The Supply mesh

George Rzevski, the renowned consultant and Professor at Brunel University, presented his vision of a new design and manufacturing paradigm. His contention is that currently prevailing design and manufacturing concepts are inappropriate for complex, rapidly changing markets and, therefore, we must expect soon a paradigm shift.

George believes that the **Transaction Cost Principle** will define that new paradigm. This is a principle promoted particularly by economists Ronald Coase and Oliver Williamson. It states that

> *The size of an organisation is a function of the difference between the cost of transactions and cost of ownership.*

The basis of the principle is that large organisations form because they are more efficient than each of the components of the organisation trading independently one with another. However, when the costs of trading between the components – the transaction costs – come down, the rationale for the large organisation also comes down. Digital networks are dramatically reducing the costs of communication and therefore the transaction costs. As a result organisations are becoming slimmer.

This same principle, and the same benefits of networked communication, apply to the manufacturing system as well as the organisation. Add to this the inexorable exponential growth in capability of local, cheap, processing power, and the consequence is that, instead of large centralised manufacturing systems we shall, in future, be building networks (or swarms) of intelligent machines capable of scheduling and re-scheduling their own operation according to dynamically changing requirements.

The new paradigm will offer, in principle, the following advantages:

- A polynomial increase in performance for the linear increase in cost (Metcalf's Principle)
- Improved scalability (to be achieved by changing the number of connected units)
- Graceful degradation of performance in cases of unit failures (by disconnecting failed units)
- Greatly reduced time to market (by incremental improvements of constituent units)
- Easy customisation (special configurations to meet special requirements)
- Rapid response to changing in operating conditions (reconfiguration)
- Placement of production close to the consumption (Transaction Costs Principle)
- Greater job satisfaction (Knowledge Distribution Principle)

In addition, the availability of digital processors and communication links in every machine and every production cell will provide opportunities for adding further value by designing into the system:

- Self-diagnosing and signalling of imminent failures
- Self-repair by reconfiguration
- Remote guidance
- Remote diagnosing and servicing

	‘Lean’ Centralised Systems	Distributed Intelligent Systems
Key features	Predictability, Repeatability, Economy of scale	Agility, Responsiveness, Self-organisation
Mechanisms for achieving key features	Deterministic algorithms, Memory, Integration	Informed guessing, Knowledge, Learning, Networking
Key limitations	Rigidity	Risk of mistakes
Mechanisms for dealing with limitations	Modularisation	Distribution of intelligence, Full use of local knowledge, Learning from experience
Application areas	Stable environments, Long production runs, Mass production	Unpredictable environments, Frequent changes in production runs, Customised products, Short lead times
Centralised hierarchy versus distributed intelligence		

What is critically important is a change in the mindset. New conditions can be conquered only if both the organisations and products designed by these organisations are created as flexible intelligent networks rather than rigidly structured and integrated hierarchies.