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Abstract

The Internet has been a key to optimizing the supply chain, enabling real-time data to be shared between supply chain partners, which usually connect together as an e-business network. Nowadays the focus is on building-in value added products/services, thereby enabling the network to differentiate itself from its competitors in a more sustainable manner. In this context, outsourcing has provided significant cost reductions for businesses, with the use of third party logistics providers (3PLs). This is today only a 'qualifying criterion' for most businesses, and no longer a competitive advantage. The creation of a fourth party logistics provider (4PL) aims at moving the client to a more competitive position, by analysing relevant business risk, and monitoring relevant KPI's, and applying these within a 4PL providers efficient alliance network.

1. Introduction

Supply Chain Management (SCM) may be viewed as "the art and science of creating and accentuating synergistic relationships among trading partners in supply and distribution channels with the common shared objective of delivering products and services to the 'right customer' in the 'right quantity' and at the 'right time'"[25]. *Demand Chain Management (DCM)* [23], provides another perspective where the locus of control is moved from the supplier to the customer. This move from a 'push' (supplier driven) to a 'pull' (customer driven) system allows customer initiated ordering to drive the entire supply chain. DCM aims first and foremost at meeting the needs of specific customer segments, rather than concentrating on internal optimization [28]. DCM also allows the single business unit to instigate new sets of efficient, co-ordinated, customer-related, data-sharing practices across its entire supply chain.

The World Wide Web and the Internet, combined with linked, innovative, integrated networks sharing digital information up-and-down the entire supply chain, provides the basis for the development of supply chains (SC), or demand chains (DC). Both supply chain management (SCM) and demand chain management (DCM) still have their place.

SCM is particularly useful in delivering longer product life-cycle items such as commodities, or complex products with long lead times such as aircraft construction. Here, all links in the chain are compared to the desired overall total performance of the entire chain, and each individual link is separately optimized. Thus the overall performance of the entire chain may be improved [5].

The Internet has been a key to optimizing the supply chain. It has enabled real-time data to be shared between supply chain members (or partners). The supply chain members usually connect together as an e-business network. They share information freely with participating partners: obtaining real-time updates of production line product positions; planning schedules; stock requirements etc.; shipping to a schedule; paying electronically; and managing individual processes for the benefit of the entire supply chain. SCM is a continuously evolving process. New strategies, methods, systems, ideas, and the like continue to drive additional learning-curve effect efficiencies. Hence SCM is a pathway towards competitive advantage and sustainability [19], but they can only ever be as efficient as the sales forecast [18].

DCM is similar to SCM, but it is customer driven. Here the customer expresses a desire for a product, with a variation to the original standard product. The aim is produce this product variation and deliver it whilst meeting the customer's expectations. It appears best suited to shorter life-cycle products such as software, computers and the like. However, even traditional, complex SCM businesses, such as automotive industry companies like GM, are moving towards the DCM model.

The Internet has enabled the customer to acquire product knowledge from a global perspective, and to do so at a rapid rate. The knowledgeable customer has become the decision-maker, and the influence of the supplier is greatly reduced. The customer now manages the performance of the total supply chain [15], and decides what they want, when they want it, and why they want it.

The DCM model has conceptualized the introduction of dynamic pricing models, make-to-customer order systems, and new lead time policies [26]. Make-to-customer order systems have typically been termed 'customized' orders. DCM models are moving towards one-on-one customized orders where the individual customer gets a variation of the product that closely meets their needs and wants.

The next level of customization is the true one-on-one approach where the customer receives a product that fits their needs and wants exactly. This one-on-one relationship is termed 'customerization' [12]. Customerization requires skilful strategic positioning of the e-business [13]. Numerous other factors must be considered, including knowledge of the customer's culture [16]. For example, e-business research indicates Japanese customers prefer detailed descriptions and little graphics on e-business web sites, whilst USA and Korean customers prefer brief text and more extensive graphical presentations - yet all groups showed a preference for a grid layout when compared to a dynamic, curved layout. Where close similarities occur between countries, for example where USA and Korean customers preferred a more visual and less text based approach, one web site design may provide satisfactory, cross-cultural usability. The individual country customers are then segmented. This segmentation does not follow traditional lines based on demographics. It is based on technographics [10] [13] [30], where the country's customer profile is segmented based on their technological ability – how techno-savvy they are. User groups are profiled, and studied, with a view to providing 'customized' web interfaces that best meet their demands. Web site visitors are tracked, and customer specific interfaces are matched to the on-line information seeker's preferences. This immense task is most cost effective at the larger or 'portal' web site level. It requires: a programmer(s)/program analyst(s) and web master(s); a database driven web site(s); quality software, hardware and communications; specific tracking tools working in conjunction with internal business intelligence and knowledge management systems; appropriate supply chains and value adds; and a system that continuously updates.

Currently, under Internet communications protocol system IPv4, the on-line customer has no fixed address, there is no performance manageability due to routing and demand issues, and it is not really 'plug and play' [4]. Consequently, there is no direct way, other than 'cookies' and competitions, of tracking the number of visits a user makes to an e-business web site. We can, however, see where the user came from, how long they visit a page, where they go within the site (and the time they spend), and from where (and to) they exit. The user's mouse clicks can be tracked along with associated actions, and the time-interval between clicks. Thus some data collection (and subsequent analysis) is possible, especially if cookies can be deposited on the user's computer.

The new flexible, agile, demand chain driven/supply chain supported, dynamic e-businesses are also stretching out to build-in value added products, thereby enabling them to differentiate themselves from their competitors in a more sustainable manner. These e-businesses, being more agile, are more likely to survive against the lowest 'selling price' pursued by many on-line customers.

The entire e-business driven-supply chain is moving towards a new level of quantifiable information sharing and collaboration. To measure such intangible assets, the 'Cap Gemini Ernst and Young Centre for Business Innovation' has developed a 'Value Creation Index' (VCI) [6] [17]. The Index assesses (through regression and other advanced statistical tools) the non-financial value drivers. These drivers must be exploited in order of importance to maximize value. When applied to e-commerce businesses, strategic alliances, investments in innovation, and number of users are of high importance as drivers of market value. This in contrast to brand awareness, minutes per page, change in usage, and change in percentage reach, which do not display a statistical association with market value. The VCI model demonstrates that 90% of an e-commerce company's value is based on these intangible factors [6]. Thus e-business alliances should be established based on the firm's ability to: add value to customers; eliminate unnecessary and uneconomical complexity in creating value adding propositions; and consideration of the total customer experience [29].

Within the services arena the current, highly-competitive global business environment requires businesses to provide value to their business offerings [22]. For example: to remain agile, and compete effectively, IBM focuses on four drivers – globalization, value creation, the extended enterprise, and operational excellence. It has redefined its supply chain as 24 hours by 7 days access with immediate or same day delivery. This data centric corporation works with real-time information from smart data capture and analysis systems.

The 'services' industry has readily adopted the Internet based e-business environment. It has linked its supply chains to web interfaces, and has offered additional 'value-adds' to move its entire supply chain to more optimal positions. For example: the real estate industry, in addition to its property listings, offers financial calculators, mortgage and loan comparisons, on-line purchasing, and the like. Other service providers - including solicitors - have out-sourced non-core areas of their business like office typing and mail rooms. As such, these service providers have embraced an outsourcing model denoted as "Third Party Logistic (3PL) providers" [27].

This notion of outsourcing is taking on a new strategic dimension, which is the focus of this paper, and which will be further elaborated.

2. Third Party Logistics Providers

First Party Logistics (1PL) providers, prior to 1980, were traditional *logistics suppliers*. In the early 1990's Second Party Logistics (2PL) *network players* like TNT and UPS commenced global operations, and in the late 1990's Third Party Logistics (3PL) providers emerged with many unexpected players (for example: integrated IT suppliers; management consultants; financial services) entering the market. The development of 3PLs was primarily due to the emergence of technology - enabling information exchange and facilitating communication between businesses.

3PL providers offered the e-business significant benefits. They play a substantial role in supply chain optimization and integration initiatives, by taking over out sourced 'non core' business functions and reducing costs, consolidating activities, and improving efficiency of the supply chain. For the demand chain, the results are: reduction of asset intensity; restructuring of distribution systems triggered by restructuring of production structures; and reduction of labour costs by switching to a non-unionized labour force provided benefits. In addition, the supply side is driven by declining profit margins in basic services (like freight and transport), and the tight availability of capital outsourced items such as shipping. 3PL providers have the potential to add value to e-businesses by sharing resources between their customers, sometimes outsourcing certain activities to second or third tier providers, (who join the value adding process as complementary providers), with the greatest impact in containing logistics costs [20]. Thus both horizontal and vertical integration develops between these optimized 3PL service providers, and the e-business benefits [2].

Table 1: 3PLP Value Creation Table

Taxonomy of Value Creation by 3PL Providers				
Direction of Increasing Complexity				
Descript ion	**Operation al efficiency**	**Integration of customer operations**	**Vertical or horizontal integration**	**Supply chain management & integration**
Driver	Factor costs	Scale	1.Asset reduction 2.Scale 3.Factor costs	Development of customer business process
Skills	1.Operatio ns 2.(IT)	1.Operations 2.IT	1.Operation s 2.IT 3.(Conceptu al)	1.Operations 2.IT 3.Conceptual
Example	Run warehouse efficiently	Share warehouse among several shippers	Outsourcing to lower tier providers	Cross-docking or other new concepts

Note:
1. Operations and IT are the basis of value creation
2. Skills - use conceptual logistics skills to improve supply chains
3. Conceptual skills - include knowledge of competitive advantage aspects

Table 1 encapsulates the four ways of adding value. Complexity and associated skills requirement increases from left to right. Vertical and horizontal integration often follows operational and resource sharing value creation. It is rare to find all three skill sets (operations, IT and conceptual) maximized to create value [2].

A major deficit of 3PLs has been the missing ingredients of continuous improvement, strategic supplier relationships, and responsiveness. This is due partially to the nature of the 3PLs - as their specialisation was provided in a narrow range of services – as well as their historical roots of a very functional operations and logistics-provider background. These skills allow incremental improvements of both cost savings and benefits in *sectors* of the supply chain (primarily logistics and procurement)- where 3PLs were able to profitably manage these functions - however there is usually a lack of flow-on effect of overall benefit to the whole supply chain.

Today, with globalisation, and a highly competitive marketplace, the narrow service provisions of 3PLs are no longer providing a competitive advantage as these are the entry qualifications for all businesses. 3PLs are also struggling with the narrow profit margins, where providers compete by bidding for tenders – the lowest bid often winning the contract. This is coupled with customer demands for new and innovative solutions for their supply chain [8]. Improvements for 3PLs would be found in significant investment in IT, research and development, and high calibre management that would foster an environment of continuous improvement – yet 3PLs often do not have the financial resources to provide these value adding services.

At this time 3PLs usually do not have either:
• the necessary profit margins to develop new services that would add value for their clients
• nor the internal influence with their business partners to implement changes and improvements if they were developed, as these would be broader than current areas of service. This limitation is due to industry attitudes towards the function and place of out-source providers, as much as due to the self-defined specialisation of 3PLs. Thus 3PLs are confined to operational excellence in specific areas of the supply chain, and are usually unable to implement changes across the supply chain due to restricted access to information and managerial input.

However some current advantages for 3PLs are [9]:
• a highly fragmented and high growth market
• possibility for 3PLs with multiple customers to gain by providing technological and expertise advantages to their customers
• potential for further differentiation.

Some 3PLs are actively expanding their service provision to include procurement, inventory management and financial services [20]). The opportunities are extensive in the area of e-business, where integrated solutions and tools, along with collaborative supply chain management is the key to competitive advantage. Occasionally, a competent group of 3PL's have banded together to become a leading solution provider, closely linked to their customers. They often manage the transport and warehousing networks for a large group of second tier 3PL's. These leading solution providers are the precursor to the latest key players.

3. Strategic Sourcing

Dunn and Bradstreet [7], report large, sustainable cost reductions are achievable when spending is aggregated across business units (and regions), and suppliers are rationalized (with those remaining striving to find new ways of removing costs). This is very different from traditional procurement, which focused on squeezing cost reductions out of an existing set of suppliers. They believe strategic sourcing must incorporate:

• Integrated procurement and accounts payable systems so details and entire spending patterns can be monitored

• Detailed understanding of the amounts spent with each supplier (leading to an integrated position of accounts payable across the supply chain)

• Performance at both ends of the supply chain (as some suppliers are also customers, or alliance partners)

• Mass services as a commodity (one global price for major items, especially with a global provider)

• Risk management allowing consolidation of purchases with fewer, quality suppliers (collected, collated and evaluated information is the key to monitoring and assisting suppliers in this less flexible environment)

Isolated bodies including Deloitte, Ernst and Young, and others have been delivering similar services at an industry specific level for several years, working with specific telecommunications companies, software providers and the like.

Although outsourcing has provided significant cost reductions for businesses - especially at first - the use of 3PLs is now only a 'qualifying criteria' for most businesses, and no longer a competitive advantage. Outsourcing is a method for a company to refine its business to concentrate on core competencies, differentiate customer service and increase operational flexibility [1]. Further cost reductions are required for businesses to gain a competitive advantage and this is potentially found in managing the complete supply chain enabled by increased visibility of information - as seen in successful e-businesses.

4. Fourth Party Logistics Providers

4.1 Characteristics

A new model of logistics service providers is emerging. This model, termed a Fourth Party Logistics (4PL) provider, is shown in Figure 1. The 4PL provider aims to assume responsibility for the entire set of a client's supply chain processes, and to manage, coordinate and drive this 'set' in a highly efficient, and cost effective manner. This approach is no longer aimed at improving the supply chain for an individual company, rather to enhance the 'value-chain' across businesses [26], www.viewlocity.com.
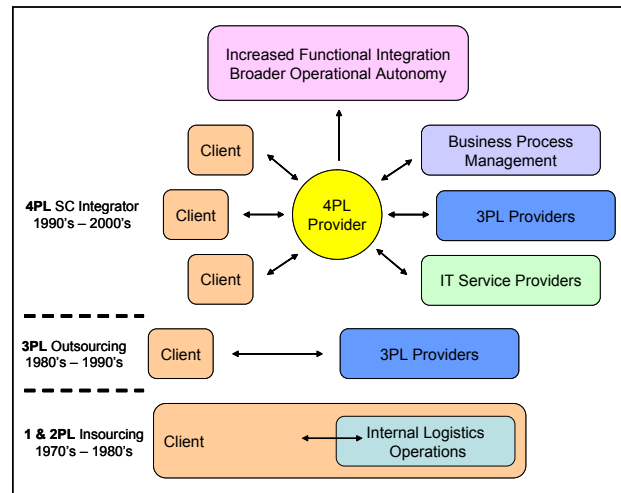

Figure 1: Evolution from 1 & 2PL to 4PL Models

A 4PL provider is a supply chain integrator that primarily provides technological capabilities to resolve a problem or opportunity for businesses [8]. The 4PL provider uses strategic sourcing to assemble and manage resources, capabilities, and technologies and assembles a conglomeration of other complimentary leading 3PL service providers for comprehensive supply chain solutions. It integrates these supply chain organisations into its 4PL structures, thereby creating unique new business models - tailor-made for the client's business or e-business, and its customer driven demand chain.

To be successful at the top of the supply chain, the 4PL provider must add value to its clients (e-businesses). It must deliver:

• Excellence in customer management, and do so in a manner that extracts maximum value. It must offer superior customer service, higher sales value, that focuses on delivering customer value and perceived value; operational excellence, that maximizes capital and human productivity; asset optimisation, that increases productivity and operational innovation; improved transparency and planning, thereby allowing visibility of forward orders across the supply chain; enhanced IT, network solutions and other business intelligence and knowledge management tools that allow lower transaction costs and world-class e-commerce solutions like e-procurement; and virtual inventory management with associated lower inventory costs.

• Corporate agility that maximizes the effectiveness of management by developing change management capabilities, teamwork, and alliance management with excellent people skills

• Strategic positioning that priorities and maximizes focus concerning relative market positioning and exploitation of the organization's capabilities within the

total supply chain, along with the related strategic choices of mode, geography, service and industry.

The success of a 4PL is dependent upon its ability to define top 3PL providers, enable technology providers to form alliances, and be extremely agile in all aspects of its operations. It has the added incentive to develop new cost reductions via leveraging integrated networks; exploring new ways to improve supply chain performance (for example, working with suppliers' external customers to improve and standardize their operations); aligning sourcing to strategic business unit needs (with CEO and CFO support); lead centrally but with local implementation (incorporating harmonious and skilled work teams); and provide excellent service to all its clients.

The 4PL provider may provide expert assistance to its alliance partners and create an extended enterprise. It must integrate ERP and gain/spend analysis data. Its IT systems must yield better information on spending and knowledge management (supplier performance knowledge, contract management, and the like).

4.2 Key Performance Indicators (KPI's)

To measure its success a 4PL must develop sets of key performance indicators (KPI). Measurable KPI's include:
- Availability of servers and applications
- Amount of work under backlog (tasks to complete eg help desk lists, IT/IS tasks)
- Utilization (database performance, resource allocation, personnel)
- Transactions per day (ordered by function, ease of payment, serviced level, responsiveness)
- Client customer satisfaction level with service
- Recovery time from disaster (business continuity metrics)
- Application functionality performance versus business requirements
- Number of problems per day
- Number of changes required per day
- Benefit realization
- Tracking and ordering (fill rates, on-time delivery, quality, rejections)
- Other (iitoolbox.com, haht.com, ncr.com and aeclever.com, 2003).

4.3 Risk Management

The 4PL must constantly assess risk. Risk-based management programs assess two key questions: what required assets are most at risk, and what constitutes risks to those assets? Risk is a relative term—an event or threat may be risky in one environment but not in another [3]. Therefore, a 4PL provider's risk management program will incorporate each strategic business unit's "worry radius" – where perceived risk and acceptable loss are defined. Effective risk management also requires determining the scope and value of assets. This cost must be considered against the estimated value of the assets

and the impact of their loss on operations and services[20].

There are numerous risk tools, risk guides, and risk services available on the Web. The 4PL's capital assets and digital assets management must be closely aligned with risk management developments. A typical progression of stages of risk management includes [14]:
- Risk identification
- Risk classification
- Risk assessment
- Risk analysis
- Risk management implementation

In addition to its KPI's, the 4PL must develop artificial intelligence methods, expert systems, knowledge management, business intelligence tools, profiles of itself, alliance partners, and its clients. The resulting tools and databases then provide evolving sources of information for analyzing potential risks.

Many decision-making and problem-solving tasks are too complex to be understood quantitatively, so 4PL's and others may succeed by using knowledge that is imprecise rather than precise. Any methodology or theory implementing "crisp" definitions such as classical set theory, arithmetic, and programming, may be "fuzzified" by generalizing the concept of a crisp set to a fuzzy set with blurred boundaries. Fuzzy logic allows these stratified sets to overlap (for example: an 85 kilogram man may be classified in both the "large" and "medium" categories, with varying degrees of belonging or membership to each group). Since fuzzy logic can handle approximate information in a systematic way, it is ideal for controlling nonlinear systems and for modelling complex systems where an inexact model exists or systems where ambiguity or vagueness is common. A typical fuzzy system consists of a rule base, membership functions, and an inference procedure. Thus the 4PL operation will generate perception-based decision analysis and decision support systems for risk analysis and management, uncertainty analysis, and new soft computing algorithms, making intelligent, semi-unsupervised use of large quantities of complex data to support its evaluation and management processes. When fuzzy logic and expert systems are applied to a customer's activities on an e-business web site, its database driven web site may be more responsive to the perceived demands of the user, thus enabling a faster, shorter path towards the customer's web site goals. Similar fuzzy logic processes may be applied across other areas of the supply chain. Thus performance against a 'business scorecard' can be established and monitored [24].

The next step for the 4PL provider is to use this business intelligence and determine the effect of changes on business effectiveness, competitive advantage, sustainability, and ROI.

5. Conclusion

The creation of a 4PL provider aims at moving the client to a more competitive position, at least until other

organisations either re-establish their competitive positions by copying such a system, or developing new innovative solutions. Analysing relevant business risk, and monitoring relevant KPI's, and applying these within 4PL provider's efficient alliance network may allow the 4PL to develop new, highly-efficient processes with added benefits to the client. These processes should increase the overall ROI of the system, and should benefit the client, the 4PL, its supply chain alliance partners, and most importantly, the client or customer.

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