

'Aerospace Manufacturing'

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Applied Complexity Theory as the New Framework for Public Policy

- Inter-firm characteristics **constitute** the supply network
- If a firm adopts an Inter-firm characteristic, there must be a **net benefit** in doing so
- The adoption of an Inter-firm characteristic contributes to one or more performance outcomes; it may bring down the overall performance for one outcome whilst increasing it for another – importantly, there is a **trade-off**
- Inter-firm characteristics are not adopted in isolation; their **inter-relationships** (positive and negative) must be recognized

Characteristics	Success criteria factors				
	Product quality	Cost efficiency	Delivery precision	Techn./ innovation	Vision for the future
Rate of characteristic to successfactor criteria High (9), None (0))					
1. Outsourcing competitive advantage	9	9	7	9	9
2. Outsourcing what is easily imitated	8	8	9	0	0
3. High level of collaborative relationship	5	5	3	8	9
4. Arms length relationships	0	0	0	0	0
5. Long-term relationship	8	7	8	7	7
6. Formal partnership	9	2	6	8	8
7. Subcontracting whole systems and sections	9	8	9	8	8
8. Flexibility of operations	8	6	7	5	7
9. Risk-sharing	6	3	4	9	9
10. Sharing knowledge	9	7	8	8	6
11. Offsets as part of sales contract	7	0	2	0	5
12. Culture of continuous improvement	8	7	8	7	6
13. Ability to handle cultural differences	5	5	5	7	6
14. High level of dominance over supplier	8	8	8	1	2
15. High level of planning and control	7	5	8	1	3
16. Easy dialogue with supplier	0	0	0	6	8
17. IT system integration	0	1	6	1	8
18. High levels of integration of chain	8	6	7	2	8
19. Responsive to market change	7	7	7	7	7
20. Transparent organisation	0	0	0	0	0
21. TQM procedures	9	7	6	5	6
22. Just-in-time delivery	5	2	9	6	6
23. Lean practice	7	7	7	7	7
24. Explorative learning practices	8	3	3	6	8
25. Investment in training	9	8	7	4	8
26. Supplier development	8	8	8	7	7
27. Monitoring supplier	7	7	7	2	1

The different dimensions of performance that matter to customers are:

- Quality of fabrication
- Cost efficiency
- Reliability of Delivery
- Level of Technology and innovativeness
- Degree of Vision in the conception of a product

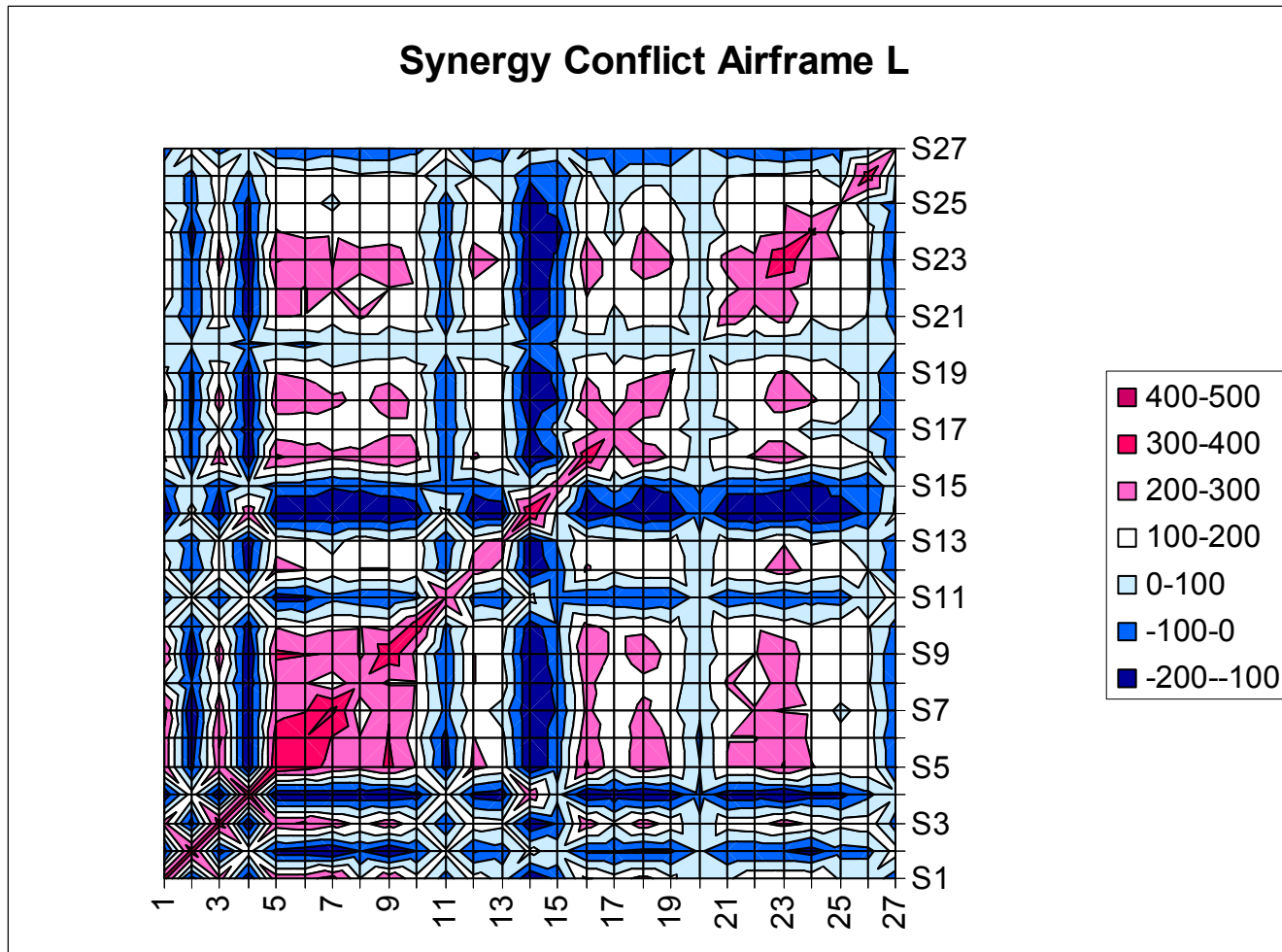
And these are not equally important

Pair Matrix Data:

Characteristics	1. Outsourcing competitive advantage	2. Outsourcing what is easily imitated	3. High level of collaborative relationship	4. Arms length relationship	5. Long-term relationship	6. Formal partnership	7. Subcontracting whole systems and sections	8. Flexibility of operations	9. Risk-sharing	10. Sharing knowledge	11. Offsets as part of sales contract	12. Culture of continuous improvement	13. Ability to handle cultural differences	14. High level of dominance over supplier	15. High level of planning and control	16. Easy dialogue with supplier	17. IT system integration	18. High levels of integration in chain	19. Responsive to market change	20. Transparent organisation	21. TQM procedures	22. Just-in-time delivery	23. Lean practices	24. Explorative learning practices	25. Investment in training	26. Supplier development	27. Monitoring suppliers
Strongly synergetic (+5), indifferent effects (0), strongly conflicting (-5)																											
2. Outsourcing what is easily imitated	▶ -5	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
3. High level of collaborative relationship	▶ 3	▶ -4	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
4. Arms length relationship	▶ -5	▶ 4	▶ -5	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
5. Long-term relationship	▶ 4	▶ -5	▶ 5	▶ -5	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
6. Formal partnership	▶ 4	▶ -4	▶ 0	▶ -4	▶ 4	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
7. Subcontracting whole systems and sections	▶ 1	▶ 2	▶ 0	▶ -4	▶ 4	▶ 5	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
8. Flexibility of operations	▶ 4	▶ 0	▶ 3	▶ 0	▶ 3	▶ 4	▶ 5	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
9. Risk-sharing	▶ 5	▶ -4	▶ 4	▶ -5	▶ 4	▶ 5	▶ 5	▶ 4	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
10. Sharing knowledge	▶ 5	▶ 5	▶ 5	▶ -3	▶ 4	▶ 4	▶ 5	▶ 2	▶ 5	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
11. Offsets as part of sales contract	▶ -5	▶ 5	▶ -3	▶ 4	▶ 0	▶ -4	▶ -4	▶ 3	▶ -3	▶ 5	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
12. Culture of continuous improvement	▶ 3	▶ -3	▶ 3	▶ -2	▶ 4	▶ 4	▶ 4	▶ 4	▶ 3	▶ 3	▶ 1	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
13. Ability to handle cultural differences	▶ 3	▶ -2	▶ 4	▶ -3	▶ 3	▶ 3	▶ 4	▶ 3	▶ 4	▶ 3	▶ 5	▶ 0	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
14. High level of dominance over supplier	▶ -5	▶ 5	▶ -5	▶ 4	▶ -4	▶ -4	▶ -5	▶ -3	▶ -4	▶ -3	▶ 2	▶ -4	▶ -5	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
15. High level of planning and control	▶ 4	▶ -4	▶ 0	▶ 0	▶ -3	▶ -4	▶ 4	▶ -3	▶ 3	▶ 2	▶ 3	▶ -3	▶ -4	▶ 5	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
16. Easy dialogue with supplier	▶ 4	▶ -3	▶ 5	▶ -3	▶ 4	▶ 4	▶ 5	▶ 4	▶ 3	▶ 5	▶ 0	▶ 4	▶ 5	▶ -4	▶ 0	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
17. IT system integration	▶ 4	▶ 0	▶ 4	▶ -5	▶ 4	▶ 4	▶ 5	▶ -3	▶ 4	▶ 4	▶ -3	▶ -4	▶ -2	▶ -3	▶ 4	▶ 3	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶	▶
18. High levels of integration in chain	▶ 0	▶ -4	▶ 3	▶ -4	▶ 5	▶ 4	▶ 5	▶ 3	▶ 4	▶ 0	▶ -3	▶ 3	▶ 3	▶ -4	▶ 2	▶ 4	▶ 4	▼	▶	▶	▶	▶	▶	▶	▶	▶	▶
19. Responsive to market change	▶ 2	▶ 0	▶ 5	▶ -3	▶ 3	▶ 4	▶ 4	▶ 5	▶ 3	▶ 0	▶ -4	▶ 0	▶ 0	▶ 0	▶ -3	▶ 4	▶ -1	▶ 4	▼	▶	▶	▶	▶	▶	▶	▶	▶
20. Transparent organisation	▶ 0	▶ 0	▶ 2	▶ 0	▶ 2	▶ 2	▶ 0	▶ 0	▶ 0	▶ 4	▶ 0	▶ 0	▶ 0	▶ 4	▶ 3	▶ 0	▶ 0	▶ 1	▼	▶	▶	▶	▶	▶	▶	▶	▶
21. TQM procedures	▶ 4	▶ 2	▶ 0	▶ 3	▶ 4	▶ 3	▶ 4	▶ 2	▶ 4	▶ 1	▶ 3	▶ 4	▶ -3	▶ -3	▶ -3	▶ 4	▶ 0	▶ 4	▶ 2	▶ 0	▼	▶	▶	▶	▶	▶	▶
22. Just-in-time delivery	▶ 3	▶ 3	▶ 2	▶ -3	▶ 5	▶ 5	▶ 4	▶ 3	▶ 2	▶ 4	▶ -2	▶ 0	▶ 0	▶ -2	▶ -3	▶ 3	▶ 4	▶ 3	▶ 1	▶ 0	▶ 4	▼	▶	▶	▶	▶	▶
23. Lean practices	▶ 4	▶ -4	▶ 4	▶ 0	▶ 5	▶ 5	▶ 4	▶ 4	▶ 3	▶ 4	▶ -2	▶ 5	▶ -3	▶ -4	▶ -4	▶ 5	▶ 0	▶ 4	▶ 3	▶ 0	▶ 5	▶ 5	▼	▶	▶	▶	▶
24. Explorative learning practices	▶ -4	▶ -3	▶ 5	▶ -4	▶ 4	▶ 4	▶ -3	▶ 4	▶ 4	▶ -3	▶ -3	▶ 3	▶ 2	▶ -4	▶ -3	▶ 4	▶ 0	▶ 3	▶ 4	▶ 0	▶ 4	▶ -1	▶ 5	▼	▶	▶	▶
25. Investment in training	▶ 3	▶ -3	▶ 1	▶ 0	▶ 4	▶ 3	▶ 4	▶ 2	▶ 4	▶ 0	▶ 4	▶ 0	▶ 0	▶ 0	▶ 0	▶ 0	▶ 0	▶ 0	▶ 0	▶ 0	▶ 0	▶ 4	▶ 4	▶ 4	▶ 4	▶ 4	▶ 4
26. Supplier development	▶ -3	▶ 5	▶ 3	▶ -4	▶ 0	▶ -3	▶ -5	▶ 3	▶ -3	▶ 5	▶ 4	▶ 2	▶ 4	▶ -4	▶ -4	▶ 5	▶ 2	▶ 4	▶ 3	▶ 3	▶ 4	▶ 4	▶ 4	▶ 4	▶ 4	▶ 5	▶ 4
27. Monitoring suppliers	▶ -3	▶ 0	▶ -4	▶ 4	▶ -3	▶ -4	▶ -2	▶ 1	▶ 0	▶ 4	▶ 4	▶ 0	▶ -1	▶ 4	▶ 4	▶ 1	▶ 4	▶ -3	▶ -2	▶ 3	▶ -3	▶ -1	▶ -1	▶ -1	▶ -1	▶ 0	▶ 2

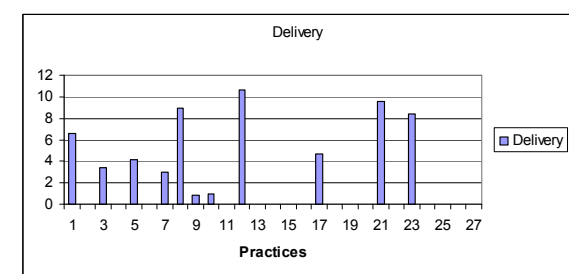
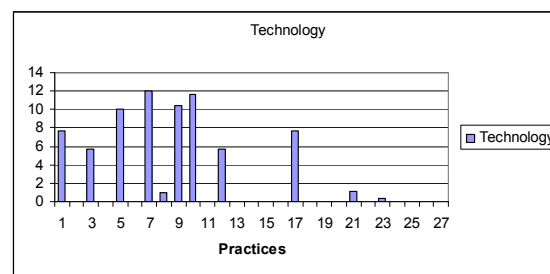
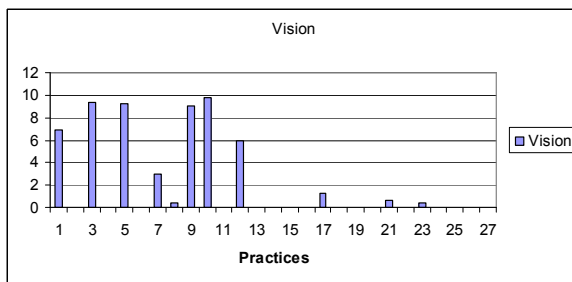
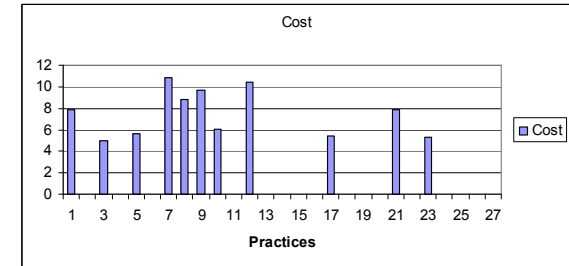
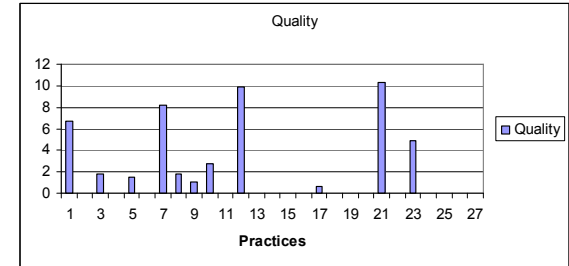
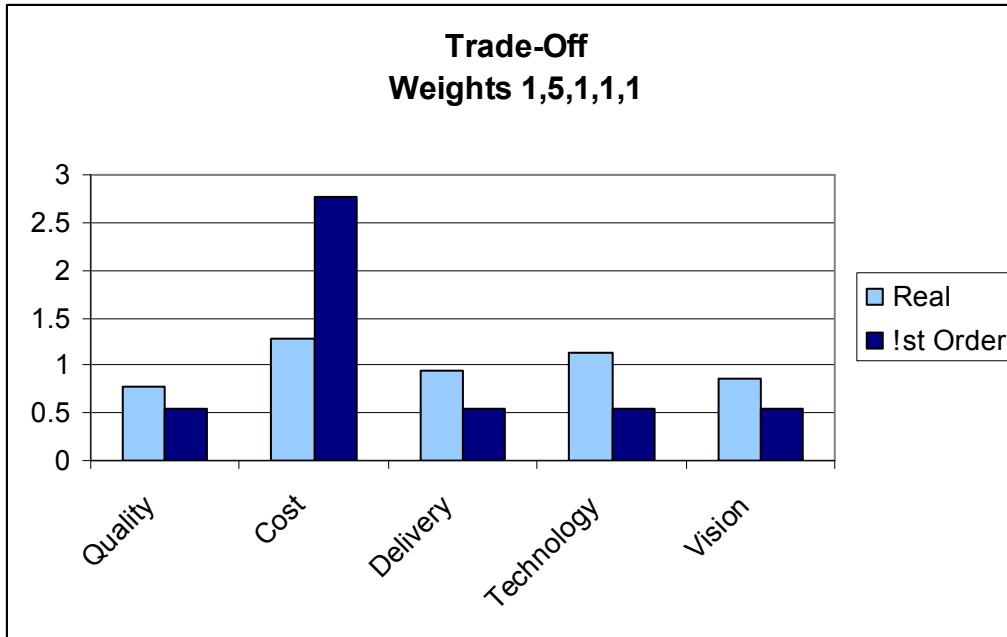
The Pair Interactions between the 27 Practices:

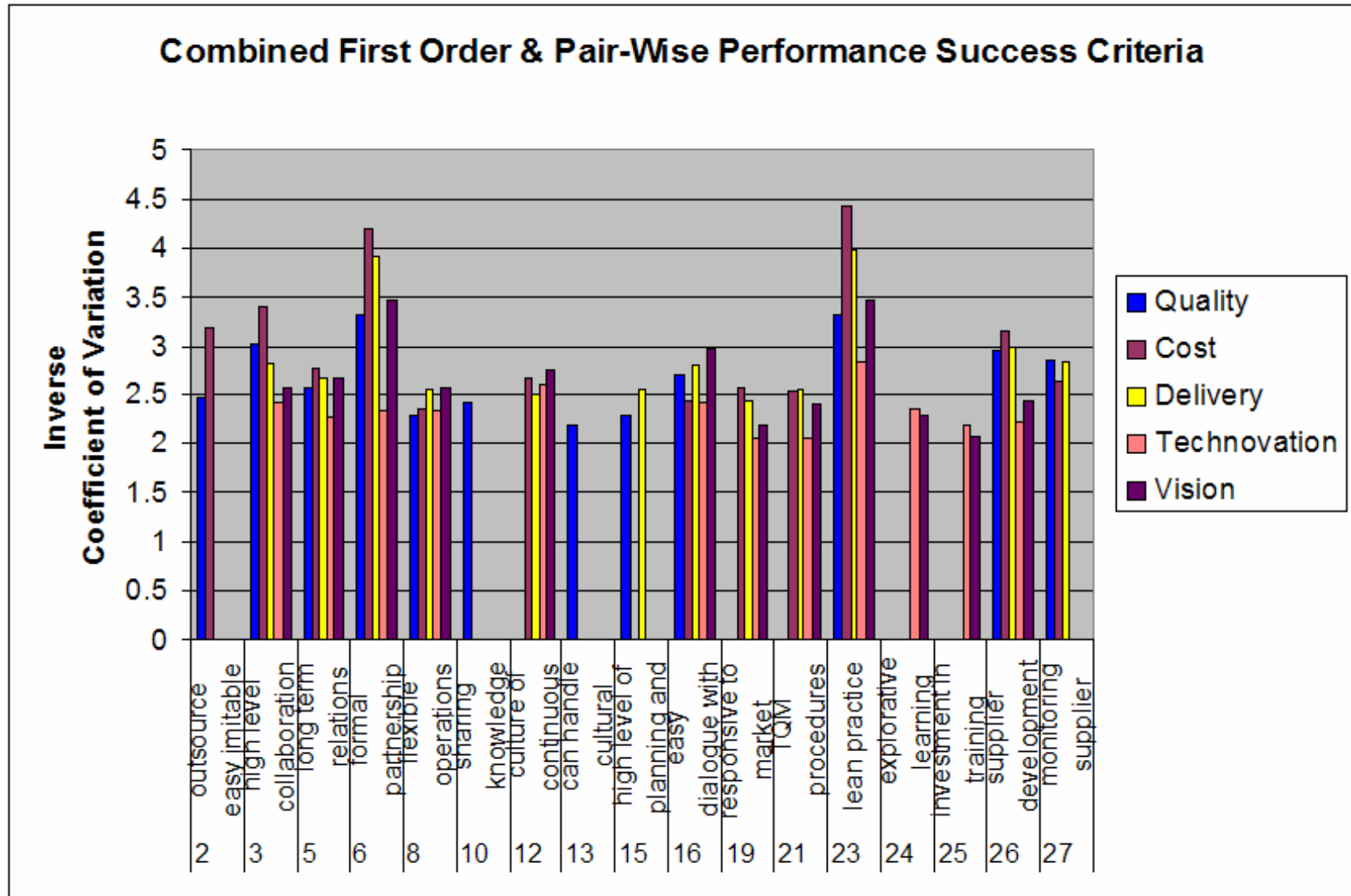
The (27x27 pair matrix)x(Transpose) = Map of total synergy/Conflicts



- The direct effects of practices on different dimensions of output performance are given in first table
- The effects of one practice on another are given by the 27x27 pair matrix
- The real output of a weighted sum of the different dimensions of performance are given by:
 - $(27 \times 27 \text{ Pair matrix}) \times (27 \times 1 \text{ Column}) = (27 \times 1) \text{ Real Output}$
- This calculates the real, observed output performances for any combination of practices

Learning Model - weighted sum of Outputs

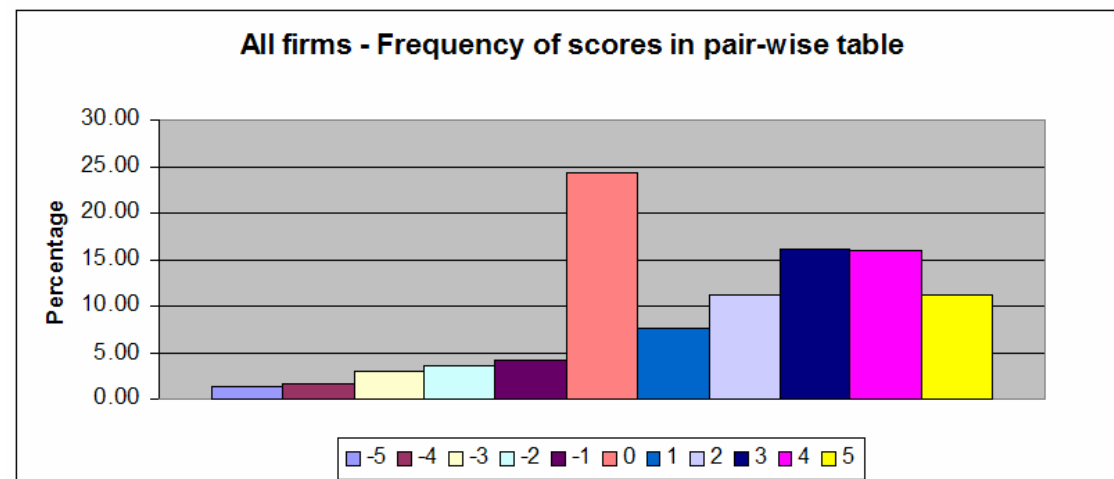




Typology of Inter-firm Characteristics

STRUCTURE	<ol style="list-style-type: none"> 1. Outsourcing competitive advantage 2. Outsourcing what is easily imitated 4. Arms length relationship 5. Long-term relationship 6. Formal partnership 7. Subcontracting whole systems and sections
INTEGRATION	<ol style="list-style-type: none"> 11. Offsets as part of sales contract 13. Ability to handle cultural differences 17. IT system integration 18. High levels of integration in chain
COEVOLUTIONARY DYNAMICS	<ol style="list-style-type: none"> 3. High level of collaborative relationship 8. Flexibility of operations 9. Risk-sharing 10. Sharing knowledge 12. Culture of continuous improvement 14. High level of dominance over supplier 15. High level of planning and control 16. Easy dialogue with supplier 19. Responsive to market change 20. Transparent organisation 21. TQM procedures 22. Just-in-time delivery 23. Lean practices 24. Explorative learning practices 25. Investment in training 26. Supplier development 27. Monitoring suppliers

- The industrial sector – manufacture of jetliners with > 100 seats
- By supply network tier
- By performance outcome
- By weighted-sum of first order performances
- By pair-wise effects:



- Firms – do other things
- Respondents – knowledge
- Interpretation – qualitative
- Assumptions!