

**NETWORK MASTER**

**&**

**THREE DIMENSIONS OF SUPPLY NETWORK COORDINATION:**

**AN INTRODUCTORY ESSAY**

– Working Paper –

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# Network Master & Three Dimensions of Supply Network Coordination – An Introductory Essay<sup>1</sup>

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## Abstract

This paper proposes three different coordination activities as requirements for coordinating supply networks across multiple tiers. In addition, the paper introduces the concept of the ‘Network Master’ as an entity, or entities to coordinate supply chain activities across multiple tiers of a supply chain or network. The framework developed suggests that business leaders attempting to coordinate across a network of companies could segment the problem into three distinct layers of activities that need to be coordinated independently. This takes on greater levels of significance at present as organizations are exploring ways to leverage information and communication technology – including the Internet – to ‘seamlessly integrate’ organizations into virtual organizations.

## 1. Introduction and Motivation

Several recent developments have brought many product-based companies in industry to consider developing new types of business-to-business relationships in and across their supply network:

- Frequent propositions in the literature that ‘supply chains will compete against supply chains’<sup>3</sup> in the future<sup>4</sup> rather than individual companies competing against companies,

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<sup>1</sup> This position paper is based on the presentation “Achieving Multi-Tier Supply Network Coordination” developed by the authors and was a foundation of the Network Master study supported by the ISCM Program.

<sup>2</sup> Mr. Hoppe was a Master of Science in Transportation Candidate & ISCM Research Associate at the MIT Center for Transportation Studies at the time this work was conducted.

<sup>3</sup> A sampling of assertions from quotes found in Appendix A.

<sup>4</sup> The authors believe the assertions are not fully justified except in very narrowly defined circumstances. See forthcoming article in *Supply Chain Management Review*, September-October 2001 for a more complete analysis.

- Information and communication technology (ICT, i.e. electronic commerce tools and capabilities, the Internet) and the proliferation of applications and software for companies to transact with other companies using the electronic and wireless media, and
- An increase in outsourcing (i.e. to third party operators) as a method for companies to focus on core competencies, creating ‘virtual organizations’<sup>5</sup> and further epitomized by ‘virtual integration’ and the examples set by Dell and Cisco in recent years.<sup>6</sup>

Hence, as companies consider the current environment and assess how to leverage ICT, outsourcing and possibly virtual capabilities, the need to develop deep and different relationships – coordinate – with other companies from their supply chain takes on greater significance.

Taken all together, these raise important questions about how companies could coordinate their businesses in order to compete as a group (rather than as an individual entities), to utilize the new ICT capabilities, and to leverage outsourcing for the benefit of the firm:

- How can companies govern these new relationships?
- What needs to be coordinated between the companies?
- How can companies coordinate their disparate organizations’ activities between adjacent-tier companies?
- What entities, governance structures and processes are necessary to coordinate across several companies in different tiers of the supply network?

Currently coordination of the supply network is most commonly established by what is popularly known as the ‘channel master.’ This term has been commonly used to describe the most powerful company of a supply chain, typically a downstream company adjacent to, or one tier removed from the end customer.<sup>7</sup> The term has not been broadly used for network or supply chain-wide coordination, and its use has been limited to describe coordination efforts that are largely single-company-centric, regardless of the other companies in the supply network. The Gartner Group<sup>8</sup> defined a channel master as follows:

*“A channel master is an enterprise within a supply chain that has compelling control over the sales of a product.”*

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<sup>5</sup> Goldman, Steve, Roger Nagel, and Kenneth Preiss, *Agile Competitors and Virtual Organizations*, New York: Van Nostrand Reinhold, 1995.

<sup>6</sup> The term ‘virtual integration’ was made popular by Joan Magretta in her interview with Michael Dell which was profiled in “The Power of Virtual Integration: An Interview with Dell Computer’s Michael Dell” from the Harvard Business Review, March-April 1998.

<sup>7</sup> Often the channel master has the most intimate knowledge of the customer and/or a strong brand name.

<sup>8</sup> Bruce Bond, “CEO and CIO Update: Automotive Supplier Exchange – A B2B Shot Heard Worldwide”, InSide Gartner Group, ICG-03222000-01, March 22, 2000.

Given this definition, the channel master exercises influence over the other companies in the supply network, often directing activities, technology, and behavior in the supply network.<sup>9</sup> In many cases the channel master is the retailer or distributor of product to the end customer, although that is not always the case.<sup>10</sup>

The literature on coordination does not directly address supply chain coordination in great detail, although the definition of coordination seems readily applicable to a supply chain environment. A high level definition of coordination developed by Malone and Crowston<sup>11</sup> follows:

*“Coordination is managing dependencies between activities.”*

Furthermore, Malone and Crowston’s work identified common dependencies between activities: shared resources, producer/consumer relationships, simultaneous constraints, and task/subtask. Of this list, ‘producer/consumer’ relationships encompasses the traditional dependencies found in a supply chain, yet there are clearly other dependencies (shared resources and simultaneous constraints) that describe some supply network relationships.

The literature on supply chain collaboration entails a scope that is mainly between two companies (point-to-point collaboration rather than collaboration across a network) and is largely software-focused.

## 2. Strategic Supply Network

If we apply the principles of network optimization to a supply network, in principle we can develop a set of potential benefits just as one would develop benefits for optimizing internal company operations. There are some key differences in that the internal company environment entails a single economic entity with common financial goals, and therefore the benefits may be different and more difficult to achieve. This represents a significant obstacle for coordinating financial flows and risk across multiple tiers.

The coordination activity increases in complexity when one considers that the supply network has far more customers and suppliers than does the internal supply chain. For this reason, it may not be feasible to attempt coordinating with all customers and

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<sup>9</sup> Examples of this can be inferred by the following: Dell Computer expects suppliers to locate operations adjacent to Dell facilities; GM and Ford expect their suppliers to utilize Covisint as a buying marketplace, and prior to Covisint each company had placed expectations on the suppliers to support their respective company-sponsored web-based purchasing environments (citations from press Nov 2000).

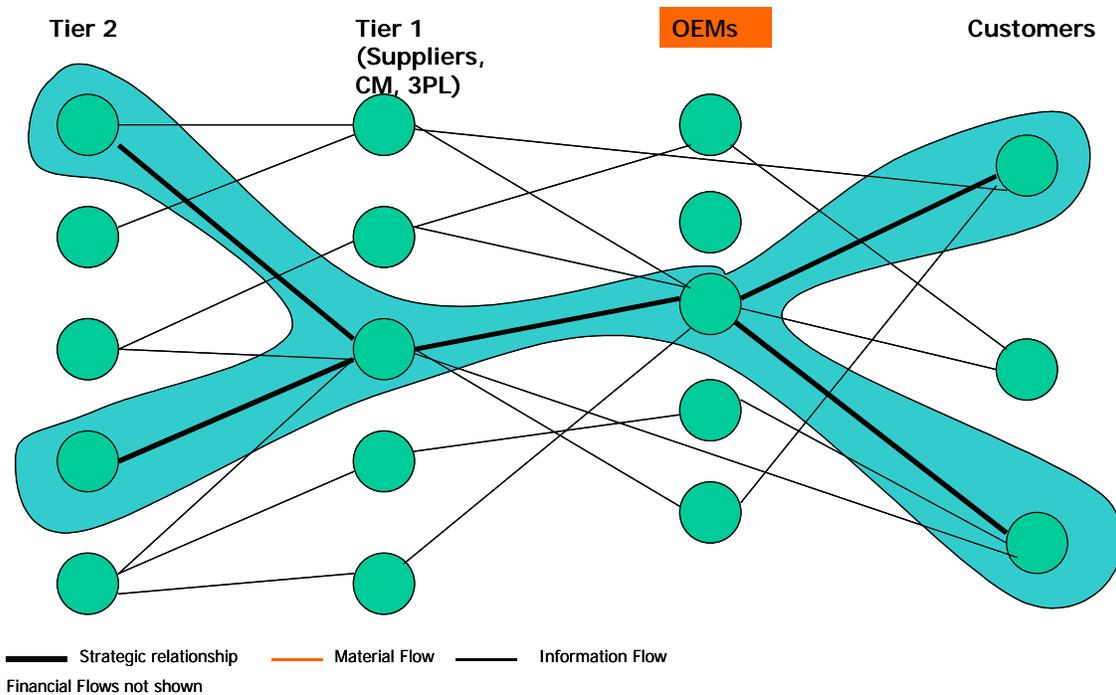
<sup>10</sup> The exceptions are where the end user may have based their purchasing decision on factors that the retailer or distributor does not control, such as the components of the product (consumers choosing PCs primarily because of the Intel processor inside) or the brand of the product itself (consumers choosing retail outlets primarily because of the Coca Cola inside). In these cases, there may be more than one channel master in the same chain.

<sup>11</sup> Malone, Thomas W., Crowston, Kevin “The Interdisciplinary Study of Coordination” ACM Computing Surveys, Vol. 26, No. 1, March 1994, p. 90.

suppliers. Given this, we propose that the highest leverage will come from coordinating with a selected subset of the supply network participants. We refer to this selected subset of companies as the ‘strategic supply network’ and we propose that this subset would have the following characteristics:

- Companies that share sensitive business information,
- Companies which are mutually dependent, and information-dependent, and
- Companies where the relationship is irreplaceable (in the short term) and/or meaningful (likely high-volume of transactions and strategic inputs).

We introduce the concept of the *strategic supply network* to define the environment for applying supply network coordination and to make the coordination tasks more realistic in application. Figure 1 illustrates one possible variation of a strategic supply network from an OEM’s perspective. In this case, the strategic supply network includes one Tier 1 supplier, two Tier 2 suppliers, and two customers. Other combinations are likely, dependent upon which subset of suppliers and customers meet the aforementioned characteristics.



**Figure 1.** Sample Strategic Supply Network

Potentially, such a strategic supply network may operate more efficiently and effectively if the group could coordinate their investments and operations. As an example, the network may perform at a higher level of performance (lower cost, reduced working capital requirements, faster response time) if the upstream Tier 2 supplier carried more

raw material and if the downstream assembler carried less finished goods inventory and more converting capacity. The group would need to make investments in the network (raw material inventory at Tier 2 supplier, additional capacity at OEM) and balance the benefits, costs, and risks of their collective operations. This calls for coordinating various activities among the respective organizations.

### 3. Multi-Tier Supply Network Coordination: Requirements

If coordination can generally be defined as managing dependencies between activities, then what are the activities that need to be coordinated in a multi-tiered supply network?

As we have noted in the previous section, we suggest that the important scope for coordination is the strategic supply network rather than the entire supply network. In a first attempt to address this question, we propose that there are three distinct coordination activities<sup>12</sup> required for coordinating across multiple tiers of the strategic supply network as follows:

1. Coordinating connected information and information systems that provide information visibility of information across the supply network (supply network visibility),
2. Coordinating logistics process and operations coordination across the supply network, and
3. Coordinating making network-level decisions and tradeoffs, balancing financial commitments (benefits, investments, operational costs, equity) and risks among the companies in the network.

The first two can be considered more tactical and operational and the third activity more strategic in nature. An initial observation is that the activities differ in their respective time frames from short-term (information flows), to mid-term (logistics and operations flows), to long-term (network-level financial and risk balancing).

These three activities represent new and potentially useful ways to understand coordination when applied to the supply network domain. Some of the powerful aspects of defining supply network coordination in this way are as follows:

- Each of the three coordination activities may be coordinated independently from the other activities, although coordinating the long-term activities may be affected by the choices selected for the short-term activities
- Each of the three coordination activities may be coordinated by different entities
- Each of the three coordination activities may be coordinated using different coordination mechanisms
- There may be several different sequences for coordinating these three activities (it may not be necessary to have the activities coordinated sequentially or even in the order being presented)

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<sup>12</sup> These may be considered a generic set of required coordination activities that are specific to coordinating supply networks.

- The third coordination activity – network level decisions, tradeoffs, balancing benefits, investments, costs and equity – is a new coordination activity that calls for potentially new coordination mechanisms and processes

Prior to this point in time, the concept of coordination in the supply network was rooted in the thought that there would be one entity conducting all coordination activities. Third party logistics providers (3PL) have recently moved towards amassing broad sets of skills and capabilities in order to serve that single coordinator role.<sup>13</sup> Similarly, consulting firms have expanded their service offering into the coordination domain by offering 4PL services.<sup>14</sup> Users have been complicit in the assumption that one entity would provide all coordination, as many companies seeking outsourcing solutions have searched in vain for one-stop-shopping where all their outsourcing needs (coordination and other) would be satisfied by one organization.

Recognizing that coordination activities may be performed by separate entities opens up many new options for coordination, both in terms of entities that would perform the coordination activity as well as the type of coordination process that would be used.<sup>15</sup> Ultimately, this translates into a broader set of choices for supply network design, greater control over selected elements of the supply network not previously imagined, and the potential for creating competitive advantage through unique supply network design.

Additionally, the third level of coordination – ‘network-level financial and risk balancing’ – is a new type of coordination from the practitioners perspective, in that we know of no examples where network-level financial and risk balancing has been coordinated among separate economic entities. This activity may provide the highest leverage for performance improvement as select groups of companies in a supply network seek this level of coordination as a way to improve performance of their supply network.<sup>16</sup> Several organizations coordinating their collective business entities may be in a better position to manage inventory, plan flows, make network investments and manage customer fulfillment than each individual company would be able to achieve if they were performing by themselves. Given this, an important activity to coordinate would be balancing investments, risks, costs, and benefits across the companies of a supply network.

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<sup>13</sup> FedEx, ConWay, UPS each have expanded their service offering through acquisition or internal development.

<sup>14</sup> Most notably Accenture with their 4PL services which entails coordinating broad operations including 3PL providers for a company.

<sup>15</sup> This paper does not address the variety of processes that are possible for coordination. Alternatives for coordination generally range from market mechanisms (purchasing on the open market, individual buy-sell transactions) to hierarchies (range of ownership) as presented by Oliver Williamson, *Markets and Hierarchies: Analysis and Antitrust Implications*, New York, NY: Free Press, 1975.

<sup>16</sup> As an example, the network may operate more efficiently if an upstream or Tier 2 supplier carried more raw material and if the downstream assembler carried less inventory and more converting capacity. Coordinating the necessary investments in materials and capacity, and balancing the benefits and costs across each member of the supply network may enable reducing operating expenses and working capital requirements, increasing response time and ultimately provide not only a cost advantage but potentially a competitive advantage as well.

This set of coordination activities is rooted in the traditional set of three supply network flows (information, materials and funds),<sup>17 18</sup> and validated by using Malone and Crowston’s methodology<sup>19</sup> for characterizing dependencies. Specifically, applying the methodology to a multi-tiered supply network, it becomes evident that different types of dependencies exist among the participants of the supply network, as suggested in the figure below.

Activity	Dependency	Potential Coordination Processes
Coordinating connected information and information systems	Producer/consumer relationships – Usability	Standardization, Participatory Design
Coordinating logistics processes and operations	Producer/consumer relationships – transfer, prerequisite constraints	Inventory management, JIT, Sequencing, Tracking
Coordinating making network-level decisions and tradeoffs, costs, benefits and risks	Shared resources	Budgets, Managerial decision, Decision rules

Source: Authors, adopted from Malone and Crowston

Each of the different dependencies may then be best served by a different type of coordination mechanism. Continuing with the logic, there will likely be different entities best suited to performing the different coordination activities.

#### 4. Network Masters

One further refinement and proposal is the Network Master. Currently, there is some measure of self-interested supply network coordination occurring on a gross level, and ‘channel masters’ are providing that coordination as has been discussed. Based on the current state-of-art, ‘channel masters’ provide coordination mainly in downstream distribution channels and operate with limited scope and narrow economic self interest. We propose that an entity or entities we call Network Master(s) would coordinate the respective activities across multiple tiers. Consistent with the potential of coordinating different dependencies with different processes and by different entities as we have suggested, the Network Master could take many different forms ranging from a single

<sup>17</sup> Metz, Peter “Demystifying Supply Chain Management” *Supply Chain Management Review* Fall 1998

<sup>18</sup> The SCOR model of four supply chain processes – Plan, Make Source and Deliver – were considered as well but these activities are subsumed by the proposed set of three coordination activities.

<sup>19</sup> Malone and Crowston, 1994 p. 91 “If coordination is defined as *managing dependencies*, then further progress should be possible by *characterizing different kinds of dependencies and identifying the coordination processes that can be used to manage them.*”

individual, to a single business entity, to a governing body comprised of representatives of the SC companies among others.

Instead of there being one ‘channel master,’ there could be multiple Network Masters: an Information Systems Network Master, a Logistics Network Master, and a Financial and Risk Coordination Network Master.

There is some evidence that this is starting to occur in the information systems environment as there is a great deal of effort is being focused on coordinating connected information systems among companies.<sup>20</sup> The broad range of information coordination offerings include connecting ERP systems, using Internet-based sites (as an information repository or a common information sharing platform), and developing information sharing standards for Internet use by different groups.<sup>21</sup> One could argue that 3PL providers are similarly focusing on logistics, although that would be inconsistent with the trend for 3PLs to amass a broad skill set and offering including information systems. Similarly, one may argue that 4PL providers are evolving to potentially perform the financial and risk coordination role although their efforts to date have been more as a single one-stop solution provider.

## Next Steps

We are currently conducting a Delphi study to assess the validity of the ‘supply chain competing against supply chain’ argument as well as to further explore these assertions and issues:

- That there are *three* coordination activities as requirements for multi-tier coordination across the supply network, and
- That a range of coordination mechanisms and entities will provide a broad and new set of coordination alternatives for practitioners.
- Limitations to the theories presented including:
  - Loss of competition (cost, technology support, product innovation) from the supply base that may come from building relationships with effectively sole source suppliers,
  - Investments in specific assets for the supply network, especially IT investments may present barriers to new technology adoption and limited reapplication of the technology for other non-strategic supply network customers and suppliers,
  - Use of suppliers that are common to other supply networks, which may:
    - Limit the ability to create unique capabilities as those capabilities would then be available to all of the supplier’s customers,
    - Limit the ability to openly share confidential business information without the risk of losing control of that information,

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<sup>20</sup> Connecting internal information systems was a core benefit proposed by enterprise resource planning (ERP) systems vendors such as SAP, JD Edwards and Peoplesoft.

<sup>21</sup> RosettaNet (electronics industry), Transora (CPG), Covisint (automotive) among others each offer some measure of information standardization for their respective industries.

- Present a potential moral conflict when the supplier has confidential information about its customers which will become evident when the supplier acts to support a specific proprietary customer initiative, and
- Inadvertently improve competitors' capabilities if they access the suppliers' improved capabilities that result from strategic supply network investments.

## Appendix A

A sampling of 'supply chain competing against supply chain' assertions from quotes found in the literature follows:

- "It's a supply chain vs. supply chain world today. Companies don't only compete with each other but with an extended web of suppliers." (Rob Rodin – CEO of Marshall Industries)
- "In more and more industries, it is becoming apparent that the competitive field is no longer limited to company A versus company B. The game is now supply chain network versus supply chain network, with an increasing reliance on collaborative relationships to create links of value." (Timothy Mould & C. Edwin Starr – Andersen Consulting)
- "Competition or rivalry occurs not in the form of individual firms competing with one another for market share within a stage, but in the form of supply chains competing for their share of the consumer's expenditures." (Michael Boehlje (Purdue University) & Steve Sonka University of Illinois)
- "International Competition is increasingly moving from being traditionally 'company vs. company' to becoming 'chain vs. chain'. To be successful companies need to join others to build competitive agri-chains." (Chains of Success, Agriculture, Fisheries and Forestry – Australia (AFFA))