Collaborative Processes in esupply Networks

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Abstract
This paper, which outlines research in progress, will attempt to provide an overview of collaborative relationships and processes within electronically-connected supply networks. These *e-Supply Networks* utilize the Internet to facilitate coordination and collaboration among multiple trading partners. We will look into the premises of interorganizational collaboration by delving into the new market landscape, *trade exchanges* and *collaborative communities*. Based on the contemporary business developments transformed by the advent of the Internet, we will describe the processes that define collaboration and take place in bilateral and multilateral relationships between partnering firms. We will expose how e-supply networks are currently deploying supply chain planning applications[185] that bind firms through information-sharing, interdependent transactions and collaborative processes that take place in Internet-based Marketplaces or Trade Exchanges. In order to establish and facilitate interorganizational collaborative partnerships, a rising number of firms use *process reference models* that have been developed via cross-industry initiatives. The most noteworthy are: a) Supply Chain Council's SCOR (supply chain operations reference process model); and b) the Voluntary Industry Collaboration's CPFR business model (Collaborative Planning, Forecasting and Replenishment). Both of these models attempt to assist managers in designing supply networks via standard, but highly customizable process descriptions. The SCOR model is more focused on performance improvement, while the CPFR model studies "how" companies can design and deploy their collaborative processes. We will show how the SCOR model is used to classify collaborative processes, and subsequently make a short presentation of the CPFR model. Finally, we will end by setting forward a research agenda that goes beyond the largely descriptive and anecdotal presentation of the advantages of e-Business from popular literature and press. We believe that companies are facing immense costs and barriers related with their transformation into collaborative communities.

Introduction
The current global environment, marked by increased demand, decreased customer loyalty, shorter product life-cycles, and mass product customization, forces companies to lower costs while increasing the quality and variety of products and services (see figure 1)[186]. In order to be able to meet these challenges, companies are extending their value-chains by cooperating with organizations whose complementary capabilities can give the whole business network a

[185] SCM consists of Supply Chain Execution (SCE) and Supply Chain Planning (SCP). Typical processes included in SCE are international trade logistics, warehouse-, transportation-, inventory-, and order-management, while SCP incorporates supply chain network design, demand planning, forecasting, supply planning, production planning, scheduling, and distribution planning.
[186] According to Forrester Research, during the past few decades, power has shifted away from manufacturers and many industries (retailers in the Consumer Packaged Goods (CPG) and end-users in Industrial Goods industries).

competitive edge. Industrial competition is therefore advancing from being between individual companies, to being between clusters[187] of tightly-knit partnering corporations with the intent of delivering to the consumer the right product at a fitting time-frame and price. So, companies are progressing from the notion of the extended supply chain[188] and *supply networks*[189] into *electronically-connected supply networks* that share information, execute transactions and collaborate on plans via Electronic Marketplaces or Trade Exchanges in an environment of constant change. By sharing activities within such trade exchanges and operating as though they were one seamless organization, synchronized to meet consumer demand, such *collaborative communities* strive to uncover significant cost savings and service enhancements (Tapscott et al. 2000).

From Supply Chains to e-Supply Networks

The dawn of the digital, networked economy[190], enables enterprises to transform themselves into *adaptable processes networks*[191]. Markets once favored competitors that could successfully integrate massive horizontal or vertical asset bases to create economies of scale. But companies have been slowly moving away from this strategy. The rise of Business-to-Business (B2B) commerce over the Internet is dramatically accelerating the shift (Tapscott et al. 2000). Businesses' ability to integrate more easily and more often with other businesses for collaboration and cooperation will remove many of the traditional advantages of large asset-based competitors. As the cost and latency or friction is removed from B2B transactions, companies will be more willing to consider outsourcing what were once core business processes. Companies find themselves as mere participants in a multicompany business processes. The need to better integrate with customers and suppliers compels businesses to dramatically alter their processes in order to survive.

[187] Clusters within networks are mentioned by Håkansson and Snehota, 1995.
[188] Ibid. Christopher 1994
[189] Supply networks as a development from linear, supply chains were presented by Harland, 1996.
[190] Among the most noteworthy proponents of the "digital economy" are Tapscott 1995, and Shapiro and Varian 1998
[191] The concept of adaptable process networks was presented by Chisholm, 1998.

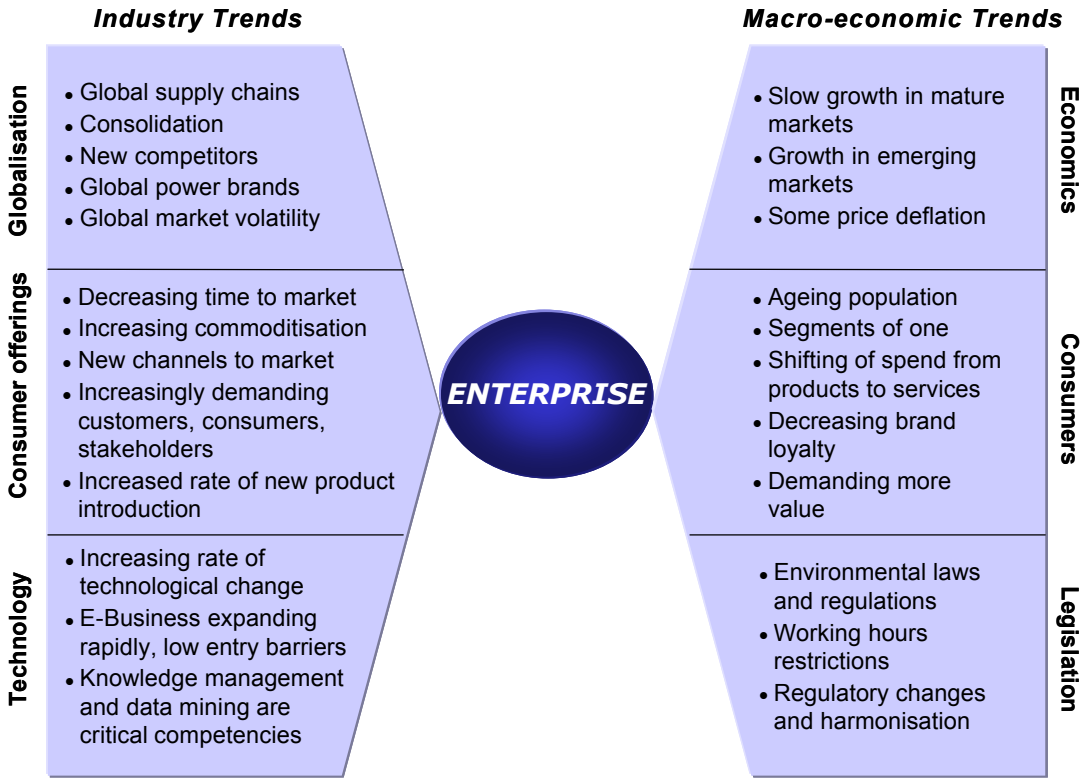

Figure 1: Micro- and Macro-economic trends facing the enterprise (adapted from PricewaterhouseCoopers,1999)

Consequently, many companies are currently disassembling their process infrastructures into independent processes and then reassemble them as parts of a *e-supply network* or *collaborative communities*. Such cooperation may be formed by outsourcing and collaborative partnerships (AMR, 11/1999). By outsourcing non-strategic operations to partners who can reduce costs and deliver higher quality products and/or services, companies can concentrate on their core competencies and process capabilities. This kind of partnering might also mean working collaboratively to share production, demand, capacity or product information in order to synchronize business behaviors across a supply network. An increasing number of firms are converging into *business-to-business* (B2B) *exchanges* or portals – over 600 were created alone in 1999. Based on the few current deployments of such applications, many research companies (AMR, Forrester, Gartner Group) proclaim that these companies are now able to expedite on-line B2B transactions; push marketing and sales initiatives to a new level; improve supply chain management; provide better customer service; and simplify the procurement, distribution, and logistics that surround a business's core products and service offerings. As a result, geographic boundaries are disappearing, which allows buyers and sellers, manufacturers and suppliers from around the world can come together in a single forum. Trading partners can globally plan and efficiently deliver goods by converging into *E-Business hubs* to meet their consumers needs. Organization- or Industry-centric E-Business Hubs or *Trade Exchanges* (like mySAP.com's Marketplace) provide the infrastructure needed to share information and process transactions electronically (AMR, 03/2000). Thus, they support inter-enterprise collaboration[192] and reduce user support,

[192] The use of the word "Collaborative" here represents all Internet-based processes – including planning, execution and measurement. However, only true collaboration "changes the transaction and hence the nature of the relationship between trading partners". And there is a test you can exert to determine if a process is true collaboration. Look at the data or information in question and ask: "is this jointly derived? If the data is jointly derived through a process, it is true collaboration. Collaboration requires that companies can share information, processes and decision making with the purpose of synchronizing their operations.

and maintenance costs, while enabling agility, the ability to change business processes at runtime. B2B operations are integrated electronically, so that execution, planning, forecasting, and collaboration can be meshed together to meet consumer demands always and in real-time, while minimizing stock-out scenarios, high inventories and the high costs associated with real-time human coordination and intervention (via meetings, faxing, phoning, mailing, etc). AMR (04/2000) projects that by 2004, 29% of the dollar value of U.S. commercial transactions will flow via the Internet -contrast that to only 1.4% in 1999, while Forrester (02/2000) forecasts that:

Transaction volume in B2B Electronic Marketplaces will grow from $43B in 1998 to $1300B in 2003. eMarketplaces will ultimately account for between 45% and 74% of eCommerce in a supply chain. The largest impact will be in the computing and electronics, shipping and warehousing, and utilities industries. By 2004 more than 70% of online trade or $2.7 trillions will go through eMarketplaces. More than 90% of firms plan to buy and sell on the Internet…

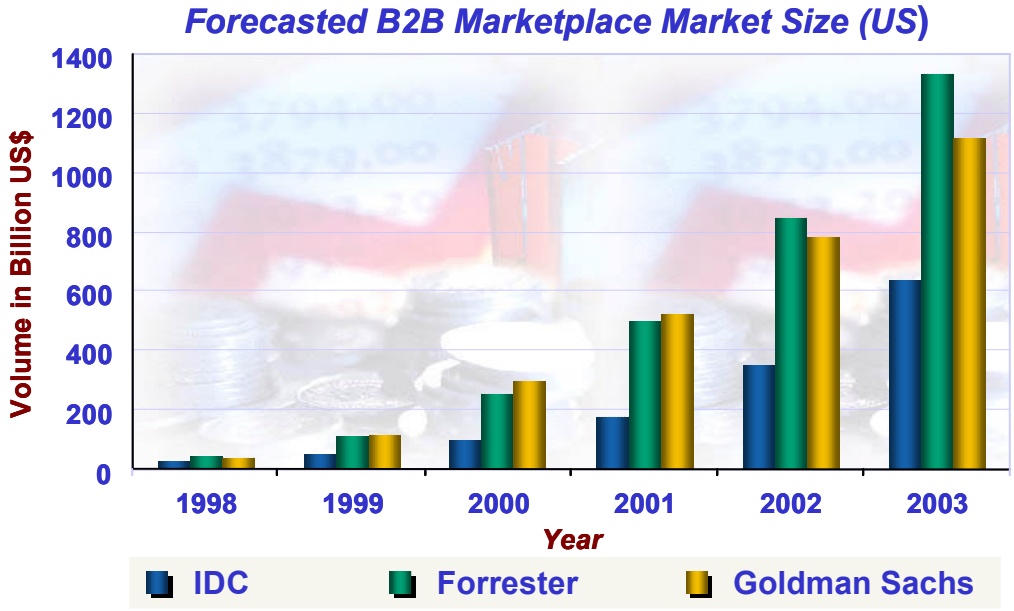

Figure 2: Forecasted size of B2B Marketplace trade by three research firms.

With such a market potential, many software vendors produce a steady stream of heavily marketed E-Business applications. Yet, looking beyond the present euphoria over the benefits of collaboration, a company has to reinvent its business processes, restructure its organization and re-skill most of the people within it. It seems that the costs of entering the e-Business phenomenon already seem prohibitive for small companies and an enormous undertaking for large, established multinationals (AMR, 04/2000).

From Event-based Business Networks to Collaborative Communities

Beyond the current hype, the study of such inter-organizational business relationships has been central in theories about Business Networks[193] in the last two decades (Hedaa, 1997;

[193] *Networks* are organizational structures in between markets and hierarchies. The network theories aim to render organizational issues in inter-organizational networks, and focus on strategic positioning or power configurations. Networks typically exist in heterogeneous business-to-business markets, because e.g. trust here is beneficial to all members as it allows the network to define its context and thus its immediate environment (Håkansson and Snehota, 1994 in Ford ed., 1997). Network-theory emphasizes the importance of two basic questions: (a) Who does what?, and (b) How are their activities connected? Furthermore, it highlights that companies in general should only perform those activities in which they may perform better than average compared to major competitors in the long run, i.e. focusing upon core competencies. Where industrial

Ford et al., 1998). These research efforts originate from Scandinavia and have been further developed by the Industrial Marketing and Purchasing (IMP) group whose seminal work on networks dates back to 1982. Some the most noteworthy constructs are the *interaction model* (Ford, 1997), the *ARA* (Activity links, Resource ties and Actor bonds) model[194] (Håkansson and Snehota, 1995), and the *event-based business network* (Hedaa and Törnroos, 1997). The first two models study business markets in terms of the nature of buyer-supplier relationships and the embeddedness of these in industrial networks, modeled as inter-connected actors, activities, and resources. Hedaa's *event networks* view interactions as streams of events that ultimately determine effectiveness in networks. Events generated by extensive interactions can reveal exception-handling processes under uncertainty, and provide insights into the dynamics of network evolution (Hedaa and Törnroos, 1997, Scheer, 1998). Where strong inter-organizational relationships exist, another type of network that is neither market nor hierarchy, emerges: *network processes* (Easton, 1992). These *network* or *collaborative processes* represent collaborative arrangements, and rely heavily on information-sharing molded by the distribution of power, influence and trust[195]. Better access to material and immaterial resources render some firms more powerful than others, which stimulates them to pursue network dominance (Håkansson and Snehota, 1995). For example, in supply networks, the obligation to spearhead cooperation often rests with a dominant, highly influential player that defines the ground-rules of collaboration by extending its processes across parts of its web of interactions. In contrast to this extended and enforced cooperation scenario (Browne et al., 1994), Scandinavian companies, are more predisposed towards loosely coupled collaborative infrastructures (Hedberg et al. 1997). The relative smaller size and consequently lower influence of the network participants create a situation where a company cannot dominate, but rather has to adapt to the network (Ford and Håkansson, 1999). Configuration of process interactions or links among multiple, equally influential partners are *negotiated* rather than dictated. This in turn requires more introspection of each member's process infrastructure. These issues clearly indicate a rising need to investigate such *e-business* companies that are linked via bilateral and multilateral relationships into loosely coupled process networks, and converge into open Trade Exchanges and/or tighter Collaborative Communities (or Value Chains according to Tapscott et al. 2000). Buyer-seller relations between partners are becoming more opportunistic, endemic and dynamic in nature, while driven by compatible goals (Hedberg et al. 1997). In the face of the rising standardization of communication and data exchange, we do have to reconsider how relationships are evolving within these electronic market networks.

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marketing is very much a matter of establishment and development of customer relationships, the network paradigm adds at least three important factors: (1) power, (2) influence and (3) trust.

[194] In general, *actors, activities* and *resources* go into the description of external networks as independent factors: a) *Actors* are characterized by their performing of activities and controlling of resources. Actors in an industrial network may be perceived broadly as individual persons, groups in organizational, or organizations. Which actor is going to be at the focus will depend upon the actual context. b) *Activities* are performed by actors when using and transforming resources and considered to be links in longer chains of activities. One such example is the chain of value added in the transformation of raw materials and other inputs into complex products and services. c) *Resources* are controlled by actors and the value of resources is determined by the activities in which they are to be used Examples of resources are technology, finance, capital and personnel (Ford, 1997).

[195] According to Thorelli (1993), trust may be viewed as confidence in the relationship, based on awareness of reputation, past performance and reciprocal benefits and demands. Trust determines potential risks and opportunities in network relationships. On the other hand, power and dependency structures often con-strain opportunistic behavior, by defining dominant directions of influence.

Enabling Technological Advances

The appearance of such ephemeral "plug-and-collaborate" supply networks and virtual B2B collaborative communities (e.g. E-Business/B2B exchanges), has been enabled by innovative advances in information technology and driven by the utilization of common communication, security and process standards. In the last decade a rising number of companies have been experimenting with process improvement, integration and automation (Scheer, 1998). Most of these business engineering (Vernadat, 1996) efforts were realized via *enterprise resource planning* - or ERP systems (from vendors like SAP, Baan, PeopleSoft, Oracle). The wider deployment of ERP systems and innovations in messaging and tracking technologies that allow real-time management of supply chain activities, has resulted in more compatible process and information infrastructures[196]. Furthermore, the Internet has emerged as an ubiquitous communication platform on which companies can collaborate with their partners, reduce cycle times and enforce data and security protocols[197]. These developments has led to the appearance of advanced planning, optimization and scheduling software (APS) that complements ERP/ MRP with an intelligent planning environment. APS systems implement supply network planning processes and act as a highly responsive nervous system of a supply network[198]. Many software vendors are currently offering APS systems (e.g. APO from SAP AG, and Rhythm from i2 Technologies) as supplementary systems to established transaction/ERP systems (SAP, 1998). Furthermore, these company-centric packages are currently being extended to provide *collaborative planning* via the Internet (i.e. APO Collaborative Planning). Collaborative planning applications utilize Internet technology (with standardized data formats like XML) to synchronize demand signals and supply chain activities, by allowing supply network partners view and share common information stored in B2B or even business-to-consumer web sites (e.g. portals as mySAP.com's Marketplace).

Towards complex e-Supply Networks

These Collaborative Planning applications, spanning whole business networks, and cheaper electronic connectivity afforded by the Internet, are drastically changing the supply network landscape (AMR, 01b/2000). Innovative companies are using these technological developments to expand their networking capabilities and the nature of their operations. They are pursuing control by reconfiguring their supply chains, focusing on core competencies that add value to the supply network, and leveraging e-business technology to connect and coordinate processes among their trading partners in real time. Electronic connectivity enable these companies to execute networked, cross-enterprise processes and integrate with trading partner operations, moving them from sequential, enterprise-centric supply chains in which an enterprise drives multiple processes, toward synchronized *electronically-connected supply*

[196] According to *Coordination Theory*, managing is a highly information-intensive activity and applying information technology (IT) to this area has a profound impact (Malone and Crowston 1994). According to Malone (1997), the dominant logic of the future might be the idea of connected decentralization enabled through a higher information technology intensity. Benjamin and Wigand (1996) have elaborated on the effects of IT and the potentials for reducing transaction and coordination costs when organizational units cooperate. This direct interrelation of IT performance and coordination costs compensates for the additional coordination requirements within networked environments. Therefore, IT enables extended networking among business units, a phenomenon called 'Electronic Strategic Networking Effect'.

[197] The parallel advance of universally accepted component infrastructures (i.e. Microsoft's COM+), agent-technologies based on business objects and workflow, will further enhance the processing and collaborative capabilities of APS systems.

[198] These systems apply sophisticated logic to the complexities of synchronizing demand requirements to available resources - taking into consideration least cost, customer service levels, corporate priorities and operational constraints. The result is a dynamic, constraint-based planning recommendation used to quote delivery dates, source materials, launch orders into production and re-schedule orders for highest service to cost optimization.

networks, where one process drives more than a single enterprise (Benjamin and Wigand, 1996). In this regard, multiple channel masters are likely to emerge within some supply networks, and not only those that control the point-of-sale selling process, but also those that dominate through distribution or manufacturing excellence[199]. For example, Cisco Systems, Dell, Adaptec and Ingram Micro in the High-Tech industry have dominated by evolving virtual business models through tight coupling with suppliers and customers (Tapscott et al. 2000; AMR, 06/2000).

E-Supply Networks objectives and challenges

This degree of collaboration supported by contemporary connectivity technologies, require that partnering companies strive to: a) provide *visibility of information* (inventories, forecasts, orders, plans, engineering changes, KPIs), b) *synchronize activities* (optimized feasible sourcing/planning, pull-based triggers), c) *promote responsiveness* (reduce time to detect demand, commit, produce, fulfill), d) *achieve process simplification* (by automating well known or routine process steps), and finally, e) *leverage market mechanisms* (e.g. aggregate buying power, use auction-based buying/selling via trade exchanges). These objectives also indicate the immense challenges faced by e-Supply Networks today (AMR, 11/1999). For example, they have to be able to:

- Take orders over the web, or automatically via B2B Trade Exchanges.
- Offer rich product selection and/or the ability to customize.
- Source the order and commit to delivery, immediately, online.
- Service the order online, including changes and inquiries.
- Deliver product quickly, efficiently, profitably.
- Be in constant communication with customers and suppliers to:
    - respond quickly to "pull signals" to manage inventories
    - adapt quickly and economically to changes in demand/supply
    - operate with low inventories
- Operate in a world of short product life cycles

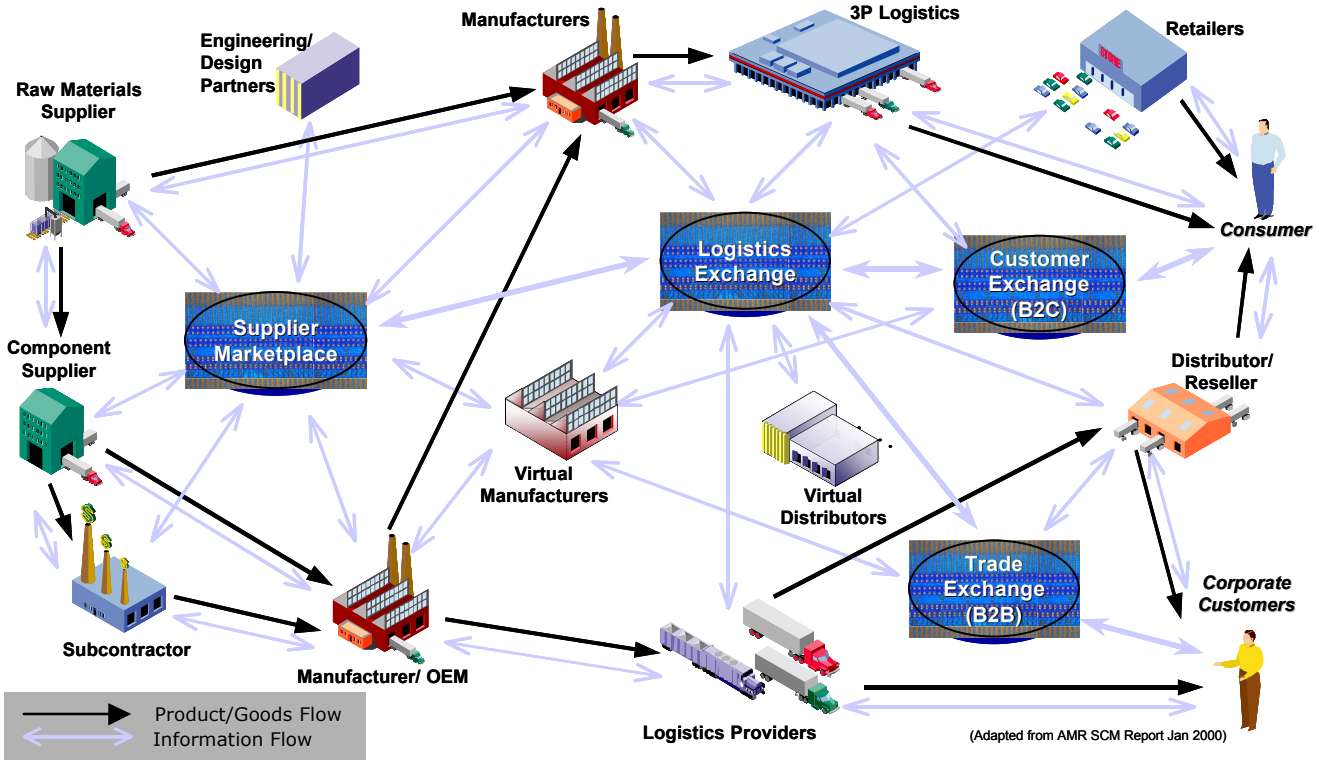
So, towards the customer, e-Supply Networks attempt to: a) shorten time to market (through collaborative engineering, outsourcing, and contract manufacturing), b) provide convenient purchasing (via direct web-based sales, online catalogs), c) enhance selection (by enhancing customization or configurable products), and d) improve response (by order promising, order tracking, event notification and fast delivery). These downstream objectives are supported by upstream operational improvements, like : 1) replace inventory with information (central inventory visibility, forecast end-of-chain demand, collaborate with channel / customer), 2) shorter planning / replenishment cycles (via automated planning / S&OP process, increased collaboration with suppliers, rate based planning), 3) reduce lead times (through supplier collaboration, "pull" replenishment / VMI and build to order/ postponement), 4) improve synchronization (by generating feasible, optimized plans & schedules, replan when conditions change), 5) provide order status and traceability, and finally, 6) use internal and external performance metrics. Thus, e-Supply Networks are increasingly relying on *Collaborative Planning* to ensure that customer demands are met (AMR, 06/2000). Application integration together with Internet connectivity, enables such real-time

[199] Currently, suppliers are more or less being forced to participate in one or more exchanges, particularly if the suppliers serve large, influential corporate buyers. Not wanting to be excluded as a preferential supplier, companies will bite the bullet in additional work requirements in order to supply content and transactional support to multiple trading exchanges. While companies may be coerced, compelled, or just supportive of pilot programs to initially join a number of exchanges, over time the shakeout will occur in industry and cross-industry marketplaces.

communication and advanced planning functionality across multiple enterprises to optimize resource allocation and synchronize information and product flow (AMR, 05a/2000).

New intermediaries in e-Supply Networks

Instead of fewer intermediaries in contemporary supply networks, these last 2 years has shown a plethora of new intermediaries entering the buyer-seller relationship. It is evident that companies are able to connect with more partners in business communities (Forrester, 02/2000). In contrast to Electronic Data Interchange (EDI), the more affordable and easier-to-implement Internet-based connectivity allow previously intracompany processes (i.e. product development, order fulfillment or operations planning) to spread across trading partners, large and small, which leads many companies to focus on their core competencies and outsource non-core processes to their partners. Some, for example, are already becoming *virtual manufacturers* that choose to only focus on product development and marketing, leaving manufacturing to contract manufacturers and order management to fulfillment houses (AMR, 05b/2000). An often used example, is Sun Microsystems' build-to-order model, that uses real-time electronic connections to contract manufacturers, distributors, and logistics providers without necessarily increasing its order fulfillment cycle time (e.g. 3PLs assemble orders and keep component inventories). Thus, these e- supply networks include traditional players, such as suppliers, manufacturers, and distributors, as well as an increased number of nontraditional intermediaries such as the following:



- **Virtual Manufacturer**: This type of organization does not manufacture anything, nor does it have any plants. A virtual manufacturer does, however, control product development, marketing, and sales as well as coordinate customer service for its products. It hires contract manufacturers and third-party logistics and fulfillment service providers to make, assemble, and ship final products to its customers. Foe example, Ingram Micro, one of the world's largest wholesale distributors of technology products and services, has since 1998 embarked on an initiative with

Solectron, a contract manufacturer, to allow Ingram to become a virtual build-to-order manufacturer of PCs. Another typical virtual manufacturer, Sun Microelectronics, a division of Sun Microsystems, Inc. views its core competency as board design and development, not manufacturing. Consequently, it has outsourced the production of electronic boards, which are then shipped by suppliers directly to customers as well as to a parent company division where computer systems are built.

- **Virtual Distributor**: This type of organization does not distribute anything and does not have any warehouses. It markets products and takes orders for multiple suppliers. The virtual distributor controls marketing and sales, and coordinates order fulfillment. However, it relies on its suppliers to make, assemble, and ship final products directly to its customers. Some of the most imposing examples from the literature are Ingram Micro and NewFlowers.
- **Virtual Retailer**: This type of organization, better known as an Internet retailer, does not own any brick-and-mortar stores. It does, however, merchandise products in virtual stores, namely hosted Websites. The virtual retailer controls order fulfillment and can rely on its own distribution capability or suppliers to ship products directly to customers. Amazon.com is probably the best-known example of this type of virtual retailer; Grainger's Orderzone.com is another.
- **Virtual Service Provider**: This type of organization does not own any assets, but it does provide SCM services. This includes Lead Logistics Providers (LLPs) that perform logistics management for a company or a Logistics Exchange (LX), which is a trading exchange for procuring and monitoring shipping services. The National Transportation Exchange, Inc. is an example of a virtual service provider, with no transportation assets while providing transportation management services.

These new intermediaries require real-time sharing of information, including execution and transactional data, such as order information, as well as real-time plan updates. So, systems and processes in electronic networks is tightly integrated through Internet-based electronic connectivity. Virtual businesses also profoundly affect the way goods, services, and information flow within an e-supply chain, decoupling goods and services from the information flow, in contrast to traditional supply chains where information follows goods and service flows. As shown in figure 3, a pivotal element of e-Supply Networks is the clustering of interorganizational relationships into online trading exchanges.

Trading Exchanges as facilitators of E-Supply Networks

Online hosted Websites or trading exchanges, such as *Independent Trading Exchanges* (ITEs), represent a less technically sophisticated approach toward establishing electronic connectivity with a broad range of trading partners, reducing or eliminating the need for building custom point-to-point connections. These electronic marketplaces enable companies to electronically and efficiently trade and collaborate with their trading partners. A trade exchange is a real-time, open, marketplace where a buyer can evaluate all the potential suppliers for a particular product or service. Within a supply network they can be classified as downstream, consumer-facing, e-commerce sites or business-to-consumer exchanges (B2C), and upstream, business-to-business exchanges (B2B):

> "*The unique feature of a B2B Exchange is that it brings multiple buyers and sellers together (in a "virtual" sense) in one central market space and enables them to buy and sell from each other at a dynamic price which is determined [at a moment in time] in accordance with the rules of the exchange*." (from: Scully and Woods, 1999)

Trade exchanges are also described as centralized portals that have either a **vertical** or **horizontal** orientation (Goldman Sachs, 1999). *Vertical trading exchanges* or *Vortals*, service a specific industry segment by delivering one location to transact business (for example, trading exchange operators PlasticsNet.com in the Plastics industry and Neoforma.com, Inc in the Medical Equipment industry). They are "vertical" in the sense that they are channeled to serve specific industries, such as computing, chemicals, steel, and agriculture. Another model is referred to as a *horizontal portal* where, for example, a given process such as procurement or transportation is transacted for several industry segments that share common traits. Horizontal trading exchanges are web-sites where buyers and sellers can come together to communicate, share ideas, advertise, bid in auctions, conduct transactions, and manage inventory and fulfillment. They are "horizontal" in the sense that they serve a wide range of diverse industries or address horizontal applications across industries (examples: VerticalNet and TradeOut.com). Another horizontal variant connects customers to a set of suppliers that specialize in a functional supply chain area (e.g., Celarix, Inc. for global logistics and The National Transportation Exchange, Inc. for the purchase of transportation services). These third-party ITE operators are effectively functioning as a new intermediary in the byer-seller relationship between trading partners by extracting financial compensation per transaction conducted. Thus, while we see ITEs as playing an important role in future supply networks by offering "easier" partner connectivity, we do not believe companies will rely exclusively on them, unless additional services can be provided.

Types of B2B Trade Exchanges

On the pre-Internet era most business focused exclusively on internal optimization; interorganizational, B2B relationships were handled on a one-on-one buyer-seller basis without any benefits or synergy being derived from pooling any processes or transactions across the supply network. In this "Old World" each individual connection or link to a business partner needed integration and customization of different technologies (EDI, Edifact, FAX, etc.), which in turn required constant maintenance. Prohibitive costs related to the setup of such *one-to-one* (1:1) relationships, left many companies out of the integration loop, thus technology did not lead to any significant benefits. With the emergence of e-Commence and e-Business (Kalakota and Robinson, 1999), numerous electronic marketplaces sprouted, which promoted the realization of e-Supply Networks, characterized by a virtual number of potential trading partners coming together to share information, transact business, and collaborate. While EDI-based interconnections have proved too costly and inflexible to be the integrating vehicle for the Digital Economy, trade exchanges enhanced by new developments in process and data-standards (e.g. XML, Java) are squezing costs associated with the placing of Purchase Orders and Customer Order towards zero (AMR, 04/2000). Undoubtedly, the impact of B2B trading exchanges on supply networks go beyond mere procurement. Yet, these developments are the result of an evolutionary path that were highly affected by the emergence of the Internet and subsequent e-Business hype. Some research has already been undertaken in order to classify these developmants into various types of trade exchanges (Tapscott et al., 2000)

1. The *Auction House* or *Agora* model is a B2C purchasing model that provides a place where all buyers and sellers can share information, auction and bid goods and services in order to reduce the transaction costs associated with doing business with each other (e.g. eBay and MSN).
2. The *Independent Trading Exchange* (ITE), a many-to-many (m:n) business model, concentrates on the physical transaction – the buyer/seller process. This model pursues to maximize industry-specific or market-based efficiencies in order to achieve cost minimization and asset optimization. Each buyer and seller is but a click away

and upon execution of the transaction, they can go their separate ways and may never meet again (i.e. no loyalty). This model is close to the neoclassic characterization of "perfect competition", in that it is supports free exchange of information such as pricing and availability of all alternative products so that buyers will always be able to make rational decisions. ITEs are the natural extension of the Auction model in a B2B commodity world. Current cases focus on vertical industries – although a provider of the technology (the hosting service, for example) could offer many focused "hubs" each to a different industry (examples: e-Chemicals, e-Steel, PlasticNet, etc.).

3. *Vendor-Trading Exchanges* are variants of ITE, and are currently being made available by technology and especially IT vendors (e.g. SAP, I2, Ariba, CommerceOne, etc.). They can host a wide variety of industry or function-specific service, and they manage interaction and collaboration between members within the confines of the technology supported by the vendor.
4. Another variant of an ITE is the *Consortium Trading Exchange* (CTE), which in many respects resembles an electronic version of an industry cartel. Various members of an industry provide the liquidity and momentum in order to achieve industry-specific efficiencies. CTEs concentrate on vertical sourcing and provide a framework for more intense intra-consortium coordination and co-operation (examples: HighTech.com, Covisint, etc).
5. A *Private Trading Exchange* (PTE), is a marketplace instigated and owned by an entrepreneurial or influential member of a supply network – typically a brand or competence owner. Participation is ensured via *cooperative coercion*, a new, but very powerful phenomenon that attempts to achieve process and cost efficiencies for a certain subset or segments of an Industry – in some cases it enforces membership (like Daimler-Chrysler's PTE requirements). In fact, *cooperative coercion* leads to a tightly-knit, contractual, long-term partnership that pursues collaboration between trading partners. So, PTEs are consolidating pre-established relationships between well known partners. PTEs are often structured as one-to-many hubs hosted by the supply network host. The initial motivation is procurement cost savings through collaboration, process control, dynamic pricing, plus cycle time and efficiency improvements. Recently three of the largest automobile manufacturers in the US "clubbed" together to create a powefull B2B PTE (Economist, Dec.1999), that incorporated Ford's and GM's portals in one $170B TradeXchange. This B2B centralized hub ensures that joint purchasing requirements are funneled to those participating suppliers, who then provide offers for bulk buy to all byers.
6. Finally, the *Collaborative Community Exchange* (CCE) or *Supply Hub*, is a hybrid model that tries to marry the benefits of transaction cost reduction of the ITE model with the additional benefits of close collaboration between trading partners, who jointly invest in the CCE, share costs and profits in order to improve the performance of the whole value-chain or business-web (Tapscott et al. 2000). Contrary to the Consortium Exchanges, which are predominantly populated by competitors, CCEs are more vertical in scope in that they may include partners from the whole value chain related to a product or services. By participating in a Collaborative Community a company plans to win in its market/brand space by strategically & operationally aligning with its partners – in effect creating a value chain battle front so that instead of company versus company being the mantra – it is community versus community. This is very much an old idea of inter-supply chain competition, but is only operable today because of the Internet. Also, CCEs promote collaboration as the supplier might be able to share and "jointly derive" some planning data if that is provided by the manufacturers. In a Collaborative Community, it is designed to be a non-zero-sum

game. A buyer basically picks key suppliers and tries to lock-in certain relationship components made up of products, services etc. so that both parties share in the costs and benefits of defeat and victory. Thus, in order to grasp the full importance of this model, one has to understand the requirements and constraints of existing plus potential business relationships.

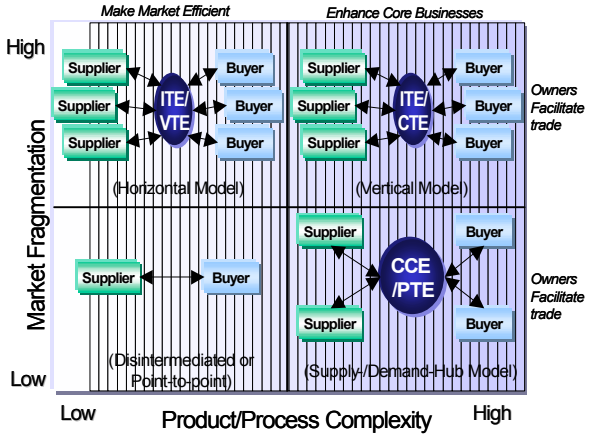
Table 1: Some key differences between the various types of Trade Exchanges (Source: cpfr.org & AMR 05b/2000)

	Collaborative Community Exchange	**Private Trading Exchange**	**Independent Trading Exchange**	**Auction House**
Structure	One to Many, Shared Private Hub (multiple owners)	Many to Many, Private Hub (one owner)	Many to Many, Public Hub (one owner)	Many to Many, Anonymous Public Hub
Purpose	Collaboration within a vertical segment of an industry – manage collaboration & interactions with members of the business community	Coersion to achieve Industry-focused efficiencies – manage interactions among industry participants	Strives to reach Industry- & Market-based efficiencies – manage interactions among exchange participants	Strives to reach Market-based efficiencies – manage interactions among exchange participants
Products	Few branded or differentiated	Many differentiated	Not differentiated	Not differentiated
Fulfillment	Heterogenous, customizable & competitive fulfillment	Heterogenous, customizable fulfillment	Homogenous	Homogenous
Innovation	Discontinuous, integrating new business processes across a multitude of partners	Discontinuous, integrating new business processes	Continuous, automating old business processes	Continuous, automating old business processes
Focus	Jointly developed Sales Forecasts + Replenishment	Visible Forecasts & Transactions	Transparent Transactions	Transparent Transactions
Pricing	Price is not primary driver	Price is not primary driver	Price is key decision factor	Price is key decision factor
Effort	Exception-based notification to access to critical info	Hybrid, Self-service & Exception-based	Self-service based (access to critical info)	Self-service based (access to critical info)
Relationship	B2B Exclusive (high volume)	B2B (medium volume)	B2C / B2B (high volume)	B2C (high volume)
Benefit	Minimizing Costs, Optimizing Transactions and Increase Revenues	Minimizing Costs and Optimizing Transactions	Minimizing Transactions Costs	Minimizing Transactions Costs
Future State	Tend to cluster into tight Value Chain Partnerships	Tend to steady state but remain small	Many will disappear due to members' margin erosion	Will predominantly be within the realm of B2C

The real opportunity in e-business is the development of collaboration throughout a company's relationship portfolio. Given the ever-increasing needs to ensure customer responsiveness and drive industry competitiveness, many companies are currently establishing their own PTEs and some even CCEs, integrated with their internal enterprise systems (e.g. ERP), to coordinate and share supply network activities and resources, in real-time among their partners[200]. According to Tapscott (2000, p.29), companies in markets with

[200] According to AMR's report, *Evaluating the Independent Trading Exchanges*, from March 2000.

low fragmentation[201] and with *high value integration*, that is, facilitating creation of specific product or service offerings by consolidating value contributions from multiple sources (high product complexity[202]), should primarily operate as interorganizational value chains via



Collaborative Community Exchanges. ITEs/VTEs should be used for low value, commodity transactions (AMR, 01a/2000, AMR, 10/1999).

Categorizing Trade Partners and Trade Exchanges

Trading exchanges provide the platform for companies to interconnect, streamline, and reinvent their interaction with customers, suppliers, service providers, and channel partners. However, these exchanges need to be considered in the context of a more comprehensive strategy that addresses a company's overall strategic business goals and how e-business and supply chain strategy will enable those goals. In general, companies need to segment their trading partners into at least two classes of goods and services for the purpose of developing their *trading exchange strategy*:

1. For *commodity-like, non-strategic direct and indirect manufacturing goods and services,* ITEs are the best alternative to electronically interconnect trading partners. For commodities, price and availability affect purchase decisions, so conducting business over a public exchange will reach a multitude of potential partners. Partnerships among these types of trading partners are relatively loose, typically lasting less than a year. Electronic connectivity primarily enables online ordering and real-time order management coordination.
2. For *strategic, high-to-low volume of direct materials and services*, companies will utilize either private trading exchanges or collaborative community exchanges. These types of goods and services require tighter more longer-term partnerships among trading partners, as price and availability are relatively less important purchase decision criteria. Electronic connectivity (EDI transactions over a VAN or the Internet) is used to facilitate information-sharing and collaboration, such as on product design and development in addition to production schedules and forecasts. CCEs are especially used where strategic partners tend to represent greater volumes and more frequent transactions (e.g. Sun Microsystems, HP Peripherals, etc.).

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[201] *Market fragmentation* is measured by the number of channel players within the industry. A highly fragmented industry will have a large number of suppliers, distributors, and buyers. No handful of channel participants disproportionately controls the flow of goods and services. In contrast, in an industry with little fragmentation, a handful of companies controls a majority of market share (AMR, 10/1999).

[202] *Product/process complexity* comprises several components: highly-specific user needs, time-sensitive product, geographic concerns, volatile market conditions or product, and efficiency or inefficiency of channel and manufacturing processes. All of the attributes can greatly impact the relationship between channel partners and the value chain (AMR, 10/1999).

To summarize, the use of private and public trading exchanges enable innovative companies to establish dynamic supply networks in which non-strategic suppliers can easier than before, enter or exit from a trading community. On the other hand a company's relationships with its strategic partners, are getting more complex and dense as the *formality*, *volume* and *intensity* of information and transactions constantly increases. For example, Internet-based collaborative planning in CCEs enables communication of consumer behavior, "as it occurs" across multiple trading partners. Instead of being lost in the placement of an order, which disguises the nature of the original demand, the wholesaler and manufacturer are "collaborating" on the interpretation of the change in demand. They could agree, for example, that this was indeed an aberration and thus prevent any costly build-up of inventory. Oppositelly, if they could collectively agree that the demand change was real, they would collectively increase supply with-out any locally harmful effects. Thus, in order to better understand the new opportunities for interorganizational collaboration, we need to comprehend the nature of such electronically enabled interorganizational relationships.

Interorganizational Supply Network Relationships

The rise of Internet connectivity and subsequently B2B Exchanges, have led many companies to reevaluate their relationships with trading partners away from traditional buyer-seller relationship, which is one of negotiation, at times adversarial in nature, where one typically tries to win at the expense of the other (Ford et al. 1998, p.110). Studies in various industries have shown that supply chain performance could improve if trading partners were able to work more closely to assess expected consumer demand and plan supply accordingly[203]. Cases have shown that manufacturers are increasingly collaborating with their partners, thereby shifting the nature of the traditional buyer-seller relationship from one that was adversarial to one that is collaborative (Tapscott et al., 2000).

What is Collaboration?

Collaboration is a negotiated cooperation between independent companies, exchanging capabilities and constraints to improve collective responsiveness & profitability. Specifically, ***interorganizational collaboration*** is defined as a:

> "*process in which organizations exchange information, alter activities, share resources and enhance each others capacity for mutual benefit and a common purpose by sharing risks, responsibilities and rewards*" (Huxham, 1996).

Companies view collaboration as a means to synchronize supply chain operations, particularly with regard to strategic, tactical, and operational planning activities. Collaboration involves optimizing and integrating various planning processes in the supply network, like: Sales & Ops-, Demand-, Capacity- Supply-, Production-, Product Lifecycle-, Category-, Transport-, and Merchandise Planning. Many companies are currently experimenting with systems technology to speed up operational and financial transactions with trading partners by using EDI and more recently, trade exchanges. This coincides with the increasing automation of internal processes, which is necessary to conduct B2B commerce (Forrester Research, May 2000). Furthermore, many internal production and

[203] The 1993 Efficient Consumer Response (ECR) study conducted by Kurt Salmon Associates, Inc. (Atlanta, GA) and sponsored by the Grocery industry showed that there were excessive inventories in the Grocery supply chain. The study estimated that the industry could save $30B annually—about 11% of supply chain costs—if suppliers, distributors, and grocers could use technology to work closely to deliver products more efficiently to consumers. It was estimated that in the dry-goods segment of the industry, inventories were at 104 days of supply and could be reduced by 41% to 61 days of supply.

distribution processes like MPS, MRP, DRP are moving outside the boundaries of the firm (e.g. Vendor Managed Inventory has changed the replenishment process). The goal of these optimization and integration efforts, is to provide functionality, such as:

- Real time communication, including business logic, as each event is monitored by alerting systems for real time transactional data and decision support information about customers and orders.
- Shared resource allocation, document generation, and profitability monitoring.
- Deliver to promise, where rates and routes are chosen accurately and dynamically, giving delivery time in hours & minutes.

Internet-Enabled Business Relationships

Internet-enabled business relationships often involve the automation of various aspects within a buyer/seller or trading relationship. Most of the discussion about interorganizational partnerships have focused on enabling business-to-business e-commerce (via Internet or EDI). Collaborative relationships involve joint planning and plan execution. While there are myriad aspects within a relationship among trading partners in a supply network, three broad categories have been identified (AMR, 07/1998): a) *Transactional*, b) *Information-Sharing*, and c) *Collaborative*.

Transactional Relationship

Transactions within a buyer-seller relationship involve the activities conducted to execute the buyer's purchase of a commodity. These activities involve information notifying the buyer and seller that a purchase is taking place and that funds need to be exchanged. Historically, trading partnerships have only dealt with the transactional aspects of a relationship. Thus automation has focused on using EDI to electronically send purchase orders and invoices and to transfer funds. The only information that must be transmitted in this type of relationship is that needed to execute a purchase.

Information-Sharing Relationship

Following the automation of buyer-seller EDI-based transactions, the next trading partnership established involves *information-sharing* or data exchange. This involves at least one of the following arrangements: a) The partners are given access to a system that has the shared information in it, or b) One partner transmits shared information to the other partner. For example, Web-based catalogs allow buyers to electronically view product information. From a buyer-side, automation has focused on electronically providing forecast needs. In this type of relationship, information ancillary to the actual purchase is shared only on an FYI basis. A variety of types of information can be shared by a buyer or seller either before or after a purchase is made. This information may involve the seller's offerings or the buyer's future needs. Historically, little information has been electronically shared among trading partners. Information-sharing relationships differ from collaborative relationships primarily in that information is sent on an FYI basis. The recipient is using the data as-is and is not providing feedback. Nevertheless, this information is helpful in improving supply chain performance. Information-sharing arrangements electronically support both supply chain planning and execution, thereby presenting the potential to improve overall network performance. Relative to planning, these arrangements only support independent planning done by each participant, rather than joint-planning. However, sharing helps to ensure that trading partners' plans are as synchronized as possible, which in turn effectively reduces uncertainty in their supply and demand situation. Rather than having to predict or forecast a partner's activitities, information sharing ensures that the parties are knowledgeable about each others activities.

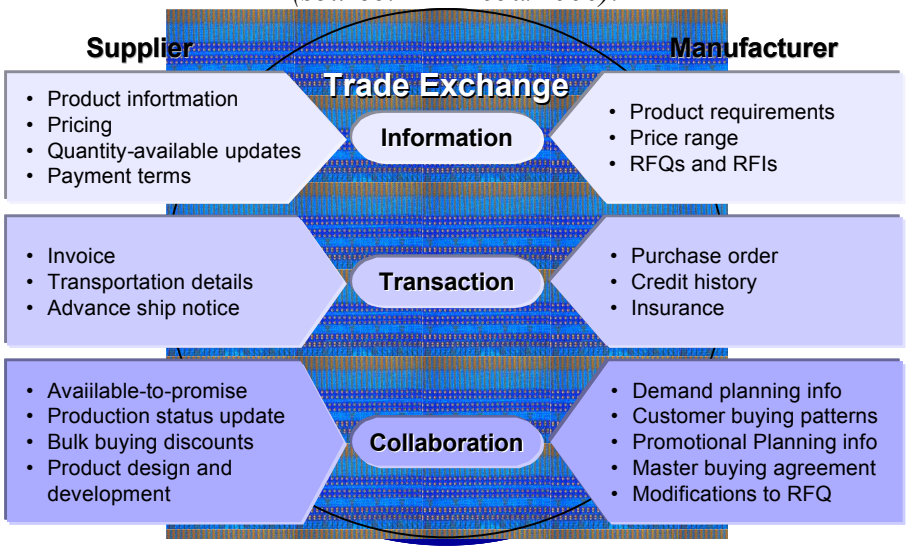
Table 2: Summary of Internet-enabled Supply Network Relationships (adapted from AMR, 08/1999).

Partnership Relationship	Description	Supply Chain Integration Support	Types of Electronic Information Included
Transactional	Computer-to-Computer transmission of fixed structure transactional information	• No support of synchronized planning • Supports synchronized execution	• Purchase Orders • Invoices • Order Acknowledgement • Shipment Notices • Load Tendering • Load Acknowledgement • Freight Invoicing • Freight Payments
Information Sharing	Trading partner information-sharing and exchange	• Supports synchronized, but independent planning • Minimum support of integrated execution	• Order Status • Shipment Tracking and Tracing • Sales Forecasts • Production Schedules • Inventories • Product Designs and Specifications • Product Descriptions and Prices • Promotional Calendars
Collaborative	Trading partner joint development of plans	• Supports joint synchronized planning • Minimum support of integrated execution	• New Product Plans • Product Design and Techical Specs • Product Packaging • PricingPromotional Plans • Demand Plans • Replenishment Plans • Store Layout and Shelf Space Plans

Collaborative Relationship

While information-sharing relationships enable supply chain synchronization, they do little to reduce the uncertainty faced by trading partners in determining future demand, and do not grant the opportunity for the other partner to provide his or her own insight and knowledge of consumer needs or other market opportunities. In addition, there is little opportunity to work together on matching supply with anticipated consumer demand. To further enhance a buyer-seller relationship some progressive companies are moving toward *collaborative relationships*, in which thay are "working jointly with others, especially in an intellectual endeavor." Collaborative efforts enable trading partners to work together to better understand future demand and to put plans in place to satisfy it profitably. In a collaborative relationship, information is not just exchanged and transmitted, but it is also jointly developed by the buyer with the seller. For example, in the case of working collaboratively on consumer requirements, trading partners might work together on new product designs and consumer demand forecasts. Generally this information deals with future product plans and needs. Much like an information-sharing relationship, related information to an actual transaction is shared in a collaborative environment, but joint plans may be altered by both parties. In the table above we elaborate on the types of information related to the various relationships. A trading partnership between a particular buyer and seller could be based on all three types of relationships described above. That is, some information may be exchanged on a transactional basis, some on an information-sharing basis, and some on a collaborative basis. Finally, collaborative relationships require that the other two types are already implemented. may be altered by both trading partners. The figure below depicts some of examples of process information being channeled through an independent trade exchange that supports the various types of business-to-business relationships.

Figure 5: Examples of process information that can be channeled via a trade exchange (source: AMR 05a/2000).



Multilateral Relationships in Collaborative Community Exchanges

Multilateral relationships among trading partners within a CCE often differ depending on the companies involved. In general, a collaborative relationship is dependent upon the specific buyer and seller involved. It is highly unlikely that all trading partners will have equal relationships with the buyer or seller (Ford et.al., 1999). There will always be favored suppliers and customers with different collaborating capabilities. Additionally, electronic collaboration will differ substantially by a trading partner's role within the supply network, depending on whether it is a manufacturer, distributor-wholesaler, retailer, or 3PL provider. The most important collaboration opportunity areas will vary along a supply chain and are likely to result in three major, bilateral types of buyer-seller collaborative relationships:

1. Manufacturer with its suppliers (including tier supplier with its suppliers)
2. Manufacturer with its customers (e.g., wholesale-distributors and retailers)
3. Companies with their 3rd Party Logistics (3PL) providers

Manufacturer-Supplier Collaboration

The major benefits that a manufacturer will get from collaborating with its suppliers include new product development and synchronized production scheduling. Collaborative product development will yield benefits by helping the manufacturer to develop stronger products more efficiently. There are several major opportunity areas within collaborative product development:

- *Design Collaboration* - Product/packaging designs will need to be electronically shared and modified--possibly using CAD files.
- *Product-Costing Information* - Costing data will need to be shared and mutually established to help ensure that target product costs are achieved.
- *Subcontracting Relationships* - Contract terms and conditions will need to be jointly established and contracts electronically passed back and forth for modification and approval.

In a similar fashion, coordinating or synchronizing all tier-supplier production schedules will help ensure that future material needs are satisfied, resulting in improved order fulfillment. This is often realized by electronically sharing schedules with suppliers, allowing them to provide feedback and make changes based on whether material needs can be met. This type

of collaboration also includes visibility into the raw material, WIP, and FG inventories of all suppliers to help ensure synchronized, realistic production schedules.

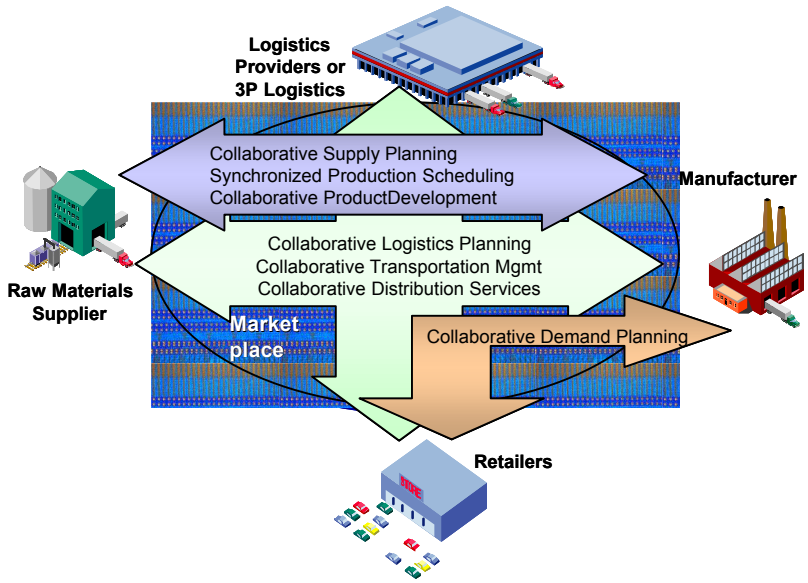
Manufacturer-Customer/Retailer Collaboration

For finished goods /brand manufacturers and their customers (such as wholesale-distributors and retailers) the major collaboration opportunities lie in demand planning and inventory replenishment. By collaborating and sychronizing sales forecasts these supply networks attempt to jointly evaluate consumer demand at the point of consumption, such as retail store shelves. Once established, a replenishment plan that meets the anticipated demand will be mutually agreed upon. Coordinating both the demand and replenishment plans will help ensure that consumer requirements are met in an optimized fashion. Such collaboration requires that the partners cooperate electronically to share and modify each other's demand plans and forecasts. Each trading partner will need to understand the other's promotional plans and the plan's impact on consumer demand. Within this context, it will be important to electronically share promotional calendars that include anticipated marketing actions designed to stimulate consumer demand:

- Pricing actions
- Consumer promotions (e.g., coupons)
- Advertising plans
- New product introductions
- Assortment plans

In addition to demand forecasts and replenishment plans, a manufacturer and retailer may collaboratively manage a category of products, possibly at store level. This will require that they electronically collaborate on store layout and shelf space plans. In addition, micromarketing or POS (point-of-sales) data involving store-level demographic information also must be shared to jointly assess the proper assortment of products to be placed within each store.

Figure 6: Collaborative Relationships within Collaborative Community Exchanges.



Manufacturer-3PL Collaboration

Collaboration among companies and their 3PL providers will focus on joint logistics planning (e.g. Dell uses ASG as a 3PL provider in Europe). 3PLs like ASG provide transportation shipper services in order to make better use of their transportation equipment and warehousing and distribution center facilities. This might involve collaborative planning to help ensure vehicles are fully loaded by the following:

- Consolidating a shipper's inbound, inter-facility, and outbound shipments
- Combining the shipper's goods with those of another trading partner

These activities involve a shipper electronically sharing the shipment plan with a carrier and comparing it to the availability of equipment, labor, and other transportation resources. Trading partners can support this through joint electronic visibility of transportation resources. Collaboration between a company and 3PLs providing distribution center (DC) services will focus on the productive use of facilities, labor, and equipment. This might involve electronic sharing of DC inventory replenishment plans with analysis to ensure that planned receipts do not overload the receiving function. Plans may also need to be shared to ensure that each DC has enough space to store planned inventories. In addition, 3PL providers can provide insight into the potential for co-sharing of space among trading partners. For example, around the Christmas holidays some of the manufacturer's DCs may be overloaded, providing an opportunity to use a 3PL facility on a temporary basis to correct the problem. This type of collaboration would be further supported by electronic visibility into the availability of DC space and other resources.

Evolution of Collaborative Functionality in Contemporary Trade Exchanges

A recent survey conducted by AMR, has shown that an increasing number of PTEs, CTEs and CCEs are providing comprehensive integration and services across intercompany supply networks. These exchanges attempt to enable e-supply networks by providing a number of services that ensure network-wide visibility, integrated planning, speed of information, logistics, transactional and customer-service capabilities. Current research has shown that these services evolve through four progressive levels of functionality: 1) information, 2) facilitation, 3) transaction, and 4) integration (see figure below)[204].

[204] **Information**-sharing services in trade exchanges convey a high level of industry expertise and relative information. The information takes the form of industry directories, product databases and catalogs, discussion forums and billboards, and professional development. **Facilitation** services in trade exchanges is the ability to match a buyer's specific need with a supplier's specific offering. However, the transaction is completed offline via traditional channels such as EDI, phone, or fax. **Transaction** services in trade exchanges involves a higher level of commitment from the trade exchange and its members. Buyers and sellers are typically registered with the exchange as well as with banking and industry institutions. The primary difference from the previous level of functionality is that trading partners can execute the transaction online. **Integration** or collaborative functionality allows ITEs to fit into a larger supply network and application integration strategy. Trade exchanges greatly increase their value to organizations if they can help companies leverage investment in installed applications and established relationships.

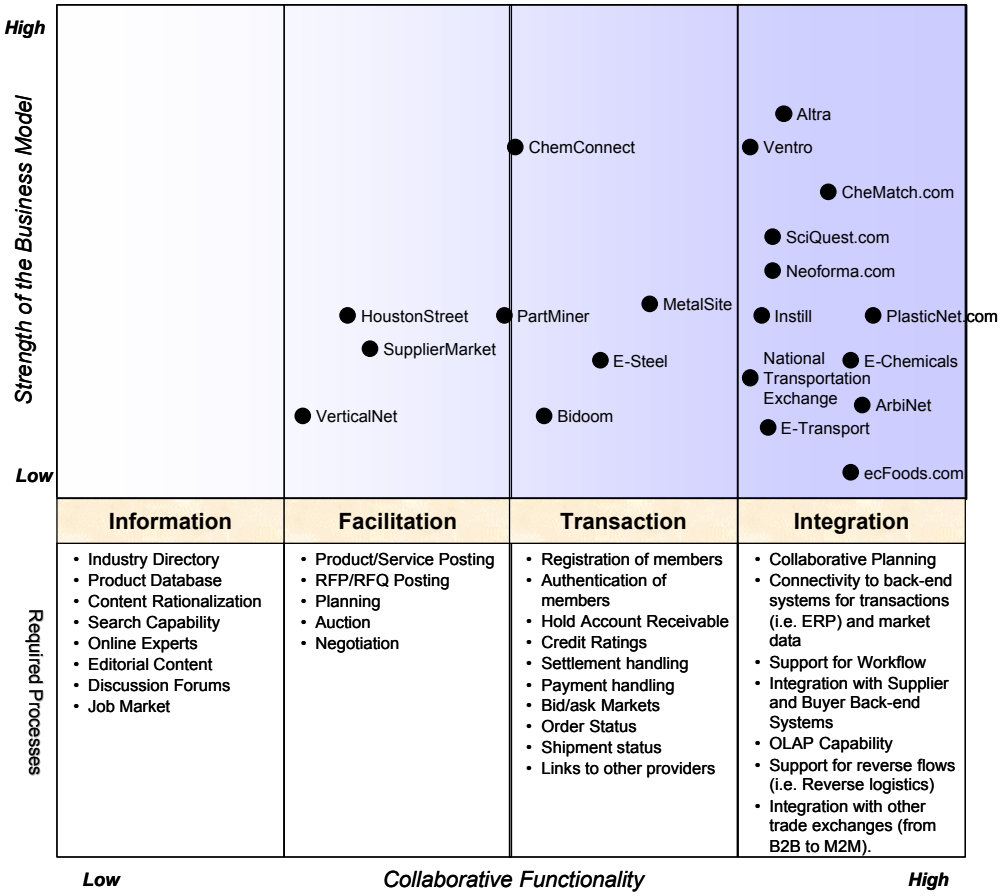


Figure 7: Evolution of ITE functionality, and ranking of current B2B exhanges (AMR, 03/2000).

Trade exchanges support close communication between an established network of supply chain partners, by providing: 1) collaboration services over the Internet for synchronized planning and decision making, 2) exchange of documents /information over the Internet for integrated planning and execution, and 3) display of information over the Internet for the latest status data of the various interorganizational processes.

Collaborative processes between partners cover standard business transactions such as:

1. Planning and forecasting
   - Collaborative forecasting
   - Collaborative supply planning
   - Collaborative project management
   - Collaborative engineering
2. Order taking
   - Contract negotiations
   - Buying / selling
3. Order fulfillment
   - Tracking order status
   - Collaborative inspection processing
   - Quality data exchange
4. Billing
   - Bill status
   - Invoice verification
5. Transportation planning
   - Planning and tracking of deliveries and distribution
6. After-sales services
   - Event Notifications
   - Claims
   - Deviation reports /notifications

So, collaborative community exchanges are providing an increasing amount of services in order to enable collaborative planning. Since collaborative planning inherently relies on sophisticated IT, aligning business and technological requirements is of foremost importance. To offer the desired customer value the members of such a supply network have to configure and tailor their relationships. In order to minimize the complexities of establishing and managing relationships, detailed *partner profiling* has been presented in the literature as a successful technique to reach these goals (Österle et al. 1999). Since business processes only communicate via business process outputs, partner profiles aim at defining standardized outputs for collaborative processes. These standard patterns are then tailored according to specific partner requirements. Each individual profile can contain the expected requirements in the organizational, functional and data dimension. Profiles provide a transparent view on the current partner situation and are the basis for broad and systematic partner integration. The modular design of coordination outputs and standard relationships may reduce the time for setting-up new collaborative relationships. An example of standard process interfaces for E-Business can be seen at the *RossetaNet* initiative[205] (see process blueprints at http://www.rosettanet.org).

Collaborative Process Methodologies

While the business press and vendors promote the ideals of the "digital economy", most not even mention that implementation of such intra-organizational collaborative planning portals is a complex undertaking. Within the last decade, several industry collaborative groups have been established (e.g. SCC, VICS) in an attempt to create a common understanding of various collaborative supply and demand processes and the role technology can play in streamlining supply networks[206]. These initiatives attempt to provide practitioners with guidelines for "best practices" in supply network and process design and accelerate the implementations of these practices by encapsulating their findings into process reference models[207]. The *supply chain operations reference* model (**SCOR**) outlines the key inter-linked supply chain processes and their component subprocesses. SCOR assists companies in evaluating their supply chain performance, identifying weak areas, and developing improvement solutions (Stewart, 1997).

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[205] *RosettaNet* is a consortium of supply chain companies that is defining common dictionaries, protocols, and dialogs for server-to-server electronic business exchange. This significant effort will improve the speed and accuracy with which supply chain companies can collaborate on a wide range of business processes such as product information exchange, order management, and forecasting. IPNet Solutions is a member of the RosettaNet Design Team and supports the RosettaNet framework as well as several Partner Interface Process (PIP) specifications.

[206] Manufacturers have begun to realize that their supply chains are inefficient, resulting in excess inventories and unproductive activities and assets. Even more important, they are not responsive to all consumer demands. As a result, companies have begun initiatives to integrate their supply chains both from an intra-enterprise and inter-enterprise perspective. Most have started getting their own house in order by ensuring that intra-enterprise supply chain management (SCM) activities within their companies are integrated. Integrated SCM typically involves coordinating the flow of physical goods from material sourcing, through manufacturing, to the points of consumption. Some have started to partner with their inter-enterprise trading partners, following the familiar catchword of SCM to "integrate from your suppliers' suppliers to your customers' customers."

[207] A process reference model describes, characterizes and evaluates a complex management process (Vernadat 1996). Such a model builds on the concepts of BPR, benchmarking and process measurement, by integrating these techniques into a cross-functional framework. Once a complex management process has been "captured" in a process reference model, it can be described unambiguously, communicated consistently, and redesigned to achieve competitive advantage. In addition, given the use of standard measurements for process elements and activities, the process itself can be measured, managed and controlled, and it may be refined to meet a specific purpose.

Another noteworthy model is the **CPFR** business model (i.e. Collaborative Planning, Forecasting and Replenishment, for additional information, see: http://www.cpfr.org). While the SCOR model provides a process overview or the "what", the CPFR business model describes "how" companies can implement collaborative processes. Both models are currently incorporated in many vendor's collaborative planning solutions (i.e. SAP's APO CE, Baan's eBusiness, JD Edwards' Numetrix, etc.). In this section we will elaborate on these two models in order to classify the types of processes that trade exchanges can provide to their members (via the SCOR model) and "how" we can establish a collaborative partnership through the CPFR methodology.

The Supply Chain Operations Reference (SCOR) model

The Supply Chain Operations Reference-model (SCOR) has been developed and endorsed by the Supply-Chain Council (SCC)[208], an independent not-for-profit corporation, as the cross-industry standard for supply-chain management. SCOR is freely available to all who wish to use the standard process reference model[209]. Table 3 below describes the SCOR model:

Table 3: What is the Supply Chain Operations Reference process model?

SCOR describes	***SCOR spans***
Standard descriptions of management processes	All customer interactions, from order entry through paid invoice.
A framework of relationships among the standard processes	All market interactions, from the understanding of aggregate demand to the fulfilment of each order.
Standard metrics to measure process performance	All physical material transactions, from the supplier's supplier to the customer's customer, including field service logistics
Management practices that produce best-in-class performance	
Software tools that enable best practices	

[208] The SCC was organized in 1996 by Pittiglio Rabin Todd & McGrath (PRTM) and Advanced Manufacturing Research (AMR), and initially included 69 voluntary member companies (today over 450).

[209] A process reference model describes, characterizes and evaluates a complex management process. Such a model builds on the concepts of BPR, benchmarking and process measurement, by integrating these techniques into a cross-functional framework. Once a complex management process has been "captured" in a process reference model, it can be described unambiguously, communicated consistently, and redesigned to achieve competitive advantage. In addition, given the use of standard measurements for process elements and activities, the process itself can be measured, managed and controlled, and it may be refined to meet a specific purpose. Process Reference Models accommodate a number of constructs by providing a balanced horizontal (cross-process) and vertical (hierarchical) view, they are designed to be (re)configurable, and are most often used to represent many different configurations of a similar process as an aggregate of a series of hierarchical process models.

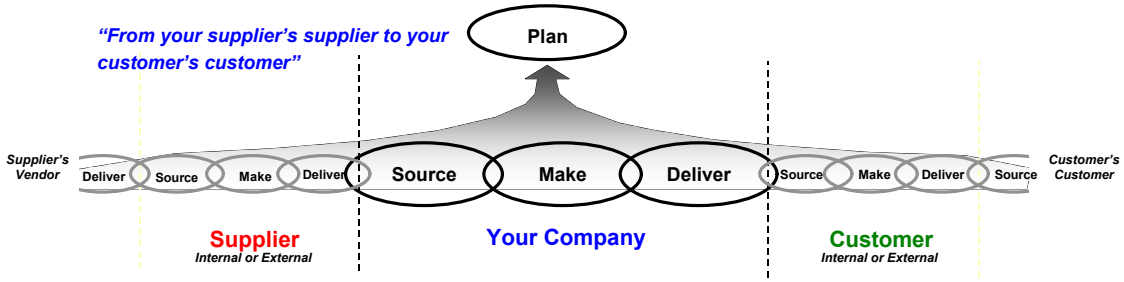

Figure 8: The four standard Supply Chain Reference Processes (adapted from Stewart, 1997).

The four basic processes – **plan, source, make, deliver** – define the top level processes that encompass a supply chain, and extend across all parts of the manufacturing and delivery process vendor payment. Scope is generally from immediate supplier's supplier to immediate customer's customer, in a "network of chains". Remark also that the planning process spans all other processes, making it the fundamental linkage of planning, sourcing, monitoring, and control (for details, see table 4).

Table 4: Overview of SCOR's 4 generic processes and subprocesses (adapted from Stewart, 1997).

PLAN	**SOURCE**
Demand/supply planning	*Sourcing/material acquisition*
Assess supply resources; aggregate and prioritize demand requirements; conduct inventory planning; assess distribution requirements; determine production, material, and rough-cut capacity for all products and all channels	Obtain, receive, inspect, hold and issue material
Plan infrastructure	*Source infrastructure*
Make/buy decisions; supply-chain configuration; long-term capacity and resource planning; business planning; product phase-in/phase-out; manufacturing ramp-up; end-of-life management; product line management.	Vendor certification and feedback; sourcing quality; inbound freight; component engineering; vendor contracts; initiation of vendor payment
MAKE	***DELIVER***
Production execution	*Demand management*
Request and receive material; manufacture and test product; package; hold and/or release product.	Conduct forecasting; plan promotions; plan projects; plan sales campaigns; collect and analyse point of sale (POS) data and actual customer orders; promote products; price products; measure customer satisfaction; execute *efficient customer response* (ECR)
Make infrastructure	*Order management*
Engineering changes; facilities and equipment; production status; production	Enter and maintain orders; generate quotations; configure product; create and maintain

quality; shop scheduling/sequencing; shortterm capacity	customer database; manage allocations; maintain product/price database; manage accounts receivables, credits, collections and invoicing
	Warehouse management
	Receive and stock finished goods; pick and pack; configure products; ship products; create customer specific package labelling; consolidate orders
	Transportation management
	Manage traffic; manage freight; manage product import/export; Installation mgmt: Schedule installation activities; perform installation; verify performance
	Deliver infrastructure
	Channel business rules; order rules; management of deliver inventories; management of deliver quantity.

SCOR is used to configure, compare and implement supply network processes. The plan, source, make, deliver model provides manufacturers with information on how to create goals and measures against industry best practices, and how to determine the financial costs and return on specific improvements. Thus, the SCOR model provides an excellent framework for classification and evaluation of collaborative processes.

SCOR Classification of Collaborative Processes in Trade Exchanges

Within a trade exchange the standard SCOR processes are transformed into their collaborative counterparts (see figure 9). Rather than the chain oriented metaphor used to depict the 4 processes, trade exhanges do not require bilateral or point-to-point relationships. Ideally, trading partners should be able to connect to their e-supply network by creating one interface to the respective trade exchange. From a process and applications support perspective, the requirement for front-facing customer processes to be integrated with back-end transactional processes becomes cross-company in scope. Companies will have to bridge or supplant information from their internal Enterprise Resource Planning (ERP), Supply Chain Management (SCM), E-Business Relationship Management (ERM), and legacy applications to one or many trading exchanges, either initially via a Web browser, or eventually via system-to-system communication. The building blocks of such communication is a) common business documents and transactions, and b) common semantics, taxonomies and standards (both data and process). Such integration shall not be taken light-heartedly.

Figure 9: Collaborative Processes in Collaborative Community Exchanges (adapted from AMR 06/2000).

As noted by the SCOR framework, the planning process spans all other processes, making it the fundamental linkage of planning, sourcing, monitoring, and control. This is one of the major reasons why many of the Advanced Planning and Scheduling (APS) software vendors were the first to embrace trading exchange and B2B functionality in their Web-based products. The original and dominant procurement and auction-focused exchange vendors, such as Ariba and Commerce One, have begun to realize the significance of added services like collaborative planning, sourcing, and scheduling. To be able to deliver these services, both vendors have initiated strategic alliances with APS or ERP vendors. Ariba's alliance is with i2 Technologies, and Commerce One--formerly with Adexa--most recently announced SAP as its strategic partner.

The CPFR process model

As we have seen, SCOR is an excellent model to provide the necessary overview and classification of collaborative arrangements. The next vexing question is “how” are we going to initiate and establish such collaborative processes. This is the realm of the CPFR model, which according to the Voluntary Inter-industry Commerce Standards (CPFR Guidelines, 1998), "*... is a business process model for value chain partners to coordinate plans in order to reduce variance between supply and demand.*" CPFR (Collaborative Planning, Forecasting, and Replenishment) is a business process model through which companies can optimize supply chain activities such as Vendor Managed Inventory (VMI) by leveraging the Internet and EDI to radically reduce inventories and expenses while improving customer service.

Historically, CPFR grew out of the retail consumer goods industry[210]. Today, CPFR as a transportable model is being adopted "as is" in numerous industry segments and countries. Recently the very model itself has been extended to include Transportation Carriers and 3PLs in a more rounded "3-way" CPFR model. This allows buyer, seller and carrier to come together to exchange key information, provides visibility to status data and conformance to plan, and then provides processes to jointly derive the plan itself. This new initiative is called Collaborative Transportation Management, or CTM. In its upcoming evolutionary stage CPFR is extended to the so called "n-Tier CPFR". This model describes an environment in which multiple tiers of a particular supply network are aligned under the same tenets. According to the CPFR organization (see under www.cpfr.org), n-tier CPFR compliant processes are currently being deployed by a number of trade exchanges.

CPFR provides a set of guidelines on *how* companies can establish dense, collaborative partnerships within a supply network[211]. From a business process standpoint, CPFR defines how retailers and suppliers can synchronize their different planning functions. Retailers are focused on predicting consumer reaction to promotions, competitors, and product category changes, while suppliers usually concentrate on managing the level of inventory at distribution centers. While the retailer's objective is to keep products in stock in stores, the supplier's objective is to create the most efficient production and replenishment process possible. These differences are reflected in each parties' sales and order forecasting processes [212]. The guiding principles developed for CPFR out of the VMI best practices are:

1. The trading partner framework and operating process definition focus on consumers[213].
2. Trading partners manage the development of a single shared forecast of consumer demand that drives planning across the value chain[214].

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[210] Today, more than 30 US companies are part of the CPFR commitee, amongst then Wal-Mart, Kmart, Schmuck, Wegmanns, SuperValue, Butt, Target on the retail side as well as manufacturers such as Procter& Gamble, Sara Lee, Levis, Nabisco, Kimberly Clark, Kodak Heineken. From the IT side partners include Sun, Hewlett Packard, IBM and SAP.

[211] Today, more than 30 US companies are part of the CPFR commitee, amongst then Wal-Mart, Kmart, Schmuck, Wegmanns, SuperValue, Butt, Target on the retail side as well as manufacturers such as Procter& Gamble, Sara Lee, Levis, Nabisco, Kimberly Clark, Kodak Heineken. From the IT side partners include Sun, Hewlett Packard, IBM and SAP. The concept is also extending to Europe and currently Procter & gamble is running pilots in 4 countries with 4 leading retailers.

[212] Sales (Consumer Demand) Forecast Comparisons Retailers produce very detailed sales forecasts, often including weekly (or even daily) store-level demand per SKU. Suppliers may also gather a great deal of intelligence about what sold from a syndi-cated data source (typically IRI or Nielsen), but they usually create only market- or account-level forecasts. The CPFR solution aggregates the more detailed sales forecasts from the retailer and compares the total with the supplier's number. Order Forecast (Replenishment Plan) Comparisons Often, retailers do not produce an order forecast at all. When retailers do produce an order forecast, it may include only base demand. Many handle promotional orders through a totally different process, tools, and personnel. Suppliers, therefore, don't often get an integrated view of the retailer's demand. A CPFR solution can improve this situation by providing a forum where replenishment order forecasts and promotional orders can be brought together and compared in full. It can also give the retailer better visibility to how the supplier makes changes to their order forecasts to meet demand.

[213] One key finding that has come out of the programs is that no single business process fits all trading partners or all situations between trading partners. Trading partners have different competencies based on their strategies and investments. They also have different sources of information and different views of the market place. CPFR is structured as a set of scenarios or CPFR process alternatives for trading partners to use. Depending on the scenario, the retailer or the manufacturer may be responsible for specific parts of the collaboration process.

[214] a single shared forecast is developed which is then shared across the entire supply chain, to ensure that both retailers, wholesalers, manufacturers and suppliers work towards a common goal. Retailers and manufacturers have different views of the marketplace. Retailers see and interact with the end consumer in person and infer consumer behaviour using POS data. They also see a range of manufacturers, their product offerings, and their plans for marketing those products. Manufacturers see a range of retailers and their merchandising plans. They

3. Trading partners jointly commit to the shared forecast through risk sharing in the removal of supply process constraints[215].

Setting up collaborative partnerships

According to the CPFR model (see figure 10), trading partners share their plans for future events, and then use an exception-based process to deal with changes or deviations from plans. By working on issues before they occur, both partners have time to react. A supplier can build inventory well in advance of receiving a promotional order, and carry less safety stock at other times. A retailer can alter the product mix to reduce the impact of supply problems. In short, both sides win, and the consumer ultimately benefits from lower prices that helps companies realize higher service levels, higher in-stock performance and lower inventories. The CPFR process is divided into nine steps.

- Step 1 - *Front-end agreement*: Participating companies identify executive sponsors, agree to confidentiality and dispute resolution processes, develop a scorecard to track key supply chain metrics relative to success criteria, and establish any financial incentives or penalties.
- Step 2 - *Joint business plan*: The project teams develop plans for promotions, inventory policy changes, store openings/closings, and product changes for each product category.
- Steps 3-5 - *Sales forecast collaboration*: Retailers and suppliers share consumer demand forecasts, and identify exceptions that occur when partners' plans do not match, or change dramatically. They resolve exceptions by determining causal factors, adjusting plans where necessary.
- Steps 6-8 *Order forecast collaboration*: Retailers and suppliers share replenishment plans, identifying and resolving exceptions.
- Step 9 - *Order generation/delivery execution*: Results data (POS, orders, shipments, on-hand inventory) is shared, and forecast accuracy problems, overstock/understock conditions, and execution issues are identified and resolved.

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can also monitor consumer activity, with some delays, through syndicated data. Given these different views, the trading partners can improve their demand planning capabilities through an interactive exchange of data and business intelligence without breaching confidences. The end result is a single shared forecast of consumer demand at the point of sale. This single shared-demand plan can then become the foundation for all internal planning activities related to that product for the retailer and the manufacturer, all the way to the manufacturers suppliers. In other words, this single shared forecast is the basis for the synchronization of the extended supply chain.

[215] The value of having a single demand plan, if nothing else changes, would be to better co-ordinate value-chain process activities. This co-ordination would yield significant, but not dramatic benefits. Dramatic benefits come from using the demand plan to affect the significant constraints inhibiting supply-process performance. An example of a significant constraint would be manufacturing flexibility. Most manufacturers hold finished goods inventory in sufficient quantities to meet retail demand. Manufacturing capacity is not used because the retailers' normally short order-cycle times are inconsistent with longer manufacturing cycle times. By extending the retailers' order cycle and thus making it consistent with the manufacturing cycle, production could move to a "make-to-order" process for some products.

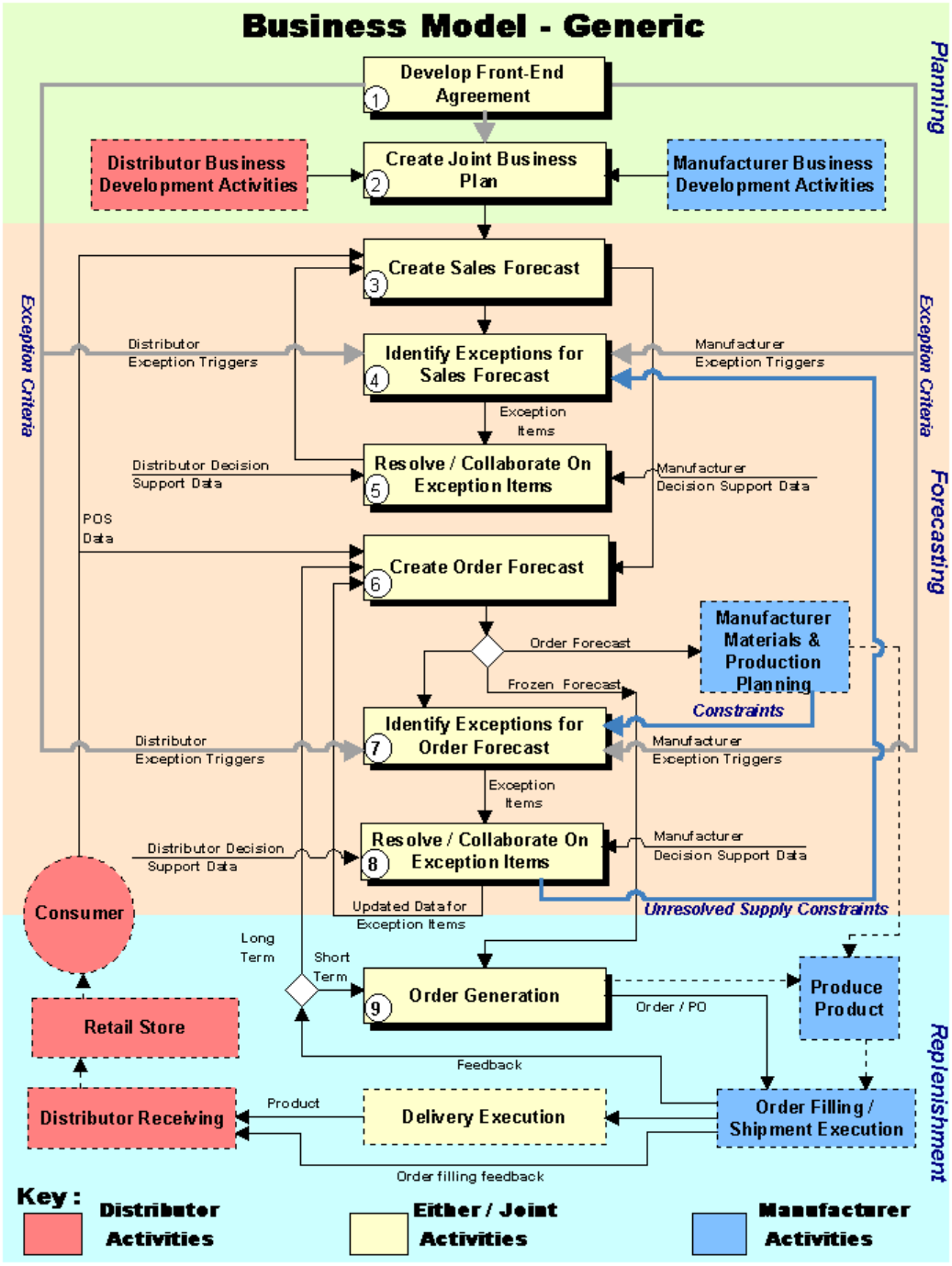

Figure 10: Setting up collaborative partnerships with CPFR's 9 process steps (Source: www.cpfr.org).

Step 1 ensures that each company has an adequate commitment to collaboration, and that all parties are aligned around common goals. This front-end agreement might be reviewed on an annual basis. Step 2 applies good category management principles-borrowed from the Efficient Consumer Response (ECR) initiative - to create a joint plan for going to market. This would typically be revised quarterly, or semi-annually. What makes CPFR unique is that this joint business plan is used to control the day-to-day activities of manufacturing, delivering, and selling products. That's where steps 3-9 come in (CPFR Guidelines, 1998).

CPFR Documented Benefits

CPFR is fast becoming the most advanced industry agnostic technology neutral B2B model for buyer and sellers. More then Vendor Managed Inventory or any other initiative that has gone before, pilot implementations of collaborative processes with the CPFR methodology (in Wall-Mart, Kimberly Clarke, HP, P&G, Nabisco and others – see CPFR Roadmap, 1999), have shown significant benefits to both buyer (retailer, manufacturer etc.) and seller (manufacturer, suppler etc.) like:

- Significant reduction in supplier and channel inventories, with decreased obsolescence rates & returned goods
- Significant reduction in excess material inventory on site due to demand steering capability
- Improvement in quality of material positioning signals and visibility of supplier capabilities leading to more optimum planning and demand management
- Increased DC labor productivity
- Significant reduction in material shortages resulting in improved customer order fulfillment and service levels
- Improved forecast accuracy and timeliness
- Improved customer service levels as a service-based barrier to competition
- Competitive advantage over the supply base by securing better commitment and terms than competitors
- More rapid new product introductions and faster time to market
- Better visibility into multiple tiers of the supply chain increasing velocity of change
- Improved capacity management for contract manufacturer
- Overall improvement in order completion times
- Increased sales with faster order to cash cycles
- Significant cost reductions by decreasing excess inventories improving revenue and profit performance

A recent survey by Industry Directions (April 2000), found that over two-thirds of those surveyed (130 Fortune-500 corporations) are actively involved in CPFR activities or pilot research. About one-quarter of the respondents have a CPFR pilot underway or plan to start a pilot within the next 6 months. To date, these pilot projects have yielded impressive results (see also table 5). For example, on average, respondents have reported:

- an 80% increase in business with a CPFR partner;
- $9M increase in sales;
- simultaneous sales growth and inventory reductions of at least 10%;
- improved fill rates with less inventory; and
- 100% service level with almost 40 inventory turns a year.

Table 5: Specific benefits identified from CPFR pilots (Source: CPFR Roadmap, 1999).

Buyer perspective	**Seller perspective**
• Superior service levels to their customer (as much as increases up to 22%) • Higher in-stock availability (as much as 8% improvement) • Lower overall inventory (18-40% reduction) • Increase in sales (20-70%) • Increase in turns (10-30%) • Reduction in returns (5-20%)	• Increase in sales (it's the sellers products that are on the shelf!) • Lower overall inventory (as above) • Increase in turns (as above) • Reduced cycle times (as much as 67% reduction) • More efficient supply chain procurement (more efficient production runs, procurement plans)

Applicability of the CPFR business model

According to experiences gained by the case companies that have implemented CPFR based collaborative processes, CPFR does not itself fit all B2B collaborative needs (CPFR Roadmap, 1999). For products that are commodity-based, have many alternative sources of supply, are undifferentiated, or where price is the primary driver for acquisition, an many-to-many independent trade exchange model makes more sense. This is because a generally anonymous ITE that focuses on transaction cost reduction works. Buyer and seller are both motivated to reduce the cost of doing business – with any buyer or seller. CPFR better fits any B2B need where these characteristics are not apparent. CPFR is more applicable where customer service and buyer and seller agree to forgo the benefits of a short-term (i.e. price deal) for the greater mutual benefit of a longer-term relationship. Thus, electronically-driven CPFR processes, are most appropriate where service and product, not price differentiation, is the factor in the buying decision. CPFR works best where the focus is on long-term relationships for highly differentiated products with limited sources of supply.

Some Interorganizational Implementation Considerations

Case companies that have already implemented the CPFR business model, have identified some critical cross-functional issues, that need to be understood and addressed by potential partners pursuing closer collaborative arrangements (CPFR Roadmap, 1999):

- Building trust and collaboration among trading partners
- Reducing channel conflict and enhancing channel services
- Pricing based on market conditions and value versus standard pricing
- Responding to customer needs and demands versus the pushing of products from the supply chain to customers.
- Adopting standard business documents, terms, and processes.

To manage and derive benefit from collaborative partnerships, companies need to consider 3 central organizational issues: *power*, *trust* and *exception-based management*. While the latter is a central point in the CPFR model, the first two issues are not treated in any extent.

Power and Trust as the cornerstones of collaboration

The key to the dynamics in a network structure is the inherent *power* and *dependency* structures and the behavior of companies to change or capitalize upon it. While the very existence of relationships implies some degree of cooperation, such cooperation does not subvert competitive goals of individual partners to that relationship. Thus, the orientation of relationships, the dominant direction of influence and the definition of the "rules" or routines of the relationship will be determined by the distribution of power dimensions between

partners. This power balance is dynamic in nature, which above all implies that major changes - e.g. a strategic shift by leading companies - induces internal threats for the companies with a weaker position or subsequently the entire network's existence. In a practical sense, the obligation to spearhead cooperation and collaboration rests with the supply network participant who enjoys the greatest relative power.

Another key element in the network approach to business interactions is the concept of "*trust*", determining both risks and opportunities in network relationships[216]. According to Ford (1997), networking is in practice business, characterized by long lasting relationships between the actors or organizations in the value system. In effect, networks create conditions for bi-lateral monopoly with high risks for both/all sides of the mutual agreements. The partnership atmosphere must include both flexibility and incentives for improvements. Prerequisites for this common platform of operations and activities in business networks are according to Thorelli (1993):

- Mutual "trust" and absence of opportunistic behavior within the network;
- Supplementary resources or capabilities improving competitive advantage;
- Compatible (or even common) goals and objectives; and
- "Free" flows and access to information.

The basic reason for developing mutual trust in networks, is subject to the very existence of imperfect information, bounded rationality, risk and uncertainty (Simon, 1997). Trust may or can reduce (potential) risks in transactions (costs) subject to the potentials of opportunistic behavior. The reason is that trust between trading partners has a role in increasing the predictability of mutual behavior through the honoring of commitments made, while it facilitates dealing with unforeseen contingencies in a mutually acceptable manner. Both "goodwill trust" and "contractual trust" imply the absence of opportunistic behavior; the suspicion that a network partner may be cheating or taking advantage amounts to distrust. However, in any case the verification of whether a network partner is worthy of trust is a matter relying partly on reputation before entering into new relationships and partly on experience to see whether the original expectations are fulfilled. So, trust, power and influence are central contingency factors (Lawrence and Lorsch, 1967) affecting an interaction between collaborating businesses in a supply network. Even within trade exchanges, trust is still crucial, as found by companies delivering B2B services. Potential participants in such B2B sites are beginning to require assurances that their information won't be misused, intentionally or even by mistake. They're also looking for assurances that the transactions that take place on trade exchanges are fair and won't land them in hot legal water (Tapscott et.al. 2000).

Internet-driven collaborative processes will amplify the need for some degree of trust relationship among customers, suppliers, and supporting organizations. In a trade exchange, a company can be a customer, supplier, and competitor, depending on the instance or mode within a supply network. Success will be driven by the ability to collaborate and share increasing levels of information throughout the entire supply network, while preserving competitor-sensitive information. Companies with organizational cultures rooted in coercion

[216] *Trust* may be viewed as confidence in the continuation of a mutually satisfying relationship and in the awareness of other parties subject to what this requires of their performance as network partners. Accordingly, trust is above all based on reputation and, more important on past performance. But personal friendship and social bonds, established in day-to-day interaction and manifested by mutual feelings of belongings and interdependence, also build it.

and the mistrust of trading partners may not make this transition in time, and they run the risk of being challenged by more open, collaborative competitors that reward integration[217].

The need to better understand exception-handling in e-supply networks

Internet-based collaborative processes magnify the speed of information and transactions among companies in a supply network. Traditionally, managers have been relying on their experience and understanding of a process in order to handle deviations from the expected flow of events. However, the rising complexity of modern supply networks, the increasing density within interorganizational business processes and the accelerating pace with which these processes evolve and change has made the reliance on individual managers' experience and intuition an increasingly less satisfactory way to deal with exceptions[218]. It is important that companies try to reduce or even eliminate *event time-lags* or *communication latency* – that is, the unnecessary time delays between the occurrence of an event and when it is communicated to the person or persons best able to take remedial or corrective action (Dellarocas and Klein, 2000). Extending this capability to include instantaneous recognition of events or problems that must be resolved across organizational boundaries enables collaboration across a supply network. Ultimately, handling of disruptive events should minimize *waiting costs* for network actors (Hedaa and Törnroos, 1997, p.9). For an e-supply network, this level of event-based collaboration will facilitate reductions in lead-times, inventory levels, stock-outs, and production interruptions throughout the community. It may also simultaneously increase overall responsiveness to the end-consumer. Yet, it requires more event-based monitoring processes that are knowledge-based and exceptions-driven.

A core *assumption* of the CPFR model is that each organization will enter the details of the joint business plans into their on-line planning systems, and then share the results on a regular basis as market conditions change and logistical problems occur (e.g., forecast revisions per product and region can be exchanged on a regular, usually weekly-basis). Because each company may manage thousands of products distributed across hundreds or even thousands of locations, it is not feasible for planners to compare these plans manually and determine which changes are significant. Instead, a specialized CPFR-compliant system (like SAP's APO or I2's Rhythm) exchanges and compares each value using *thresholds* that planners have set. If changes in one plan, or differences between them exceed the threshold, an exception is generated by the system, which appropriately alerts the relevant person or planner of the problem. Companies that have already implemented inter-enterprise electronic processes (e.g. in the High-Tech industry), describe the need for having highly skilled, cross-functional process knowledge experts in place to provide customers and trading partners with a single point of contact for status and exceptions handling.

Thus, just as CPFR prescribes, there is an increasing need for systematic treatment of exceptions that may arise under enactment of a collaborative process, so partnering

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[217] Another organizational consideration is that of rewards and recognition. Traditional functional-based rewards and recognition will not suffice in an electronically-driven supply network. Some of the positive learning derived from both B2C and B2B early adopter companies was the importance of company- or division-wide rewards and recognition tied to overall measures of performance and business change. Organizations need to develop and implement customer-centered rewards and recognition, driven by supply-chain-wide key performance metrics of satisfaction, efficiency, and responsiveness.

[218] We define an *exception* as any deviation from an "ideal" collaborative process that uses the available resources to achieve the task requirements on an optimal way. An exception can thus include errors in enacting a task or distributing results between tasks, inadequate responses to changes in tasks or resources, missed opportunities and so on (Klein, 1997).

companies can anticipate potential disruptive events that can either be avoided or be detected on time. By understanding and subsequently managing exceptions partners might help the smooth enactment of a collaborative process (CPFR Roadmap, 1999).

Research Agenda

What we have presented so far is the substantial structural changes that are underway within the area of supply networks. The functionally-driven stovepipes present in many contemporary supply chains are currently being transformed and replaced by more streamlined, electronically-based processes (Poirier, 1999). Propelled by the accelerating permeation of information and communication technology into intraorganizational processes, which also enables interorganizational collaboration, companies are *clustering* into private and collaborative exchanges to conduct their business. Even non-strategic sourcing can be facilitated by independent, commodity oriented exchanges. These marketplaces are entering in betweeen the buyer-seller relationship and are bound to change the rules of the game[219].

Previously, research in business networks and supply chain management was focused on the issue of linkages (or relationships) between companies. With trade exchanges the issue becomes more the creation of *one* standardized process and data interface or relationship to an exchange, which then will function as a *hub* for the company's facilitation of information, business transactions and collaborative processes. So, instead of creating customized links to the company's strategic partners, the exchange becomes the central conduit of most business relationships. A current tendency is that vertical exchanges are interconnecting with other vertical and horizontal exchanges (also called Marketplace-to-Marketplace or M2M). This enables member companies to get access to a wider selection of services – from product development to financing. Thus, a multiplicity of network structures are evolving on top of each other, from B2B to M2M. The relative distances of a node from the other nodes in a business network is changing by enabling a company to create relationships with distant suppliers and other small specialized firms[220]. The *network horizon* (Ford, 1997, p.231) becomes less opague, as it extends the reach of the focal company. This has been enabled by

[219] The notion of the online exchange and its supporting technology are revolutionary in terms of their potential to bring trading communities together and enhance services, but ownership of the supply chain remains a very sensitive topic, with many companies unwilling to give up process ownership to a third party.

[220] Small or midsize companies that cannot afford to incrementally invest in expensive infrastructure or supply chain management software (like SAP's APO) benefit the most by participating within an trade exchange. Benefits accrue from the selling, buying, and customer responsiveness aspects of their businesses. A trading exchange can overcome marketing and selling barriers in finding and serving markets. Through global connectivity, smaller suppliers get visibility and access to markets that they could not otherwise afford to access. Transaction fees paid to an exchange can present savings over hiring and maintaining permanent sales and marketing staff, providing a more positive economic model for joining. Utilizing a trading exchange presents further opportunities for smaller companies in managing internal resources and gaining efficiency. For the cost of an Internet connection, smaller companies can take advantage of leveraged buying negotiated by a trading community or customer host on behalf of its trading community members. By participating in a private or industry-focused exchange, smaller companies gain the benefits of reach and speed of transaction flow. The added capability of auctioning services to either sell or buy uncommitted inventory, or even post excess available capacity for other companies to use, are now open to smaller firms. Customer responsiveness benefits stem from visibility to end-customer and end-product demand and supply planning forecasts as well as transportation and logistics execution services. Prior to trading exchanges, the ability to leverage electronic connections to a larger customer supply chain had to be achieved through the adoption of EDI. The cost of building and maintaining EDI infrastructure prohibited many smaller companies from being able to leverage and effectively use these electronically-based processes. Trading exchanges, with their utilization of both XML- and EDI-based messaging and electronic alert capability, may overcome these economic hurdles.

the ubiquitous interconnectivity provided by the Internet and the resulting standardization of processes, based on communication and data protocols. Companies are able to create more dense interactions, consisting of interrelationships between process activities, participating actors and applications. Consequently, the nature of relationships between actors in different companies is also altered as more intracompany processes are extended beyond the boundaries of the firm. Highly *reciprocal* or collaboratice processes running via an exchange, move the decision-making process from within the company to the relationship between companies, where decisions with partners are derived in a joint fashion.

All these trends reflect the evolution of business networks into streams of *network processes* (Ford, 1997, p.117), characterized by collaborative communities with high intracluster relationship density (within B2B exchanges) and low degrees of intercluster interfaces (between M2Ms). Business networks are fragmented into sets of linked companies (Miles et al, 1992), or sets of connected relationships (Ford, 1997, p.228). These new business models utilize internet-enabled relationships and are substancially challenging the ramifications of the current Interaction Model (see figure), and ARA (actors, resources and activities) model as presented by Håkanson and Snehota (in Ford, 1997). For example, relationships running via an exchange are "polyadic" rather than "dyadic" (or multilateral rather than bilateral). The company doesn't customize each dyadic relationship, but rather develops a wider pathway to the exchange, which then "publishes" the data and process formats to a multiplicity of exchange members. In order to comprehend the dynamics of these relationships, we need to enhance our view of business networks beyond ARA to include the network of interdependent *events* (Hedaa, 1998, Hedaa and Törnroos, 1997, p.18).

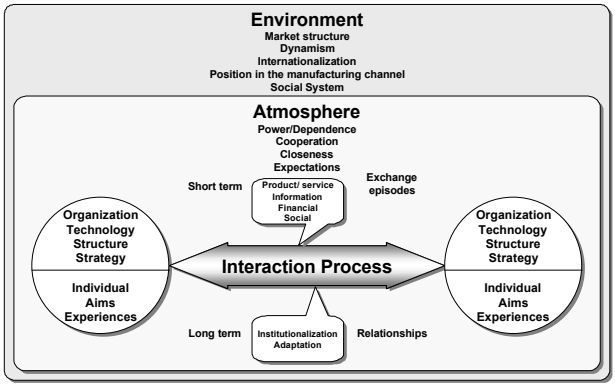

Figure 11: The Interaction Model (Ford,

Yet, there is still no research done, to the authors knowledge, on the changes afflicted by trade exchanges on contemporary business networks. Large parts of the evidence supporting the above developments is both sparse and anecdotal. This is also accentuated by the fact that, while an abundance of independent trade exchanges have sprouted within the last 2 years, very few pionering companies have ventured into the domain of collaborative community exchanges (AMR report 2000). Nonetheless, we can still use a lot of contributions from the IMP group, for example Ford's (1997, p.69-71) dimensions of of interorganizational relationships (i.e. *formalization, intensity, reciprocity, standardization* and *conflict*). Furthermore, we could use Ford's (1997, p.58-59) aspects of interaction to study the effects of interaction (*capability* and *mutuality*), and the implementation of interaction (*particularity* and *inconsistency*). What we are promoting is that the IMP group has an excellent "toolbox" to study the issues attached to the trade exchange phenomenon.

Beyond the need to better understand the structural and processual aspects of change in "clustered" networks, one of the areas that we will concentrate our research is that of *exception handling* (or conflict resolution of inconsistent and disruptive events) within collaborative planning processes executed in trade exchanges. One of the central tenents of the aforementioned CPFR model is the deduction, classification and handling of exceptions that lead to inconsistencies within the collaborative processes. This process consumes

according to the preliminary pilots more than 70% of the time spent to establish a close collaborative partnership (CPFR Roadmap, 1999). According to Ford (1997, p.59), "inconsistency captures the dynamic nature of interaction" and adds that "inconsistency is an important but neglected aspect of interaction". Finally, "inconsistency is an important key to change and development of interaction, and the management of inconsistency [or exception based management], is central to intercompany interaction." Exceptions often arise from changes in resources, organizational structure, company policy, task requirements or task priority. They can also include incorrectly or delayed performed tasks, resource contentions between two or more distinct processes, unanticipated opportunities to merge or eliminate tasks, conflicts between actions taken in different process steps and so on. Exceptions can be frequent and extremely disruptive (Saastamoinen, 1995). They often are not detected until some task actually becomes obsolete, at which point they are typically rise up to higher management layers for clarification (Klein, 1997). Such events may generate cascading exceptions as normal work is shoved aside to handle the problem at hand (i.e. fire-fighting). Exceptions often do not have standardized preferred processes for handling them so they can be addressed inconsistently and with uneven effectiveness. If not detected and handled effectively, exceptions can thus result in severe impacts on the cost and schedule performance of process enactment systems (Klein, 1997), (i.e., SCM applications like SAP's APO that support interorganizational processes). Thus, there is an increasing need for systematic exception-handling methodologies within collaborative processes. Such methodologies could assist process and application designers to anticipate potential exceptions and instrument their processes so that exceptions can either be avoided or be detected on time. The practical implications of research into event networks of collaborative processes and conflict resolution areas of e-supply networks, focus on assisting companies with the daunting task of designing and managing their portfolio of interactions[221]. We believe, that such supply network configuration is necessary, in order to extract the often elusive benefits of information technology (also proposed by Österle, 1999).

Studying e-Supply Networks with Participative Action Research

To explore the context of exception handling in e-supply networks in terms of its holistic scope, the initial research questions should focus on what, why and how in order to better understand the problems organizations face in collaborative planning situations. The nature of the research question is more likely to be explored using a post-positivist approach and with explorative case studies. One of the main reasons why a positivist approach is declined is that the body of knowledge in the area of supply networks is not sound enough to produce law-like (nomothetic) generalizations (Österle et al. 1999). The ultimate research objectives will be to provide companies with guidance and design recommendations to address collaborative planning problems and opportunities. The extent to which the models and best practice guidelines aid practical problem solving are the measures for the contribution to knowledge in this field (Österle et al. 1999). The assumption is that only models which are perceived as an aid to problem solving (depending on the context under consideration) may be considered as extending an understanding of the phenomena in question. The chosen epistemological

[221] The fact of life is that most companies entering closer partnerships with other companies via Collaborative Planning processes through APS systems have to mutually understand and configure their own processes, business links and structures. Thus far, little guidance to companies and managers on how to configure and deploy supply networks has been provided. There is a need to better understand exactly "how" and "why" links or interactions between processes are created, what do they depend upon, and how can they be designed to ensure proper management attention, resource and time allocation. We need to understand just how different network structures demand differing degrees of integration. Finally, we believe that it is imperative to expose the opportunities and deficiencies of the current APS systems and supporting modeling methodologies in order to ensure exactly how comprehensive collaborative planning solutions we can deploy.

approach will be based on the research traditions of interpretative research (Orlikowski 1992) and action research (Brown et al. 1999). The first perspective helps to encompass the interpretive flexibility of information systems (Orlikowski 1992) which focuses on the mutual influence of information and communication systems, organizations and human actors. By taking an action research perspective the role of the researcher is not only to observe but also to influence the system once context, problem area and status quo of current projects and solutions are sufficiently understood. Based on that, the research project will be conducted in the tradition of *participative action research* in order to develop new solutions in a multiple-case study approach (Brown et al. 1999). Deficiencies and dysfunctionalities will be explored and ways to solve problems will be proposed in close collaboration with case companies. This should hopefully initiate a mutually beneficial learning cycle. Research into highly complex socio-technical systems like inter-organizational networks is preferably based on an *eclectic* approach that tries to include many perspectives and paradigms (Brown et al. 1999). The results will be made applicable to other business networks following the principle of analytic generalization.

Conclusion

As we enter into the new millennium, we continue to see new exciting developments in supply chain management and business networks. E-business is changing the Industrial Age models of customer acquisition, procurement, pricing, and customer satisfaction as well as how we measure performance of a corporation. Focus on the customer is all-consuming; customers want to buy products anytime, anywhere, cheap and fast, and fulfillment processes must be structured to meet these demanding requirements. Companies are simply recognizing that the old rules will not give them the continued success that they had enjoyed, but instead, new ways and protocols are emerging (Tapscott et al. 2000). First, is the increasing realization that companies are embedded in a complex, interdependent business networks or *supply networks*. Companies dwell in complex webs of often thousands of interactions or business links. Second, by utilizing the enormous technological and communication advances of the last decade, companies are migrating to new thinking, new platforms, and new competitive fields. The Internet has of course rewritten many rules of the game. New channels have been developed, we see more and more build-to-order or mass customization processes being used, and information is increasingly used to replace physical flows or inventory assets (Kalakota and Robinson, 1999). Third, real-time electronic connectivity among trading partners lets companies outsource business processes that add little value, without adding processing time. While vertical integration was common several decades ago, providing manufacturers with improved supply chain efficiencies, companies, of late, are disassembling their supply chains to focus on core competencies. Electronic connectivity, especially Internet-based, will allow more manufacturers to outsource and reassemble their supply chains by enabling real-time coordination of fulfillment and supply processes among trading partners. In this context, companies can add value by becoming virtual supply chain providers and coordinating others in the fulfillment process through real-time information sharing. Moreover, Internet-driven collaborative processes force internal and external organizations to come together and resolve problems of trust, collaboration, standard practices, and taxonomy – old themes of research in Business Networks.

Hence, a new breed of supply network been created that is strongly flavored by the use of information technology to enable more dense relationships among trading partners (Simchi-Levi, 1999). Such electronically connected business networks or *e-Supply Networks* would be able to utilize information in an intelligent way to provide visibility and transparency, thus

enabling themselves to coordinate plans and flows across the supply network, and to restructure their operations for efficiency and for reaching out to new customer segments and needs (AMR, 06/2000). In short, we believe that the development, promotion, and adoption of these network and business models (like event networks and collaborative community exchanges), will maximize the impact of E-Business in most industries, and enable companies and consumers to begin reaping the myriad benefits of the new digital economy.

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