

Inter-organizational Information Systems (IOIS) and Cybermediaries for Agriculture and Food Supply Chain

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Abstract Competition in supply chain has moved from between being organizations to between supply chain. To enhance competitiveness in supply chain, there is a need for organisations to establish and manage collaborative relationships among supply chain partners and share operational and strategic information timely and accurately. As a result, food supply chain partners have adopted of inter organisational information systems (IOIS) such as EDI, IEDI, RFID, internet, and extranets to facilitate exchange of information, streamline production and to effectively manage inventory processes so as to deliver value to the customer. Together with IOIS, cybermediaries also plays a key role in facilitating agriculture and food supply chain. This paper investigates the role and significance of IOIS and cybermediaries in facilitating agriculture and food supply chain. Convergent interviewing was conducted with agriculture producers, food processors and retailers. The study identified logistics, supply chain and customer services benefits perceived from implementing IOIS and utilising cybermediaries services in the food supply chain. To conclude the conceptual paper outlined managerial implications and areas for future research.

Keywords Inter-organizational information systems, Cybermediaries. Agriculture and food supply chain, Retailer, Convergent interviewing

1 Introduction

As competition has moved from being between organisation to across supply chain, timely and accurate sharing of information and data across supply chain partners is considered key for the success of business. To enhance competitiveness, supply chain partners are required to establish trust, commitment and collaboration within value adding supply chain. Such supply chain consists of interdependent channel members that directly or indirectly interacts and collaborate to achieve mutual benefits (Lambert and Cooper 2000). Advancement in information systems altered the global supply chain processes significantly and simplified the interactions. Inter-organizational information systems (IOIS) such as Electronic Data Interchange (EDI) and Radio Frequency Identification (RFID) facilitate supply chain processes and improve efficiency and effectiveness of supply chain. According to Lancioni et al. (2003), by enabling real time and accurate communications among the supply chain participants, IOIS enabled networks can facilitate collaborated forecasting and reduce costs associated with the perishable inventory. Thus, IOIS enables supply chain to decrease friction within the chain, facilitate timeliness of delivery and improve supply chain responsiveness (Boyle et al. 1999; Baourakis and Kourgiantakis, 2002).

The increasing importance of IOIS for supply chain management has been attracting considerable attention across industries. IOIS system has been used since 1970 to link organisations to their upstream and downstream supply chain partners (Archer and Yuan, 2000). However, IOIS usage and adoption differ across type of organizations and industry. Specifically, financial and resource constraints often hinder small and medium sized enterprises to adopt sophisticated information technologies and affect their ability to collaborate with supply chain partners. Though IOIS has the capability of facilitating the delivery of perishable agriculture products to downstream supply chain partners, majority of agricultural firms found difficulties in adopting information technologies due to the location difficulties and

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resource constraints. Research indicates the need for virtual supply chain facilitator to transact information across supply chain partners. As a type of virtual information broker, cybermediaries can play important role in managing IOIS and facilitating linkages between supply chain partners, government agencies, industry associations and third part logistic providers (Bailey and Bakos, 1997). For instance, cybermediaries are performing public roles and assisting legal and regulatory bodies in providing institutional support for electronic markets (Giagilis et al.1999). However, the role and performance of cybermediaries in facilitating agriculture and food supply chain is not clear. In addition, the quality of information shared through the cybermediaries and the security of data transferred are dubious. Thus, the studies aimed at investigate the role and significance of IOIS and cybermediaries in facilitating agriculture and food supply chain. Also, the study investigates the quality and security of information shared through cybermediaries.

and importance for each quality attribute are independent from each other and performance for each attribute and overall satisfaction are in symmetric relations. Thus, it is necessary to consider the asymmetric structure of each quality attributes as well as to combine with IPA as a tool

2 Literature Review

2.1 IOIS for Supply Chain Management

Supply chain management has undergone tremendous changes over the past decade. In 1950s and 1960s, manufacturers put emphasis on mass production to minimise unit cost, with little product and process flexibility (Tan 2001). Institutions believed that sharing of information and expertise with upstream and downstream supply chain partners was too risky and unacceptable and little attention was paid to cooperative and strategic buyer-supplier partnerships. In the 1980s, rapid changes in competition required organisations to offer low cost, high quality products with greater design flexibility, which urge the organisations to utilise the supply chain concepts and techniques such as; logistics management, just-in-time delivery and inventory management techniques (Tan 2001). Such supply chain techniques required frequent and accurate sharing of information and data among supply chain members, which resulted in the need for better information sharing techniques (Tan 2001). IOIS is globally being accepted as a platform for sharing strategic information across supply chain partners (Humphreys 2001).

Organisations rely on IOIS for sharing operational and strategic information such as; purchase order, invoices, inventory and scheduling details and order status. Williamson et al. (2004) categorised IOIS development into four phases

in terms of its usage in supply chain and the type of IOIS used. During the first phase of development, information and documents were shared as paper copies and by using telecommunication technologies such as faxes. Though this method is effective, not used by organisations due the requirements of high cost, time and labour. The introduction of Electronic Data Interchange (EDI) is viewed as the second stage in the development of IOIS and it has dramatically influenced information flow and eliminated intensive laborious processes within supply and netchain. Golden and Powell (1997) argue that EDI limits the flexibility of supply and netchain due to its requirement for specific software, EDI standards and technical expertise. The third phase of IOIS development is the integrated phase in which EDI is coupled with Effective Resource Planning (ERP) systems for the purpose of facilitating the automated sharing of information and data across supply chain partners. In the fourth phase, information resources are integrated with web development technologies such as XML and Java. The introduction of Radio Frequency Identification (RFID) technology is the next stage of IOIS development (Prater and Frazier 2005). The successful implementation and use of IOIS require compatible hardware and software protocols and technical expertise, which require supply and netchain partner to utilise cybermediaries to coordinate supply chain activities and to build supply chain capabilities.

2.2 IOIS and Food Supply Chain

Supply chain concept was first successfully used in the car industry and it then spread to other industries. Historically, the agriculture and food industry has lagged behind the other industries in its approach to supply chain management (Fearne and Hughes 2000). However, the past decade has witnessed a surge in the globalisation of food supply chain facilitated by successive trade liberalisation and improvements in the transaction infrastructure (Hill and Scudder 2002). The agriculture and food industry is slow to emulate the success of the motor industry supply chain and it is only in recent years the supply chain concept is popular among food manufacturers and suppliers (Hill and Scudder 2002). However, the use of IOIS and supply chain concepts are at primitive stage with the primary agriculture producers. Lack of financial and technical resources hinder the small and medium sized primary agriculture producers to use sophisticated IOIS (Rajaguru and Matanda, 2011). Supporting this, Ingwesen (2000) state that electronic commerce is still in its infancy in the food sector as the lack of trust between the trading partners has made the implementation of IOIS in supply chain more difficult. Baourakis and Kourgiantakis (2003) suggest that IOIS could soon revolutionise the vast food supply chain by linking primary agriculture growers to retailers, processors and other intermediaries. The large

volume, diversified product varieties, seasonality, perishability of the products and the competitive nature of the food industry make the food supply chain a prime candidate for the implementation of performance enhancing technologies such as IOIS (Hill 2000).

Further, changing consumer needs and the growing power of retailers drive changes in the food industry (Fynes and Ainamo 1998; Rademakers and McKnight 1998). To meet the volatile demand and needs of consumers, and other downstream supply chain partners, primary agriculture producers are structuring information systems supported supply chain systems. Food supply chain partners are pushing for the rationalisation of the supply chain in to achieve supply chain integrity, product quality consistency, cost reduction and efficiency (Fearne and Hughes 2000). For example; the U.K beef industry has maximised the use of IOIS in promoting information sharing and traceability in the beef supply chain. U.K consumers are quality conscious and are ready to pay more for products with guaranteed quality and traceability (Fearne 1998). To gain a competitive edge in these markets supply chain members are forced to develop more efficient and responsive supply chain. Tracesafe, a cooperative beef producer used computer controlled birth card system to provide consumers with details of the beef parentage, medication administered and nutrient status. Likewise, based on the changing consumer preferences downstream chain members can inform the upstream members of necessary changes that need to be undertake on the quality and quantity of the beef production. Tracesafe processes are felt to be a time and labour consuming process and to fulfil their demands chain members need better IOIS that can help them to meet the demands of other chain members and consumers.

2.3 EDI and the Food Supply Chain

According to Elgarah et al. (2005), the most common form of technology to support data exchange between business partners is Electronic Data Interchange. EDI is an electronic platform that facilitates transfer of business documents between or within firms (including their agents or intermediaries) in a structured, machine retrievable form with minimum human interactions (Hansen and Hill, 1989). EDI improve logistics and supply chain performance by facilitating information and document sharing between the supply chain partners (Power 2005). According to Hill and Scudder (2002), EDI facilitates supply chain integration by frequent and automatic transformation of information and by improving coordination within the supply chain. In particular, EDI facilitates the traceability of food products by enabling the supply chain partners to collaborate and communicate each other through integrated computer linked information systems. Such information systems further

help supply chain partners to plan their operations more effectively (Mc Kinnon 1992).

According to Delforce et al. (2005), EDI improve the efficiency of food retailers by allowing them to optimise stockholdings and keep high turnover stock continuously on their supermarket shelves. The perishable nature of food products forces food retailers to have frequent order, stock check out and delivery, which require time and labour. EDI can perform checkout and order the products automatically and thus reducing the inventory and labour requirements. EDI facilitates manufacturers to procure raw materials and to receive invoices from retailer. According to Lee et al. (1999), EDI benefits the supply and net chain participants by reducing processing cost, improving operational efficiency and customer satisfaction and facilitating coordination, cooperation, and commitment between EDI.

2.4 RFID and Food Supply Chain

Radio frequency identification technology (RFID) is a wireless technology that identifies objects without having either contact or sight of them (Angeles 2005). RFID tags follow the products from the point of production to till the product reach the consumer. RFID technology significantly increases the effectiveness of tracking materials along the supply chain and substantially reduces thefts. By reading the tags, consumers can identify the quality and transaction history of the products. RFID technology is becoming popular among the grocery retailers. According to Prater et al. (2005) each products should have their own identity to recognize them easily in the supply and netchain processes. RFID facilitates such traceability by providing information such as, when and where the product was made, where its components came from, and when they might perish. Therefore, RFID also viewed as a way to ensure that primary producers and processors take control and responsibility for the product as it moves from the paddock to plate. In food retailing, RFID reduces inventory and labour by automatic stockout and ordering process (Prater et al. 2005).. According to Angeles (2005), instead of using RFID alone, using in conjunction with EDI/IEDI, RFID improve supply and netchain performance effectively.

2.5 Cybermediaries and Food Supply Chain

Prior research indicates that IOIS have failed to deliver real value to most organisations as ownership of proprietary electronic technology can be too high for most organisations. This issue is compounded in the food retailing sector where most of channel supply chain and netchain participants are small food manufactures and producers in remote geographic locations. To facilitate the benefits realised from IOIS, linking agents and carriers (cybermediaries) can be

used and this would enable supply chain partners to concentrate on their core businesses. Cybermediaries are organizations that operate in electronic markets to facilitate exchanges between producers and consumers by meeting the needs of both producers and consumers (Sarkar et al. 1996). Cybermediaries as a type of virtual information broker that can play an important role in implementing and managing IOIS as they can facilitate linkages between chain partners, government agencies, industry associations and third party logistic providers (Bailey and Bakos, 1997). Electronic intermediaries can perform functions such as aggregating, trust building, matching and facilitating (Sarkar et al, 1996; McIover and Humphreys, 2004)

According to Althoff and Peterson (2004), it is important to integrate all supply chain members with proper information system so as to improve the performance of industry. It is difficult to develop and use a common information system model that suits all supply chain members and facilitate standardised information exchange (Hofstede 2004). Internet based information systems can better satisfy the needs of supply chain members. According to Hofstede et al. (2000), food industry supply chain are not straight forward and to a large extent non linear. Due to the complexity of food supply chain, it is difficult to integrate all the chain members using value added network based EDI. It is imperative to use cybermediaries services to facilitate the integration process in supply chain. Cybermediaries can perform routine business transaction function and value added services. However, the performance and expected benefits perceived from cybermediaries expected to differ based on the industry and the type supply chain members. Thus the study aimed at investigating the role and significance of cybermediaries in facilitating agriculture and food supply chain.

3 IOIS/Cybermediaries Cases in Agriculture and Food Industry

3.1 Case1: Efdex: Electronic Food & Drink Exchange

Efdex is a global company founded in 1995 headquarters in Connecticut, USA. The main objective of Efdex is to bring together and connect previously unknown buyers and sellers in the food and beverage industry. Efdex system provides an independent platform for buyers and sellers on which they can facilitate their existing trading relationships and expand their respective business opportunities.

Using Efdex system sellers gained benefits by identifying new business partners and distribution channels. Sellers gained opportunity to deal with the entire food and beverage industry instead of only dealing with small segment of the market. The Efdex system also provides an opportunity

for sellers to expand the customer base and reduce transaction and administration costs. The system also allows sellers to save even more by enabling them to perform better target marketing by having an access to vital information about the buyers (like credit reports and buying histories). On the other side Efdex services help buyers to find better prices in the food and beverage industry, while reducing transaction costs. Buyers gained access to accurate and timely information about upstream supply chain partners, pricing and promotions.

3.2 Case 2: Pefa.com: Pan European Fish Auction

Pefa.com is a largest online auction platform and act as a cybermediary to facilitate fresh fish marketing in Europe. Pefa started its operation in 1998 in Zeebrugge, Belgium with a strategy of matching northern European fresh fish supply with southern Europe demand. Currently thirteen associated auctions in Sweden, Denmark, the Netherlands, Belgium and Italy enjoy the opportunity of accessing a larger market through Pefa's online auction system. The concept of pefa.com is to link together buyers and sellers by creating a virtual online auction marketplace for fish across Europe that can be equally accessible to all market participants alike. With this concept the sellers (fishermen) gain access to a wider market and get better prices. Similarly remote buyers gain opportunity to access supplies as like local buyers physically present at the auction.

The central database in pefa.com system provides extensive information about fish like time of catch, location and fishing method used. Also the buyers and suppliers are provided with the information like statistical data on price development and supply fluctuations. Pefa.com system also allows buyers to track numerous markets at the same time and the buyers are also able to switch between auctions in the matter of seconds. To ensure quality and reduce transportation costs pefa.com encourages the local processing of fish. For this purpose the buyers are also provided with the information of local processors (Collins and Bechler 2002).

4 Methods

The study followed exploratory research approach to identify the role of IOIS and cybermediaries for agriculture and food supply chain. Data was collected through the convergent interviewing technique. Minett (2002) recommend exploratory research to understand the factors that stay beneath the business-to-business marketing situations, as it observes the unique properties of business-to-business conditions and explains supply chain and business problems. According to Rao and Perry (2003) the convergent interviewing technique is more suitable for exploring business-

to-business oriented marketing problems, finding relationships between variables and developing propositions. The flexibility provided by convergent interviewing allows refinement of research issues throughout the course of interviews and consolidates the existing body of knowledge. Therefore, the research adopted the convergent interviewing technique.

In this study, interviews were conducted with the primary producers, processors and retailers of agriculture products. Purposive and snowball sampling techniques were used to select the respondents. Purposive sampling is suitable for convergent interviewing as it allows the researchers to select the respondents who are capable of providing the information needed for the research. In this study, purposive sampling technique was used to select the first respondent in each category and the other respondents were identified using snowball-sampling techniques. Stability and agreement among interviewees were achieved after conducting interviews with 15 primary producers, 6 food processors and 10 food retailers. To ensure stability and consistency of results, follow-up interviews were made with respondents using phone and e-mail.

The interview included questions about the types of IOIS being used, benefits perceived from IOIS and supply chain, reason for using cybermediaries services and the benefits achieved from cybermediaries services. As suggested by Alam (2005), a fieldwork database was created to assure the credibility of the reported data. The database included interview notes, tape recordings, web-site information, and information from other documents. Within-case analysis was performed. Cross-case analysis was undertaken to identify similarities and differences between the cases on IOIS benefits to food and agriculture supply chain and the role of cybermediaries.

5 Results and Discussion

5.1 Perceiver Benefits of IOIS and Cybermediaries to Supply Chain

The results indicate differences in the perception of IOIS and its benefits to supply chain across agriculture and food supply chain partners (Table 1). Similarly, the usage and perceived benefits from cybermediaries differ across primary producers, food processors and retailers. Respondents participated in the study indicated cybermediaries benefits to supply chain in the dimensions of aggregating, matching and facilitating transactions. As each supply chain partners requirements and expectations on IOIS and cybermediaries varies, it is imperative to choose appropriate IOIS tool to perceive better benefits. This observation concur with the research done by Salmon Associates (2003) in the consumer packaged goods (CPG) industry, which found manu-

facturers use RFID to achieve supply chain visibility and labour advance and CPG retailers use RFID for the purpose of avoiding stock-out and theft.

5.2 Primary Producer Perception of IOIS and Cybermediaries

Primary producers of agricultural products are considered to be the starting point of agriculture and food supply and chain. Majority of the respondents participated in the study haven't had experience with sophisticated IOIS. Small and medium sized producers participated in the study indicated financial and technological constraints in the use of IOIS technologies. However, few respondents avail the use of cybermediaries to facilitate their business transaction with the supply chain partners. They use cybermediaries services for receiving sales order and invoices, sharing product related information with downstream supply chain partners and for forecasting demand. Government offer cybermediaries services through agriculture departments and universities. Primary producers also receive such support from the agriculture co-operative agents and consultants. Based on the quality and sales order information received from downstream supply chain partners, primary producers transfer the raw materials to the processors with detailed record of information that includes parentage of the seeds, chemicals used and operations practiced. Thus primary producer enjoy the benefits of EDI and RFID through cybermediaries. Respondents indicated that cybermediaries facilitate their operational efficiency and strategic business collaboration with supply chain partners through sophisticated IOIS. However, large size producer have their own IOIS and that facilitate their information sharing and business transactions. For example, a large sized milk producer use RFID technology and keep update of his product movement to milk processor and retailing firms.

5.3 Food Processors Perception of IOIS and Cybermediaries

IOIS are salient for food and agriculture processors, as they required having routine business relationships and transactions with both upstream and downstream supply chain partners to achieve efficiency and effectiveness in supply chain. Majority of the respondents participated in the study have had internet based EDI and few respondents have had EDI and RFID systems. Food processors indicated that they utilise IOIS to send and receive purchase order and invoice to the suppliers, retailers and other supply chain intermediaries. Food processes C indicated that;

".....Changing consumers taste and preferences require us to maintain strategic relationships and share strategic demand related information with retailers, as the retailers are familiar with consumer preferences".

Growing consumer's consciousness about the food quality and safety encourage the food processors to provide detailed product information to retailers and consumers, which is facilitated by IOIS such as EDI and RFID. Highlighting the consumer conscious about the product quality Silva et al. (2004) indicate that, it is necessary for food processors to collect, store and exchange data and information on issues such as the type and variety of product, fertilisation history and their residual status to meet the quality and safety standards. RFID simplifies the recording of such information and transaction details by the automated entry process (Angeles 2005). Food processor A indicated that

"... RFID facilitates the traceability of the products in the supply chain and I can easily locate where the product is and I can assess quality of the product from my office".

Respondents indicated other supply chain benefits such as; improved collaboration and coordination with upstream and downstream partners, reduced inventory and order cycle time, Production planning and forecasting. Though food processes have had sophisticated IOIS, their dependence on cybermediaries are inevitable to maintain operational and strategic relationship with upward supply chain partners such as primary food producers.

5.4 Retailer perception of IOIS and Cybermediaries

Large sized retailers participated in the study have had sophisticated IOIS such as EDI and other retailers used internet based EDI technologies to communicate with upstream supply chain partners. Retailers utilise IOIS to transact purchase order and invoice, reduce inventory and order cycle time, improve responsiveness to consumer order and requests, improve product traceability and to achieve supply chain coordination. According to Retailer A

"... EDI and electronic transaction reduces the inventory cost through automatic ordering and product replenishment"

Respondents participated in the study indicated that point-of-sale (POS) information and the consumers demand information transferred effectively and efficiently to upward supply chain partners using IOIS. In addition, retailers used RFID systems to reduce shelf-stock inventory and offer more space to display the new products. As a captain of food supply chain, food retailers use RFID and IEDI to provide accurate and timely product related information to consumers and demand related information to other supply chain members. Retailer use IOIS to achieve product traceability and visibility in the supply chain. Thus retailers used IOIS to attract consumers and to increase their satisfaction. Major retailing chain such as Wal-Mart adopts RFID in their supermarket to improve logistics, just-in-time delivery

and traceability and to gain market share and profit. The performance of food supply chain depends on retailers' activities and their timely sharing of information with upward supply chain partners.

5.5 Cybermediaries, information quality and data security

Respondents participated in the study indicated their concern over the quality of information shared through IOIS and cybermediaries. In is interesting, though the primary producers use cybermediaries services frequently to communicate with food processors, their concern on information quality and data security is significantly low. On the other hand, food processors indicated their concern over the security of the information transferred through cybermediaries. Specifically, they concern the possibility of strategic information being reached their competitors, as cybemediaries are not part of their supply chain. Interestingly, respondents were satisfied with the timeliness and accuracy of information shared between supply chain partners through cybermediaries.

IOIS and Cybermediaries Benefits to Food Supply Chain Members

Table 1 IOIS and Cybermediaries Benefits to Food Supply Chain

IOIS/SC Members	Primary Producer	Processors	Retailers	References
EDI/ IEDI	<ul style="list-style-type: none"> •Receive purchase order and invoice from retailer and food processor •Receiving product demand data •Receiving price information •Sharing product quality related information •Assure product identification •Build collaboration and commitment 	<ul style="list-style-type: none"> •Transact purchase order and invoice with supplier and retailer •Improve flexibility and traceability in the supply chain •Improve collaboration and coordination with upstream and downstream members •Build trust and commitment •Reduce inventory and order cycle time by production scheduling. •Production planning as per the guidelines of downstream members 	<ul style="list-style-type: none"> •Transact purchase order and invoice •Improve customer responsibility and satisfaction •Improve supply chain flexibility •Reduce inventory and order cycle time •Improve coordination and collaboration with supply chain members •Transferring product demand information 	Angeles and Nath, 2001; Craighead et al., 2000; Kim et al., 2011.
Internet	<ul style="list-style-type: none"> •Receipt of orders •Product negotiation 	<ul style="list-style-type: none"> •Receive and send orders •Sharing of operational Information and data 	<ul style="list-style-type: none"> •Send and receive orders •Provide online vendor catalogs •Improve customer services 	Hart et al., (2001) Tanskanen et al., (2000)
RFID	<ul style="list-style-type: none"> •Track production details •Record product information 	<ul style="list-style-type: none"> •Maintain record of the products •Assure product identification •Improve traceability and visibility •Reduce warehouse inventory •Automation process 	<ul style="list-style-type: none"> •Assure product identification •Automated ordering process •Reduce theft •Facilitate reverse logistics 	Prater et al., (2005) Kärkkäinen. (2003) Jones et al., (2005)
Cybermediaries	<ul style="list-style-type: none"> •Sharing information and data on behalf of primary producers •Receiving purchase order and sending invoice •Receiving forecasting and pricing data through government supported cybermediaries •Facilitating collaboration 	<ul style="list-style-type: none"> •Communicate with upstream supply chain partner such as primary producers •Sharing strategic information with upstream and downstream supply chain partners •Facilitating business collaboration and matching 	<ul style="list-style-type: none"> •Routine business transaction with primary producers •Facilitating business collaboration and matching 	Giagilis et al., 1999 Sarkar et al., 1996

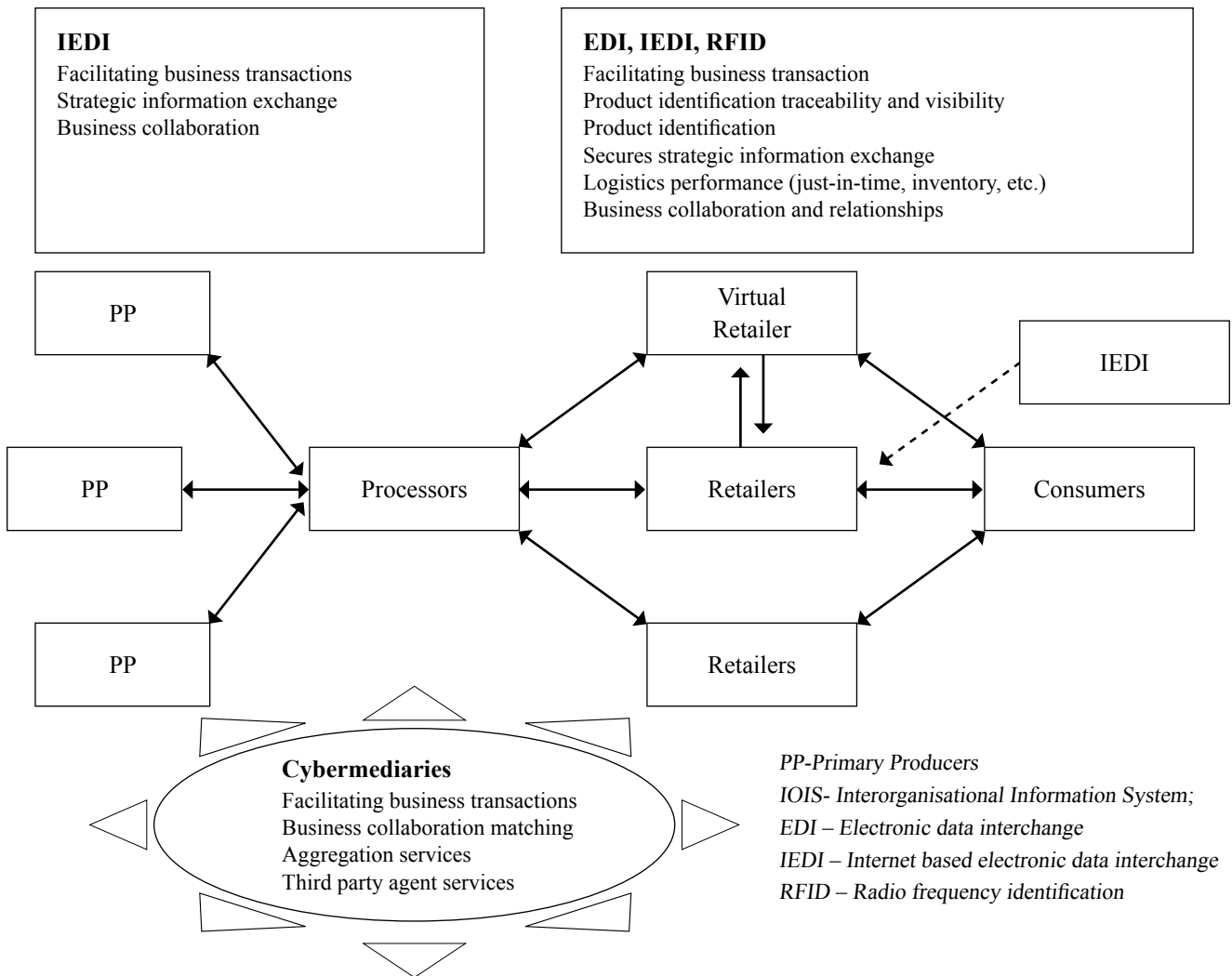


Fig. 1 Agriculture and Food Supply Chain

6 Managerial Implications and Areas for Future Research

The implementation and use of IOIS in supply chain is increasing rapidly across industries and nations. Supply chain participants are expected to manage IOIS as a strategic tool rather than operational tool to facilitate the value pie of all supply chain members. As IOIS are industry and organisation specific tool, food supply chain members should pay considerable attention to identify and select appropriate IOIS. The chosen IOIS for business purposes should be based on product characteristics as well as the participant's position in the supply chain and should be compatible with other supply chain partners IOIS. For instance, processors who requires to have constant contact with both upstream and downstream supply chain partners need to have both traditional and internet based EDI and RFID to achieve better supply chain benefits. For primary producers, the high

costs of proprietary EDI indicate that network based IEDI could be more appropriate. Given the complexity of supply chain and the need for communicating with several food processors and retailers simultaneously, primary producers are advised to use cybermediaries services. The use of IOIS brokers such as cybermediaries is seen as a more efficient and egalitarian way of utilising and managing IOIS, especially in the food sector where most players are too small or do not have the skills and resources to manage proprietary systems.

As consumers are becoming quality conscious, the requirement of identity preservation and traceability is getting attention among food retailers. IOIS is a promising technology to assure identity preservation and traceability. The growing importance of cost reduction, quality, traceability of the food products induce the retailers and supermarkets to adopt RFID technology.

Though, prior research indicates the benefits of utilising

IOIS in improving supply chain performance, limited attention has been paid to the impact of IOIS to individual chain participants. Future research could focus on the analysis of each IOIS effect at each stages of the food supply chain. Further, context specific empirical work is needed to investigate benefits of different IOIS to food supply chain participants. The role and importance of cybermediaries in the food supply chain needs to be investigated empirically. Though IOIS are believed to bypass intermediaries in the supply chain, the emergence of information brokers such as cybermediaries is inevitable. Future research need to investigate the effect of cybermediaries mediated IOIS effect on supply chain management.

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