Toward an Intelligent Sea and Air Freight Logistics Information Services Platform: A Coordination Theory Perspective

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Abstract

International logistics were identified in 2009 by the Advisory Board for Finance and Economy Affairs, Office of the President, Taiwan, as one of the ten focus areas for future service industry development, as part of the action plans of the International Logistics Services Development Project (LSDP) launched in 2000. Under LSDP, the Intelligent Sea and Air Freight Logistics Information Services Planning Project aims to propose an intelligent logistics service platform for domestic and international logistics service providers to facilitate efficient logistic processes. This project intends to integrate cloud technology, GNSS, RFID, and wireless communication technologies, following and complying with the strategic initiatives of APEC, IATA, FIATA, IMO, and many other international organizations. The platform fosters a sequential dependency relationship among participating logistics service providers. Through the theoretical lens of the coordination theory, this paper investigates the impacts of the intelligent logistics service platform as a technology-enabled coordination. By deriving insights from relevant literature on coordination theory, this paper contributes to the body of knowledge related to coordination in the logistics industry. Future research directions are also proposed.

Keywords: Coordination theory, interdependence, sea and air freight, intelligent logistics information services platform

1. Introduction

Taiwan has long been highly dependent on foreign trade to support its economic development. On October 22, 2000, the Executive Yuan accepted the Action Plan of the International Logistic Services Development Project 2010-2013 (Executive Yuan, 2010). The Council for Economic Planning and Development also founded the Service Industry Promotion Office, Executive Yuan (Council for Economic Planning and Development, 2010). This office provides a platform for the communication and integration of inter-ministerial issues. It invites the Ministry of Economic Affairs, the Ministry of Finance, the Ministry of Transportation and Communications, and the Council of Labor Affairs to propose specific plans for improving the competitiveness of Taiwan's international logistic services. International logistics were further identified in the 16th Meeting of the Advisory Board for Finance and Economic Affairs, Office of the President, held on October 15, 2009, as one of the ten focus areas for service industry development, aiming to establish Taiwan as a leader in adding value

to logistics and integrating supply chain resources. After efforts are made to implement the proposals, the hope is that the result will be an overall enhancement of efficiency, attracting international businesses.

The Intelligent Sea and Air Freight Logistics Information Services Planning Project (Institute of Transportation, 2012) aims to propose an intelligent logistics service platform for domestic and international logistics service providers that will facilitate an improvement in the efficiency of logistic processes. This project intends to increase logistics safety and efficiency through the integration of cloud technology, Global Navigation Satellite Systems (GNSS), radio frequency identification (RFID), and wireless communication technologies. It will also comply with the strategic initiatives of the Asia-Pacific Economic Cooperation (APEC), the Air Transport Association (IATA), the International Federation of Freight Forwarders Associations (FIATA), the International Maritime Organization (IMO), and many other international organizations.

From Scott's (1981) system perspective, logistics operations can be seen as composed of many nodes that depend on each other. Due to practical concerns, when it comes to the logistics industry chain, scholars have always emphasized the ability to coordinate and communicate between the nodes as this dictates the smoothness and efficiency of the entire logistical operation. In general, the supply chain in the logistics industry involves integration, coordination, and cooperation issues that are related to planning and control, information access and dissemination, and physical delivery. Prior research has indicated the use of information technology as an important instrument within the supply chain that facilitates coordination mechanisms. For example, targeting US manufacturing facilities, Craighead and Laforge (2003) investigated the adoption of IT in supply chains and explored the issues and benefits reported by the adopting firms. Craighead et al. (2006) and Hill and Scudder (2002) examined the use of EDI in supply chains with respect to inter-firm coordination activities involving suppliers and customers. Through an analysis of the structural relationships and the methods in which information systems are utilized for supply chain integration and supply chain management performance, Kim and Narasimhan (2002) argued that there might be a recommended sequence when using information systems for supply chain integration. Subramani's (2004) study supported Bakos and Brynjyolfsson's (1993) vendors-to-partners thesis, which stated that IT deployments in supply chains lead to closer buyer-supplier relationships.

While prior studies have identified the role of IT in supply chain coordination, little attention has been paid to how it can be applied to common information platforms in the logistic services industry. This research thus draws on the coordination theory perspective to investigate the planning of an intelligent sea and air freight logistics information services platform by investigating the fit between interdependence and coordination strategies.

2. Literature Review

2.1 Coordination Theory

2.1.1 Interdependence

Thompson (1967) proposed the concept of interdependence and suggested that it takes three forms, namely pooled, sequential, and reciprocal. Pooled interdependence is the weakest form of the three because it represents a situation where each node has its own unique function which are gathered together to support the entire operation. Under this condition, all nodes are loosely coupled (Astley and Zajac, 1991). Since the nodes do not have any direct relationships, what pooled interdependence implies is actually closer to independence (van de Ven and Delbecq, 1976). In fact, Malone and Crowston (1994) defined pooled interdependence as a form where nodes share or produce common resources

during activities but are otherwise independent from each other. Even though the concept of interdependence was first applied to intraorganizational contexts, it has been extended into contexts that go beyond organization borders (Gulati and Singh, 1998).

The second form of interdependence is sequential interdependence, in which nodes are sequentially related, and where the output of a node will become the input of the next node (Thompson, 1967). The difference between sequential and pooled interdependence is that nodes in the former situation also share an ordered relationship other than having direct dependency. Malone and Crowston (1994) also proposed a similar idea and explored how node activities take place by defining sequential interdependence as a relationship, where the activity of a node can only be initiated after the completion of another node's activity.

Under sequential interdependence, time is a necessary factor when defining the relationship between nodes (Malone and Crowston, 1994; Thompson, 1967) as it reflects the order of triggering node activities. Also, when nodes share a sequential interdependence, not only do previous nodes affect whether a node's activity is set off or not, but the activity of the node itself will also decide whether the activities of later nodes will take place or not. The common buyer and seller relationship falls under this category (Borys and Jemison, 1989).

The third form, as proposed by Thompson (1967), is called reciprocal interdependence. Under this form, the output and input of each node are still related but reciprocal interdependence differs from sequential interdependence in that, here, the interdependence between the input and output is bidirectional (Malone and Crowston, 1994). Additionally, the characteristic of this form of interdependence is that there is constantly an input-output-input type of exchange between the nodes (Lemak and Reed, 2000). As a result, under this form of interdependence, network nodes share interdependence in their decisions and activities. Generally speaking, reciprocal interdependence may emerge in a product network of a strategic alliance (Gulati and Singh, 1998), among nodes that have common culture, identification or standard (Dyer and Nobeoka, 2000), or in a service network such as carriers (Thompson, 1967).

2.1.2 Coordination Strategy

Malone and Crowston (1994) defined coordination strategy as "managing the interdependence among activities." A coordination strategy forms the connection between nodes in a way that can facilitate better communication. It also helps in gathering knowledge and develops the necessary language standards across nodes through the interaction between them (Daft and Weick, 1984; Galbraith, 1993). Consequently, under the three different forms of interdependence described earlier, one can expect the formation of a corresponding coordination strategy. Thompson (1967), based upon the work of March and Simon (1958), thus proposed three types of coordination strategy, namely coordination by standardization, by plan, and by mutual adjustment.

For pooled interdependence, there is coordination by standardization, which establishes the procedure or rule for node activities so as to ensure the consistency between the functioning of a node and the other nodes in a system or organization. A coordination strategy based on standardization allows each node to meet the needs and expectations of the entire system or organization by following a standardized operating procedure. In other words, under coordination by standardization, each node can minimize the need for communication between nodes by acting in accordance with a clear and consistent standard, maintaining their high independence and low interdependence (Thompson, 1967). Through coordination by standardization, nodes with pooled interdependence have a low need for knowledge sharing, and this

characteristic may even put knowledge sharing at a disadvantage (Rivkin, 2000). The progress (or response) of all node activities takes on the same mode under the established rules, which makes knowledge sharing and communication between nodes a lower priority.

The second type of coordination strategy is coordination by plan (Thompson, 1967). This kind of coordination strategy formulates a detailed schedule to manage each node's activity under sequential interdependence. Compared with coordination by standardization designed for pooled interdependence, coordination by plan is lower on routinization but allows greater flexibility to adapt to changes in the external environment (March and Simon, 1958). Under coordination by plan, there is usually a coordinator/manager/planning agent who is in charge of product or information circulation between nodes so as to ensure operational efficiency and the ability to respond to external changes. With the existence of a coordinator, each node, other than functioning independently, can also understand the factors involved before and after its activity. In fact, the introduction of coordination by plan also implies the formation of a shared goal among the nodes (Galbraith, 1977).

Because of the importance of time and order in sequential interdependence, coordination by plan has a stronger need for knowledge sharing and communication than coordination by standardization. Each node must share its basic knowledge of operating processes and negotiate a coordination plan. Under this condition, judgments and interventions by the management or executive level are usually considered necessary (Beamon, 1998). For example, the logistics industry is a typical system of coordination by plan. To arrange delivery, there is usually a need to have a planner (or system) that can schedule and plan, map out the routes, arrange modes of transportation, and manage the contracts in order to carry out the sequential procedures between consignors and consignees (Wada and Nickerson, 1998). Therefore, the idea of standardization is still part of coordination by plan. However, there is a need to define a clear and explicit schedule in advance and establish an agreement on the rule for the input and output activities between nodes. The common information platform that follows the industry standard is a typical example.

Coordination by mutual adjustment also takes into account the communication of information in node activities. It is usually used under high variability or uncertainty, such as reciprocal interdependence, because this kind of coordination strategy is necessary for nodes to share information regarding each other's activities through an interactive reciprocal mechanism (Thompson, 1967). The difference between coordination by mutual adjustment and coordination by plan is that the former emphasizes joint decision making while the latter focuses on the coordinator playing the role of a central planner. Because coordination by mutual adjustment involves complicated activities, reactions, communication, and knowledge sharing, nodes must make a decision on and evaluate the activities of the previous node, their responses to the activity of the previous node, as well as the potential consequence of these responses. The increasing need for knowledge sharing and communication for reciprocal communication among nodes has thus elevated this need to the basis for decision-making. The coordination for these activities and reactions is neither through discrete exchanges, as in coordination by standardization, nor by administrative control, as in coordination by plan, but through networks of individuals engaged in reciprocal, preferential, and mutually supportive actions (Powell, 1990).

3. Planning for the Intelligent Sea and Air Freight Logistics Information Services Platform

The core idea of the coordination theory is that the form of interdependence among nodes will decide the coordination

mechanism. Each of the three forms of interdependence among nodes corresponds to one of the three coordination strategies of standardization, plan, or mutual adjustment. Using coordination theory to plan an intelligent logistics information services platform that is suitable for Taiwan's sea and air freight logistics, one must first clarify the interdependence among the participating roles.

Generally speaking, the participating roles in the logistics industry consist of customs, customs broker, carrier, local trucking, forwarder, shipping agency, container yard and terminal warehouse, and warehouse or distribution center (Institute for Information Industry, 1999).

Activities concerned with the logistics value chain include cargo pick-up → customs declaration → forwarding → warehousing → customs clearance → sea/air transportation → warehousing → customs declaration → ground transportation → customs clearance → logistics VMI (Vendor Managed Inventory) → cargo delivery (Farn, 2003). One should note, however, that differences lie between the import and export processes and that some activities have to be repeated because they happen in a different place. In the import process, logistic companies need to first collect the goods from the foreign seller and apply for customs declaration, then send the goods to customs for declaration. This process may involve temporary storage at a small warehouse, distribution center, or terminal for large containers. It then proceeds with customs clearance after the air or sea carriers arrive. Finally, the freight is transported by air or sea to the customs area of the importing country. Once the freight enters the importing country, it will be stored temporarily at a customs office whilst waiting for the buyer to complete the customs declaration procedure. After that is done, the logistics company entrusted by the seller will continue with cargo pick-up, customs clearance, and the diversion of goods. The cargo will be temporarily stored at a distribution center or a small warehouse awaiting direct delivery, or after being slightly processed by a third party logistics VMI, to the storage of different buyers. If one starts from the view of exportation, then the activity flow is exactly the opposite of that described above.

Although the operation of the actual logistics is far more complicated than the description above, the processes mentioned can virtually reflect most of the functions involved in the logistics operation. In Taiwan, there is no large integrated logistics company. Each logistics company only takes part in a certain segment of the entire process. Even though companies, such as HCT Logistics, T.V.L. Group, and T.H.I. Group, have attempted to provide a comprehensive service through the instigation of a logistics alliance, they still need the strategic cooperation from their business partners in order to attain a one-stop shopping logistics service.

Because of such characteristics, there is a sequential relationship in the operating procedure and information transmission between logistic nodes when taking into account the interactions among logistics companies. While a cooperative relationship may exist between nodes, the execution of later node activities still depends on the completion of the previous node's activity, along with the transmission and exchange of relevant information that is used to initiate later activities.

If one thinks of each logistic node as a task in the logistics industry chain, then the subject of this research, namely the planning of an intelligent sea and air freight logistics information services platform, can be seen as a shared resource of interdependent tasks (see Crowston, 1994). In other words, the platform is a resource shared by the multiple interdependent tasks (logistic activities) so as to carry out their collective goal, i.e., a comprehensive logistics service. Two particular characteristics must be considered at the planning phase: shareability and reusability.

Shareability refers to whether multiple tasks can use the resource simultaneously.

According to Crowston (1994), most production resources, such as raw materials needed for production, are not shareable due to the fact that they go through a transformation process during the production process. In contrast, since "information" can be transmitted and shared between different tasks, it is a shareable resource. Reusability denotes whether multiple tasks can use the resource time and again (von Martial, 1989). Raw materials used for production are not reusable in this sense but, because the information can be accessed repeatedly, reusability is shown.

Crowston (1994) also highlighted the fact that one can decide the order of access by setting priorities in order to avoid possible conflicts due to concurrent access to the resource. Regarding the information sharing issue investigated in the current study, one can resolve this issue by defining the roles in the industry value chain and constructing a common information services platform. To effectively integrate the roles of domestic customs affairs, value-added collaboration between the logistics companies, freight tracking at each node, and the utilization of intelligent technology, the planning of an intelligent sea and air freight logistics information services platform must satisfy the following needs in order to optimize the coordination efficiency and outcome among logistics nodes:

- *Strengthen the integration of B2B processes between suppliers and buyers in the logistics value chain:* The CMT Single Window that our customs currently work on focuses on operational integration, covering G2G (Government to Government) between government subunits, B2G (Business to Government) between business companies and customs units, and N2N (National to National) between countries, suggesting the need for B2B service integration between business companies. If the B2B processes between suppliers and buyers in the logistics value chain can be integrated, other than the benefit of minimizing repetitive data entry and increasing data accuracy, it can also attain the efficiency created by collaborative operations. For example, when a forwarder changes the information on a ship schedule, the platform should be able to notify the customs broker in time. If the customs declaration procedure is yet to be completed, the platform should automatically update any information regarding ship name, voyage number, and master and house B/L numbers. If the customs declaration has already been done, then the platform must make corrections and go through the declaration process again.
- *Be in line with current international standards:* Other than the B2B process integration among domestic companies, the platform must also be compatible with international standards. The benefit of complying with international standards not only includes an incentive for domestic companies to participate in the operation of international logistics, but also improves the global freight management and service of Taiwanese companies by reaching the critical mass.
- *Promote the integration between logistics services and the supply chain:* The current standard for operating efficiency, whether it be Just-in-Time or Delivery-on-Line, requires tight integration between logistics information and client-end supply chain management so as to stay on top of the status of each invoice (for instance, whether the status of the goods is at the production line, in transit, or in the warehouse). This integration brings the benefit of combining logistics companies with client-end supply chain systems as well as strengthening the irreplaceability of the logistics companies by increasing the efficiency of the client-end supply chain management.
- *Boost the application of intelligent and mobile technologies:* In order to improve the efficiency of the logistics management and operations, the plat-

form should effectively utilize physical devices, such as smart phones, electronic tags, and mobile readers, by linking them with the Internet and cloud services. This enables one to have access to logistics information services at any location.

- *Provide comprehensive information on freight status:* Due to the strong demand from clients, freight status information has become the most crucial issue in the entire service process for many logistics companies. Therefore, the platform should be able to serve the consignors' and logistics companies' need to provide real-time tracking for freight status information. Before the introduction of the platform, many companies could only provide the freight status of the physical logistics. If companies can have effective control over logistic information regarding the sea and air freight status, visibility throughout the service process can be significantly enhanced, helping the companies to move from providing port-to-port freight status to supporting door-to-door freight status inquiries.
- *Improve the interconnection between current applications and offer value-added services:* The operation of an intelligent sea and air freight logistics information services platform should also combine current information systems or applications between governments and companies through the interconnection capabilities of the intelligent platform. For example, the value-added service of providing all the forms required during the process can overcome the shortcoming of present information services operations where most services carry out customization themselves based on their individual needs, which suggests the lack of an integrated system among participating parties.

4. Intelligent Sea and Air Freight Logistics Information Services

4.1 Data Collection

To assist with the planning of the Intelligent Logistics Information Services Platform, in-depth interviews were conducted between May and December, 2011. The interviews focused on issues of the current bottleneck, information requirements, policy suggestions, and platform operations. The interviewees covered the major roles in the logistics industry. The companies interviewed are shown below:

- Importers/exporters: ASUSTeK Computer Inc. and Advantech Co., Ltd.
- Forwarders/customs brokers: Speedmark Transportation Inc. and Leader Mutual Freight System Inc.
- Container yards: Farglory Free Trade Zone
- Carriers/shipping agencies: Evergreen Marine Corp. (Taiwan) Ltd. and Realco Shipping Agency Ltd.
- Government agencies: Port of Keelung and Department of Navigation and Aviation, Ministry of Transportation and Communications

4.2 Proposals for the Framework of the Intelligent Logistics Information Services Platform

Key points in the planning of the framework and functions of the common information services platform include user characteristics, user needs, source of raw data, standards, and operating procedures. One should consider the environment of international business, the integration with backend supply chain management, and a coordinated service that eliminates horizontal competition. The area surrounded by the dotted line in Figure 1 of the intelligent logistics information services platform indicates the planned functions.

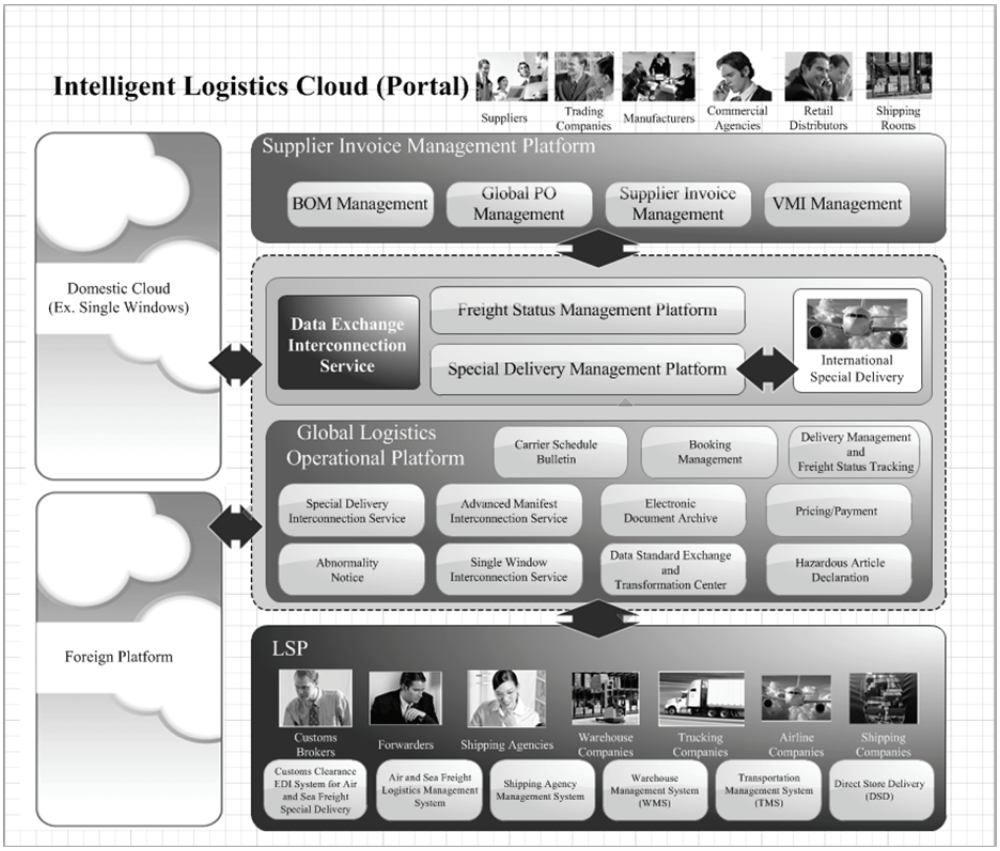

Figure 1: Framework of the Intelligent Logistics Information Services Platform

- *Carrier Schedule*: This service allows inquiries regarding recent carrier schedules so that one can confirm the flight number, ship name, and voyage number in advance.
- *Booking Management*: Based on the inquired carrier information, importers and exporters can enter the expected delivery information for forwarders or shipping companies to have access to. The booking information entered by the importers, exporters, or the forwarders can also be sent to the shipping or airline companies and used as information for advanced shipping notices. It can also be imported into internal ERP systems to prepare for bills of lading (B/L).
- *Delivery Management and Freight Status Tracking*: This module allows one to access and track the freight status online after booking. Freight status can be obtained through B2B and Web input, as well as GPRS and RFID.
- *Special Delivery Interconnection Service*: For speed deliveries, one can directly exchange information regarding taxation, B/L, invoice, and freight status with the four major international special delivery companies.
- *Advance Manifest Interconnection Service*: This function serves to convert the delivery data into manifest information for the carriers, and for them to use as foreign advanced manifests.
- *Electronic Document Archive*: This function responds to online inquiries regarding customs clearance documents, such as accompanying/customs declaration documents, taxation forms, B/L, booking notes, and warehouse receipts.

- *Pricing/Payment*: Logistics companies can enter pricing and payment information here. The system will automatically examine whether there is a match between payment and pricing, whether the freight is delivered, and whether there was a duplicated payment.
- *Abnormality Notice*: The platform will define an estimated time of arrival to the next logistics node according to the freight status of previous nodes. If there is a delay, it will send out an abnormality notice, both online and through text messaging, so that people out of the office or at a meeting can also be kept up-to-date.
- *Single Window Interconnection Service*: The official version of single window interconnection available offers a transformation mechanism that allows customs brokers to engage in customs clearance as well as obtain information concerning advance manifests of future imports.
- *Data Standard Exchange and Transformation Center*: It is expected that, through the platform importer and exporter, freight information can be transferred directly to customs brokers and be used for customs clearance documentation. The platform also delivers the ability to supply information exchange with foreign customs and carriers.
- *Hazardous Article Declaration*: Once the companies input the delivery information, they or their forwarders can then declare hazardous articles in the shipment. Such declaration information can be given to trucking companies who need to take note of hazardous articles. The information can also be transferred to MTNet for hazardous article declaration.

Under this planning model, the intelligent logistics information services platform also comes with a cloud portal and backend management module, as indicated in the following figure. Other than offering flexibility and malleability to the management and operation of backend infrastructure, through IaaS companies, a cloud framework also allows interconnection with other single windows once they are made available to other countries or other government units.

5. Conclusion and Suggestion

The planning of an intelligent air and sea freight logistics information services platform is a continual effort in the development of international logistics, one of the ten focus service industries identified by the Taiwanese government. In response to the rapid development of the domestic and foreign logistics industry, the goal of the intelligent logistics platform is to assist domestic logistics operations to connect with international businesses. More specifically, the current trends in global logistics operations have made logistics security and efficiency key factors in determining the competitiveness of Taiwanese logistics operations. Also, the ability to comply with international standards and regulations has also being aggressively promoted internationally in recent years.

From the perspective of information flow, the nature of the nodes in the logistics industry chain suggests that information must flow sequentially between the nodes in order to efficiently complete the entire logistics operation. As suggested by the coordination theory, coordination by plan can integrate standardization (international logistics standards and regulations) and the input and output principles between nodes (standard information operation platform), which would benefit the process of logistics operations, as well as Taiwanese companies, and enable them to become part of the international logistics system. Guided by this understanding, this research has proposed a plan for an intelligent sea and air freight logistics information services platform based on the coordination theory. Both the planning framework and application were discussed in the hope of taking the Taiwanese logistics industry a step fur-

ther, beyond the achievements of the Customs Clearance System of the Ministry of Finance, the MTNet of the Ministry of Transportation and Communications, and the FTNet of the Ministry of Economic Affairs.

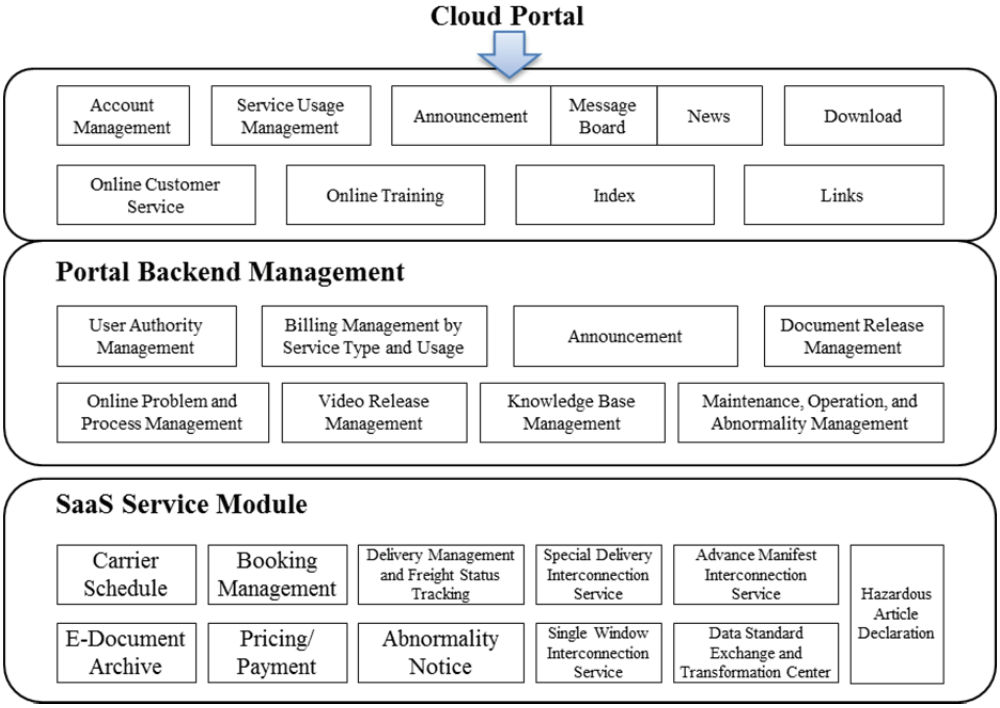

Figure 2: Service Module of the Intelligent Logistics Information Services Platform

This platform plan offers several issues for further research. First of all, at the industry level, there is the possibility of exploring the influence of international logistics development trends on local logistics industries and companies. Secondly, other than looking at the industry level, the organization level also suggests potential research issues. Examples of the research issues include factors that influence the adoption and continuance of the platform, the transformation of logistics companies' business models, from the viewpoint of cost or competition, and case studies on the internalization of logistics companies (e.g., strategic alliances).

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References

Astley, W. G., & Zajac, E. J. (1991). Intra-organizational power and organizational design: reconciling rational and coalitional models of organization. *Organization Science: A Journal of the Institute of Management Sciences*, *2*(4), 399-411.

Bakos, J. Y., and Brynjyolfsson, E. (1993). From vendors to partners: Information technologies and incomplete contracts in buyer seller relationships. *Journal of Organizational Computing*, *3*(3), 301-329.

Beamon, B. M. (1998). Supply chain design and analysis: Models and methods. *International Journal of Production Economics*, *55*(3), 281-294.

Borys, B., & Jemison, D. B. (1989). Hybrid arrangements as strategic alliances: Theoretical issues in organizational

combinations. *Academy of Management Review*, *14*(2), 234-249.

Council for Economic Planning and Development. (2010). The Service Industry Promotion Office, Executive Yuan. Available at: http://www.cepd.gov.tw/m1.aspx?sNo=0012829. Accessed March 26, 2013.

Craighead, C. W., & Laforge, R. L. (2003). Taxonomy of information technology adoption patterns in manufacturing firms. *International Journal of Production Research*, *41*(11), 2431-2449.

Craighead, C. W., Patterson, J. W., Roth, P. L., & Segars, A. H. (2006). Enabling the benefits of supply chain management systems: An empirical study of electronic data interchange (EDI) in manufacturing. *International Journal of Production Research*, *44*(1), 135-157.

Crowston, K. (1994). A taxonomy of organizational dependencies and coordination mechanisms. *Working Paper Series #174, MIT Center for Coordination Science*, available at: http://ccs.mit.edu/papers/CCSWP174.html. Accessed November 20, 2011.

Daft, R. L. (2001). *Organization Theory and Design*. Cincinnati, OH: South-Western College Publishing.

Daft, R. L., & Weick, K. E. (1984). Toward a model of organizations as interpretation systems. *Academy of Management Review*, *9*(2), 284-295.

Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. *Strategic Management Journal*, *21*(3), 345-367.

Executive Yuan. (2010). Action plan of International Logistic Services Development Project. Available at: http://www.ey.gov.tw/News_Content.aspx?n=7084F4E88F1E9A4F&s=C3374D34D1715462. Accessed March 26, 2013.

Farn, C. K. (2003). *Strategic Model for Global Competitiveness of Taiwanese Logistics Industry*. Taipei: Department of Commerce, Ministry of Economic Affairs, R.O.C.

Galbraith, J. R. (1977). *Organization Design.* Reading, MA: Addison-Wesley.

Galbraith, J. R. (1993). *Competing with Flexible Lateral Organizations*. Reading, MA: Addison-Wesley.

Gulati, R., & Singh, H. (1998). The architecture of cooperation: Managing coordination costs and appropriation concerns in strategic alliances. *Administrative Science Quarterly*, *43*(4), 781-814.

Hill, C. A., & Scudder, G. D. (2002). The use of electronic data interchange for supply chain coordination in the food industry. *Journal of Operations Management*, *20*(4), 375-387.

Institute for Information Industry. (1999). *Promotion Plan for the Application of Maritime Transport Electronic Data Interchange (EDI)*. Taipei: Department of Navigation and Aviation, Ministry of Transportation and Communications, R.O.C.

Institute of Transportation. (2012). *The Planning for Intelligent Sea and Air Freight Logistics Information Services*, available at: http://www.iot.gov.tw/public/Data/210414185571.pdf. Accessed March 26, 2013.

Kim, S. W., & Narasimhan, R. (2002). Information system utilization in supply chain integration efforts. *International Journal of Production Research*, *40*(18), 4585-4609.

Lemak, D. J., & Reed, R. (2000). An application of Thompson's typology to TQM in service firms. *Journal of Quality Management*, *5*(1), 67-83.

Malone, T. W., & Crowston, K. (1994). The interdisciplinary study of coordination. *ACM Computing Surveys*, *26*(1), 87-120.

March, J. G., & Simon, H. A., (1958). *Organizations*. New York, NY: Wiley.

Powell, W. W. (1990). Neither market nor hierarchy: Network forms of organi-

zation. *Research in Organizational Behavior*, *12*, 295-336.
Rivkin, J. W. (2000). Imitation of complex strategies. *Management Science*, *46*(6), 824-844.
Scott, R. W. (1981). O*rganizations: Rational, Natural, and Open Systems.* Englewood Cliffs, NJ: Prentice-Hall.
Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? *MIS Quarterly*, *28*(1), 45-73.
Thompson, J. D. (1967). *Organizations in Action*. New York, NY: McGraw-Hill.
van de Ven, A. H., & Delbecq, A. L. (1976). Determinants of coordination modes within organizations. *American Sociological Review*, *41*(2), 322-338.
von Martial, F. (1989). Multiagent plan relationships. *Proceedings of the Ninth Workshop on Distributed Artificial Intelligence* (pp. 59-72). Eastwound, WA, USA.
Wada, T., & Nickerson, J. A. (1998). Proprietary information networks and the scope of the firm: The case of international courier and small package services in Japan. In M. A. Crew, & P. R. Kleidorfer (Eds.), *Emerging Competition in Postal and Delivery Services* (pp. 123-138). Boston, MA: Kluwer.

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