



Tricordant Supply Chains

Organising Complex Supply Chains. What Is The Problem?

With increased globalisation the organisation of supply chains is becoming an ever more important issue for large international businesses. The drivers are, as ever, to reduce costs whilst maintaining service and delivery. For large companies supply chains are constantly growing in scale and complexity as they serve more markets, traverse more countries, deliver increased variety to tighter timescales, and cope with shorter new product introduction cycles. As supply chains get ever longer and more complex organising people to manage them efficiently and effectively becomes ever more problematic.

As supply chains grow in scope and complexity the hoped for economies-of-scale are often disappointingly offset by hidden costs. Supply chains can develop their own internal systemic problems with negative internal feedback loops and self-generated noise. The increasing complexity of the supply chain processes require increasingly complex IT systems, procedures, policies, and bureaucracy. The roles of managers and departmental teams become fractured and unclear. The organisation of the supply chain is no longer simple, but requires multiple reporting lines and matrix structures. Peoples' sense of empowerment, responsibility and ownership is diluted. People become frustrated and de-motivated as they try to manage in a world of un-wholeness and disconnection.

How can we design complex global supply chains as integrated whole systems so that they can still retain simplicity and run as smoothly as possible? How can we organise supply chains so that teams have clear whole units of work to perform, with minimal interference and overlap between themselves and other teams? How can we empower teams by asking them to manage discrete sub-systems within the framework of the wider whole system? How do we design it so that the right work is done at the right organisational level? How can we give whole work to whole people?

Illustration of Increasing Complexity

The effects of integration on the whole system can be illustrated by two levels of Sandwich shop. The first, the Simple Sandwich Shop, is typified by the classical Italian, family run outlets that make sandwiches on demand for customers. The second is the chain type of operation typified by Pret a Manger and other such outlets/

Simple Sandwich Shop

The midday sandwich shop is an example of a supply system. It is a more of 'supply point' than a 'supply chain'. Consider the process:

- The customer presents at the counter and has a free choice of sandwiches made from a range of raw materials in view, stored in the counter.
- The manufacture of the sandwich is achieved on the spot, in real-time with a lead time target given by the patience limit of the customer and those in the queue behind.

- Most of the raw materials can be assembled in different combinations to make an array of products. So sandwiches are late-configured and raw material supply has a natural resilience.
- In the main customers will choose a sandwich from what is available and so 'stock outs' are not critical.
- The people organisation is simple and effective: 2 or 3 sandwich makers; a drinks fixer and person on the till.
- All jobs are interchangeable and staff can cover for each other to allow for surges in demand.
- Communication with both customer and between the team is easy and instant, with effective feedback and correction loops.
- Raw materials demand, is handled as a separate task, to replenish customer consumption.

So provided there are no weird fads or fashions that sweep through the sandwich-eating public in their locality, one has a manageable system, which contains: a) sales and marketing; b) customer purchasing patterns; c) manufacture; d) process planning; e) raw materials acquisition and goods inwards storage; and f) financial management

If only we could keep things simple like this when supply goes global!

Consider a regional sandwich supply chain.

The simplicity of the sandwich shop springs from the fact that there is a single task which contains all of the activities around selling and manufacturing the sandwich, happening in real-time over the counter. This is supported by the second task of raw materials planning, purchase and storage happening on a 24 hour cycle. The two tasks are buffered by an adequate supply of raw materials in the counter. The process is resilient with raw materials only being committed to finished product at the latest possible stage of the process. The whole is directly driven by customer demand. The people organisation is simple, the communication is direct, and immediate feedback and evaluation loops ensure the effectiveness of the system.

Now imagine we notice that we have a duplication of sandwich counters and multiple stores of raw material across all the sandwich shops in a region. Obviously the thing to do is to reduce duplication and waste and set up a central sandwich factory and distribute ready-packed sandwiches across the town to outlets that are now no longer mini-factories but just sales outlets.

We start to realise economies of scale but at the whole systems level increased complexities begin to emerge:

- Raw materials are committed to being one type of sandwich at a much earlier stage in the process. This means it is important to accurately forecast what the demand for a particular sandwich will be tomorrow. A whole level of new effort needs to go into demand forecasting to schedule the work in the sandwich factory.
- Wrong demand forecasts now lead to sandwiches being thrown away.
- The shifts in customer taste have a concentrated impact on single units of production, storage and other supply chain resources. A 2% shift in demand when you are selling 100 sandwiches is a production peak of 2 sandwiches. However, when you are mass manufacturing 200,000 then a 2% shift is a production peak of 2,000 sandwiches.
- Demand surges can be further amplified upstream by stocking policies, batch rules and 'economic' purchase quantities.

- The capacity of the delivery system becomes critical. Distribution must now be completed in real time between start of daily production and the consumption window to avoid sandwiches going stale. If the delivery system is overloaded, or the traffic is bad so that a delivery is delayed and does not reach a sandwich outlet until 2.30 pm, then a whole day's trading can be lost and a whole days production scrapped.
- Communication has become complicated. One is no longer chatting behind the counter but using faxes, e-mails and telephones interfacing with multiple teams, with the risk of Chinese whispers distorting information and of messages and reality getting out of sync with each other.
- People organisation and HR issues may become an issue with multiple job roles and employment contracts. To get fresh sandwiches to the counter in time for lunch we are now running night shifts.
- People motivation has potentially dropped because the sandwich makers get no satisfaction from happy customers or feed back on the good work they are doing and the sales outlet staff have no ownership of the sandwiches they sell. 'Our problems are somebody else's fault.'
- Evaluation is harder, because it is difficult to identify the cause of errors in the total system and therefore to link cause and effect, good performance and credit, sources of problems and their rectification

We are seeing several things happening: a) differences in activities, which are minor in a distributed network, being amplified by the concentration of activities into a small number of processing units; b) each of the functional components of the whole system [sales and marketing, manufacture, process planning; raw materials acquisition; storage; and finance] now operate independently with their own agendas and targets c) The people organisation has become complex; d) communication has been complicated and e) feedback loops are disabled.

In going from many simple sandwich 'supply points' to a supposedly more economic major sandwich 'supply chain', many whole systems issues have been triggered. These must be managed effectively at the whole systems level if the expected economies of scale are to be realised

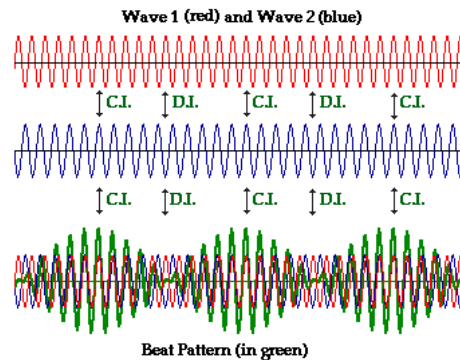
Rhythm and Flow in a Supply Chain – Interference Patterns

A global market may have a steady average demand with relatively minor statistical variances however at the local level demand will be much more blocky. Even with smooth demand, different factors operating within the supply chain will combine together to disturb the natural rhythm and flow. These are self-generated disturbances which can add together, like interference patterns, causing unexpected, amplified peaks and troughs. In this situation surges in demand are secondary symptoms of underlying primary causes. Here are some of the underlying factors:

- **How customers are marketed to.** This affects how they buy and the sales strategies and marketing activities influence the demand on the supply system. The businesses can often be responsible for artificially distorting demand by promotions, offers and sales drives.
- **Economies of Manufacturing.** The scale and 'economies' of the manufacturing system often drives businesses to make in minimum batch sizes in fewer locations. A batched-up, lumpy rhythm is created in production that is driven by the nature and scale of the equipment used, raw materials supply, goods inwards and goods outwards storage, and the regulations that control manufacturing operation.

- **Dimensions of Transport.** Case, pallet, lorry and tanker sizes determine the package size that flows through the delivery system. The speed of travel along a pathway, its length and the regulatory gateways a package must pass through determine the pulse of the delivery system.
- **Inventory Reduction.** The economic drive to minimise working capital leads businesses to reduce stock levels and the number of stores. However the fewer and more centralised the stores, and the more closely that inventory is controlled the less slack there is in the system and the more vulnerable it will be to surges and stock-outs. A stock-out triggers emergency action that distorts the supply chain system for some time before steady flow is resumed.
- **New Product Introductions.** New products and increased product variety serve customers better but disrupt the established patterns. The substitution of one product for another, however valuable in the market, still leads to a discontinuity in supply and demand.

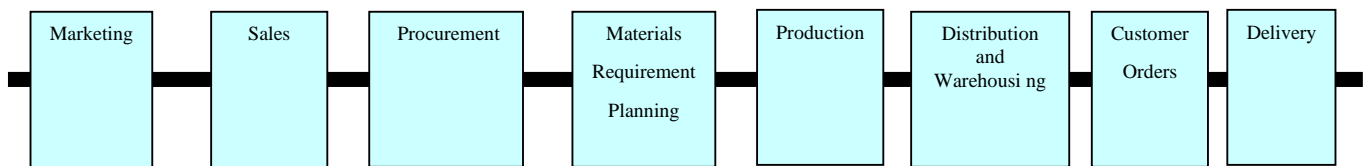
Each of these dimensions brings with it a disturbance or distortion to the natural demand rhythm. These different dimensions can and frequently do, interfere and conflict with each other. The overall flow pattern one is seeing in the total system is not the primary demand pattern but the interaction of the primary demand pattern with these the patterns imposed by these other elements of the total chain. The diagram below shows just two waves interfering to produce a ‘beat pattern’.



In the supply chain one is seeing the beat pattern of multiple sources of pulsed activity. At the whole systems level the challenge is to manage the primary drivers and not the secondary symptoms.

A Traditional View Of Supply Chain Organisation

A supply chain is often seen as a linear row of process steps. The diagram below shows such a ‘chain’. It is a supply chain for an imaginary consumer product starting with brand marketing and ending with the product in the customer’s hand.



Typically the functions along such a supply chain are driven by their own set of performance measures. Each organisational unit is usually optimised locally driven by the managers held responsible. For example:

- **Production Objectives:** Optimum production effectiveness including: maximum capital utilisation, maximum labour utilisations, minimum unit costs, minimum work in progress, minimum change over times, close adherence to the production plan etc.
- **Supply Logistics objectives:** Minimum stock levels and maximum order fulfilment, including: optimum space utilisation; minimum cost per unit of storage; minimum number of uncompleted orders, minimum number of undelivered orders, optimum stock turns etc.
- **Sales and Marketing Objectives:** Maximum market size and margin; including: optimum volume to price balance, highest level of correlation between forecast and actual orders; promotions that drive volume without depressing normal sales; maximum level of order fulfilment etc.

This approach leads to optimising performance at the level of the individual system components. But for this approach to work the units must each be a natural complete, semi-independent subsystem in its own right which can operate separately from the rest of the whole system. Unless we happen to have the boundaries in the right place this will not be the case. This is in fact rarely the case and attempts to organise and optimise in this way will deliver mixed results for the reasons outline above.

Local Perspectives on the Supply Chain Problem

When one sets out to optimise a supply chain then one must also consider the natural views of those empowered to manage parts of the whole system. The natural reaction of people is to seek to regain control by simplifying their local part of the system, driving out local rather than whole systems' complexity. The options selected by a player will depend on the view point of the person delivering the solution. For example lets look at three people's perspective

- The regional manager will look to local manufacture, storage and delivery. This moves the model in the local market towards the sandwich shop analogy and gives the local business community the ability to meet customers' needs. The benefit of this approach is local responsiveness and customer satisfaction. The disadvantage is duplication of resources and increased capital costs and overall stock levels.
- The global supply chain manager will look to reduce the number of hubs in the system. The benefit of this approach is to reduce costs and provides a unified approach to the supply chain. The disadvantages are relative inflexibility, the lack of customer focus and service at the regional level and the burdens placed on the system by the necessity for variety which will prevent the system from being as simple and straightforward as the pure concept suggests.
- The IT manager will see the supply chain in terms of transaction management, load scheduling and load tracking. The assumption is that if the whole system can be simulated in a computer then it can be managed on the ground. While this should be true, reality is always more complex than can be simulated in a computer, and people often do not behave as computers expect them to. This means of supporting the supply chain can become a straightjacket that constrains delivery, reduces the ability manage quality especially through change and ultimately prevents the company from serving its customers well.

Whole systems thinking says that all these approaches might be individually right – but need to be balanced with each other by taking an holistic perspective. They are not alternatives they must all be used and must be optimised together to serve the needs of this market for the company’s range of products.

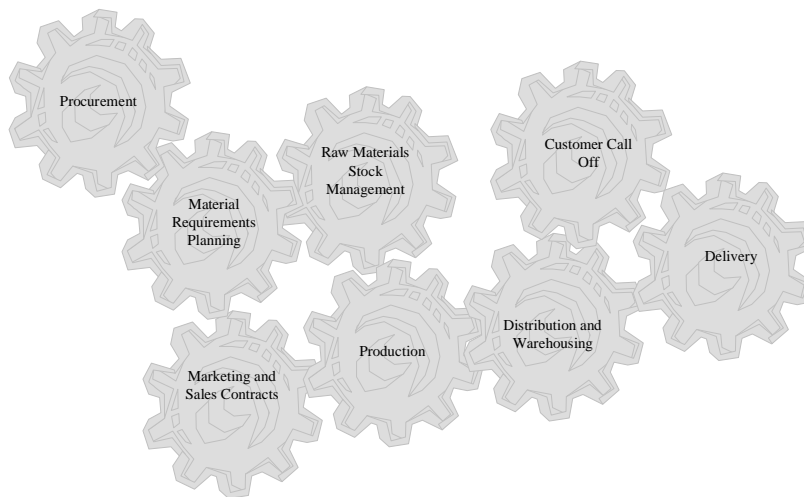
Summary of the problems of a traditional approach to supply chain organisation

The problem can be summarised as follows:

- Valid economies of scale arguments have led to the splitting up of combined units of marketing, sales, manufacture and supply into specialists units each doing one functional component of the whole.
- The organisation of people and processes into these separate components leads each to be optimised on it own right, but without people easily seeing the interconnectedness of the whole system, and thus failing to optimise the supply chain a whole.
- This plus the impact of local functional policies and decisions can lead to the surges passing through the system whose roots cannot be easily traced or understood and therefore hard to turn off or countermand.
- In improving the whole system different people operating within in it will have different perspectives on the nature of the problem and therefore different solution for them, which may be incompatible with one another.

A Whole Systems Approach to Supply Chain Organisation

When viewed from a whole systems perspective one realises that a supply ‘chain’ is a bit of a misnomer. It is not like a chain, where one link is neatly pulled by another in a orderly fashion, but more like a series of cogs in the gear box of a transmission system; and actually not particularly well-meshed, all trying to spin at different speeds, causing grinding and friction.



Each of our supply chain ‘gears’ are in fact local socio-technical sub-systems. That is they are made up of:

- Technical systems in the means to sell, procure, manufacture, distribute, etc.
- People in teams and departments (the 'socio' aspect) who co-work to deliver the task
- Communications within and between the gears in the system
- Evaluation loops, self-correction within and between the gears, governing their rate of turn and their interaction with each other.

The diagram is of course greatly over-simplified, because frequently there are multiple factories and warehouses and multiple sales organisations serving different markets, and a significant number of products flowing through, each with its own characteristics.

What is clear however from this is:

- A well-designed gear box runs more smoothly than a badly designed one. The gears need to be the right shape with simple boundaries and fit together as a whole.
- The more the wheels in the system spin independently of each other the more the cogs will clash and the more heat and wasted energy will be produced by the system.
- The more the wheels turn in time with each other, the less friction there is, the less resources are wasted and the more the energy in the total system goes into productive work.

Identifying the Right Gears

Tricordant's approach to supply chain organisation starts by simply recognising that the supply chain is a whole system. It is critical to develop a socio-technical systems language to talk about the 'gears' and how they relate to each other.

Secondly, the approach recognises that the whole system must be broken down into appropriate primary units of system. These are the natural primary sub-systems.

To identify these lowest whole-system units it is important to understand both the primary processes and the sources and patterns of rhythm and pulses that flow down these processes.

This is achieved by firstly mapping the primary processes from end to end. Typically the approach maps:

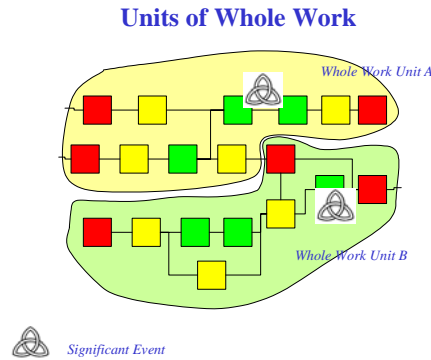
1. The sales and marketing processes
2. The primary material flow process, from raw materials to delivered finished product.
3. The primary logistical information flows, including order taking, raw material ordering, production control, delivery control.
4. The new product introduction process.

We also need to understand the natural underlying demand pattern and the sources of internal secondary flow disturbances. The latter include the:

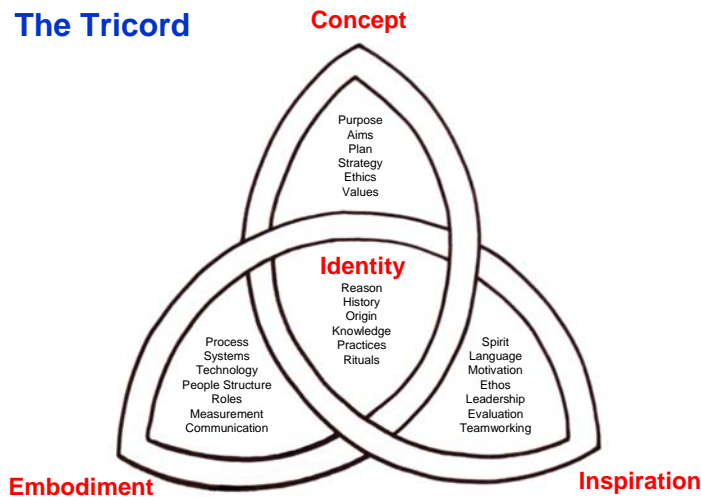
- a) impact of regulatory changes at the market level and how that effects production and stock management;
- b) way that sales and marketing interact with the units of market and how the customers and consumers respond to their stimulation of demand;
- d) number and nature of new product interventions;

- e) stock management policies and rules
- e) manufacturing batching rules
- f) aggregation of different products through the distribution system to national delivery (e.g. pallet sizes, container loads)

The objective is then to identify units of whole work. These are the fundamental sub-units of whole system, our natural sub-systems, or ‘gears’. We identify the chunks of the process significant enough in their own right to be a sustainable, semi-autonomous sub-system. Each unit of whole work will have a purposeful, value-adding and significant event at its heart.



The ‘tricord’, shown below is our model for designing each of these whole work units or ‘gears’ as a whole socio-technical sub-system. Each of the four domains must exist and be in alignment with the other three.



(Please see www.tricordant.com for a fuller introduction to the tricord if required.)

This result of the application of the tricord is that:

- Teams are delegated to complete their unit of whole work
- Teams are on a human scale inline with people's social and technical capacity
- Communications act effectively within the unit of system
- Evaluation control loops driving systems-unit optimisation and self-correction act effectively within each unit of system
- The conditions are established to enable motivated team working and effective leadership.

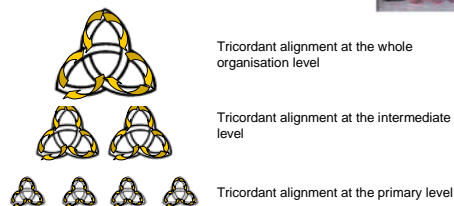
The application of the tricord ensures that each of the cogs is treated as a whole and healthy socio-technical system in its own right. It is only possible to assemble a whole and healthy organisation from whole and healthy sub-systems. The team responsible for each gear is thus empowered to plan, deliver and continuously develop a meaningful, semi-autonomous unit of whole work. This releases ownership, control and motivation into a system naturally constructed to deliver significant value and to be self-improving.

Organisation Build-up of the Supply Chain

The tricord is a 'fractal' pattern of organisation. The same pattern is true at every level of the organisation: the organisation as a whole; its sub-systems and its sub-sub-systems. The need for tricordant alignment is a universal pattern that needs to exist at every level throughout an organisation. It is like lettering in seaside rock; the same pattern runs through the whole.

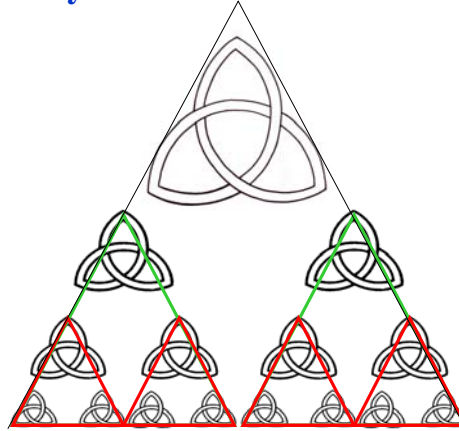
The logic that applies to the primary units of whole system also applies to the secondary level of the whole system (the next higher level of sub-systems) and so on up till the entirety of the whole supply chain is aligned by a consistent set of socio-technical systems principles.

Multi-Level Alignment



The tricord can be used to ensure that the higher levels of the organisation (value chains, departments, divisions, sites, etc.) are in balance with the rhythm of the whole supply chain, and are delegated to right-sized, fully equipped whole work teams, using effective communication channels and are able to manage because of integrated feed-back loops.

Building-up our system from sub-systems and sub-sub-systems



Tricordant understands how to identify the clusters of lower level whole work units that naturally form a whole work unit at the next higher level of system.

Conclusion

With increased globalisation the organisation of supply chains is becoming an ever more important issue for large international businesses. The drivers are, as ever, to reduce costs whilst maintaining service and delivery. For large companies supply chains are constantly growing in scale and complexity as they serve more markets, traverse more countries, deliver increased variety to tighter timescales, and cope with shorter new product introduction cycles. As supply chains get ever longer and more complex organising people to manage them efficiently and effectively becomes ever more problematic.

Tricordant's approach enables organisations to design complex global supply chains as an integrated whole system so that they retain simplicity and run as smoothly as possible. It enables them to organise supply chains so that teams have clear whole units of work to perform, with minimal interference and overlap between themselves and other teams. It enables them to empower teams by asking them to manage discrete sub-systems within the framework of the wider whole system. They can design it so that the right work is done at the right organisational level. They can we give whole work to whole people?

Tricordant's approach looks beyond just the leaning of the supply chain process or value stream, and addresses the human structure of the system in a way that is naturally empowering. It avoids the cost and waste created by the clash and friction between its unaligned parts. It creates a natural structure so that the full benefits are gained from the application of lean principles. If one engages the energies of the people running the process in a situation where they can improve what is happening, one creates jobs that are motivating and a system which is self-improving.