A logistics model’s usefulness can diminish unless the model successfully links interrelated logistics activities.

An Integrated Decision Support System for Global Logistics

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Introduction

Over the last few years, we have witnessed a series of revolutionary changes overseas, illustrated by three historical events:

(1) the establishment of the European Single Market in 1992 under the auspices of the Single European Act

(2) the passage of a North American Free Trade Agreement (NAFTA), and

(3) the rise of Pacific-rim economic bases.

These landmarks precipitated unprecedented changes in the world economy by augmenting the global market wider than ever before. As the global marketplace expands, many multinational firms (MNFs) have been influenced by mounting pressures to develop a world-wide communication, distribution and information network that facilitates the free flow of information and goods across national boundaries.

Such a network is vital to the success of the MNF in the foreign market for three main reasons. First, to satisfy the unique needs and preferences of foreign customers, the MNF needs to build a network of multi-user databases which contain data about a host of endogeneous and exogeneous variables affecting foreign consumer behaviours. Second, to improve foreign customer service, the MNF should dramatically reduce the response time (e.g. lead-time) required to meet the foreign customers’ needs. This can be accomplished by developing not only a direct distribution channel between the MNF and its foreign customers, but also a cross-border communication channel (or a global “information highway”) which constantly provides timely information to the MNF and its foreign business partners (e.g. foreign joint ventures, subsidiaries and licensing firms). Third, to overcome many geographical, cultural and legal barriers extant in the foreign market, the MNF must create a network of standardized information systems that directly transmit data about law, culture, custom, lifestyle, foreign currency, economy and politics in the foreign countries to the MNF headquarters without either interruption or decipher.

Knowing the importance of such a network, this article describes the design of an integrated (cross-function and cross-border) decision support system (IDSS) that enhances the effectiveness and efficiency of a world-wide communication and information network embedded within a pre-established distribution network. Specifically, this article:

(1) Reviews the current status of DSS utilization in the logistics industry to explain how logistics problems are solved by DSSs in efficient and effective manners.

(2) Provides practical guidelines for the design of IDSS for global logistics and describes the basic architecture of IDSS with its benefits and shortcomings.

The Evolution and Current Development of DSS for Logistics

Commonly, DSS development is evolutionary in that a complex global DSS should be built upon the DSS developed for simple domestic problems. Therefore, reviewing the past two decades of DSS applications in a domestic environment offers useful insight. A recent study by Eom and Lee[1] indicates that marketing/logistics has been the predominant field for DSS applications, contributing approximately one-third of all published DSS applications in the corporate

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functional management field. In improving logistics decisions, we can use two basic approaches:

(1) the implementation of integrated organizational information and decision support systems; and

(2) the implementation of specific DSSs to aid specific logistics decisions (Eom and Lee[1]).

Since Eom and Lee[2] already provided various examples of DSS applications in logistics areas as summarized in Table I, this section discusses only two well-known examples which fall into the categories of the aforementioned approaches:

Implementation of a Logistics DSS as a Subsystem of Organizational Decision and Information Systems

It is interesting to note that a substantial number of Franz Edelman Awards for Management Science Achievement, sponsored by the Institute of Management Science, go to logistics applications every year. The bestowing of this prestigious award to logistics applications would seem to indicate that DSSs, along with computer-based models, have made a significant contribution towards solving complex logistics problems. In fact, five of the six award-winning articles published in a special issue of Interfaces in 1987[6] described the successful implementation of DSSs for solving a variety of logistics problems. For instance, Citgo Petroleum Corporation obtained enormous financial success (from a pretax loss of over $50 million to a pretax profit of $70 million) through the application of a management support system[6] which is referred to as a computer-based system consisting of DSS, expert systems and executive information systems. Citgo broke down the departmental information walls to develop a corporate-wide operational database using the mainframe database management system called ADABAS. ADABAS contains all pertinent data and information concerning crude oil inventory planning, crude oil and feedstock acquisition, accounts receivables and payables, refinery costs and so forth.

The subsystem, tracking, reporting, and aggregation of Citgo segmented sales (TRACS), was designed to evaluate the profitability of existing markets as well as current and future market segments. TRACS is a combination of a database management system and a rule-based expert system. The other subsystems are optimization model-based systems comprising the refinery LP model and SDM models. The refinery LP model was incorporated to control the cost of refinery, refinery run levels, crude-oil acquisition and its source selection. The SDM models were incorporated to integrate the company’s supply, distribution and marketing decisions and thus help improve interdepartmental co-ordination.

### Table I. DSS Application in Transport and Logistics Areas

| Strategic planning systems                                                                 |
| CITGO petroleum company’s strategic marketing, production and logistics planning system – 128 |
| Tactical and operational planning systems                                               |
| Vehicle routeing by sea                                                                   |
| An interactive ship scheduling system – 146                                               |
| Stowing seagoing chemical tankers – 182                                                   |
| Planning and scheduling systems for ocean-borne transport – 184                           |
| An interactive DSS for analysing ship voyage alternatives – 26                           |
| Vehicle routeing by land                                                                  |
| Vehicle routeing systems at quality stores – 201                                          |
| Vehicle routeing decision support systems in the food service industry – 67, 83          |
| Transport management decision support systems for a large corporation – 75               |
| Micro-computer graphics-based vehicle routeing systems – 14                               |
| Routeing and scheduling optimization systems for the distribution of industrial gases – 15 |
| Microcomputer-based logistics planning systems – 35                                      |
| Distribution support systems – 76                                                        |
| Short-term petroleum product planning systems – 129                                      |
| Optimization-based train dispatching systems – 164                                      |
| A linear programming based fleet management system – 6                                    |
| Real-time computer-aided wide area dispatching system of Mobil oil tanks – 31            |
| A logistics DSS for shipping tomato paste at Heinz USA[3]                                 |
| Manufacturing logistics management                                                       |
| Monitoring and controlling manufacturing flow of semiconductor facility[4,5]             |
| Airline operational planning                                                             |
| Airline programme planning in British Airways – 136                                     |
| Airline operational planning support systems at Arkia Israeli Airlines – 24               |

Note: Each number corresponds to the reference number in the bibliography of DSS application articles and appeared in the European Journal of Operational Research[2] and for other DSSs without the reference numbers, see references of this article.

Implementation of a Logistics DSS as an Independent DSS for Solving a Specific Logistics Problem

Table I shows that the vast majority of DSSs were designed and implemented as independent DSSs to solve a specific set of related logistics problems. One noticeable trend is the popularity of DSS applications for vehicle routeing and fleet management in the trucking industry.
Also, many airliners, ocean carriers, and pipeline industries are actively utilizing specific DSSs for airline crew scheduling, port selection, ocean-carrier scheduling, ocean-carrier route selection, pipeline network construction and so forth. For example, Northern Plains Natural Gas company used a computer-based simulation model as part of the model-based DSS to construct the 823-mile pipeline network system which extends from the Saskatchewan, Canada and Montana, US border to north central Iowa. This DSS led to a 20 per cent reduction in the usage of railcars needed for shipping pipes and eventually saved $4.5 million in transport costs[7].

Conceptual Basis of the IDSS for Global Logistics

In the era of globalization, an IDSS can be conceived as a viable strategic weapon for improving customer service, competitiveness, and economies of scale in transnational logistics operations. The IDSS, by providing accurate and timely information, helps the logistics manager to respond quickly to the dynamic transformation taking place in the worldwide distribution network. Despite its strategic importance, the IDSS for global logistics (IDSSGL) is a relatively new and evolving concept, which has come to the forefront of a DSS study due to the increasing globalization of the marketplace. Generally speaking, the IDSSGL is a world-wide network of multi-user decision support systems that integrates the MNF’s various logistics operations and standardizes databases across national, cultural and market boundaries. The set of DSSs are linked electronically in the MNF’s headquarters to a set of local DSSs located at foreign business partners, branch offices, suppliers and third-party logisticians (see Figure 1).

The major aims of the IDSSGL are to co-ordinate international distribution plans, share a central communication network and evaluate trade-offs throughout the global logistics system. The successful achievement of these goals may bring important benefits such as the elimination of duplicated data or models, the utilization of global scale economies through consolidation or volume distribution and the reduction of...
response time via fast electronic transmission of information or currencies.

To design an IDSSGL better, we need to understand the evolution of computer-based information systems during the past two decades. In the 1970s, management information systems (MIS) in a domestic environment were the major focus of information system studies due to the importance of meaningful, aggregated information for managerial decision making. In the 1980s, several fascinating developments of computing and telecommunication technologies took place, including their convergence into telematics such as local area networking, global networking, teleconferencing, electronic data interchange, integrated service digital networking and so forth. All of these technological developments further accelerated the advances in global MIS upon which DSS applications could be further expanded to international areas.

During the same period, computer technologies such as DSS and expert systems were increasingly applied to enhance the firm's decision-making process and ability to exploit linkages across different organizations (see, e.g., Porter and Millar[8]). In the 1990s, application areas of computer technologies are expected to expand in international domains which may be characterized by growing global economic interdependence and subsequent global-scale, time-based competition. To survive in this fierce global-scale, time-based competition, the MNF should develop DSSs for international and time-sensitive business activities. In particular, an IDSS should play a critical role for such developments. The important elements of the IDSS may include:

1. Electronic data interchange (EDI);
2. Value added network (VAN);
3. Integrated service digital network (ISDN);
4. Knowledge-based decision support system (KBDSS); and
5. Distributed decision-making systems such as group DSS and videoconferencing.

These elements are essential for the IDSS due to various differences between global and domestic operations. These differences include geographical separation among the operating units of MNFs and their environmental complexity stemming from heterogeneous culture, and diverse infrastructure and political settings. To overcome geographical problems, telecommunication technologies such as EDI and videoconferencing may be used. For instance, EDI can reduce time delays often caused by lengthy overseas distribution channels through paperless intra- and inter-organizational communication. Similarly, videoconferencing can bring multiple parties located thousands of miles away from each other for face-to-face meetings without making expensive and time-consuming overseas trips.

These communication technologies will be further enhanced by VAN and ISDN. The VAN allows the MNF to establish quickly an EDI network among suppliers, and customers with minimum disruption to their existing communication network such as order processing and invoicing systems by allowing the prompt conversion of document formats and protocols. Without using VAN services, a common format needs to be negotiated among suppliers and customers for data interchanges[9]. Also, the ISDN is a powerful tool for streamlining the operations of the MNF due to its ability to facilitate logistics operations through high-speed transfer of voice, image, text, video, and audio. Other benefits of ISDN include improved database access for multiple users, greater network reliability and security, and fewer transmission errors[10].

Finally, in dealing with the environmental complexity, KBDSS is a proper tool because it allows the MNF to establish general guidelines in coping with typical international risks without extensive global business experiences by automating problem-solving knowhows or knowledges of noted foreign analysts.

An Architecture of the IDSS for Global Logistics

Considering the complexity of global decision making, the proposed IDSSGL was constructed according to four separate components: databases, model bases, dialogue bases and knowledge bases. This four-component DSS is an addition of the user's knowledge bases to the traditional three originally suggested by Sprague and Carlson[11]. Within this encompassing framework, the detailed architecture of the proposed IDSSGL is described as follows.

Databases
Due to the diversity and immensely large number of factors influencing transnational logistics operations, databases are built upon three different sources: (1) external, (2) internal and (3) government sources. External sources available from the USA are summarized in Table II.

A another source of external databases includes the databases created by foreign organizations. For example, Australia has created a central database that stores information supplied by the shipping lines, terminal depots, port authorities, customs offices and quarantine stations through the joint efforts of a telecommunication company and shipping companies[12]. Data and information in this database include accurate shipping schedules, an up-to-date record of each container's...
location and other necessary information related to handling, storage and inbound and outbound cargo movements. A recent advance in data communication and technology has allowed logistics managers to access this kind of external database to co-ordinate international cargo shipping and storage.

Internal sources may be available from the MNF and its foreign business partners’ own data files. These files contain cross-functional data about marketing, sales, accounting, purchasing, distribution and so on. Government sources include handbooks (e.g. Asian Economic, West European Economic, and country area handbooks), reports covering US and international business practices (e.g. overseas business report), surveys (e.g. global market and country market surveys) and legal documents issued by the US and foreign governments. These sources are classified in Table III.

Once the database is established in accordance with the above data classification, these data should be prioritized with respect to their importance or potential contributions to global logistics strategy. For instance, since the MNF’s success often depends on the sensitivity of foreign business practices to cultural, religious and political differences, the MNF may prioritize some external and government sources that clarify the distinctive nature of foreign business practices. After

### Table II. Examples of External Sources

<table>
<thead>
<tr>
<th>Data files from:</th>
<th>Commercial sources from:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. US Department of Commerce</td>
<td>1. Business International</td>
</tr>
<tr>
<td>2. Chambers of commerce (bilateral, local and overseas)</td>
<td>2. Dun and Bradstreet</td>
</tr>
<tr>
<td>5. Trade associations</td>
<td>5. World information services</td>
</tr>
<tr>
<td>6. Trade journals</td>
<td>6. Overseas business reports (OBRs)</td>
</tr>
<tr>
<td>7. Banks (e.g. Eximbank) and other financial institutions</td>
<td>Handbooks issued by:</td>
</tr>
<tr>
<td>8. Foreign embassy</td>
<td>International organizations such as OPEC, the IMF and the EC</td>
</tr>
<tr>
<td>9. Import and export brokers</td>
<td></td>
</tr>
<tr>
<td>10. Large accounting/consulting firms such as Price Waterhouse</td>
<td></td>
</tr>
</tbody>
</table>

### Table III. Database Classification

| 1. | Cost data – freight rate for weight/mode/class, tariff rate, wage rate, interest rate, exchange rate, inflation rate, tax incentives, insurance, terms of payment, depreciation. |
| 2. | Service data – benchmarking, service quality assurance, transit time reliability, intermodal compatibility, handling and packaging services, return privileges, claims and complaints handling, goodwill. |
| 3. | Market data – demographic infrastructure (e.g. population, population growth, per capita income), economic infrastructure (e.g. the stage of economic development, common market participation), market segment, competition, the threat of substitution or new entrants, negotiability, foreign market entry mode, banking and capital system. |
| 4. | Channel data – supply chain, communication channel, type of intermediaries and facilitators, channel options (direct versus indirect), the establishment of a local distribution channel, shipping route/pattern. |
| 5. | Customer data – past order volume, customer bargaining power, language, customs, culture, lifestyle, social structure, gender roles, urbanization, local business practices. |
| 6. | Port data – port size and location, special equipment availability, loading/unloading services, modal availability, customs duty, union strength, weather at the port, accessibility to local transport networks, proximity to local distribution centres, foreign trade zones, bonded warehouses. |
| 7. | Traffic data – traffic congestion, public transit systems, major transport arteries including highways, parking facilities and difficulties, road conditions, accident rates. |
| 8. | Policy and legal data – documentation requirements, licence requirements, quota opening, price control, environmental regulation, labour laws, international dispute resolution, the type and stability of host governments, the degree of control or involvement of the host government in business, repatriation allowances, foreign currency conversion, data privacy laws. |
| 9. | Technological data – the compatibility of hardware and software, warehouse automation, the sophistication of telecommunication, transport and warehouse equipments. |
prioritization, necessary data should be transmitted across national boundaries via computer and telecommunication networks for data sharing among international business partners. One effective means of such data transmission is electronic data interchange (EDI).

Generally speaking, EDI is referred to as the company-to-company electronic transmission of business data (or information) in a computer readable standard format[13]. The main purpose of EDI is to enhance paperless transactions and thereby facilitate the exchange of data/information in an efficient, effective manner using state-of-the-art computer and communication technologies[14]. Potential applications of EDI to global logistics include air cargo tracking, order/delivery confirmation, freight reservations, cargo booking, damage control, shortage/overage adjustment, bill of lading exchange, shipping/billing notice, automated billing/payment and transmission of routeing/carrier information (see, e.g. Lavery [15,16]). For example, American Consolidation Services (ACS)-Stride Rite and its customs house broker developed an EDI system that allowed Stride Rite to participate in the pre-classification programme offered by US Customs and to consolidate materials from multiple suppliers in Asia at the ACS facilities[17]. Similarly, US customs agency utilizes an automated manifest system (AMS) which allows customs brokers to electronically file customs paperwork prior to the arrival of imported goods on the US shore via the automated broker interface provided by the Customs Data Center in Virginia[18]. Another application of EDI is an automated customs clearing system (ACS) which can be utilized to clear customs declarations electronically without cumbersome and time-consuming documentation procedures which are otherwise required by global-scale transactions[19].

Model Bases
A logistics model can play an important role in identifying and evaluating alternative courses of logistics actions due to its ability to structure complex managerial goals, constraints and variables with enormous accuracy and speed. The usefulness of a logistics model can diminish, however, unless it successfully links interrelated logistics activities and establishes an integrated view of a total logistics system. The successful linkage of logistics activities requires better communication and more co-ordination that, in turn, necessitate an effective flow of information across the entire logistics system. In fact, House and Karrenbauer[20] indicated that an availability of relevant data (or information) was essential for a successful implementation of the logistics model. Consequently, as practitioners try to adapt a logistics model to specific logistics decision environments, it is desirable to not only integrate a database with a model base, but also develop a number of task- and function-specific models and combine those, rather than designing a single large-scale, esoteric model for intricate global logistics operations. In light of this, the model base should be a mixture of the following submodels, each targeted for specific tasks and functions central to global logistics decision making.

(1) Forecasting model – Forecasting is a driving force behind all logistics activities requiring forward planning[21]. International logistics is no exception in demanding a careful forward planning due to the volatile and uncertain nature of data (e.g. census, economic and political data) relevant to global logistics operations. Therefore, choosing or developing a right forecasting model will be crucial for minimizing the degree of risk and uncertainty involved in global logistics operations. Furthermore, since the forecasting model can be used to determine the parameter values of other task and function-specific models, it can increase the validity of model solutions by improving the accuracy of the parameters.

(2) Network model – The spatial and temporal inequality problems existing between production and consumption can be resolved by the effective linkage of customers/intermediaries/ manufacturers. Such a linkage often requires the design of a network model which can smooth out the flow of goods and information between various nodes of different location. A network model is especially useful for this linkage because the visual aspect of the network model contributes to increased insights into the logistics problem structure and consequently facilitates communication and understanding of key logistics operations among customers, intermediaries and manufacturers[22]. Good examples of network models may include models dealing with nodal location-allocation, terminal capacity planning, computer-communication, data file merging, pipeline network design and production-distribution problems.

(3) Transport model – Since transport is the core of all the global logistics activities, a transport model is in great demand as a viable tool which overcomes the multinational barriers resulting from longer transport routes and transit times. Such models include the models of vehicle routeing/scheduling, backhauling, freight consolidation, modal/carrier choices, container management, trans-shipment, traffic planning, freight billing and port selection.

(4) Inventory model – Due largely to unexpected traffic delays, potential forecasting errors and timely order-filling requirements, inventory is a necessary evil for daily logistics operations. To make the best use of inventory, the logistics manager can utilize either independent or
dependent demand inventory models (see, e.g. Orlicky[23] for the distinction between these two models). Examples of independent demand inventory models are economic order quantity (EOQ), economic production run size (EPQ) and quantity/shipping discount models. On the other hand, a model designed for handling dependent demand inventory such as raw materials and parts is material requirements planning (MRP). A nother model similar to MRP is distribution resource planning (DRP) which applies the MRP principles and techniques to distribution inventories at the various channels of distribution[24]. In particular, spreadsheet-based MRP/DRP models have proven very effective for on-time order filling/processing and shipment scheduling[25].

Warehousing model - Warehousing is often needed to perform routine logistics operations such as inventory storage, freight consolidation, product/supply mixing, service enhancement, contingency protection and smoothing[26]. However, warehousing consumes valuable company resources such as space, equipment and operators which incur additional distribution costs. To balance the benefit against the cost of warehousing, one must make a number of critical decisions that can be aided by computer-based models. These decisions are related to warehousing ownership, number, size, location, layout, design, automation, material handling, packaging, employee planning and so forth. In particular, the decision regarding centralization of warehousing facilities to adapt to a single common market (e.g. a single European market in EC countries) is increasingly important as we move to global business environments.

Integrated logistics model - Because of the interrelated nature of logistics activities, La Londe et al.[27] and Bendiner[25] observed that sub-optimization stemming from the separate treatment of various logistics problems might lead to poor customer service, distribution inefficiency, costly waste and low employee morale. Sub-optimization may also be detrimental to global logistics activities which often require channel integration for co-ordination and information sharing across the channels[28]. In this regard, it may be more desirable to construct a large-scale, fully integrated model, rather than building smaller submodels separately. Nevertheless, the added problem complexity often prohibits the simultaneous treatment of interrelated logistics models. Although integrated model building may still remain a theoretical goal, complexity can be dealt with by using a multi-phase decomposition procedure which solves subproblems in sequence and then relates the earlier-phase solution to the later ones.

So far we have discussed the main elements of model bases for IDSSGL which were designed to handle task- or function-specific problems. In addition to these, there are a number of complementary models or state-of-the-art approaches that can provide significant insights into intricate interrelationships among key logistics variables in global environments. Examples of these are simulation models, multivariate statistical analysis, analytic hierarchy process (AHP), computer-aided mapping (CAD) and geodata analysis and distribution system (GADS). In particular, a simulation model is known to be a great tool for evaluating "what-if" logistics scenarios[20]. To summarize the structure of the proposed model bases, Figure 2 depicts multi-way linkages among the various models described above.

Despite the multiway linkages among these models, the integration of these models may not be trivial. A rather pragmatic approach would be the parallel (gradual, stage-wise) integration of the models across three-stage decision levels: strategic, tactical and operational (see Figure 3). Thus, a higher priority may be given to the integration of longer-term, strategic decision support models because this integration may be the basis for the gradual integration of tactical and operational models. As the MNF grows more adept at the use of advanced communication technologies such as real-time EDI, radio frequency communication, client-server architecture and satellite tracking, the MNF can integrate logistics models...
across functions at various decision levels from its headquarters to global business partners, and from its production plants to global customers. Therefore, a dialogue base should play a more important role in combining these models.

Dialogue Bases
Dialogue bases traditionally focused attention on the user-model interface or the user-friendliness to enable the end-user to recognize and enumerate system-wide trade-offs as a means to evaluate alternative courses of logistics actions. However, the role of dialogue bases in global environments should be extended to facilitate cross-border, cross-culture, cross-firm communication among the geographically or temporally dispersed users around the globe. An immediate response to such an extension is the use of videoconferencing, value added network (VAN) and integrated service digital network (ISDN) services. In particular, videoconferencing is especially useful as it allows face-to-face meetings/negotiations as well as the exchange of urgent messages between two parties located hundreds or thousands of miles apart and consequently helps two distant parties share crucial information and exchange ideas without leaving their home bases.

Other communication technologies which have often been put forward as useful world-wide telecommunication tools are a value added network (VAN) and an integrated services digital network (ISDN), both of which aim to reach more potential trading partners overseas through the expansion of information diffusion capability. In a global communication network where different trading partners often have different communication protocols or systems, VANs can provide additional dimensions by converting from asynchronous to synchronous protocols and interfacing facsimiles. Also, VAN offers a variety of value-added services encompassing translation of information to EDI standard, conversion of electronic messages to hardcopy paper messages, dial-in information retrieval, encryption and authentication of EDI messages [29].

Consequently, VANs enhance the integration and dialogue across organizations and national boundaries. Further, the use of ISDN will greatly benefit world-wide data and voice communications because ISDN has the ability to send and receive voice, data, text and image signals simultaneously over a global digital network and subsequently absorb all types of information via telephones, computers, facsimiles and videos (see e.g., Deans and Kane[30]).

Knowledge Bases
Since a model is merely an abstraction of real-world phenomena under certain assumptions, a model base often creates a “practicality gap” - a gap between a model and reality - that can leave many complicated, unstructured issues unresolved. Such a gap may grow as globalization of business practices makes all logistics problems more complex, volatile and uncertain. Perhaps a missing link that may reduce such a gap is a knowledge base which exploits experts' knowhows in a specific domain such as international laws, regulations, or distribution activities. According to Peppard and Henry[31], a knowledge base is a means of automating problem-solving knowhows (e.g., knowledge, experience and judgement) of human experts (e.g., executives and consultants) in an attempt to provide the decision maker with intellectual tools consisting of rules, facts and heuristics which are necessary to solve dynamic and complex problems.

Another trait is its capability to explain, learn and refine intellectual problem-solving processes in a human-like fashion by mimicking human behaviours. As such, the knowledge base enables logistics managers to cope with constantly changing global decision environments. Consequently, an addition of the knowledge base to the traditional DSS components can greatly enhance the real-time flexibility and interaction capability of DSS by intermingling the experts' managerial skills with sophisticated model output (see Figure 4). For further details and potential applications of this concept, the interested reader may refer to an excellent book written by Allen and Helferich[32].
Potential Benefits and Limitations of IDSS for Global Logistics

Potential Benefits

Once the IDSSGL is in place and implemented properly, it can offer a number of synergistic benefits for global logistics operations since it is an integrated system built on various information technologies such as EDI, ISDN and KBDSS. The main benefits are:

1. Improved customer service - The electronic transmission of data, reports and funds through the global on-line communication network can accelerate responsiveness to customers all around the world. Faster response time means shorter lead time which, in turn, leads to improved customer service through on-time deliveries and faster reactions to market changes.

2. Reduced communication waste - The integration of all the logistics-related data can create common and standardized data bases shared by all the users around the world, thereby improving coordination among them and avoiding duplication of data collection/processing efforts.

3. Distribution cost savings - Since the IDSSGL through a world-wide telecommunication network enables the users to obtain up-to-date information about freight rates and customs duties all across the world, it reduces transport cost by allowing the users to compare those rates and charges and then choose the best available price in the world. Also, world-wide communication via videoconferencing can drastically reduce travel cost and time[3]. In addition to reducing transport cost, the IDSSGL can reduce inventory carrying cost by substituting information for inventory investment[34].

4. Reduced paperwork and documentation cost - There is an old joke among logisticians that, in global logistics operations, the weight of paperwork equals the weight of shipment (Anderson et al.[35]). However, the need to prepare and mail hardcopies of documents will be greatly reduced using the IDSSGL, because data and funds are electronically transmitted between computers in the MNF and computers in its foreign counterparts.

5. Stronger and closer partnerships - The implementation of the IDSSGL requires world-wide co-ordination that, in turn, gradually encourages mutual trust and assistance among all the participating parties including the MNF headquarters and its trading partners around the world. Thus in the long run the IDSSGL can help solidify business ties and relationships with the MNF’s trading partners.

6. Better strategic decision making - The assimilation of up-to-date information and knowledge from different countries and fields can provide a “macroscopic” or “bird’s eye” view to the logistics planner and subsequently help him to make better long-range plans and decisions. The strategic value of the IDSSGL is to allow many MNFs to make fundamental changes in the way their business is conducted through streamlining transnational information and decision flows. EDI alone has been recognized as a significant strategic weapon of this decade[36]. For instance, EDI has become a major driving force to streamline the entire ranges of manufacturing and marketing activities through the rapid, accurate replenishment of merchandise and tighter control of purchase order. Moreover, benefits of an IDSSGL can be extended far beyond the usefulness of EDI in improving strategic decision making by allowing the incorporation of management science models into the IDSSGL.

Potential Limitations

Despite its numerous benefits, the IDSSGL is not without limitations. These limitations are:
Increased censorship for transborder data transfers - By implementing data protection laws, some foreign governments such as Germany, Belgium, Canada, and Taiwan have imposed a number of restrictions on the content of data transmitted or on data processing services[37]. These restrictions may limit the orderly and free flow of information across borders via IDSSGL and can cause unexpected delays and disruptions for data transmission which may offset the benefits of the IDSSGL.

Less security for the firm’s proprietary information - Since almost anyone from anywhere in the world can gain access to the common data and knowledge base, it would be very difficult for the MNF to protect its sensitive information from unauthorized outside access and rogue electronic viruses such as “Michelangelo”.

Incompatible software and hardware - Due to differences in technology, standards, systems and languages, both software and hardware used in foreign countries may not be compatible with their domestic counterparts. Accordingly, without uniform software and hardware, the IDSSGL can cause major communication breakdowns especially for the MNF with a limited (three or less) number of trading partners which demand direct EDI links. For example, there are several document format standards in EDI transactions, each used by different countries, such as T DCC and ANSI X.12 currently used by the USA and Canada, UN/EDIFACT backed by UN, or article numbering association tradecoms standard used by the UK. However, a lack of uniform standards will not necessarily delay the implementation of EDI if translations between different standards can be done by value added network (V AN) services[35].

More rigorous user training - To keep abreast of new communication and information technology essential for IDSSGL, the MNF should constantly provide the users with broader technical skills and knowledge through more rigorous training programmes.

Huge startup cost - Although the application of IDSSGL to global logistics operations can dramatically increase productivity in the long-run, during the initial stage a large financial outlay is required for full-scale user training and equipment purchasing.

Conclusions
In the era of global trade and investment, successful firms will be those which can restructure their logistics systems fast enough to serve the changing need of multinational, multicultural customers. Such restructuring often follows the integration of logistics operations across borders, organizations and functions to take advantage of global economies of scale. Integrating logistics operations also means the system-wide coordination and control of information flows around the world. From the company’s standpoint, the primary advantage of integrated logistics operations is logistics productivity improvement gained by establishing a common, online, data-sharing DSS which can eliminate confusion and duplication of effort among the users. From the customer’s standpoint, the main advantage is greater customer satisfaction gained from more responsive, speedier service from the company.

To attain the above advantages, this article proposes and designs the conceptual framework of an integrated DSS linked by worldwide communication and distribution networks. This proposed system should be embraced by MNFs seeking to compete in the global marketplace. However, this research is by no means complete. Although the proposed IDSSGL provides a good conceptual basis for developing efficient and effective decision support tools at the “macro” level, future research needs to focus attention on the detailed design of subsystems at the “micro” level such as telephony-activated order processing systems, direct store delivery systems (DSD) and the EDI-based electronic invoice system.

References

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