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The Collaborative Supply Chain: A Scheme for Information Sharing and Incentive Alignment[♠]

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The Collaborative Supply Chain: A Scheme for Information Sharing and Incentive Alignment

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Abstract

Collaboration in a supply chain helps different members of the chain match demand with supply more effectively than they could alone. Although collaboration promises mutual benefits to the members, those benefits are rarely realised due to differences in interest among them. This paper argues that managerial inertia manifested in local perspective and opportunistic behaviour of chain members contribute to mismatch between supply and demand. Identifying the managerial inertia of various chain members that prevents them from gaining mutual benefits, and studying the underlying reasons for self-interested behaviour are very important research issues. A collaborative supply chain is proposed to simultaneously consider information sharing incentive alignment in consonant with appropriate performance measures and integrated policies as initiatives to mitigate the detrimental effects of managerial inertia on chain performance.

Keywords: supply chain management, collaboration, incentive alignment, information sharing, and asymmetric information.

Introduction

Intensive competition in the market place has forced companies to respond more quickly to customer needs through faster product development and shorter delivery time. Increasing customer awareness and preferences have led to an unprecedented explosion in product variety. End customers give credit only to companies that are able to deliver products with excellent quality, and on time. However, the demand of customers for product variety, especially in the case of

short life-cycle products such as food, apparel, toys, and computers, makes it difficult for manufacturers and retailers to predict which particular variety of the products the markets will accept. To be effective in matching demand with supply, manufacturers and retailers need to collaborate in the supply chain [1].

Wal-Mart, which is recorded as one of the heavy weight champions in supply chain management, uses checkout scanners to transmit up-to-date sales and inventory information via satellite to its suppliers' systems to reduce order cycle time and enable stocking decisions to be based on observed early sales rather than on pure educated guesses [2]. Wal-Mart focuses on the creation of customer services and non-price benefits and collaborates with its important suppliers in forecasting and replenishment [3]. Both parties receive mutual benefits. Wal-Mart gains competitive retail price and a reduction in lost sales and stocking costs, while the suppliers are able to replenish goods as they are sold, minimise stockouts, and improve brand loyalty.

Although supply chain partnership promises mutual benefits for the partners, those benefits are rarely realised due to differences in interest [4]. Differences in interest can be seen by examining the managerial inertia of chain members as they seek only their own profit instead of the overall chain profit. The chain members habitually work as an individual firm based on local perspective and opportunistic behaviour. However, local perspective and opportunistic behaviour of maximising individual profit often occurs at the expense of other members and works against the overall profitability. Due to local perspective and opportunistic behaviour, products or services are unlikely to flow properly to end customers, which results in a mismatch between supply and demand [5]. Examples of mismatch include too many units, too few units, wrong SKU, wrong location, wrong time, and all combinations of these errors. Mismatch between supply and demand becomes costlier as compared to production costs, especially in a supply chain with short life-cycle products [6]. Losses due to supply and demand mismatch, a chronic problem in many supply chains, include stockout costs, markdowns, expediting, transshipment, advertising and sale preparation costs, excess inventory costs, obsolescence, and disposal costs. For instance,

department store markdowns in the apparel industry due to supply and demand mismatch doubled in about ten years [7].

In this paper, the authors are concerned with supply chains that consist of different, but interrelated, firms. The issues presented here may also be applicable to some supply chains that are entirely within a single firm, but which operate as autonomous divisions. Reasons for managerial inertia that prevent the chain members from functioning effectively are examined, and a collaborative supply chain that deals with mitigating the sources of managerial inertia with an emphasis on information sharing and incentive alignment is proposed. In the next section, the reasons for conflicts in supply chains are examined, and a collaborative supply chain aimed at mitigating the conflict is suggested. Issues of appropriate performance measures, integrated policies, information sharing, and incentive alignment as a means of meeting the overall chain goal are discussed, followed by concluding remarks.

Conflicts in Supply Chains

A supply chain consists of interdependent firms involved in the flow and transformation of goods, services, and related information, as well as funds from point of origin through to the end customers. Those chain members often become involved in supply chain management to integrate planning, implementing, and controlling the effective flow of goods and services, related information, and associated funds for the purpose of conforming to customer requirements [8]. Closed cooperation helps chain members to effectively match demand and supply that contribute to the increase of the overall chain profitability.

There can be no doubt that considerable antagonism exists among the chain members due to mutual distrust and relationship difficulties before and during cooperation. The manifestation of distrust and cooperative difficulties in supply chains is often in the form of conflict that impedes the efforts of chain members to improve the overall chain performance. Rosenberg and Stern [9] define channel conflict as actions and decisions of one of the chain members that prevent the relationship from achieving its overall goals. They also introduce the circular conflict model consisting of causes, level, and outcomes. A number of causes

generate a measurable level of conflict. This level of conflict affects the outcomes in the form of performance results. In turn, the outcomes will influence the original conflict causes.

Although conflict in the distribution channel has been extensively studied (see Gaski [10] for a seminal analysis of conflict and power from a marketing channel perspective), the source of conflict, the level of conflict, and the management of conflict are increasingly important in supply chain management. As Rosenberg and Stern [11] suggest, the existence of conflict does not automatically determine dysfunctional outcomes, but the conflict resolution that properly manages conflict will result in functional outcomes. Participating members that regularly face conflicts thus need to manage conflict in a constructive way. The starting point of managing conflict is to identify the sources and then to deploy proper interventions to produce functional outcomes.

Extensive studies of causes of conflict have been carried out from the marketing channel perspective. Stern and Heskett [12] propose three types of conflict causes: differences between chain members' goals and objectives (goal conflict), disagreements over domain of decisions and actions (domain conflict), and differences in perceptions of reality used in joint decision-making (perceptual conflict). Etgar [13] differentiates between attitudinal and structural causes of conflict. The former stem from differences in the ways chain members acquire and process information about their chain - such as roles, expectations, perceptions, and communications. The later reflect a clash of opposing interests such as goal divergence, drive for autonomy, and competition for scarce resources. Gaski [14] proposes that the coercive and non-coercive sources of power used influence the frequency of disagreement among channel members. Nonetheless, the previous research can be extended to include the managerial inertia as a supplementary cause of conflict in supply chain management.

The basic reason for managerial inertia pertains to the obsolescence of existing procedures or the lack of updated procedures for a new level of cooperation among multiple parties that requires global perspective to effectively manage the supply chain. A common dilemma is a conflict between making decisions based on a local perspective and making decisions based on a global

perspective of the overall supply chain [15]. Adopting a global perspective is often difficult because the individual member has been trained to work as a single entity only guided by local perspective and often exhibits opportunistic behaviour.

In fact, the local perspective and opportunistic behaviour prevent the chain members from achieving the chain goal of optimising profit. The detrimental effects of local perspective on the chain performance can be seen by examining how the chain members compromise performance measures along the supply chain. As they, individually, have policies on demand forecast, ordering systems, inventory systems, facilities, transportation, and transfer payments or pricing, they become involved in a series of tradeoffs that contribute to cost ineffectiveness, poor customer service, and lower profitability of the overall chain [16]. Furthermore, the phenomenon of self-optimising or opportunistic behaviour of the chain members, which leads to mismatch between supply and demand, can be observed from increased demand amplification on the chain and difficulty in meeting end customer demand [17]. Demand amplification occurs when small variations in end customer demand become increasingly large variations as demand information is transmitted upstream along a supply chain.

The sources of managerial inertia can be categorised as follows: (i) inappropriate measures of performance, (ii) outdated policies, (iii) asymmetric information, and (iv) incentive misalignment. The underlying causes of inertia and their detrimental effects on chain performance are set out below.

Inappropriate measures of performance refer to existing traditional measures of individual performance irrelevant to the maximisation of chain profit. In many instances, chain members simply do not have supply chain metrics that reflect the attainment of chain profit. Chain performance is measured in oversimplified and sometimes counterproductive (cost-reduction-based) terms. The traditional measures that emphasise mainly costs distort the way in which the chain members reach key decisions concerning which customers are the most important and therefore the most profitable to serve. The fundamental problem of cost-centric measures is to minimise individual costs and not to maximise value to end customers. A supply chain which limits itself to local measures of performance does not work together as an integrated link [18]. Chain performance should be

integrated in a big picture that entails measuring the overall chain performance rather than the performance of the individual chain members.

Any action directed at improving individual performance without appreciation for the overall chain (i.e., improving customer service at reduced overall costs), is likely to have a detrimental effect on at least one or more chain partners. For example, a stocking transaction between the chain members is considered as a sale that increases the local performance. In fact, a sale occurs only when end customers pay for the products offered by the chain. As a result, each member tends to push inventory to the downstream partners to increase his own performance without considering the actual demands of end customers. This practice increases the risks of too much inventory of unwanted products and insufficient inventory of popular products. Moreover, inappropriate performance measures that emphasise minimising local costs also cause internal gaming phenomena among functional divisions within the individual firm [19]. The marketing manager, for example, attempts to maintain large inventories as opposed to the production manager, who tries to keep inventories low.

Outdated policies are decision guides, particularly rules and procedures, which are no longer relevant to the new conditions of inter-organisational relationship [20]. Policies provide control guides for decision-making which minimise the risks of delegated decisions. They ensure a minimum level of consistency and uniformity in making decisions such as demand forecasting, capacity utilisation, inventory levels, and purchasing quantity. Policies are often prompted by the need to respond to particular conditions. Changing conditions can mean that they are quickly outdated. Current policies quickly become outdated because they are created largely to suit the local company only, and not the overall chain. Moreover, the chain members often take advantage of the existence of outdated policies in an attempt to maximise their own benefits. Policies such as minimum order quantity, volume and price discounts, order batching, and order quota drive the buying behaviour that often results in demand floors and ceilings that create demand amplification [21].

Asymmetric information refers to different parties having different states of private information about demand conditions, products, and the chain operations.

The problem of asymmetric information arises because participating firms generally lack the knowledge required about each other's plans and intentions to adequately harmonise their services and activities. The chain members often do not wish to share their private information completely and faithfully with all other chain members due to the economic value of that information (actual or perceived). As a result, the supply chain suffers from sub-optimal decisions and opportunistic behaviour. Sub-optimal decisions occur when the chain members do not have sufficient visibility to resolve various trade-offs in decision-making because lack of information causes decisions to be made in a narrow scope that cannot ensure that products flow properly to end customers [22]. Moreover, with limited information sharing, the chain members do not have consistent perceptions of market needs and visibility over performance at the other levels of the supply chain. As a consequence, decisions are made based on either the best estimation of the available data or on educated guess. Such decisions can be biased and prevent the individual chain member from attaining the optimal solution of the chain. For example, the manufacturer often uses incoming orders with larger variance - and not sales data - from the retailer as a signal about the likely future product demand [23].

Asymmetric information also produces two problems of vulnerability of opportunistic behaviour. Specifically, adverse selection (i.e., concealing prior information of capabilities from parties with less accurate information) and moral hazard (i.e., cutting the effort levels or shirking) manifest themselves in the relationship among the chain members. The negative effect of adverse selection, for example, is that the chain members cannot optimise chain performance because they do not possess the required capability to meet the predetermined customer service level. Figure 1 shows different sources of asymmetric information contributing to poor chain performance.

Place Figure 1 about here

Incentive misalignment occurs when a player makes decisions considering only local rewards and penalties, which typically often differ from maximising the overall profitability - sometimes at the expense of the others. The problem of incentive misalignment arises because firms generally lack the means to compel others to adjust their policies and priorities to align with the overall profit. Often, actions and decisions by one member result in uncompensated costs or benefits to others. This phenomenon has been known as externalities, spill-over, or neighbourhood effects [24]. For example, the retailer makes a decision on an order quantity which is less than the optimal supply chain quantity because he does not consider the supplier's profit margin. The phenomenon of each player's receiving only a portion of the total contribution margin is known as classic double marginalisation [25]. Other examples of externalities are customer service improvement by the retailer without compensating reduced wholesale price setting by the manufacturer, and increased investments in information technology without compensating retail price increases. Furthermore, misaligned incentives often cause retailers to manipulate wholesale price discounting, rebates, and quantity discounts given by suppliers during a certain promoting period, to maximise their profits through forward buying and diverting [26]. Opportunistic behaviour such as forward buying and diverting gives a distorted amplified view of customer demand to suppliers as retailers buy larger quantities than needed and stockpile for future selling.

As has been demonstrated, there is adequate evidence to show the detrimental effects of local perspective and opportunistic behaviour resulting in inefficiencies along the supply chain. The following sections provide the rationale for a collaborative supply chain to improve performance vis-à-vis the overall chain profitability while addressing initiatives to obviate the sources of managerial inertia.

Collaborative Supply Chains

A collaborative supply chain simply means that two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation. Many researchers have proposed equivalent

definitions to the collaborative supply chain. Lambert *et al.* [27] suggest a particular degree of relationship among chain members as a means to share risks and rewards that result in higher business performance than would be achieved by the firms individually. Bowersox [28] reports that logistics alliances among different firms offer opportunities to dramatically improve customer service and at the same time lower distribution and storage operating costs. Narus and Anderson [29] define a collaborative supply chain as the cooperation among independent but related firms to share resources and capabilities to meet their customers' most extraordinary needs.

Although collaboration is based on a mutual objective, collaboration is a self-interested process in which firms will participate only if it contributes to their own survival. Each member seeks to achieve individual benefits such as eliminating redundant functions, reducing transactions, achieving lower inventory, increasing responsiveness, and so forth. Nevertheless, the focus of a mutual objective should be on the outcome and experience of joint offers to end customers. By sharing their resources and capabilities, chain members can exploit profit-making opportunities that they cannot create alone. For example, Morash *et al.* [30] identify the logistics capabilities for competitive advantage as delivery reliability, post sale customer service, responsiveness to target market, delivery speed, presale customer service, widespread distribution coverage, and low total cost distribution. In return for its contribution, each member of the collaboration shares in the resulting better sales and profits.

Collaborative supply chain has been studied extensively given its breadth of application. Different initiators offer different concepts, so it is necessary to briefly review several types of collaborations. A collaborative supply chain is commonly differentiated in terms of its structure: vertical, horizontal, and lateral. Vertical collaboration occurs when two or more organisations such as the manufacturer, the distributor, the carrier, and the retailer share their responsibilities, resources, and performance information to serve relatively similar end customers. Several examples are Vendor Managed Inventory (VMI), Efficient Customer Response (ECR), and Collaborative, Planning, Forecasting, and Replenishment (CPFR). Horizontal collaboration occurs when two or more

unrelated or competing organisations cooperate to share their private information or resources such as joint distribution centres between two retailers. A lateral collaboration aims to gain more flexibility by combining and sharing capabilities in both vertical and horizontal manners. Nistevo, Lean Logistics, and Transport Dynamics are examples of lateral collaborations that attempt to synchronise shippers and carriers of multi-enterprises in an effective transportation network [31]. Other types of collaborations are based on formality (degree to which exchange procedure are specified in advance) [32]; supply chain related strategic alliances (retailer-supplier partnerships, third party logistics, and distributor integration) [33]; and resource pooling (same-function, cross functions, and parallel development of new products) [34].

Collaboration has a life cycle from the time of engagement to disengagement. This involves four primary business processes. First, the engagement process aims to identify the strategic needs of collaboration, find the right partners with the right capabilities, and set mutual agreements concerning performance [35]. The second process involves forward-looking planning to manage interdependencies of resources, tasks, and capabilities for future requirements. A forward-looking plan should be robust to disturbances (e.g., demand fluctuations and rush orders) and realistic to the genuine resource scarcity. Third, the chain members perform daily operations to effectively meet the requirements of short and long-term goals. This is the implementation process in which the chain members execute the planning including how to handle exceptions and to assess the overall performance. Fourth, the evaluation process is to evaluate and decide either to modify or to terminate the agreements. These four basic processes apply to any kind of collaborative relationship such as joint material supply, joint production, joint transportation, joint product development, and joint marketing.

Interdependence is a key concept in the analysis of such collaboration. Thomson [36] suggests that one organisation is dependent on another to the extent that it relies on resources and services the other provides which cannot be obtained elsewhere. Since the chain members seek to ensure their own survival and protect their own interests, collaboration may be viewed as one means by

which they seek to manage their dependence. The concept of managing dependence becomes a critical process in collaboration. Malone *et al.* [37] propose general types of dependencies and the required coordination process of how to manage that typical dependency. Dependencies in supply chains can be in the form of tasks and tasks, tasks and resources, and resources and resources that occur along the supply chain. Tasks are main activities such as planning, forecasting, ordering, distributing, replenishing, pricing, paying, and serving. Resources include inventory, funds, capacity, and capabilities. For example, the demand interdependence can be managed when the supplier and the retailer cooperate in joint demand planning.

The required coordination process is often used as a basis for the development of decision domain. This decision domain describes the redeployment of decision rights and associated areas of responsibilities. The idea of domain consensus of decision rights and responsibilities is a main prerequisite for successful collaboration. Without prior agreement between firms on their legitimate spheres of operations and authority, relations will be slowed down by persistent conflict over who does what. Decision domain thus needs to be managed carefully among the participating members. For example, Vendor Managed Inventory provides stocking decision right to the suppliers for ensuring continuous replenishment of products at the retail stores [38].

The intensity of collaboration depends on the impact horizon on chain performance: short-term (effects on operational performance within one year), medium-term (effects on operational performance over one to three years) and long-term (effects on operational performance over two to five years) (see Table 1 for the intensity of collaboration based on horizon impact). Each opportunity for collaboration focuses on better customer service outcomes such as greater responsiveness and flexibility [39]. Collaboration in the short term refers primarily to the cooperation among different chain members aimed at meeting the needs of both usual and unusual demands for products/services. Collaboration in the medium term involves the sharing of responsibilities to synchronise product design and logistic capability in order to cope with growing demands for broader

market offerings. Collaboration in the long term aims to create superior service capabilities through the setting of joint priorities and the sharing of capabilities.

Place Table 1 about here

Table 1 also exhibits the types of intervention required to ensure that collaborative supply chain will remain feasible. The starting point is to set mutual objectives and sub-objectives for the individual members that identify cooperative and competitive challenges to create value that is markedly superior to the status quo. Next, since the focus of collaboration is on mutual competitive advantage, the chain members need to change individual policies to those based on inter-organisational processes and to institute performance measures to track progress in keeping collaboration on course. Information sharing and incentive alignment facilitate the collaboration process. The following sections discuss performance measures, integrated policies, information sharing, and incentive alignment that need to be redesigned to ensure that collaboration remains feasible in attaining the mutual objectives.

Appropriate Performance Measures

In a productive collaboration, participating members should jointly agree on a performance system. An effective performance measurement system provides the basis for understanding the system, influences behaviour throughout the system, and provides information regarding the results of system efforts to supply chain members and outside stakeholders [40]. The focus of the performance measurement system should be on continual improvement for end customers because satisfied customers determine the extent to which all chain members successfully generate real sales.

The broad process of a performance measurement system requires the chain member to carry out four steps: design performance, facilitate performance, encourage performance, and intensify performance. Design performance means to

develop a performance system that enables the chain members to monitor and improve chain performance. There are three related components of a performance system: performance model, metrics, and measurement method. A performance model is a chosen framework that links the overall chain performance with different levels of decision hierarchy among the individual members in meeting the objectives of the supply chain. In doing so, chain members know the mutual objective of collaboration, how overall strategy relates to the individual processes, and how to measure the relative contribution and the performance of each member of the collaboration. Several system-wide performance models have been developed, for example, the balanced scorecard [41], supply chain metrics [42], the supply chain operations reference (SCOR) model [43], and Constraint Management [44]. For example, the balanced scorecard approach can be adopted as an initial performance model that provides a framework for looking at a strategy from four different perspectives: financial, customer, internal business processes, and learning and growth. It incorporates both financial and operating performance measures that are used at all levels of the supply chains.

Performance metrics refer to measures that indicate the extent to which the mutual objectives have been accomplished. The specific performance measures that indicate the overall chain performance can be customer satisfaction, supply chain response time, supply chain total costs, total inventory, and assets utilisation. Responsiveness, for example, relates to the adaptability of the supply chain as a whole to meet emergent customer needs. Assets can be measured as cash-to-cash cycle time, inventory days of supply, and changes in both the average volume of inventory held and frequency of inventory turns across the supply chain over time. These global performance measures are translated into secondary measures for each of the individual members. They then regularly collect, display, transfer, and analyse to determine how well their individual performance, such as on-time deliveries, affects the overall global performance metrics [45].

One way to communicate the appropriate performance system is by using a performance map in a chain of cause and effect logic that describes how individual operations become transformed into financial and customer outcomes (see Figure 2). The map defines specific reasonable linkages of mutual objectives,

the global measures, individual measures, and customer requirements. The map is also useful in assisting the chain members to assess actual performance so that members can identify and eliminate causes of operational problems within the supply chain that impair customer services. The assessment of performance can be undertaken at several levels: at the level of the supply chain as a whole, at the level of individual member, and at the level of functional divisions or activities. In essence what is required is a timely and accurate assessment of overall chain and individual performance consisting of a comparison of desired customer service outcomes with actual outcomes, an assessment of any divergences, and proposals for future courses of action. The results of performance assessment can also be used as bases for incentives.

Place Figure 2 about here

Facilitating performance means developing an adequate performance information sharing system and resource allocation. A performance information sharing system provides dynamic communication to monitor and control from time to time how actual performance compares with desired performance. A web-based performance system, for example, displays real time track records of stocking levels at different locations that can be used to trace and solve delivery problems. A final aspect of performance facilitation is to provide adequate resources for employees to accomplish their work. These tasks require a variety of modes of planned communication such as e-mail, voice mail, internet, video conferencing, and perhaps most importantly, periodic face-to-face communication.

To encourage consistent performance, chain members need to provide a sufficient number of incentives that participating chain members really value. Since different chain members have different needs for enforcement, incentives should be tailored so that chain members can choose from a menu of equitable-valued options. Delivery of incentives needs to be in a timely manner, soon after major accomplishments. The incentive loses its potential to motivate successive

high performance if there is a long delay between effective performance and receipt of incentive. The incentive should also be fair. The chain members can engage in an open book contract about costs and benefits to determine the equitableness of revenue sharing [46].

To intensify a performance system means to regularly compare and modify performance measures to suit emerging competitive imperatives. This may involve a third party who can provide updated information as well as criticise the current measures. For example, the chain members may appoint external auditors to conduct customer satisfaction surveys or evaluate sales performance. They may also engage in logistics benchmarking to compare the results of internal logistics performance with other competitive supply chains in a wide variety of industries.

Integrated Policies

Changing outdated policies is a way to remove the local policies that prevent the chain members from attaining overall profitability. Since the functions of the chain members are interdependent, integration of policies must be achieved along the chain operations. The chain members can jointly identify outdated policies which need to be changed and how to compensate for making the changes. Outdated policies exist at different management levels such as strategic and tactical planning. Different levels of horizon planning require different approaches to updating policies. At the strategic level, the top management of chain members is responsible for broad policy making, long-range planning, and resource guidance. They can jointly resolve the conflicting issues which may arise from the creation of the competitive advantage that guides collaborative activities. For example, if a particular product mix is decided upon to serve a market segment potential, then concomitantly the quality, price, and stock quantity must fit the predetermined policy. If any one of the chain policies is changed significantly, then the other policies must also be changed accordingly. At the tactical level, procedural guidelines such as collaborative plans can be developed to reconcile conflicting decision criteria or individual objectives. Irrespective of their forms, all policies serve the primary purpose of aligning chain member behaviour with overall profitability.

The structure of integrated policies provides guidelines for carrying out action in a fully developed framework for the planning and implementation of logistics excellence at distributed processes among chain members (see Figure 3). There are three levels of integrated policies: major, secondary, and operational. A major policy aims to ensure the continued viability of the chain members. It determines the statement of priority of competitive advantage such as target market segments and positioning. Target market segments identify dimensions used to segment the market, the segments, and the customer service needs of each segment. Positioning attempts to differentiate products/services from others in the eyes of customers in terms of costs and product features.

Place Figure 3 about here

Secondary policies derived from major policies aim to align customer expectations with logistics capabilities, including various strategies of leveraging value over cost. A primary task includes the utilisation and management of scarce resources and the interpretation of major policies that competitive advantage must fit to logistics capability. Strategies that can be used to leverage value over cost include standardisation, customisation, postponement, accurate forecasting, capacity planning, demand planning, and lead-time planning. Secondary policies are action oriented and aim to ensure that the individual objectives used as criteria to evaluate decisions are aligned with the overall chain profitability. These can be guided through information sharing of performance status, application of Activity Based Costing (ABC), and priority setting of improvement.

Operational policies are procedures and rules for activities that are detailed or technical in nature. The responsibilities assigned to operational function include the control of routine and technical tasks. Decisions must be made on order quantity and review, inventory control, terms of payment, facility, production schedule, delivery schedule, transportation, and manpower assignments. The concern of management at the operational level is to execute medium-term plans in order to deliver products and services at the least overall costs. A primary

means of control commonly uses performance standards and incentive alignment. For instance, removing a policy of minimum order quantity and allowing smaller order quantity according to the actual customer consumption patterns can minimise demand amplification [47]. The manufacturer can consolidate smaller order quantities from different retailers and use third party carriers. Moreover, introducing a new pricing policy, such as an everyday low price, provides the ability to preclude opportunistic behaviour such as forward buying and diverting [48].

Information Sharing

The chain members share the information in both forward and backward flows that provide adequate visibility across both internal functions and organisations. The data which are most often shared include the availability of resources (e.g., capacity, inventory, funds, and capability), the status of performance (e.g., time, quality, costs, and flexibility), the status of processes (e.g., forecasting, ordering, delivering, replenishing, and servicing), and the status of contract. The advancement of information technology such as the internet enables those data to be gathered and transferred either in real time or on demand. For example, web-based information sharing is able to provide a central database that glues together all activities and resources along the supply chain from raw material procurements to customer service.

A global scope of supply chain visibility is the key to improving system performance. Based on relevant and accurate data, the chain members can consider both external and internal factors to make good decisions that directly relate to sales generation to end customers. For example, the retailer is able to place an order on time with optimum quantity to meet unexpected demand by considering inventory data at the upstream sites, transportation costs, and delivery lead-times. Using accurate and timely data makes it easier to filter out the noise from explanatory variables using decision support systems. In doing so, the chain members are able to extract knowledge from shared data, and that knowledge can then be used to design and conduct better operations that are robust in performance.

Generally, information sharing provides substantial benefits to participating members (see Table 2 for exhaustive lists of concomitant benefits). At the strategic level, information sharing of business objectives enables individual managers to achieve mutual understanding of competitive advantage and the system-wide supply chain as a starting point of collaboration [49]. At the tactical level, the information integration helps the chain members to mitigate demand uncertainty and cope with decision-making complexity at different levels of planning horizon and in different organisations [50]. Finally, information sharing is also useful when coping with the relational vulnerability of opportunistic behaviour - including adverse selection and moral hazard.

Place Table 2 about here

Incentive Alignment

One of the most essential features for the success of a collaborative supply chain is a high level of commitment by the participating chain members. They should also give a degree of priority to the collaboration in their resource allocation. However, how to induce participating members to increase both customer and shareholder values is a long-standing difficulty. Incentive alignment aims to provide a mechanism for realignment of the benefits and burdens that are incurred when process changes occur within the supply chain.

There are three types of incentive alignments that can be used to motivate different chain members to align their behaviour with the overall chain goal. Those types of incentives arise from the need to personalise or internalise responsibility for the attainment of desired overall profitability. First, incentive alignment can be designed based on productive behaviour [51]. This means rewarding the steps of observable actions that lead to a specific mutual objective, rather than the attainment of the objective itself. Rewarding the partners for steps rather than end results will allow them to improve their performance and also serve to motivate them, since it recognises them not just for their performance but

also for their effort. Consistent incentives to progress toward the mutual objective focus the attention and efforts of the chain members on joint problem solving. For example, if the mutual objective of the retailer and the supplier is to increase sales, the retailer who commits to holding extra stocks for minimising out of stocks during seasonal fluctuations should be rewarded.

There are two basic processes to introduce behaviour-based incentive: design and delivery. First, the participating members need to agree with the strategic objectives and how to motivate the partners to achieve each of these objectives. The schemes include determining which types of activities that need to be measured to improve the objective attainment. Identifying these activities and their associated rewards is useful in giving immediate recognition to the partner's efforts. They also plan how much they can afford to spend on incentives and how incentive programs will benefit their mutual efforts financially. Second, they need to deliver the incentive schemes and provide a communicator so that the chain members can view their scorecard on line. This communicator helps to keep track of the partners' efforts. For example, if the objective is to provide high customer service, one way of achieving this could be through information sharing. The retailers can motivate their suppliers to become involved in quick response by sharing point of sales data, and in return, the suppliers can share their delivery schedules. Furthermore, the retailer regularly notifies the sales performance of suppliers' important products and keeps records of the suppliers' delivery performances. The suppliers can keep track of their points by accessing their scorecard on line. The retailer can translate these points into monetary rewards or penalties that will pass to the suppliers at the end of a specific pay period. Both parties commit themselves to maintaining high customer service with low inventory costs under this arrangement.

Second, there is pay-for-performance - which means setting performance metrics to evaluate the partners and rewarding them based on outcomes of the most important activities. Pay-for-performance allows the participating parties to recognise each other for a job well done, to motivate desired performance, and to control costs. Activity Based Costing (ABC) can be used to trace which partners should receive benefits or bear burdens and pay-for-performance can be used to

allow a fair compensation. Narus and Anderson [52] report two examples of incentives based on pay-for-performance: fee-for-service arrangements and functional allowances. Both types reflect the partners' actual costs and provide dependable revenues. Moreover, a focal member can develop and offer a menu of incentive schemes to be selected by the other members in sharing joint savings or making side payments. For example, quick response provides the retailers with reduced inventory due to better forecast and shorter lead-time. The suppliers do not enjoy a similar gain, but suffer from carrying extra inventory. To compensate with fair benefits, the retailers can offer an incentive menu such as high service level, guaranteed purchase volume, and lower wholesale price. Similarly, some retailers have started to apply lead-time dependent payments to provide incentives to their suppliers to achieve just-in-time delivery [53].

The third type of incentive alignment is equitable compensation. The participating parties jointly agree on a single set of performance measures and on a gain sharing formula universally perceived as equitable. They carry out open book practice that consists of both the overall costs and benefits and the individual costs and benefits. They share risks and fairly assess the actual performance in determining the fair distribution of gains. For example, retailers and manufacturers can develop parallel sets of T-accounts, one for themselves and one for their partners [54]. The T-accounts consist of two columns, one column lists all the investments the firms will have to make and the other lists all the gains they expect. Based on open book practice, the participating parties can cover operating costs and ensure a fair return on their investments.

Practical Implications

There are three implications for practitioners drawn from this study. A collaborative supply chain does not deal only with how the chain members share responsibilities and capture benefits from improved overall profitability, but also with managerial inertia. Since the chain members have familiarised themselves with a local perspective that enables them to optimise their individual objectives instead of the overall profitability, the collaborative supply chain described above can be useful in identifying and removing the managerial inertia that inhibits

them from attaining better chain performance. By removing the managerial inertia, they simultaneously solve the problems of lower productivity caused by supply chain conflict and poor supply chain design.

The second implication relates to who should initiate the changes. Logistics management literature suggests that the channel champion with market power to influence the logistics decisions of others can lead the changes [55]. Instead of shifting responsibilities and inventory burdens to the other partners, the collaborative supply chain offers mutual efforts to resolve the managerial inertia so the members can focus on creating values to end customers that enhance the total profit without jeopardising their individual survival.

Finally, implementing and maintaining a collaborative supply chain often means being confronted with resistance to change. Collaboration with multiple partners means that there is a need to identify and overcome sources of resistance to change. Resistance to change has been known to impede the success of logistics collaboration [56]. The collaborative supply chain can be used as a framework to identify several sources of the managerial inertia that contribute to resistance to change. Furthermore, by viewing resistance to change in different layers, Dettmer [57] contends that the participating members need to mutually understand core problems, proposed solutions, negative consequences, obstacles, real supports from partners, and fears. Based on these layers, they can focus on ongoing improvement that has a direct impact on chain performance.

Concluding Remarks

Supply chain management has been known as a collaborative strategy that attempts to deliver values to end customers. However, it is possible for some chain members to take advantage in opportunistic ways from trade deals at the expense of other members. This paper identifies that managerial inertia is responsible for supply chain conflict. The managerial inertia manifested in local perspective and opportunistic behaviour results in unnecessary costs and a poor customer service. The sources of managerial inertia include inappropriate measures of performance, outdated policies, asymmetric information, and incentive misalignment. This paper argues that resolving managerial inertia should be carried out in the

interests of the participants. The main idea is building a collaborative supply chain aimed at eliminating the sources of managerial inertia that prevents the chain members from expanding and capturing optimal profit from delivering values to end customers.

A collaborative supply chain develops joint initiatives to ensure that each partner has a stake in success. It is proposed that the chain members should simultaneously consider appropriate performance measures, integrated policies, information sharing, and incentive alignment. The initiatives of appropriate performance measures and integrated policies address *orientation issues* and the initiatives of information sharing and incentive alignment address *enabling issues*. If orientation and enabling issues are aligned across the chain members, then potential benefits can be reaped successfully from an effective collaboration. This paper provides insights which enable both practitioners and academicians to understand how the chain members should structure information sharing and incentive schemes in order to attain overall profitability.

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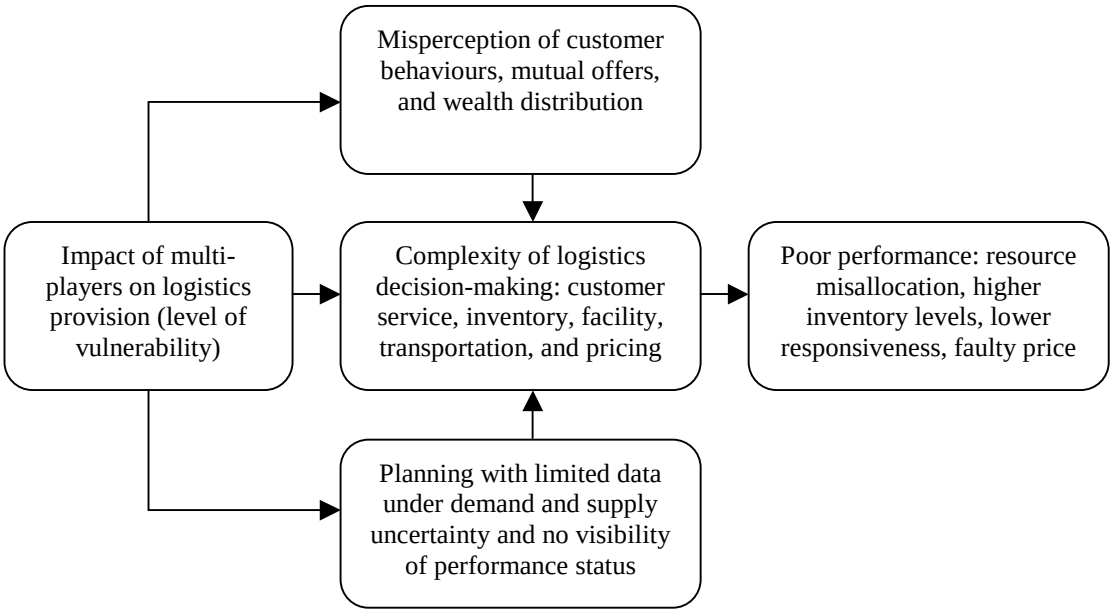

Figure 1. Different sources of asymmetric information contributing to poor chain performance

Table 1. Means of interventions for effective collaborative supply chains

No.	Means of interventions	Horizon Impact		
		Short Term	Medium Term	Long Term
1.	Mutual objectives	Coping with both usual and unusual demands for products/services.	Coping with growing demands for broader market offerings.	Coping with growing demands for superior service capabilities.
2.	Integrated policies	Matching demand and logistics capability	Matching product design and logistics capability	Matching superior service and logistics capability
3.	Appropriate performance measures	Increased planning capability, improved customer service, shorter order cycles, reliable delivery, assets utilised, reduced inventory, cash flow increase	Increased product variety, effective product life cycles, time to market, reduced overhead cost, flexibility increase	Increased market share, increased human resource capability, increased customer service, reduced overhead costs
4.	Decision domain	Customer service requirements, forecasting, inventory, ordering, transportation, replenishment, promotion, pricing	Market segmentation, product development, logistics capability	Business objectives, marketing strategy, capability planning
5.	Information sharing	POS data, the availability of products/services, delivery schedule, promotion schedule, performance status	Customer data, product life cycle plans, costs related data, performance status.	Market data, the availability of capabilities, costs related data, performance status
6.	Incentive alignment	Productive behaviour-based incentives and pay-for-performance	Equitable compensation	Equitable compensation

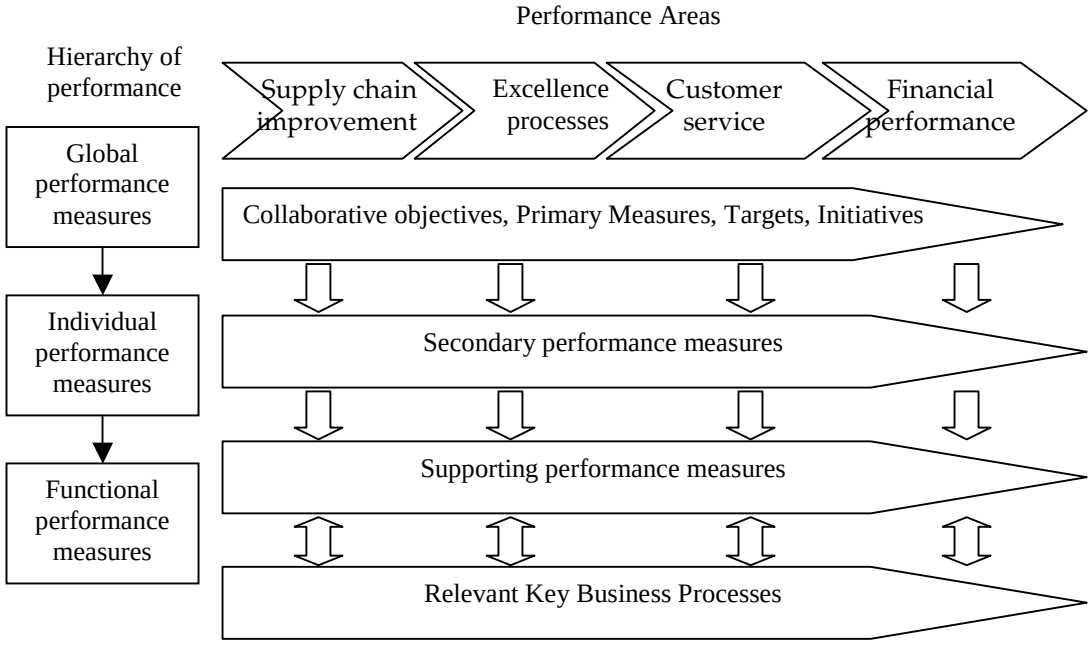

Figure 2. Appropriate supply chain performance measures

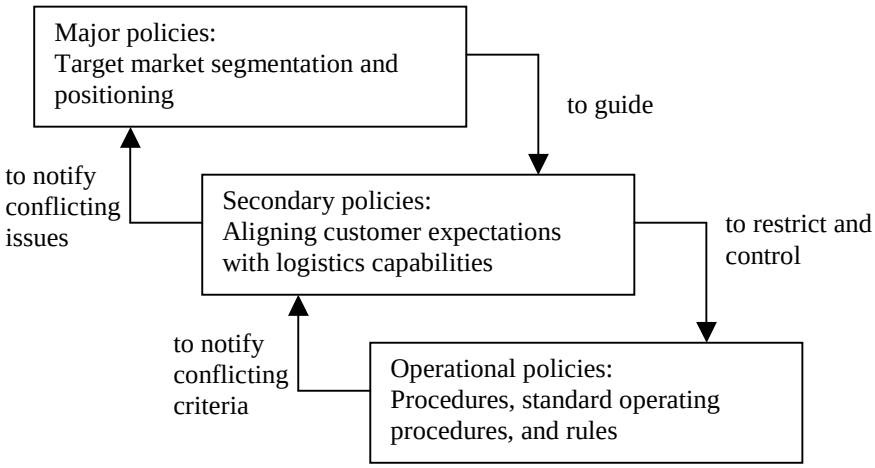

Figure 3. The structure of integrated policies

Table 2. Benefits of information sharing in supply chains

No.	Challenges	Opportunities	Illustrative benefits
1.	Coping with misperception or ambiguity of collaborative supply chain initiatives.	Achieving mutual understanding of customer behaviour and system-wide supply chain.	Improved consensus on mutual competitive advantages on customer and shareholder values, system-wide performance measures, integrated policies, and shared responsibilities.
2.	Coping with demand uncertainty	Sharing customer data at points of purchase, buying patterns, and customers' tastes to improve forecast accuracy.	Improved forecast accuracy, reduced mark-down, reduced inventory and out of stock, increased responsiveness.
3.	Coping with logistics decision-making complexity	Synchronising logistics decision horizon for forward-looking planning.	Improved customer service; improved capacity utilisation; improved rates for procurement and transportation contracts; reduced inventories.
		Consolidating multi-party logistics processes in the short and medium term such as matching of price and resource availability (yield management) and matching of shippers and carriers.	Improved customer service, improved use of resources (capacity, employees, inventory), reduced total inventory, increased responsiveness, reduced material handling.
		Integrating functional scope such as product development, logistics, and marketing.	Reduced time to market, improved product life cycle management, increased reliability of available to promise.
4.	Dealing with vulnerability of opportunistic behaviour to protect individual interest	Dealing with adverse selection: improved truthful information sharing (signalling) and matching of capabilities and requirements (e.g., auction) in ensuring excellent performance.	Reduced risk of underperformance, improved customer service, increased use of resources, reduced transaction costs, improved data confidentiality.
		Dealing with moral hazard: improved performance monitoring, improved resource commitment, and mitigating manipulation.	Improved customer service, reduced monitoring costs, improved data accuracy, reduced inventory speculation, improved data confidentiality.