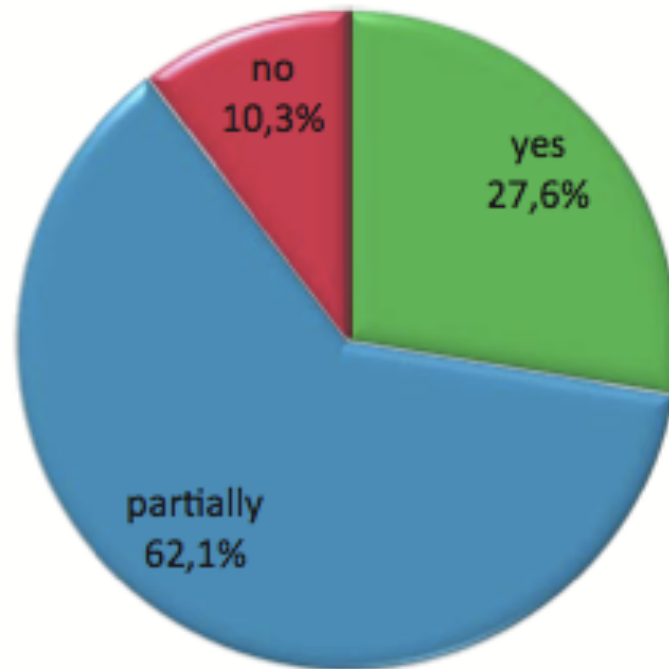


Measures taken in response to issues.

"We are pretty reactive when it comes to this. Usual reaction is building up the stock, either in house or at the supplier."

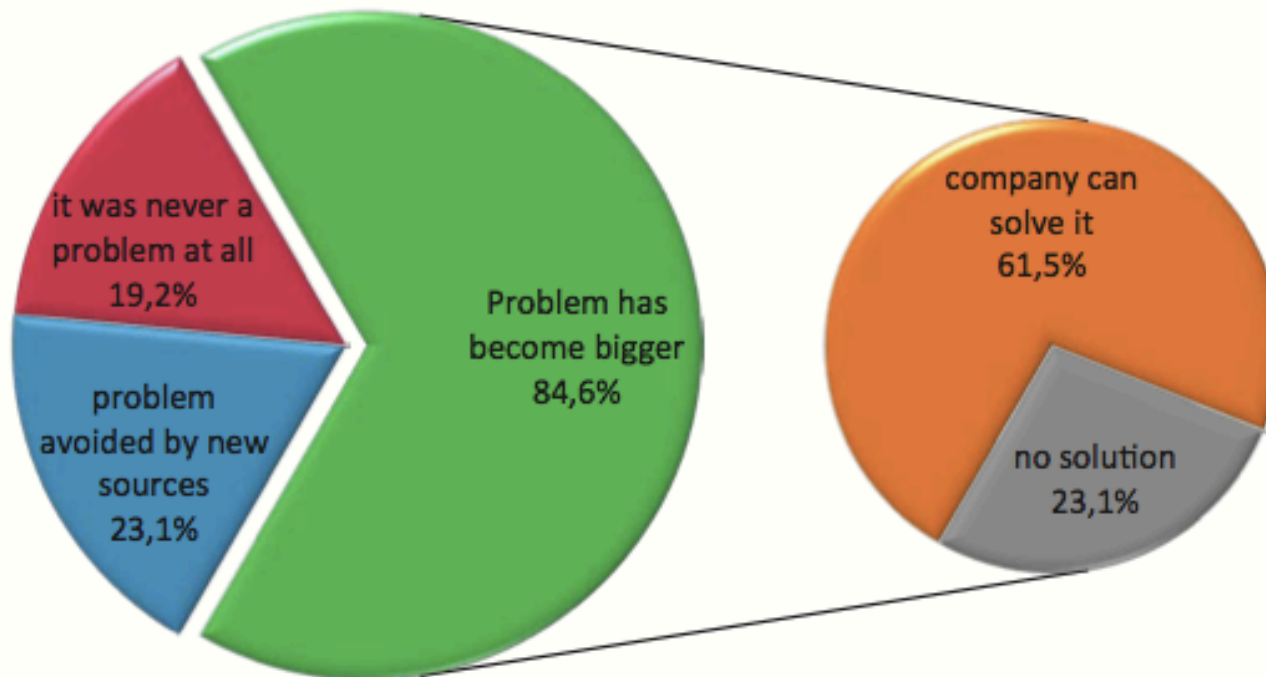


Can you name critical materials in your product range?



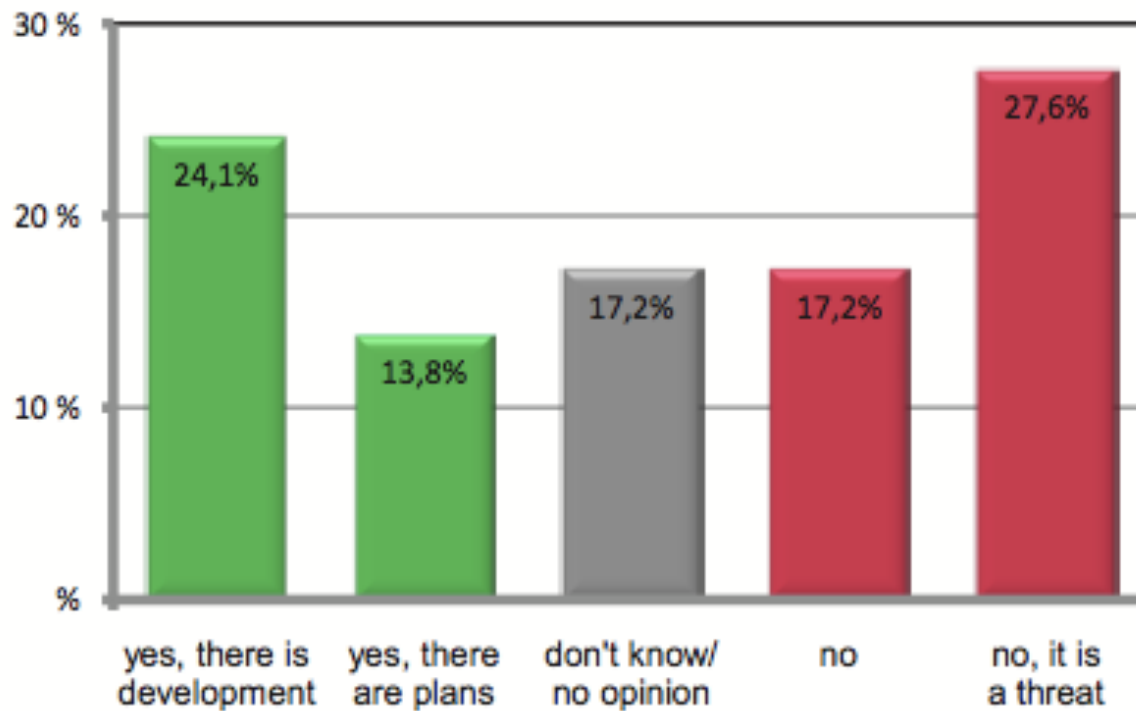
Critical material change expected – 3 to 5 years

“If there is someone who really believes the materials criticality is not an issue, than that person is not aware of what is going on in the world.”



Business potential for the company?

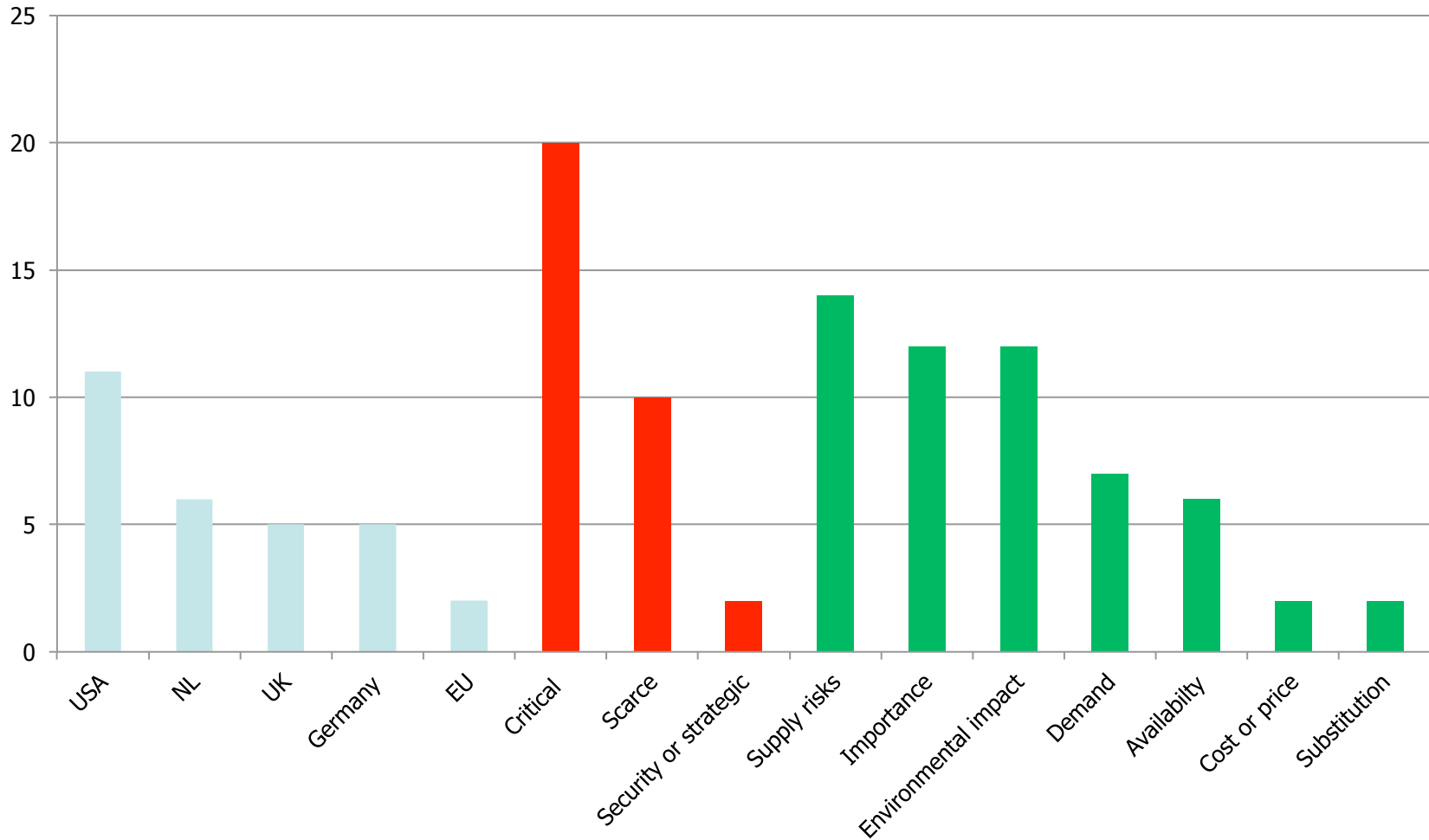
“Actually we are trying to avoid critical materials and to create our business opportunities elsewhere.”



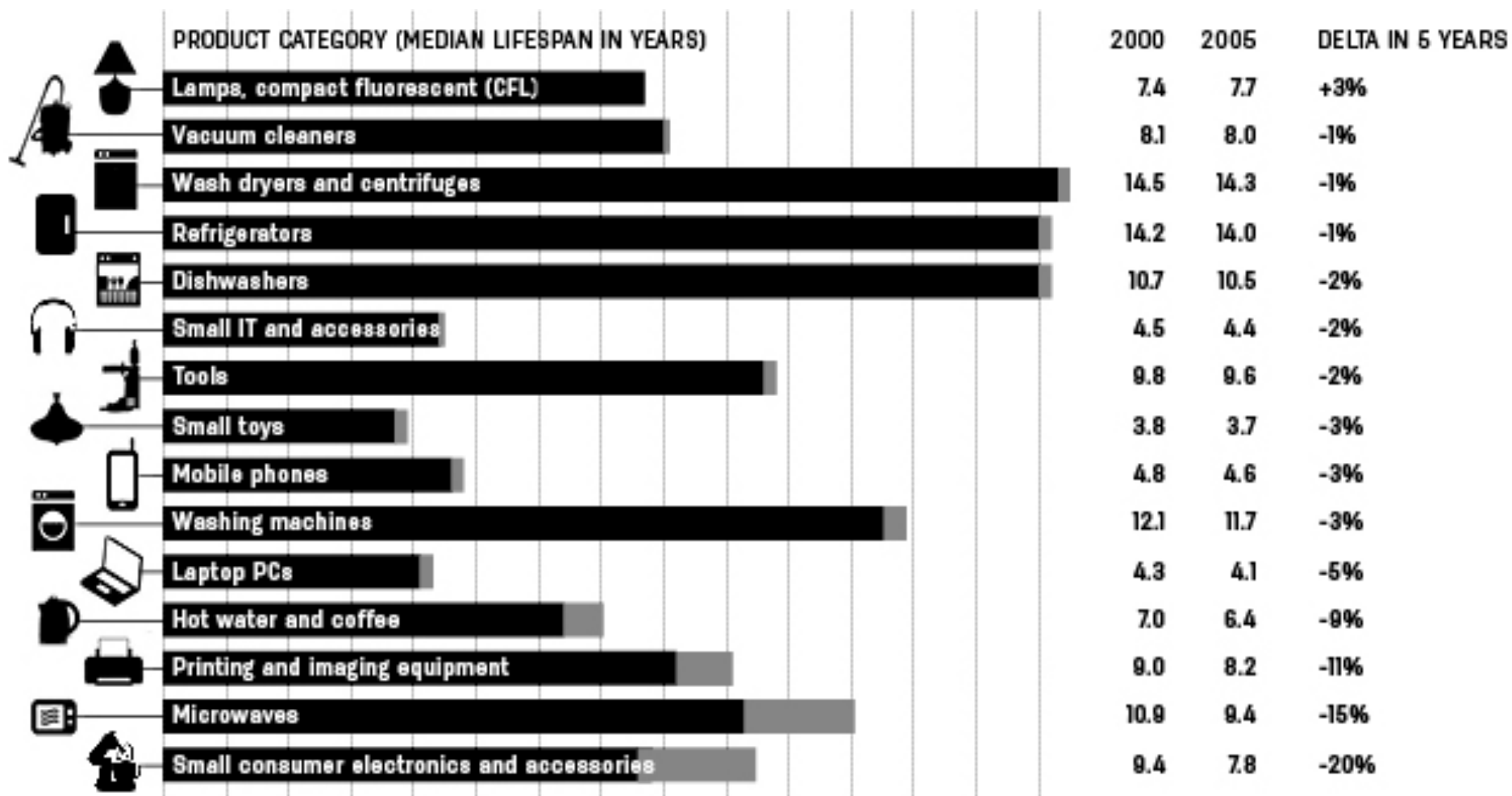
Peck &
Moerland, 2013



29 publications 2000-2013 defining Critical Materials:



Current designs can be challenging...Lifespan



Median lifespans of a selection of household products and change over time (delta), based on Dutch data (Wang et al., 2013)



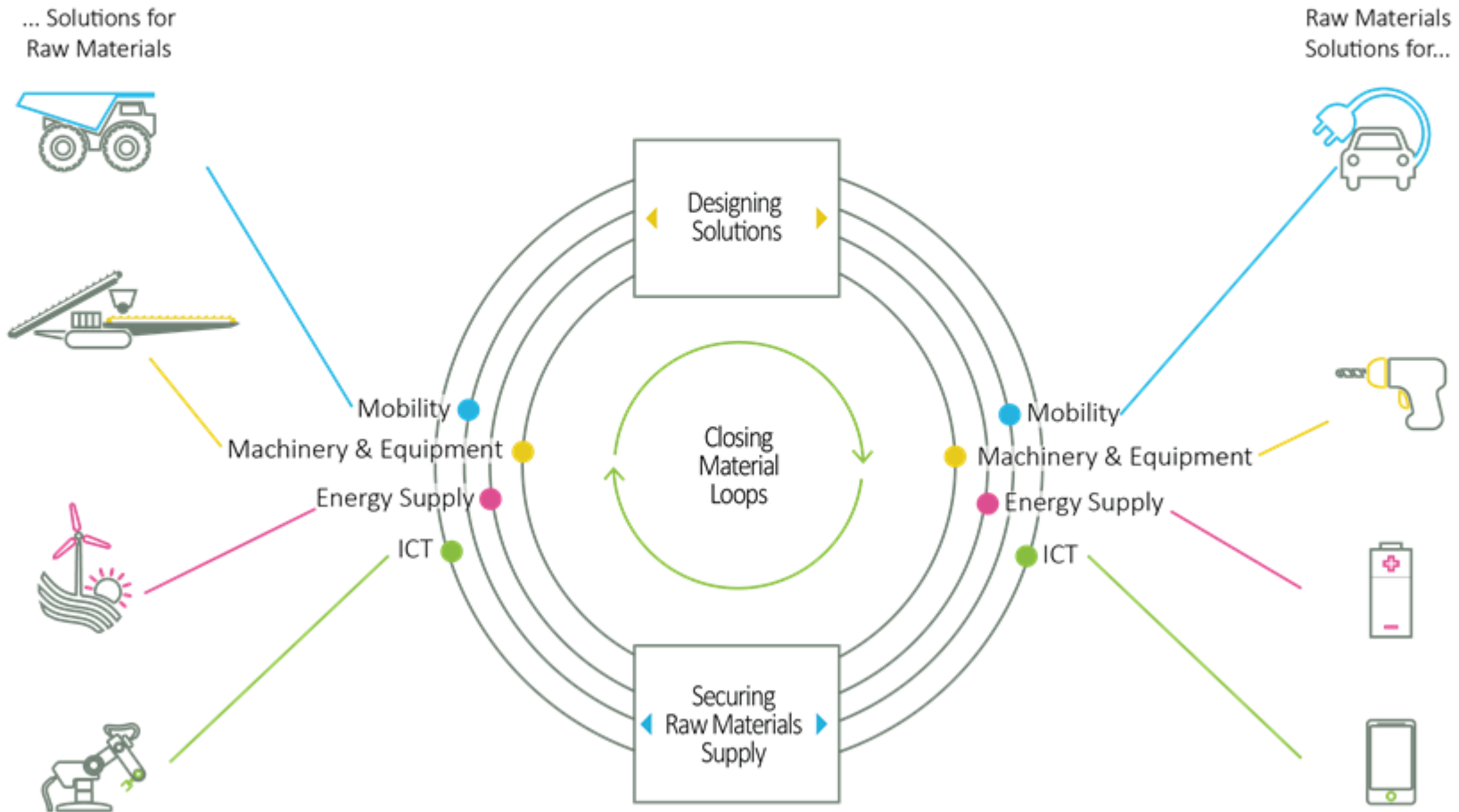
Final Design



This project is funded by the European Union

Katherine A. Whalen, Whalen & Peck 2014 IJAT  **CRM_InnoNet**
Substitution of Critical Raw Materials

Solutions lie across the whole raw materials value chain



EU EIT* call; KIC Raw materials: sustainable exploration, extraction, processing, recycling and substitution. Proposal KIC Raw MatTERS, 2014



Tale of two strategies.....

Either, or ?



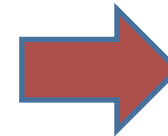
T Robert Malthus

Design products differently in response to a resource constrained world



Robert Solow

Develop exciting opportunities arising out of Sci /tech & product research



No more 'duelling'

Time is tight

Collaboration is essential

All need both approaches to find innovative solutions

