Intelligent logistic concepts within network centric warfare

The control of ILC: centralized or decentralized?

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Logistic concepts are increasingly becoming smarter. With the advent of Network Centric Warfare in the defense organization new logistic concepts have begun to emerge, based on the advanced possibilities of distributed ICT. There is a lot of experience with this in the civilian sector. Thus, Xerox designed printers, linked to the Internet through a modem, that call in to a service point without human intervention when maintenance or new toner is required. This enhances a quick handling of maintenance and supply, but at the same time it implies that the complete logistic process behind maintenance and supply, and the planning thereof, must be geared to this quick handling. The introduction of such intelligent logistic concepts does not stand on its own, and, as a consequence, also requires an adjustment of the business processes. (note 1)

Apart from the problem of arranging the logistic network, there are a number of questions regarding the control of ILC, the employment of ICT and the division of tasks and responsibilities within the supply chain. In particular the last question is interesting: who is going to take the decisions on the ILC? This contribution deals with this organizational question: centralized or decentralized? First, the background of ILC is discussed, after which the possible choice between a centralized or decentralized logistics organization is worked out. Initially, this will be done from the perspective of individual organizations, and subsequently, from the cross-company ILC perspective. Examples from the civilian as well as the defense organization will be presented.

Better logistic performance requires cooperation

Good logistics is a basic condition for successful operations. This is as true for the defense organization as it is for civilian companies. Environment factors that keep changing make new demands. When the management does not make timely adjustments in its logistics, the result may be an increase in the cost of logistics or a failure to get the products to the clients in time and the organization falling short of its targets. That is why logistic professionals always react actively on changes in their environment. Relevant trends for logistics and supply chain management are:

- The dematerialization of products; the secretarial department does not purchase a copier, but a hitchfree flow of documents; the army does not buy a tank, but combat power; the family does not buy a TV set, but home entertainment. Products thus become services. When acquiring the Scania container loading systems there were
specific investigations to see whether the commercial market could deliver the full transport capacity, regarding materiel as well as personnel, in the deployment area. The traditional flow of goods is only one of many elements in this. There is a requirement for coordination of an increasing number of processes.

- The increasing responsiveness of the supply chain: shortening of lead-times, rapid introduction of new products, introduction of innovations in new distribution channels (e-commerce). The DART (Disaster Assistance Response Team) emergency aid has to be shipped within 24 hours. Recently, the NATO Response Force (NRF) was established, a rapid response force that can be deployed in crisis areas all over the world within five days, intended to be able to hold out for thirty days as a relatively small, but well-trained and well-equipped group.

- Meeting the individual needs of clients, which in case of the defense organization are the operational units, and realizing increasingly higher logistic performances: speed, reliability, packaging, reverse logistics.

- Reduction of the cost and working capital in the supply chain and the actual realization of a synergy in collaboration. The NRF combines the land, air and sea forces of fourteen NATO countries, including the Netherlands. Experiences with the Laurus merger show that this is no easy matter in the civilian sector, either.

- Generating higher profits by an intelligent use of logistic supply chain management. Civilian companies such as Cisco, Office Depot, Dell and Wall Mart owe their success largely to supply chain management. But also the experiences of the American forces in Iraq, for instance, are an example of the successful application of new logistic concepts.

- A requirement of logistic solutions to simultaneously meet durability criteria. Environment tax and quality of life are important criteria in logistic solutions such as city distribution, reverse logistics and modal shift.

The Council of Logistics Management (CLM) regularly investigates the consequences of changing environmental factors for logistics and supply management. The ‘21st Century Logistics’ research indicates how the focus of attention of logistics has changed over the past few decades. First, it changed from efficiency and cost to the quality of logistics (customer service). Subsequently, there was a shift towards more integral approaches, integrating degree of service and financial targets. Still later, the attention moved away from internal logistics to an external orientation through partnerships with customers and suppliers, external integration and supply chain management.
CLM (1999) states that logistics integration requires integration on six levels:

1. **Customer integration** encompasses the identification of long-term needs and preferences of present and potential customers. Only on the basis of this insight can the organization increase its value for a customer.

2. **Internal integration** requires an integration of all functional activities within an organization in order to realize high external logistic performances against acceptable internal logistic efforts.

3. **Supplier integration** is aimed at a perfectly organized supply of services, raw materials, auxiliary materials and semi-finished products, as well as the exchange of information. Only then is there a real integral process.

4. **Technology and planning integration** concerns the building and maintaining of information and communication technology (ICT). This makes it possible for clients to be really connected to suppliers. Where hitherto the management has always been involved in the internal flow of goods, it is now required to also establish coordination with suppliers and clients.

5. **Measurements integration** is intended to enable the performances of all supply chain parties. Organizations must have unambiguous performance indicators for the supply chain in order to be able to interfere in case of abnormalities in the agreed performances by one or more parties.

6. **Relationship integration** should result in a common vision of clients and suppliers about the targets to be attained through cooperation. All efforts must be directed at delivering the best value for the client.

**Integration and coordination**

The coordination within the organization, but also increasingly within the entire supply chain, has to be more and more precise. The margin that was there in the past in, for instance, waiting times and supplies has disappeared. Processes in the supply chain are directly linked and the management of those processes knows no borders. So, logistics has acquired a new dimension; the collaboration in supply chains and networks. Under the catchword of supply chain management the logistics profession has developed many new concepts to support this collaboration and integration. (Van Goor, et al., 2003).

Without any pretence at completeness, here is a selection: Collaborative Planning, Efficient Consumer Response (ECR), Continuous Replenishment, Vendor Managed Inventory (VMI), Collaborative Planning Forecasting and Replenishment (CPFR), Synchronized Production, Supply Chain Planning, Advanced Planning Systems (APS), Supply Chain Execution softwares, e-procurement and B2B market places. One of the latest shoots to the logistics tree is ILC, in which often several of these supply chain concepts are combined. An example of VMI will be presented below.
Akzo Nobel Case
Akzo Nobel are a world leader in coatings. They produce paint, varnishes and stains for industrial use, the transport sector, yacht and shipbuilding, the DIY sector and house painters. At the same time Akzo Nobel distribute paint to professional house painters through wholesalers, usually owned by the company itself. The wholesalers keep their own stock; they determine its volume and moment of replenishment. There are ideas to centralize this by means of Vendor Managed Inventory (VMI). To this end all wholesalers have introduced one and the same ERP, enabling a smooth transition to VMI. The system allows the central control of ordering and production at Akzo Nobel.

Intelligent logistics concepts
It is in particular the emergence of an advanced ICT that enhances a more efficient and effective mode of operating and offers possibilities for improving the management. ILCs are innovative high-value concepts, whose increased transparency in the supply chain creates opportunities for improvement of efficiency and effectiveness of cross-company logistic processes. An ILC meets the following criteria:

Cross-company
There is an exchange of information between several parties that make up at least two successive links in the supply chain.

Innovative
There should be innovation. Existing and postponed functionalities are introduced in new company environments and/or new facilities for improving the connectivity and logistic coordination are developed.

IT-component
The employment of ICT plays a key role in the cross-company logistic coordination. The central issue in ILC is how to link up existing systems with IT applications in other organizations in such a way as to support the desired logistic coordination between those organizations. There is an important common ground here with network centric warfare, in which the use of sensor technology is combined with more and more powerful ways of processing information. (Smith, 2004, Albert et al., 1999).
Transparent
Transparency represents the actual mutual exchange of information between parties in the supply chain. The information exchange leads to a strengthening of the supply chain control. Transparency is a characteristic of network centric warfare.

Effective and efficient
An improved connectivity and/or electrification of information flows alone is not sufficient. There has to be a clear improvement of the logistic performances through an adjustment of the physical processes supported by an improved availability of information.

ILC can be seen as a philosophy propagating that there is still a lot to be gained in the broad field of adjustment and planning in the supply chain. Apart from that, ILC has two emphases. First, the philosophy clearly distinguishes the elements that are necessary to come to a chain-wide coordination: network design, connectivity, transparency (through collaboration) and control and planning. Which form of control and planning are required and possible and what is adjusted will differ per situation and supply chain and the decisions will be based on the above-mentioned supply chain concepts. Secondly, the philosophy recognizes the supply chain design aspect. The supply chain is not an invariable. Depending on the dynamics of the market it will have to be rearranged and redesigned, and again require subsequent coordination and planning. Intelligent logistic concepts aim to improve efficiency and effectiveness of the supply chain by improving the coordination and planning of activities throughout the entire chain. As an example the Bloemeneveling (Flower Auction) Holland may serve. Subsequently, the elements of an ILC and the role of the logistic organization in it will be discussed.

Bloemeneveling Holland Case
The Bloemeneveling Holland daily gets large quantities of flowers and plants from growers. These products are destined for several dealers and the auction sorts them per dealer by means of a cross-dock system. Up to now the auction has hardly received any information from the growers, transport companies or dealers about which sorts and quantities are supplied and at which times. The consequence is that the auction has no information for the planning of the unloading and the internal logistics. The transport companies do not know exactly in advance what quantities they will pick up at the grower’s and at which times they can deliver them at the auction. The result is waiting times at the loading and unloading docks.
Within the framework of ILC a logistic ‘datahub’, an information collection and distribution point, is set up for the supply side of the auction. There the growers inform the dealers in what quantities and for whom they will supply their products. With the help of these data the transport companies can plan their pick-up rides and the Bloemenveld in Holland can plan the internal logistic processes and dock transactions, with a possibility to fine-tune between the transport companies and the auction.

Thus, the transparency realized through the datahub offers possibilities for each of the parties in the supply side not only to improve their own planning, but also to fine-tune between the planning of the parties.

The logistic concept behind ILC

For the benefit of a logistic policy a design model was worked out (Van Goor, 1992), a so-called integral logistic concept. It comes into play when interrelated decisions are taken with regard to the strategy of the supply chain, the logistic targets, the logistic network and the processes within it, the logistic control, the logistic ICT and the logistic organization. The same concept also forms the basis for the OLC 2006. The way the logistic concept is realized ultimately determines logistic performance. Therefore, the concept is complemented with performance indicators. At all times these elements should be related. Below, the elements of the integral logistic concept, which can also be employed when developing an ILC, will be discussed.

![Figure 1: Integral logistic concept (after Van Goor, 1992)](image-url)
Supply chain and logistic targets
Logistic targets are the outcome of the strategy adopted by the parties in the supply chain. Fisher (1997) makes a valuable distinction between ‘physically efficient’ supply chains and ‘market-responsive’ supply chains. The Dutch transport concept for inland navigation DistriVaart is geared to the efficient transport of paletized products with a low value density, and it is therefore mainly physically efficient. The design of the basic logistics of the Netherlands defense organization is also directed at a physically efficient supply chain.

Responsiveness is sought in the complementing road transport. The datahub at the Bloemeneveling Holland, too, is directed at improving efficiency. There is certainly a necessity for responsiveness in expeditionary deployment. The American army uses the ILC JTAV which has all the features of a ‘market-responsive’ supply chain (Van Merrienboer et al., 2002, http://www.dla.mil). This case will be discussed below.

Joint Total Asset Visibility (JTAV) Case
In every deployment in the 20th century, the U.S. military was plagued by not having visibility of its assets as they flow from their origins, through a long pipeline to the warfighter. The problems during Desert Storm affected the operational effectiveness of the units, that had no visibility of the status of their orders; it was not clear whether a particular item had been ordered or not. Besides they did not know where and when the goods would be delivered, and where they were in the supply chain at a certain time. The consequence was that the logistic system was taxed more than necessary, because items were ordered twice or they arrived in places where they were not needed. During Operations Desert Shield and Desert Storm approximately 40,000 containers of materiel were shipped to the Middle East. Because personnel in theater did not know the contents or final destination of the containers, 20,000 had to be opened, inventoried, resealed and reinserted into the transportation system. Additionally, over 60% of all patients being evacuated from the theater ended up at the wrong destination. DoD has estimated that over $2 billion could have been saved during Desert Shield and Desert Storm if the military could only have ‘seen’ its assets.

The American armed forces want to be able to deliver ‘rapid crisis response’. One of the ways to achieve this is to support their combat personnel better by increasing responsiveness, transparency and accessibility of logistic assets. They call this approach ‘Focused Logistics’. The JTAV Program mission is to develop a capability which provides users with timely and accurate data on the location, movement, status and identity of units, personnel, equipment and supplies.
JTAV is implemented in a two-tier system. The first phase involves the linking of existing information systems (‘legacy systems’) to a central database, in which all the relevant data is stored; it is subsequently made available to the users via the Internet. The extent to which the information is correct and up-to-date depends on the correctness of the data that are fed to the database and the frequency with which they are updated. In the second phase there is a transfer to a system that filters the information from the existing information systems on the basis of the needs of a client (who requests specific information). The most important difference between the two approaches is that in the second phase the data are no longer recorded centrally, but a so-called ‘IT-backbone’ allows the downloading of direct information from the linked information systems. This involves ‘intelligent’ software that searches for the right information from all sorts of data systems and makes it available to the inquirer in a language he can understand. The intelligent software acts as a sort of translator between several information systems. The big advantage is that the information that is produced is always up-to-date, provided the intelligent software is faster than the time that elapses between updating of the data sources.

Johnson Nancy Johnson, JTAV Office director and personal adviser to the Director Defense Logistics Agency pointed out that visibility of data, in and of itself, won’t accomplish, ‘Given today’s technology,’ she added, ‘we have an opportunity to achieve a “leap-ahead” in logistics management. Instead of using the JTAV capability to manage the logistics ‘iron mountain’, we can use it to significantly reduce or eliminate it. Inventory reduction happens to be a major goal of DoD’s Logistics Strategic plan.’ JTAV is viewed from two customer perspectives. On the ‘factory’ end of the ‘pipeline’ are DoD corporate users, wholesale business managers and personnel/item managers who need JTAV to manage the business processes more effectively. Beneficial outcomes include limiting unnecessary buys, redistributing assets, reducing inventory and managing the pipeline more efficiently. On the ‘foxhole’ end of the pipeline are commanders, JIs/J4s and warfighters who are concerned about contingency planning, readiness and timely operational/mission support. The JTAV ‘To be’ architecture is recognized as the cornerstone of the Global Combat Support System data access strategy and will be completely synchronized with the Defense Information Systems Agency and other key players to support development of the Common Operating Picture. The objective is to have an ‘any user, any box, anywhere’ environment.

ILC network and processes
Hoekstra and Romme (1991) describe the logistic network as a model that represents the flow of goods with the following elements: the primary processes of buying up to
including after sales service, the location of the stock points in the flow of goods and the goods movements between the processes and stock points. For instance, in DistriVaart a central position is taken up by the intermodal network in which the pallets coming from the producer go from the road to the ship and from the ship via the road to the Distribution Center of the retailer. The de-coupling point is in the ship, where anonymous supply can be allocated to concrete client orders.

In the 2006 operational logistic concept (OLC 2006) a distinction is made between several supply chains for user goods, materiel and military health care. Goods come from a supplier and are temporarily stored in a (military or civilian) warehouse in the Netherlands. The goods leave the Netherlands via the Point of Embarkation (POE) and reach the country of their destination via the Point of Debarkation (POD). The goods are again temporarily stored ('Logistic Base') and from there they are shipped to the operational area. The control of the flow of goods takes place on the basis of the demand from the operational area. When the stocks fall below a certain point, goods are requested from the Logistic Base. When the levels drop below a certain level there, orders are placed in the warehouses in the Netherlands. When stocks are too low, orders are placed with the suppliers. Apart from the various links figure 2 also represents the maximum distances between them.

![Figure 2: The physical distribution chain](image)
The logistic control model

The basic logistics network determines the way in which the flow of goods can find its way in line with the logistic targets. Logistic control encompasses the organization, planning and management of the flow of goods from design, procurement, via production and distribution to the final customer, with the intent to satisfy the needs of the customer at the lowest cost and a controlled use of capital. Logistic control has three sub-targets: satisfying as much as possible the needs of the customer with regard to delivery times, product specifications, installations, after sales service, provision of information and flexibility; using the available capacities in the network of production operations, distribution and transport network and after sales, in order to keep the logistic efforts (costs and working capital) as low as possible; and, finally, ensuring the fastest and most reliable flow of material, raw and auxiliary materials, semi-manufactured and final products through the supply chain.

The distinction in three levels of decisions made by Bertrand (1990) offers a good basis for designing the logistic control in ILC:

1. The strategic/supply chain level
   This involves determining the basic rules and targets of the logistics policy. As examples may serve the desired capacity load, the required lead-times, the levels of safety stocks in the network, delivery times and required delivery reliability. These elements determine the pre-requisites the orders have to meet, if the agreed quality, price and delivery arrangements are to be observed, and the margin of individual parties in the logistic control.

2. The tactical/flow of goods level
   Here, the future flow of work orders for the parties in the supply chain is geared to the available capacities in the network. Examples are: stock levels and locations, production planning, determining the distribution capacity of the network, and making the timetables at Distrivaart.

3. The operational/executive level
   Given the volume of flows of goods agreed on at the tactical level and the specified basic rules, the operational, executive departments are responsible for the acceptance and registration of the generated work orders. This involves the daily scheduling of orders, prioritization of client orders, the planning of distribution facilities, determining the routes and suggesting a delivery time.

The logistic ICT
As stated above, the use of ICT is a key factor in ILC for the realization of cross-company logistic coordination. Logistic ICT supports ILC processes and their control. Many
companies have already integrated ERP systems and complementary transport management (TMS) and warehouse management (WMS) applications. Connectivity represents the necessary ICT-infrastructure to exchange electronic data between the existing systems. ERP systems will remain central to the ICT infrastructure, in particular for registering purposes, as the core backbone. This will allow a seamless integration of all information flows. The ERP systems will be complemented with applications for the execution of various processes (WMS, TMS, scheduling software) and advanced applications for planning and day-to-day optimization of the supply chain. The cases of Akzo Nobel, JTAV and Bloemenvelding Holland, described above, show that ICT forms a critical factor.

The logistic organization
The logistic organization is directed at identifying which roles and responsibilities there are and the persons that go with them. It is all about laying down the tasks and responsibilities. In the Akzo Nobel case the operational responsibilities for the stocks at the wholesalers and the production control are centralized. Often coordination is slow to get started. The logistic performance is influenced by decisions of employees with conflicting interests. This implies a constant necessity of fine-tuning. As said above, when the demands from the environment increase, the need for coordination becomes more pressing. At moments like these there are companies that decide for a centralized organization of their logistic control in a single logistic department. There are also organizations that decentralize their logistic control in functional departments. The organizational structure determines the extent of the integratedness in the perception of logistics of the employees who take those logistic decisions and the emphases and priorities in their actions. (Ploos van Amstel, 2002) The logistic organization is therefore considered a key factor for the realization of good logistic performance. The Outokumpu case is included here as an example of a centralized logistic control, in particular on the tactical level.

Outokumpu Case
Outokumpu, Finland, is a large steel multinational operating on a global scale. Their focus lies on basic metals, stainless steel, copper and metallurgic technology. In 2001 Outokumpu took over Norzink AS, whose factory in Odda has a yearly output of 150,000 tons of zinc. It is one of the most profitable and efficient producers in the world. Outokumpu took over Norzink to be able to realize economics of scale: lower costs, better use of capacity but also a better allocation of customers to a production loca-
tion, which led to a lowering of transport costs. The reduction of costs, customer allocation to production location and a better use of capacity is only possible if these locations are centrally managed. This is done by means of an Internet application in the head office in Rotterdam which determines centrally what is produced where, in what quantity, and for which customers.

Achieving integration

In the past there was usually little need to coordinate activities in the supply chain. The trends described above have also forced the defense organization to speed up the supply chain, especially in expeditionary operations. Activities have to succeed each other accurately, take place simultaneously or even fully integrated. This implies they have to fit seamlessly. In realizing coordination and the ensuing fitting coordination facilities, it is of importance to have an idea of how activities in organizational units interdepend and relate. Galbraith (1983) states that the best way of organizing depends on the uncertainty in and the diversity of the work. It involves the reduction of the need of coordination, by creating a margin or autonomous logistic units in the organization, or the improvement of the coordination capacity, by investing in integral information and communication or establishing horizontal and lateral relations through an adaptation of the organizational structure.

Creating a margin is achieved by reducing the performance level. It diminishes the quantity of data that need to be processed during the execution of the task and prevents over-taxation of hierarchical channels.

By establishing autonomous logistic units in the organization (e.g. product divisions or creating shared service facilities) every organizational unit has the necessary means, expertise and authority. These units accept work orders independently and execute them within the agreed pre-requisites for capacity load, costs, lead-times and quality. From a commercial, economic and technical viewpoint, however, there are limits to the process of autonomous organizational units. In view of an effective logistic control, creating small product divisions cannot go unpunished, so other solutions are required to realize better coordination. Carrying autonomous organizational units too far may limit any advantages of scale, synergetic effects can get lost and the cohesion between the units can even completely disappear.

Investing in integral ICT allows a better coordination by enabling the sending of more and better information through the organization, which is the core of network centric warfare. The ideal in such logistic ICT is to come to a fully on-line real-time system such as ERP or APS, Internet applications or agents based applications.

On the one hand, there are coordinating and support roles, on the other more active
directive roles in which the logistics manager himself determines the logistic decision process (see figure 3). The introduction of vertical, horizontal and lateral relations involves investments. Heavier burdens are laid on the organization and the costs rise. At the same time non-essential, but excessive, built-in facilities are seen as disruptive. The use of a multitude of coordination facilities can in some cases have a dysfunctional effect because of the many rules, procedures and forms of consultation and constant territorial claims of the logistic employees. This in its turn can lead to additional organizational measures that bring along their own problems of coordination. A well-considered choice of coordination facilities is therefore required.

Figure 3: Horizontal and lateral relations

In ILC the question whether the supply chain should be organized in a centralized or decentralized manner keeps coming up. Centralization is the most stringent method of coordinating the decision making (Ploos van Amstel, 2002). A central organization has certain advantages. The control is well-organized, allowing a better use of capacity of the resources of multiple parties in the supply chain, which saves costs. There is also the advantage of the knowledge and experience being managed centrally, which allows multiple parties to benefit from them. Of course, it is possible to opt for a decentralized organization. One advantage there is flexibility, which allows a smooth adjustment to a changing environment. This reduces the complexity and employees are empowered to take their own decisions and be responsible for them. The decision making goes faster which makes for a more efficient and effective organization. Not all the consequences of decisions can be overseen by one person in one center and in the case of decentralization there is the possibility to react quickly on circumstances on the spot.
Nevertheless, a loss of transparency and overview, making it difficult to oversee where resources are available, must be taken into account (Mintzberg, 1993). This is why Outokum has opted for a centralized logistic control on a tactical level.

A decentralized organization; where and when?
Empirical research has shown that it is not a matter of either decentralized or centralized, but that the situational factors determine the choice for one form of logistic organizational structure or another.

The logistic complexity and logistic predictability determine the logistic organization. Where it concerns a low complexity and high predictability coordination can be realized within an existing structure; the decentralized logistic organization, supported by rules and procedures. Low complexity and low predictability requires frequent interventions in order to keep the flow of goods on the right track. Coordination is immediate. As complexity is low the consequences of decisions can be overseen at a glance: so, a decentralized logistic organization. When complexity is high and predictability low, the coordination can no longer be realized exclusively through an existing structure. The need for a centralized logistic organization with an integrator manager emerges. When complexity and predictability are both high, there is a need for a centralized logistic organization.

Practical experiences
There has been research into the central logistic organization. A decentralized logistic organization is suitable in situations with low complexity and high predictability, with persistently good performance. If in a situation of high logistic complexity and predictability an organization has a decentralized logistic organization, logistic performance is poor. This fact prompts the question whether a centralized logistic organization is suitable in a situation of high logistic complexity and low predictability. Practice shows that this is not necessarily the case. Organizations that opted for a centralized organization of the logistic control initially did well, but after some time performance deteriorated. Therefore, the answer to the question whether a centralized organization is suitable in a situation of high logistic complexity and low predictability cannot be unreservedly positive.

Logistic organization in ILC
Now that it is clear how the organization of logistic control is viewed from within the
walls of organizations, it is time to discuss how logistic organizations should be considered when they go beyond the boundaries of organizations, as is the case in ILC. Here, there are also certain organizational problems. Take, for instance, Distrivaart. On the strategic level: who determines the establishment of the distribution network? Who determines the investments in ships and shore-to-ship interfaces? Who determines the division of the operational costs over the parties? On the tactical level: who determines the parties for the road transport? Who determines the schedules? How is the capacity divided over the parties? On the operational level: which stock is allocated to which customer? Which products will be unloaded first and delivered to the retailer’s DC? How much stock will be kept in which ship? This is just a selection from the multitude of logistic decisions to be taken. Comparable questions will come up in future NRF-operations.

ILCs can often be found in logistically complex and unpredictable environments. At first sight a centralized logistic organization seems to be the right way to gain control and attain more transparency. Enter the famous ‘orchestrator’. However, this is a sensitive point in the implementation of an ILC. The organizational question also leads to the question who holds the power in or over the chain (and thus determines customer satisfaction). A centralized control of the supply chain has a great capacity for coordination, leads to better use of capacity and saves costs. But what about the operational level? Here it is all about making choices as to which customer is served first, which ship is to be unloaded first. These choices have a direct bearing on the logistic performance of the shipper. That is why it is so important to approach the organizational question with much subtlety. There are quite a few snags attached to a centralized logistic control; within the organization itself, but most certainly in cross-company coordination. Therefore, it is an open question whether the fully centralized operational stock control at Akzo Nobel is not a bridge too far.

Logistic control is a key factor in the success of ILC. Many decisions are taken at several levels (strategic, tactical and operational). On the first two levels a collective planning from a collaborative perspective is very well possible; or in logistic organizational terms, collective central planning.

Operational coordination should preferably take place as low as possible in the organization; decentralized execution. The above-mentioned advantages of a decentralized organization are of the utmost importance. The decision making is faster, which makes the organization more efficient and effective. In decentralized organizations it is possible to react quickly on circumstances on the spot. And this is precisely the great logistic challenge in network centric warfare (Smith, 2004). It implies, however, first and foremost an improvement of predictability and a decrease in complexity through good collective strategic and tactical planning by the parties in the supply chain. Otherwise a cen-
centralized logistic organization of the supply chain, also for operational decisions, becomes inevitable; with all the possible problems that may ensue from it.

The clout is in the operational level. There are, however, several points of attention in a decentralized organization. A continuous improvisation may lead to a decrease of responsiveness and reliability and an increase in costs. This will again increase the tendency to centralize. Supply chain performance must be transparent. It is all about learning from improvisation, as this will decrease complexity and increase predictability. The capacity for learning must be developed on the strategic and tactical levels: Plan Do Check Act (PDCA). On the operational level the organization must always be decentralized, but it should be clear who is allowed to talk about what; who is allowed to take which decisions; who is responsible for tracking and tracing; who is responsible for the right data, etc. Or in terms of the five Ps: perfect preparation prevents poor performance. NATO initiatives such as TOPFAS (Tool for Operational Planning, Force Activation and Simulation) can support this.

The logistics manager and the organization
What does all this mean for the traditional logistics manager who is often seen in organizations - a manager with a strong focus on centralization, who will have to function in ILCs in the future? What is required is a transfer from internal to external logistics. A successful supply chain demands a perfectly tuned internal logistics involving all the parties. In boundaryless organizations operational employees take most decisions, managers share information about strategy and performance of the organization, employees are encouraged and managers ensure that everyone pursues the same targets. In order to break down the external boundaries managers of a boundaryless organization aim at maximizing the value for the eventual customer of the supply chain, they look for collaboration and trust-based partnership, they spend most of their time with customers, suppliers and other parties in the supply chain. (Ashkenas et al., 1996)

Summary and conclusion
Within the framework of NCW, ILC has a future in the defense organization; a better responsiveness against an optimum effort in the supply chain through collaboration, transparency and a maximum use of information. Logistics control plays a determining role in the success of ILC. However beautifully the logistic network may have been designed, however advanced the ICT, the planning and control in the end determine the efficiency and effectiveness. The logistic organizational question may not be evaded. Often the first instinct is to organize in a centralized manner. The present article argues
that much more subtlety is needed. The centralized logistic organization within ILC has
even more snags to it than the centralized logistic organization in a closed organization.
Decentralization is the preferred option, as that determines the clout. But this presup-
poses a collective effort of all parties in the supply chain to improve the logistic com-
plexity and predictability at the strategic and tactical levels. If the operational day-to-day
complexity is high and the predictability low, a centralized organization seems
inevitable, with all the risks attached to it. In short, the organizational perspective is rel-
evant in the evaluation of success or failure of ILC.

References
Ashkenas, R., D. Ulrich, T. Jick, en S. Kerr (1995), The boundaryless organization,
Jossey-Bass Inc., San Francisco
Bertrand, J.W.M., J.C. Wortmann en J. Wijngaard (1990), 'Production control: a struc-
tural and a designoriented approach', Elsevier, Amsterdam
Christopher, M. (1998), Logistics and supply chain management, Financial
Times/Prentice Hall, Heathrow
CLM (1999), 21st Century logistics, Council of Logistics Management, Oak Brook, Ill.
Defense Industry and Innovation, Orbis, Volume 46, Issue 3, Summer 2002, Pages 523-
536
Fisher, M.L. (1997), What is the right supply chain for your products, Harvard Business
Review, March/April 1997
Goor, A.R. van (1992), 'Integraal customer service concept', Tijdschrift voor Inkoop &
Goor, A.R. van (2003), M.J. Ploos van Amstel, W. Ploos van Amstel, European distribu-
tion and supply chain logistics, Eduactieve Partners, Groningen
Hoekstra, Sj., en J.H.J.M. Romme (1991), Integral logistics structures: developing cus-
Landmacht [The physical distribution concept of the Royal Netherlands Army], Militaire
Spectator, Thema: Logistiek., Jrg 171, 11-2002
ak of gevaar voor defensie [Transparency: necessity or risk for the defense organization],
Militaire Spectator, Jrg 171, 2002/11

89
Smith, E.A. (2004), 'Network centric warfare: where's the beef', submission to the Naval War College Review
Verduijn, T.M. (2003), B. van de Loo, Intelligent logistics concepts: improving your supply chain with collaboration and ICT, Eburon, Delft
Vries, J. de (1999), Logistiek organiseren [Logistic organizing], Van Denderen, Groningen
Wit, P. de (2001), en T. Verduijn, Intelligente logistieke concepten: concepten, mogelijkheden, implementatie en ervaringen [Intelligent logistic concepts: concepts, possibilities, implementation and experiences], TNO Inro/NDL, Delft

Notes:
1 For this, see P.L.J. Thoolen's contribution to this volume of NL-ARMS