Opportunities for Competitive Advantage in Logistics through Information Technology

Marvin L. Manheim
J. L. Kellogg Graduate School of Management, Northwestern University, Evanston, Illinois 60208
e-mail: mlmanheim@nwu.edu

Abstract

We examine the strategic issues facing Logistics Service Providers (LSP) and the Information Technology (IT) options open to them. We conclude that "supply chain integration" and deploying EDI are, at best, short-term competitive advantages and will soon become competitive necessities.

To identify opportunities for long-term competitive advantage, we then examine the emerging management issues in logistics and identify the characteristics of a "Truly-Productive Organization (TPO)." We argue that building a TPO is a potential source of advantage, because it is based on people skills which are difficult and expensive to duplicate. A key element in building a TPO is to influence the ways in which people work, by adopting Patterns of thinking and acting which reinforce desired objectives. Information Technology can support achieving a Pattern-based organization. To show this, we identify and discuss a number of emerging technologies such as Groupware and Workflow Management Systems, and new types of PIM's, and show how they fit together into an integrated information architecture for supporting a Pattern-based TPO. We argue that this is an architecture which can support achieving a people-based competitive advantage.

Objectives

Our goal is to examine the information technology strategies which Logistics Service Providers should be considering in order to gain competitive advantage in the dynamic world of intense global competition. (See [31, 12, 6-8] for fuller discussion of this material.) The arguments also apply to other business processes and business strategies in general.

The forces of today's intensely-competitive business environment call for significant changes in how business processes are conducted. One critical business process [1] is Order Cycle Management: The order cycle begins when the customer places the order, and ends with delivery of the final product to the customer. It includes production planning and scheduling, logistics for inbound and finished products, production coordination between schedulers and suppliers, and other types of integration and coordination. Order cycle management is also called "supply-chain integration" or "demand-chain integration." In this process Logistics Services Providers (LSP's) are key players. LSP's include transportation carriers, warehousers, third-party service providers, and others providing a range of transportation, logistics, and related value-added services to shippers of goods. We also include the internal logistics functions which provide services to the rest of a manufacturing or merchandising organization.

In today's world of global competition, LSP's face many challenges. These challenges are shaped by the forces on the manufacturing and merchandising companies which are the LSP's customers, and customers' customers. The LSP has a key role to play, in assisting its customers (and their customers) to create integrated order cycle management capabilities. [2-5] A LSP must be able to provide a timely, cost-effective, high-quality service to its customer and be an integral part of the shipper's management of its order cycle. To a lesser degree, it must also play appropriate roles in the shipper's product cycle and customer relationship management.

Basic strategies: Pipeline Management Systems

Information technology (IT) is already widely used in Order Cycle Management (OCM). We presume an environment of electronically-mediated work, in which the computer is the basic working environment for many people in an organization and in which inter-organizational systems connect the parties in the supply chain. In production and logistics, many parties are involved in coordinating all the processes that are involved in fulfilling a customer's order: manufacturer, suppliers of parts and subassemblies, material managers, logistics managers, transportation carriers, customer service representatives, quality assurance staffs, and others. The goals are to reduce the cycle time to fill a customer's order, reduce the inventory of parts, work in process, and finished goods in the pipeline, increase the accuracy and completeness of filling a customer's order and of billing him for it, and accelerate the payment for the delivered items to put
cash in the bank as soon as possible.

To achieve this degree of Order Cycle Integration, manufacturers, merchandisers, and their trading partners are using EDI and other technologies to create coordinated information systems to manage this "pipeline" of materials flows. These coordinated systems, called "Pipeline Management Systems (PLMS)," [6-7] deal with structured data and structured processes: purchase order initiation, purchase transmission via EDI, purchase order receipt and entry into an order-entry system, production scheduling, etc. PLMS provide the capabilities for managing high volumes of data for highly-structured transactions. Typically, a PLMS consists of Transaction Processing, Management Information System, Executive Information System, and Decision Support System components, in a number of organizations, coordinated loosely or tightly. Typical functions include:

- Shipment status tracking - location of a shipment at each major transition point as it moves through the transportation segments of the supply chain
- Inventory status tracking - current inventories by item while in production, warehousing, or movement through transportation carriers
- Movements of ancillary information in document or electronic form.

Assessing the basic PLMS strategy

The critical tasks in implementing PLMS include, among others, integration of transaction processing capabilities between firms (suppliers, customers), e.g., sending purchase orders from the inventory management systems of one company to the order entry system of another. This integration is achieved in part through utilizing widely-accepted EDI standards (e.g., ANSI X.12 in North America, EDIFACT in Europe) for message formats. While implementing EDI has many practical difficulties, there are many vendors offering software packages and many consultants offering technical expertise, and so the EDI knowledge is widely available.

Other elements include use of Management Information Systems (MIS) and Executive Information Systems (EIS) to provide capabilities for executive monitoring and reporting of the pipeline processes. Shipment status and tracking systems on a carrier-specific and multi-carrier or forwarder basis are one key element of the MIS in most cases. Decision Support Systems (DSS) for operational purposes (e.g., planning and scheduling, dispatching) are also important; many companies are beginning to implement these.

In an analysis of PLMS as a strategy [6-8] we conclude that it is a competitive necessity to have a world-class capability to manage the order cycle. Some companies are already engaged in implementing such processes; the benefits show up in reduced costs, through reduction of inventory and logistics facilities and services, and improved customer services [5,9,10]. If a company fails to implement a PLMS, it is likely that it will have higher inventory costs than its competitors, will have higher order processing and related costs, and will provide a lower level of service to its customers.

Is implementation of PLMS a source of competitive advantage? Currently, the knowledge about how to accomplish the integration of the order cycle, and including implementation of PLMS, is readily-available, and not unique; and the technology, including EDI standards and packages, and other software packages, is widely available. If there is a key differentiating variable, it is the management capacity to lead and to implement effectively. Thus, while effective implementation of PLMS is indeed a difficult management and technical task, the knowledge about what to do and how to do it is wide-spread.

Therefore, we conclude that effective implementation of PLMS is a competitive necessity and is not likely to be a source of a sustainable competitive advantage. Further, within a few years PLMS will not even be a necessity, but will be a part of the basic infrastructure of a business.

Where then are the opportunities for LSP's to use information technology for competitive advantage? There are many different forms of information technologies available today. Which ones are most promising? In [6-8], we analyze a broad range of IST options involving elements of PLMS. We conclude that these options are rarely sources of competitive advantage; but are at best competitive necessities and in many cases basic elements of business today.

Enhanced Pipeline Management Systems (PLMS-2)

Are there ways of building on and extending PLMS which may offer an opportunity for competitive advantage? Possibilities include:

- Integrating technological changes with organizational changes, to exploit the information available and to be able to respond to the new customer needs.
- Business process redesign can be an effective strategy, when conducted as an integrated process to redesign the nature of the work, the information systems support to that work, and the organization (both formal and informal) around that work.
- Improved shipment location and status data: new developments in information technology include improved capabilities to track the location and status of goods in motion. These include: AEI (automated equipment identification via Radio Frequency tags); transponders, satellite and other wireless communications as used in Intelligent Vehicle-Highway Systems and other applications; on-board computing and other forms of wireless computing, and others. While initially intended for operational needs of carriers, these do offer opportunities for supporting supply-chain integration.
- Yield management has been applied very successfully in the air passenger industry [11,7,8]. In yield management,
A homogeneous product is divided artificially into subproducts by price and non-price attributes (such as terms of purchase conditions), and the sale of the differentiated product is managed dynamically through the use of computer-based reservation systems and supplementary techniques (optimization and AI models, e.g.). While there has been significant interest in applying this approach to freight transportation (as well as car rentals, hotel rooms, and others), the freight market is substantially different from the passenger market. In the passenger market, each consumer makes independent decisions. In the freight market, major shippers make decisions about a large number of shipments. The problem is simply this: If a carrier offers a discounted product with a lower level of service than a premium product, the largest shippers are likely to have enough market power to force the carrier to provide the premium product at the discounted price. Thus, yield management as usually defined cannot work in freight transportation.

Assessment of Enhanced PLMS (PLMS-2)

Can a company gain a competitive advantage with an "Enhanced PLMS" strategy? Our assessment is a qualified "yes." Business Process Redesign can be effective, but the knowledge on how to do it is now wide-spread; improved business processes are at best a short-term advantage.

With respect to improved location technology, some companies are leading in this area. Where a company can control its own vehicles and services, improved location technology can be a source of a competitive advantage. For example, Federal Express has been a leader in the use of bar coding and scanning for package express; and Schneider National has been a leader in trucking applications of satellite-based tracking. However, while it takes several years to plan, develop, and implement a new location technology and implement the integrated processes which exploit that technology, knowledge about how to do this is also relatively widespread, and no specific location technology is likely to be protected from imitation or diffusion. In fact, in most cases, as in the case of AEI, the location technology is likely to be adopted by a group of competing carriers or LSP's simultaneously. Only where a carrier or service provider operates a "closed" system will there be an opportunity to take advantage of a particular technology in a unique way. Therefore, effective use of location technologies is likely to be, at best, a short-term advantage.

In the case of yield management, the picture is less clear. As argued above, the techniques which have been developed in the airline passenger business do not translate successfully to freight transportation and logistics services. New approaches are required. No company that we are aware of has implemented yield management effectively for freight in the sense in which it is defined here. It is possible that a yield management approach might be developed which could be the basis of a sustainable competitive advantage, or at least a significant short-term advantage. (Current research is suggesting some promising approaches.)

Thus, with the possible exception of Yield Management, we conclude that the PLMS-2 approach is at best a source of a short-term competitive advantage. Further, we would anticipate that within 3-5 years, the knowledge of how to do this would become sufficiently widespread that PLMS-2 will become a competitive necessity.

Opportunities for competitive advantage: enhancing people through IT

One set of strategies for gaining competitive advantage is based on a simple principle: Use information technology to enhance the ways in which people work. In applying this principle, the emphasis shifts from using IT to replace people through automating organizational processes, to designing appropriate balances of human and computer skills. To sketch the directions of this new, emerging strategic thrust, and its application to OCM, we begin with a discussion of management styles.

The Management Challenge

The nature of the emerging business environment calls for new styles of management. In this environment, every organization is pushing costs down, and at the same time demanding higher quality and higher service from its suppliers. Often, too, the organization is itself down-sizing, reducing the size of in-house staffs, and in many cases, moving to outsourcing of services such as information processing, transportation, warehousing, and logistics, and using outside contractors and individuals to a greater and greater degree. These pressures are especially important to LSP's, as a major source of their business results from the outsourcing of logistics services previously performed by in-house units.

As a consequence, many organizations have focussed on reducing costs through increased productivity, while also attempting to improve quality and service at the same time. A consequence of continuously reducing costs and striving to improve service is that a company begins to find itself in a difficult situation: the dilemma of being a "commodity provider" versus a "value-added supplier." A commodity provider is one which attempts to compete on price, and to be a lowest-cost supplier. In that mode, it is difficult to offer a service level that is above that offered by others. To be a value-added supplier, means to provide a level of service which stands above the majority or all of the competition; this can rarely be provided at the lowest cost.

If all competitors have roughly the same capabilities - technology, people skills, management systems, physical
facilities, etc. - and face essentially the same market conditions for labor and capital, then it is very difficult for any organization to offer both lower costs and better service than its competitors. There are two exceptions: where an organization obtains important resources in a lower-cost market, such as companies which use low-cost labor from developing countries; and where an organization has introduced new practices, processes, and skills that result in a qualitative difference in its capabilities relative to those of its competitors. This latter approach is the most promising.

**Needed: a New Management Approach**

It is no longer sufficient to simply be highly-productive in a narrow sense; a more subtle, varied, style of work is needed. To be competitive, an organization must have these characteristics [12]:

**Customer-Satisfaction Focussed.** Many management experts argue that, by focussing on total customer satisfaction, a company can improve its processes to deliver better service at a lower cost. Customer-satisfaction driven is often described as the next step beyond TQM, total quality management: the objective is not simply to deliver some abstract definition of quality, but to deliver total satisfaction to the customer, of which the delivery of quality is only a part.

**Disciplined, yet Innovative.** To keep costs down, an organization must have a high level of discipline: each person knows what needs to be done, knows how to do it, and does it quickly and efficiently. This argues for the organization to have a high degree of standardized procedures, and for everyone to be trained in these procedures and to execute them without question.

Yet, in an ever-changing market place, it is important to also be able to innovate, to offer new service packages and new organizational linkages with the customer. To do this requires a discipline of change which encourages innovation, and yet retains the stability of existing procedures until innovations are ready for wide-spread adoption.

**Stable, yet Experimental.** In a highly-disciplined organization, it is risky to experiment. Yet, experimentation and risk-taking is essential, for an organization to adapt to a rapidly-changing environment successfully. Therefore, an organization must develop ways in which experimentation can be accepted and risk-taking rewarded, at the same time as maintaining a disciplined approach to existing processes.

**Simultaneously Global and Local: "Glocability".** Each customer and each local situation will be different. If a company is serving a major multinational customer, or a number of different countries and regions. In each situation, there are unique local characteristics, customs, business practices, and ways of getting things done effectively. The same global procedures cannot be applied uniformly in every local situation. There has to be a balance between the desired uniformity of global practices, and the local variations.

We define "Glocability" as the capability to act locally with a global perspective, and to be effective globally with both global and local perspectives. The roots of this concept are in product planning and design, where many companies are striving to develop global products. A global product can be a single standard product; or it can be a generic product with specific local variations for a several local markets. The term "globalization" is sometimes used to describe the development of a product design which can be modified for specific sets of local markets.

**Committed to Continuous, Rapid Learning.** The need for continued learning is acute in today's competitive environment. As new teams are formed, individuals must be able to learn rapidly what is needed to deal with a new set of issues. As new knowledge is developed, it must be made available to other members of the team and to individuals in other parts of the larger organization. While responsibilities for maintaining formal assemblies of knowledge (e.g., libraries, data bases) may lie in specific formal organization units, making that knowledge available on an as-needed basis throughout the larger organization is an important element of competitive advantage. Clearly, the ultimate objective is to make a piece of information available to an individual who doesn't even know he needs it!

**Simultaneous Tight-Loose.** One way to summarize the implications of these dimensions of management style is in the descriptive phrase, "simultaneously tight - loose:" an organization must be "tight" at the same time that it is "loose."

By tight, we mean the need to have a lean, disciplined operation, in which there is a strong and ceaseless attention to keeping costs down and providing quality service at the same time. By loose, we mean the need to be innovative, to be responsive to customers' needs, to be flexible and adaptive to changing conditions and changing customer needs. This requires, for example, the ability to be able to customize capabilities so as to provide customer-specific tailored services, together with customized information systems support.

The need to be simultaneously tight-loose is especially critical in logistics organizations. In today's environment, where low cost, high quality, and outstanding service are all critical objectives, all three goals must be met simultaneously.

**Focussed on the Ways People Work.** This is the perhaps the most important element of all. The work of an organization gets done by people, aided by machines: the ways in which people work is central to the competitive effectiveness of an organization.

**The Strategic Opportunity: The "Truly-Productive Organization" (TPO)**

With the perspective of the preceding discussion, we can see that the notion of productivity is one which must be treated...
carefully. In a traditional sense, an organization with high productivity is one which, implicitly, has a high rate of output relative to the input resources in a specific time period. This can only be achieved by having a tightly-disciplined, cost-reduction-focused organization. Yet, the preceding discussion illustrates how important other attributes of the organization are as well. There is no sense in having a high degree of discipline to execute previously-defined business processes, if in fact those process definitions are no longer valid, and no one in the organization has the time or other resources to support invention of new processes. In reality, organizations must continually adapt to changing conditions, both internal and external. The static, disciplined processes that worked last week may not be at all relevant for the problems the firm encounters this week.

Because an organization must adapt to changing conditions, resources must be spent on such adaptation. While in the short term that may be considered to be inefficient, in the longer term such expenditure may be more than justified if it leads to organization being effective over the long term.

We define the "Truly Productive Organization" as one which utilizes its resources effectively over the long term, one which is able to deal with new and novel situations efficiently, and has all of the characteristics described here: customer-satisfaction focussed, disciplined yet innovative, stable yet experimental, simultaneously global and local, committed to continuous, rapid learning, simultaneous tight-loose, and focussed on the ways that people work.

Building A Truly-Productive Organization

How can a Truly-Productive Organization (TPO) be developed? In our view, there are several key elements in building a TPO:
- enhance individual work
- enhance collaborative work
- use "patterns" as a resource for individual and collaborative thought, management and action
- enhance individual learning and empowerment to manage patterns and pattern evolution and the mastery of new skills
- provide the integrated information architecture to support these goals.

We now examine the role of "patterns," central to our argument.

Patterns in Individual and Organizational Processes in a TPO

Building a TPO means building an organization in which "patterns" of work are managed as critical resources. These patterns deal with ways of thinking, ways of acting, ways of interacting, and many other aspects of organization life.

In the narrow sense, high productivity is achieved by people working hard and efficiently by executing rapidly previously-learned patterns of behavior. In a Taylorist or machine-age perspective, people behave like machines, concentrating on executing rapidly the previously-learned patterns of work. The image of apprenticeship is an image of young men and women learning well-developed styles of working, in a highly-repetitive and pressured environment for work.

In the broadest sense, high productivity is also achieved by people working hard and sufficiently industriously, but with patterns of behavior that allow innovation, richness, problem-solving and other flexibilities.

Thus, a key to building a Truly-Productive Organization is to help people develop patterns of thinking and acting which embody the desired patterns of behavior.

To understand how patterns enter into the processes of organizations, consider how the organization deals with various types of situations. In a disciplined, stable organization, there will be patterns of performance which individuals will follow in performing their work. Examples include:
- patterns for answering the telephone
- patterns for the processes of filing a customs declaration on behalf of a customer
- patterns for the process of booking transportation for a shipment of freight
- patterns for selecting carriers and routings of shipments
- patterns for setting meeting agendas
- patterns for being effective in a sales call on a customer
- patterns of behavior that allow innovation, richness, problem-solving and other flexibilities.

A truly productive organization utilizes many patterns.

Example: Patterns in Implementing Total Quality Management. The TQM approach is now widely accepted as an important strategy for a company to consider adopting. The objective of TQM is to change the patterns by which people work in their company.

Example: A major pattern is that "continuous improvement is the only way." This is contrasted to the idea that "if it ain't broke, don't fix it." This Continuous Improvement pattern requires one to identify and address the shortcomings; develop alternative proposals; address the shortcomings; improve the product/service; choose one; begin implementing; assess the implementation and modify as necessary.

To adopt this pattern throughout an organization requires change at several levels. Management must place high priority on this pattern and must indicate by deeds, not simply words, that it is important, for example by recognizing and rewarding improvements. Conversely, managers must show that they are always open to critiques of the existing procedures, and ready to welcome proposals for new procedures.

In addition to management attitudes and deeds, individuals
must adopt a new set of values and a new set of skills. Most people are comfortable with the status quo, and do not often welcome change. Yet this pattern is exhorting people to not simply welcome change, but to create and participate in an environment of continuous change. Many actions are necessary to help people adjust to this new style. Some of the supporting patterns often utilized are: measurement of existing processes and monitoring their quality; open discussion of strengths and weaknesses of existing processes; open brainstorming on ways of improving processes; empowering individuals and teams to make changes in their own processes; and others.

Another TQM pattern is that of “build quality into products and services from the start.” This requires anticipating and planning, rather than simply doing. It is also complemented by open discussions, empowerment, and many other related patterns of behavior.

Thus, effective process change requires changes in patterns:
- patterns define the content of change: to bring about change means to change the patterns of the ways in which people work: what they perceive, what they act on, how they act on it, what results they try to achieve, what skills and knowledge they bring to bear on the task, and so forth
- patterns underlie the process of effective change: to be effective in bringing about change requires using some patterns for interaction with others, what to do and how to do it, which will increase the likelihood of successful change and acceptance on the part of those involved in the processes to be changed.

Example: Patterns for Effective Management of Environmental, Health and Safety Issues. Many organizations have a critical need to manage changing knowledge about Environmental, Health and Safety (EHS) issues in a dynamic way. As new information is developed, its operational implications need to be assessed and the changes in operating procedures disseminated throughout the organization to those whose behavior needs to be affected. These EHS issues are especially critical in OCM.

For example, consider a company which manages terminals and storage facilities for environmentally-sensitive liquids. These liquids may be loaded into or discharged from trucks, barges, ships, railcars, pipelines, and/or storage containers. Every step of the process - what valves to turn when, what inspections to make, etc. - needs to be specified so that operating personnel at the field level follow the right procedures for every specific type of liquid. To ensure that people actually follow these procedures, there have to be procedures for disseminating the new procedures to the field, training people in the new operating procedures, and monitoring and assessing the procedures in practice and the extent of conformity to the procedures.

The overall process itself is a pattern, which includes a number of procedures as component patterns:
- patterns for assessing new information and determining whether changes in procedures are required
- patterns for developing the new operating procedures when needed
- patterns for disseminating the new procedures to the field organization
- patterns for training people in the new procedures
- patterns for monitoring and evaluating the changed procedures and people's conformance to the changes.

In organizations that have developed an effective approach to EHS management, such procedures have been developed and implemented. Once this has been done, the knowledge of how to do this, how to do it well, how to deal with changed situations, etc. becomes a key knowledge asset of the organization; the organization is now an effective responder to changes in externally-driven EHS requirements. In an organization which has not developed such patterns, each change in EHS requirements is a crisis and is dealt with as it needs. Thus, EHS management is a good example of the importance of the ability to develop, implement, and follow desired patterns of behavior.

Patterns

Patterns are the ways in which individuals or groups of individuals think and act. These processes are guided by the patterns which they have learned. When a new process is implemented, one of the major tasks is to teach people the new patterns of working (and ideally to revise the process design based on what people learn about the workability and effectiveness of the new patterns).

The range of patterns is very broad. An overall process design is a pattern; the way a screen display for data input is constructed is a pattern; the way a customer service agent tries alternative search patterns to query a database for information requested by a customer, is a pattern (more precisely, a pattern of patterns).

Business process redesign can be understood as a process of changing people's patterns. When a process is redesigned, it is still a "paper" design. To be effective, the paper design must be implemented, that is, translated into action as a "live" process being used by the organization.

The cognitive bases of patterns

Patterns play a powerful role in guiding personal action, whether in work or in personal life. Patterns are manifest in individual and organizational behavior ("programmed" and "unprogrammed behavior," e.g.). Their basis is cognitive, leading us to define a theory of "Cognitive Informatics (CI)." This theory draws on cognitive science, organization behavior and other concepts. The central concern of Cognitive
Informatics is to understand how information technology, broadly defined, can or could enhance the ways of thinking and acting of people as individuals and as participants in shared work activities.

At the core, the role of patterns is as a guide to individual thought and action. Isenberg’s studies of managerial effectiveness [18, 20-23] showed that effective general managers were effective precisely because they had libraries of mental patterns which they could execute effectively and efficiently, with little waste of mental energy. Mental patterns are stored and retrieved as structures called schemas. Manheim and Isenberg [23] showed the link of Isenberg's results to the concept of schemas [24-27]. The skills of effective managers can be described as the ability to store a large variety of patterns, to retrieve appropriate patterns quickly, and to adapt patterns or invent new ones effectively as needed for novel situations.

These findings were used in the design of Symbiotic DSS and Personal Construct-based Action-support Systems (PCAS)[28-30]. We now extend these results to designing managerially-responsive information architectures for the enterprise [8,12,31].

Patterns as Templates but not Constraints

Do patterns imply that an organization is constrained and "bureaucratic," in the sense that there is only one right way to do something? Not necessarily, though that danger always exists. The key is to recognize that patterns are templates, not necessarily rigid procedures; and that patterns are implemented by individuals [13,14,26,27].

Part of the repertory of patterns of the organization are patterns for developing and modifying patterns. For example, there need to be patterns for flagging when a process is not working, and needs to be reexamined. There also should be patterns for thinking creatively; for example, a pattern for initiating a "brainstorming" session, or a "issue surfacing" session. There need to be patterns for accepting criticism, initiating experiments ("intrapreneurship," e.g.), for rewarding and recognizing risk-taking even when experiments are not successful, and so forth.

Patterns are templates. Sometimes, the patterns available to an individual will be fully-specified operational procedures. More often, the patterns will be templates, or frames, which an individual then operationalizes by creating an instance in the context of a particular situation and the information he/she has about that specific case and circumstances. Often, too, each individual will have unique, personal ways in which they tend to instantiate patterns. Put another way, there will usually be organizational template patterns, and individual template patterns, as resources; and the specific actions taken by an individual will utilize case-specific patterns derived from these templates.

Patterns and Information Technology

How are patterns related to information technology? The concept of patterns leads to a unifying architecture for IT in the enterprise. Cf. [12,31] for fuller discussion.

Existing IT applications of patterns

IT is being used today to support patterns of work and thought in a variety of ways; however, at present they are independent implementations.

Patterns in existing software products. Present desktop packages come with a number of patterns. A wordprocessor typically comes with templates for business letters, invoices, social letters, newsletters, etc. A business presentation package (e.g., Lotus Freelance) comes with design templates with different visual design treatments such as typefaces, colors, etc. Especially importantly, Freelance also includes presentation designs which are patterns for marketing plan presentations, business plan presentations, and other.

Workflows as patterns. Workflow management systems are used to manage the flow of work among individuals, roles and/or organization units, to accomplish a business task - e.g., process an insurance claim. The "data" of a workflow is in the form of a pattern: a set of conditions under which a workflow might apply (e.g., the type of claim), and the rules for passing the responsibility for task execution among different individuals or units. The work of the Workflow Management Coalition (representing some 150 vendors) is very important, in that they are developing a set of standards for interoperability of workflow processes among the systems of different vendors. In particular, the Coalition's standards will include a standard data structure for managing workflow patterns independent of which engine will execute them.

Patterns for groupware. Most groupware products are designed as pattern libraries. For example, Lotus Notes is an application-development platform for groupware applications. A standard client package includes some 50 templates for possible applications, including a discussion template, a customer service template, and others. To use Notes, a user or developer takes a template as a pattern, and creates an instance of it, establishing the name of the discussion instance and which users have access to that discussion.

Personal Construct-Based Action-Support Systems. Basic Personal Information Managers (PIM's) include address book, calendar/schedule, and note-taking capabilities. Advanced PIM's provide the ability to manage information according to personal constructs. Tools like Lotus Agenda and NetManage Eccos allow the user to create text items such as "discuss Acme marketing plan with Mary before Friday" and have these categorized and assigned to personally-defined constructs such as "Mary," "Acme," "Marketing," and indirectly to constructs such as "high priority," "management
Emerging IT roles for patterns

The above applications illustrate the variety of emerging uses of patterns. What is immediately obvious is that at present the uses of patterns are very specific to an application context. What is needed is a top-level, architecture approach which unifies these uses of patterns and provides a generic approach to management, development, and use of patterns.

Components of a unified pattern-based IT architecture.

To summarize (cf. [31]), an integrated pattern-based architecture will involve the following components:

- an application-independent and document-format independent pattern library
- a user-oriented capability for applying patterns as is, or for modifying patterns or developing new ones
- a library of standard optional patterns, such as workflow management, groupware, and PCAS-type patterns
- and other features.

Exploiting patterns: using a Multi-Level Architecture.

To understand the business power of the pattern approach, consider the application to a “Multi-Level Service Architecture.”

In a typical situation, the PLMS to serve a particular customer is operated by a number of partners, interacting in various ways. Consider the coordination of the overall order cycle in a typical national or global company. Different functions are dispersed in different locations across the region or across the world, and must be linked together to function properly. These teams are located organizationally in different functions - e.g., marketing, production planning, logistics coordination - and in different geographic locations. In the Open Enterprise, the coordination of work in business process integration often extends across business units in multiple enterprises. The teams must manage quite complex processes, often under difficult time constraints.

For managing the overall process, teamwork involving the representatives of the various business units involved in the Order Cycle is necessary. For example, if a problem arises, such as weather causing a disruption in transportation in one region, or a machine breakdown causing a temporary shortage of a needed part, or other problems, people must step in and manage the process of searching for a problem solution, gaining consensus among the concerned parties, and implementing the solution and monitoring its effectiveness. This type of crisis occurred in a particularly significant way in the summer of 1993. There was a fire in a Sumitomo Chemical Corporation plant in Japan, which wiped out the source of 50% of the world supply of a special plastic resin used in assembling computer chips. As a consequence, chips were suddenly in short supply on a world-wide basis, and computer manufacturers and others suddenly had to scramble for replacements for the chips they needed to manufacture computers. Structured systems such as PLMS are not capable of handling crises or other complex exceptions, but teamwork can handle complex issues.

Thus, Order Cycle Management illustrates the need for two kinds of fundamentally-different processes: the highly-structured processes using Transaction Processing, MIS, and DSS, represented in this case by Pipeline Management Systems; and the unstructured or partially-structured processes which support people-based problem-solving. This is where Groupware is needed: to provide information technology support to people-based problem-solving.

This conclusion is general: Two kinds of fundamentally-different processes are needed, in general, in integrating business processes in the Open Enterprise. In structured processes, all of the process can be embodied in software, and once data is entered, no additional input from humans is required. In contrast, in unstructured and semi-structured processes, human input plays an important or even dominant role. To assure appropriate integration, an enterprise information architecture must involve appropriate roles for unstructured and semi-structured processes, as well as structured processes, and these roles must be coordinated.

From a strategy perspective, we want a library of patterns for dealing with all of these types of processes. Some patterns will be embodied completely in code, triggering the execution of structured processes. Other patterns will involve mixtures of code and human roles. Some semi-structured processes will be supported by workflow patterns, executed under control of workflow management systems and using both human and software agents. Unstructured processes will be supported by patterns for person-to-person interaction, including face-to-face meetings, and the full range of groupware functionalities, including voicemail, e-mail, discussions, videoconferencing, etc. Then, these patterns are complemented by an overall process management pattern, which scans an incoming message and determines through a triage function which pattern to apply.

For example, in Wuerttemberg Insurance Co.[8,12], routine policy renewals are routed by the triage process to host-based transaction processing applications with no human involvement; minor claims are routed to workflow processes with some human involvement in reviewing the claims; and
requests for new types of insurance coverage are routed to a
groupware process for electronically-supported discussions.

Conclusions

We began by assessing the business issues around Order
Cycle Management (OCM) and supply chain integration. We
then assessed present strategies for using IT in OCM,
specifically the development and implementation of Pipeline
Management Systems (PLMS). We concluded that both basic
PLMS was becoming a competitive necessity, and that
Enhanced PLMS-2 would provide a short-term advantage and
would likely soon be also only a competitive necessity.

We then examined the opportunities for competitive
advantage, by looking at management issues and people issues.
We introduced the concept of a Truly-Productive
Organization, and showed how this linked to the uses of
patterns as guides to thinking and acting. We then suggested
that the information architecture of an organization must be
based on the basic principle that the role of IT is to enhance
the ways of working of people in the organization. People
think and act schematically. Their work involves the execution
of patterns, representing previously-learned processes or the
development of new processes or revision of old processes.

Therefore, a key element of an IT-based strategy is how
individuals can access a library of patterns, use patterns and
associated processes to perform desired tasks or achieve
desired goals, and manage the evolution of their patterns and
processes, both individual and organizational. We then showed
how such present and emerging software tools as advanced
Personal Information Managers, Workflow Management
Systems and other forms of Groupware, and others are key
elements of a pattern-based approach. We closed by
illustrating the practical application of patterns to supporting
OCM with an example of multi-service processes from the
insurance industry.

Thus, we conclude that a major source of competitive
advantage for LSPs lies in the development and adoption of a
new information architecture, based on enhancing people's
capabilities through the use of patterns. This conclusion
applies to many other sectors as well.

Acknowledgments

We gratefully acknowledge research support to the
Strategic Informatics Research Program: Harper Group and
John Robinson; Consolidated Freightways; Yellow Freight;
British Airways; Avantos Performance Systems; Intertrans,
Inc.; Conrail Corporation; IBM Transportation Industry
Marketing and IBM German Software Development
Laboratory; Volpe National Transportation Systems Center, U.
S. Department of Transportation; Wuertermbergische
Versicherungsgruppe, and the William A. Patterson chair at the
Transportation Center, Northwestern University. Additional
support was provided by Lotus Development Corp.

The author is particularly grateful to Robert Blanning,
Vanderbilt University; David King, Conshare; and Donald
Amoroso, University of Colorado at Colorado Springs, and
Director, PRIISM; who have stimulated and encouraged the
author's work in this direction. The leadership of Ralph
Sprague in developing HICSS and PRIISM as environments
for presentation of emerging research has been especially
important. The Black Forest Group members and activities
have been a major and essential stimulus to the development
of these ideas. The author acknowledges especially extensive
conversations and joint work with Lutz Doblaski, Hans
Hoffman, Karl-Heinz Weinman, Erik Wilde, and Monique
Pfeffer at Wuerternberg Insurance Company; their enthusiasm
and collaboration have been immensely valuable. The author
has been profoundly influenced by Christopher W. J.
Alexander and his "Pattern Language" body of work over the
past thirty years. The author acknowledges this influence with
great gratitude. The approach taken here is somewhat different
than Alexander’s, however; and he may or may not agree with
it. The author also acknowledges the research assistance of
Erik Brit-Webb and Yinyin Xie.

The author gratefully acknowledges the benefits of the
research support of the sponsors and the advice of colleagues,
but he alone is responsible for any errors presented here.

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