

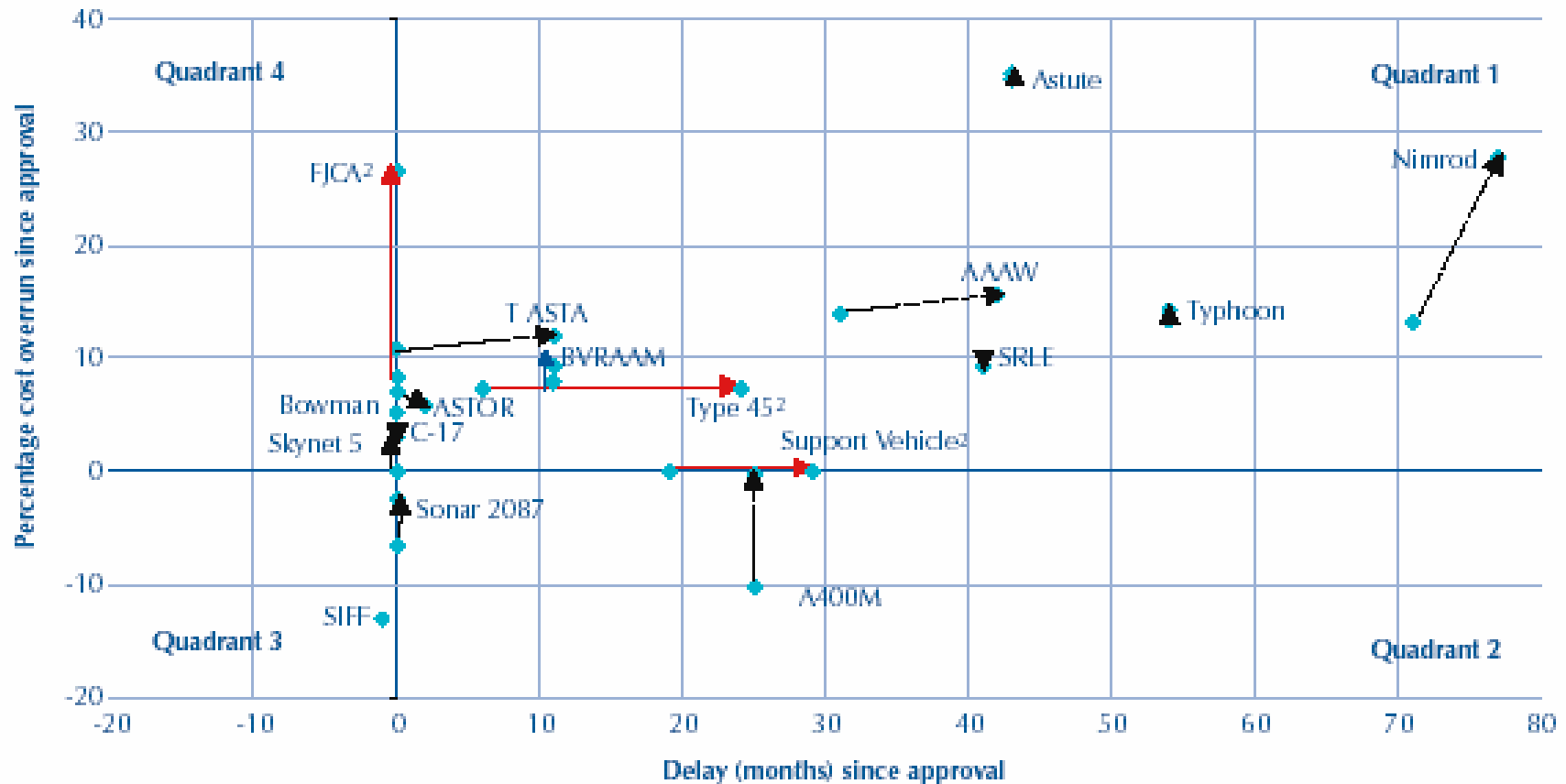


Improving Behaviours in Defence Acquisition

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The Problem



Source: MOD Major Projects Review 2004, National Audit Office. The arrows represent drift from 2003 position

Approach

- Use simple Game Theory methods to develop a theory to explain the problem.
- Test this theory using experiment.
 - Syndicates of high level experts.
- Use the theory to suggest ways of improving the situation, including players' behaviour.

Impact

- Work was carried out for and briefed directly to the Chief Scientific Adviser at 4* level.
- The Conspiracy of Optimism now generally accepted as a key part of the explanation.
- The McKane Report 'Enabling Acquisition Change' takes forward much of our work.

Initial Structured Interviews

- MoD and Industry 'players' who had participated in Acquisition at a senior level (around 1*).
- Aim was to tease out the key drivers of the process.

	MOD budgets optimistically	MOD budgets realistically
Industry bids optimistically	<p><u>MOD</u></p> <ul style="list-style-type: none"> Eases entry to EP (+) Expectation of good VFM (+) No budgetary problems post-bid (+) <p><u>Industry</u></p> <ul style="list-style-type: none"> Eases entry to EP (+) Wins bid over rivals (+) Keeps project in EP (+) 	<p><u>MOD</u></p> <ul style="list-style-type: none"> Difficult entry to EP (-) Perceived bad VFM pre-bid (-) Positive budgetary implications post-bid (+) Perception of good VFM post-bid (+) <p><u>Industry</u></p> <ul style="list-style-type: none"> Difficult entry to EP (-) Wins bid over rivals (+) Keeps project in EP (+)
Industry bids realistically	<p><u>MOD</u></p> <ul style="list-style-type: none"> Eases entry to EP (+) Budgetary problems post-bid (-) Danger to continuation of project (-) <p><u>Industry</u></p> <ul style="list-style-type: none"> Eases entry to EP (+) May lose bid to rivals (-) Danger to continuation of project (-) 	<p><u>MOD</u></p> <ul style="list-style-type: none"> Difficult entry to EP (-) Perceived bad VFM (-) No budgetary problems post-bid (+) <p><u>Industry</u></p> <ul style="list-style-type: none"> Difficult entry to EP (-) May lose bid to rivals (-) Low risk to continuation of project (+)

A Simple 2 Player Game

- MOD plays a “level of realism” $x \in [0,1]$
- Industry plays a “level of realism” $y \in [0,1]$
 - $x, y = 1$ (realistic), $x, y = 0$ (optimistic)
- Threshold of Credibility $\alpha \in [0,1]$
 - α is the smallest possible percentage of final cost that could reasonably function as a legitimate cost estimate.

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$$P_{MOD}(x, y, \alpha) = \alpha x^3 + (1 - \alpha)(1 - x^3) - \frac{1}{2} \frac{\max(y - x, 0)}{1 + 100r}$$

$$P_{IND}(x, y, \alpha) = \frac{1}{2} \left(\alpha x^3 + (1 - \alpha)(1 - x^3) \right) + \alpha y^3 + (1 - \alpha)(1 - y^3) - \frac{1}{2} \frac{\max(y - x, 0)}{1 + 100r}$$

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Entry to EP

credibility $\alpha \in [0,1]$

Stay in EP

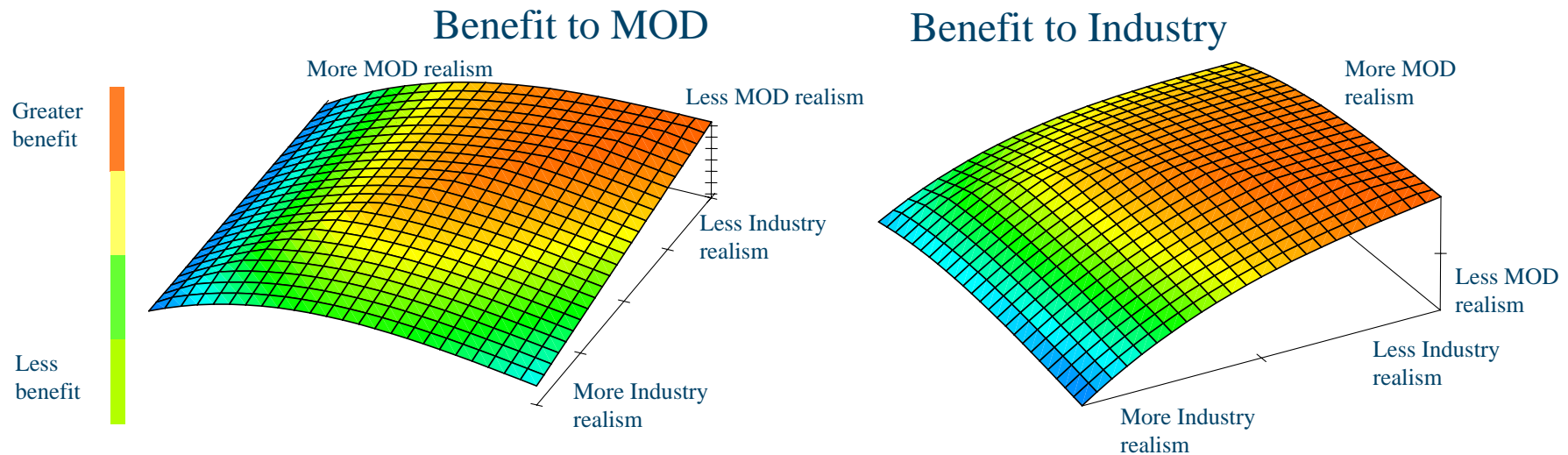
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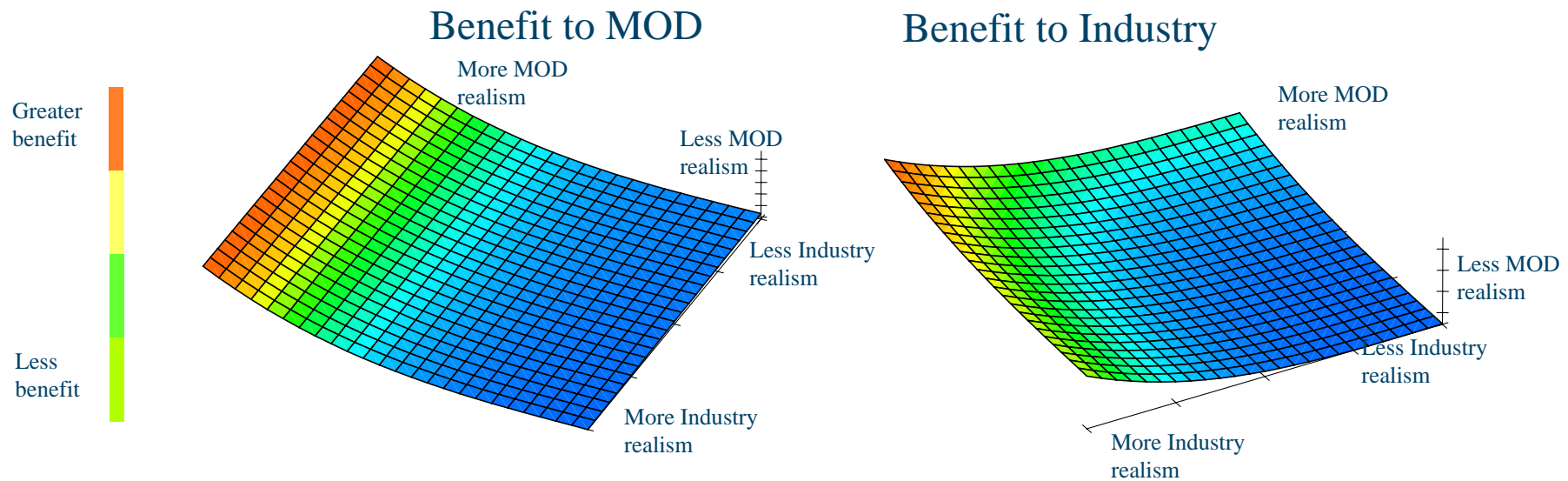
Win the Bid

Payoff to MOD and Industry



Levels of MOD/Industry realism vary but α is fixed at $\alpha = 50\%$

Payoff to MOD and Industry



Levels of MOD/Industry realism vary but α is fixed at $\alpha = 95\%$

Impact of Uncertainty

- If there is high certainty at a project's early stages then the rational strategy for both MOD and Industry is to be realistic about project costs.
- If there is high uncertainty then the rational strategy for both MOD and Industry is to be unrealistic about project costs.

The Impact of Uncertainty

- If there is high certainty at a project's early stages then the rational strategy for both MOD and Industry is to be realistic about project costs.
- If there is high uncertainty then the rational strategy for both MOD and Industry is to be unrealistic about project costs.

Managing the Uncertainty

- If we can “unpack” α and improve our control of uncertainty then this will produce a much better balanced EP without the need for radical restructuring to cope with fiscally and temporally challenged projects.

“Unpacking” α

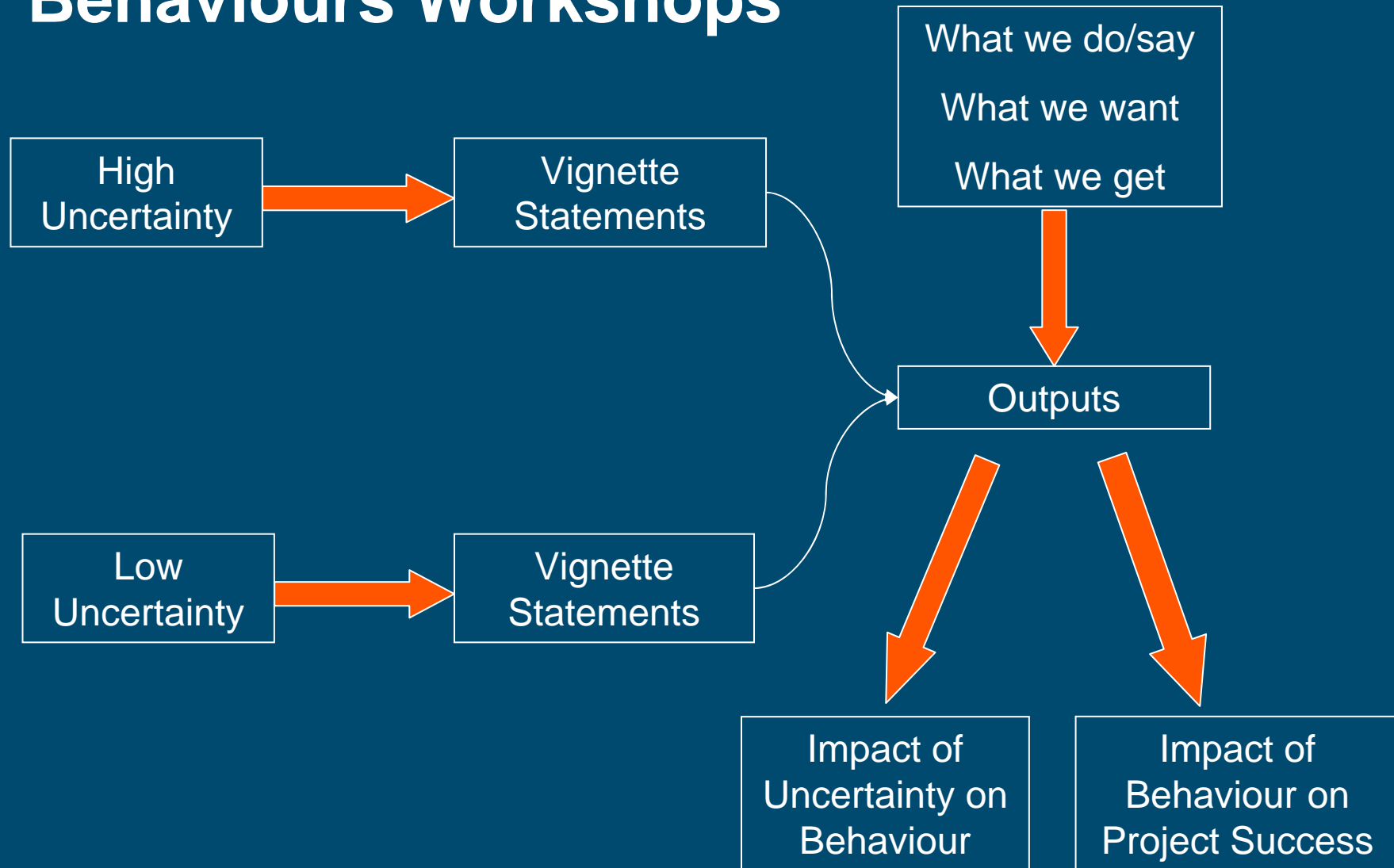
- Uncertainty is made up of many parts:
 - technical risk
 - financial risk
 - commercial risk
 - industrial risk
 - military risk

**Trust between
MOD and
Industry**

Syndicate Sessions to Test the Theory

- Jointly with Directorate for Defence Acquisition
- Sponsored by Tim Flesher (Deputy Chief of Defence Logistics) and Bob Barton (Director, Capability Consultancy, BAE Systems)
- Two workshops with participants, up to 3* level, from MOD, NAO and Industry.

Behaviours Workshops



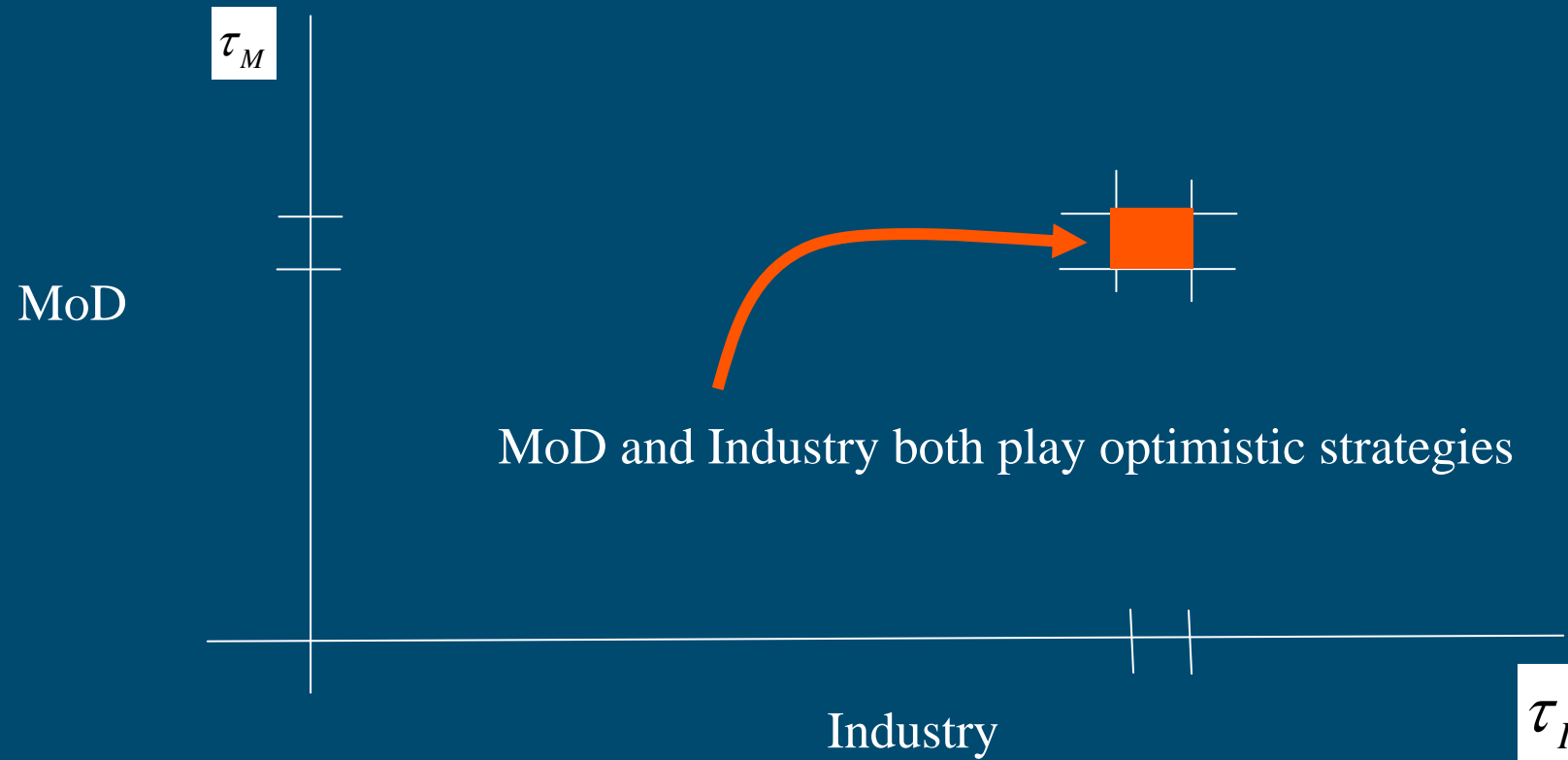
Behaviours Workshops – some conclusions

- Positive feedback from participants on how they now have a better appreciation of the pressures and perspectives of colleagues elsewhere in acquisition
- Work now exploited in the Change Management Programme under D Def Acq
- Validation of the theory that the Conspiracy of Optimism is driven by uncertainty

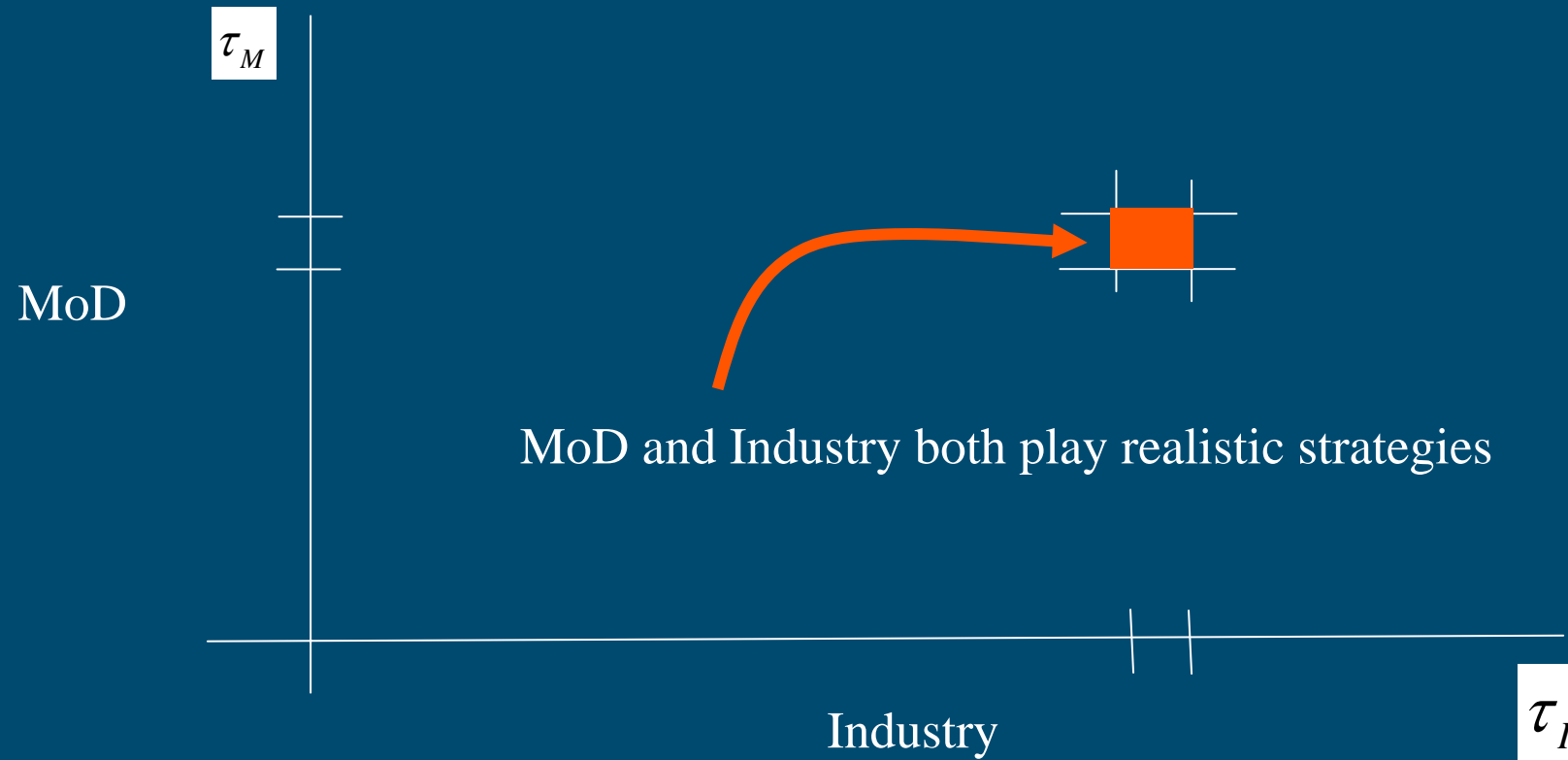
Developing the Simple Game

- “*Dynamic Evolution of Preferences*” Heifitz, Shannon, Spiegel (Open University of Israel, UC Berkeley, Tel Aviv University)
 - A population of optimists and pessimists interact with each other
 - Optimists overestimate their pay-offs and pessimists underestimate
 - Over time players adapt their *characters* in order to survive in a competitive environment
- Heifitz et al demonstrate (under certain hypotheses) that the population will converge to an optimistic character: *the evolutionary stable strategy*.
- Dstl has adapted this to apply to defence acquisition.

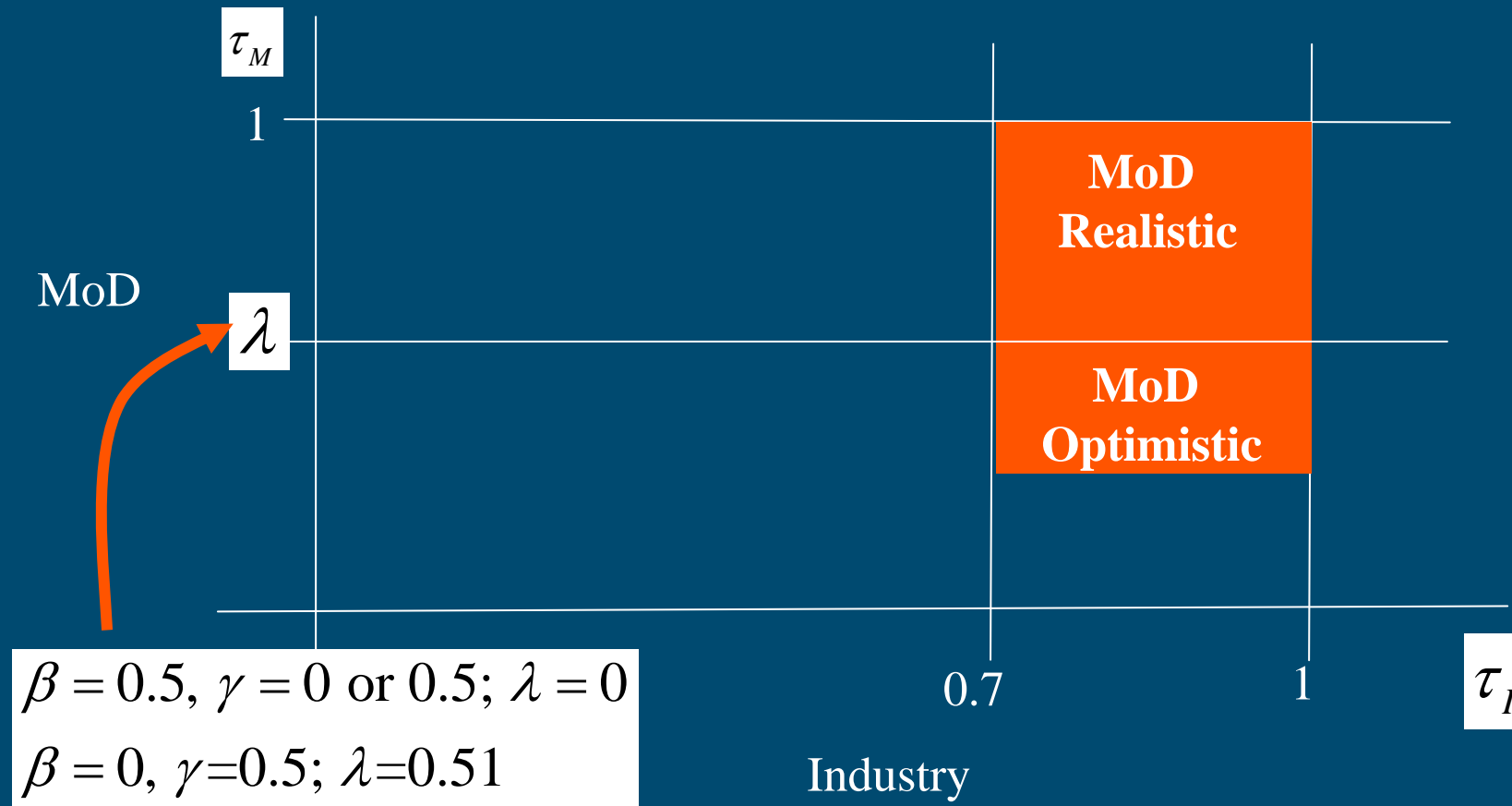
The Character Space – High Project Uncertainty



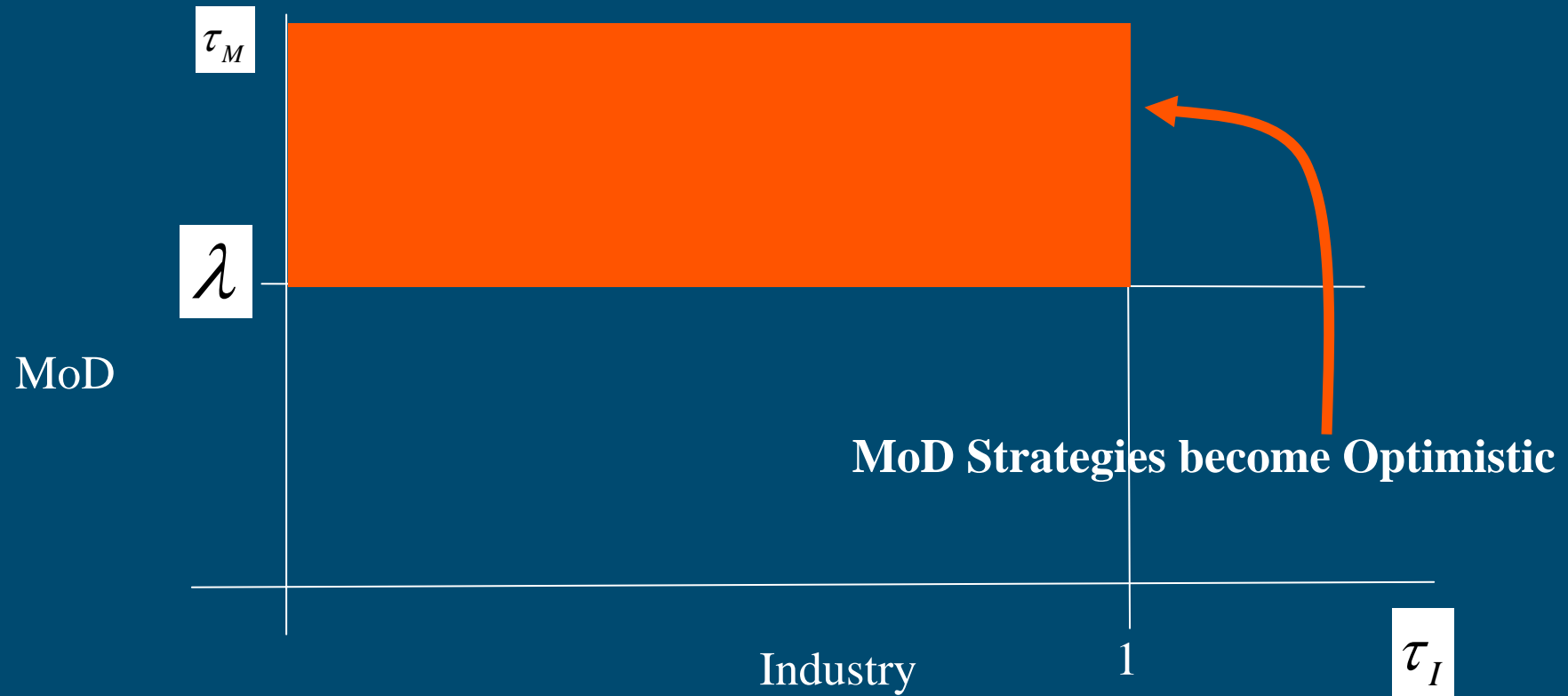
The Character Space – Low Project Uncertainty



The Threshold for Optimistic MoD Strategies – The Effect of Externalities



The 'Invasion of Optimism'



Some Conclusions

- We have built a model *illustrative* of the system.
- A key behaviour is the “conspiracy of optimism” in relation to cost and risk.
- This must be addressed to move the system towards more realistic behaviours.