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Deriving Value from Information Technology: Role of Concordance Investments

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ABSTRACT

The role of complementary investments in successful implementation of information technology is now widely accepted. However, for information technology implemented in collaborative arrangements such as supply chain partners, complementary investments may lead to successful implementation yet prove insufficient in creating the expected value. Our research in the implementation of Collaborative Planning, Forecasting and Replenishment (CPFR) systems finds a second set of investments, called concordance investments, is needed to derive the expected value of reduced forecast errors. Our preliminary results of two case studies provide evidence that without concordance investments, the benefits of IT investments to the partners are limited.

Keywords: Collaborative Planning, Forecasting and Replenishment, Supply Chain Management, Concordance Investments, Complementary Investments, Business Value of Information Technology

INTRODUCTION

Information Technology (IT) has played a decisive role in reducing inertia between partner transactions through the use of inter-organizational systems. Previous studies have shown that IT can reduce the cost of exchanging information about demand, product characteristics, and availability between partners without increasing risk (Clemons, Reddi and Row, 1993). Performance of such systems is dependent upon the firms' ability to coordinate their activities and to take advantage of shared information by acting upon it.

In this paper we present a framework for measuring IT's value in supporting coordination between supply chain partners. We propose that in examining collaborative arrangements such as the use of collaborative planning, forecasting and replenishment (CPFR) systems, organizations should go beyond the traditional measurement approach involving complementary investments and consider the impact of concordance investments. While complementary investments involve organizational and process changes targeted towards successful CPFR systems implementation, concordance investments involve mutual adjustment of inter-organizational processes and relationships for sustained collaborative success resulting from use of the system. We present preliminary results from two case studies where a pair of partners in each case attempted to exploit CPFR. One set of partners made complementary investments and another set made concordance investments in addition to complementary investments.

IT AND COORDINATION MECHANISMS

In a supply chain environment, coordination occurs when decisions are aligned to accomplish global system effectiveness. A previous study has identified four coordination modes in a supply chain – logistics synchronization, information sharing, incentive alignment, and collective learning (Simatupang, Wright, & Sridharan, 2002). Along the same lines, channel coordination resulting in operational efficiencies is known to improve overall supply chain performance (Lee, Padmanabhan, & Whang, 1997). However, failure to integrate and coordinate activities among partners can lead to stock outs and increase transaction costs.

In supply chains, coordination is achieved through information sharing, logistics coordination and organizational relationship linkage (Lee, 2000). Coordination theory provides a foundation for analyzing the trade-offs in selecting appropriate coordination mechanisms (Thompson, 1967). Thompson suggested that the type of interdependence determines the coordination level. He identified three types of interdependence - pooled, sequential, and reciprocal - and the appropriate coordination mechanisms as - coordination by standardization, plan, and mutual adjustment – respectively. A mismatch of the coordination type with the task can further increase the costs as well as risk of supply chain partners. [For a discussion of coordination of supply chain and relevant metrics see (Kohli & Sherer, 2004)].

IT alone is not sufficient to achieve coordination even if appropriately matched to the interdependence task; other resources must support IT investments in coordination. Previous research has highlighted the need to convert IT investment into proper assets which when put to appropriate use lead to a successful implementation and organizational payoff (Soh & Markus, 1995). This competency is referred to as ‘conversion effectiveness.’ Conversion effectiveness is the ability of the organization to successfully implement an information technology initiative (Lucas, 1999). Weill (1992) suggests that conversion effectiveness consists of four factors – top management commitment, previous experience with IT, user satisfaction with IT and turbulence of the political environment within the firm. Soh and Markus (1995) approached conversion effectiveness from a practical perspective as the ability of an organization to create the proper IT assets and appropriate use. A related idea in achieving conversion effectiveness is that firms must make complementary investments along with IT investment (see Figure 1). Types of complementary investments that add value are investments in communication mechanisms (Barua, Lee, & Whinston, 1996), redesigned organizational structures (Davern & Kauffman, 2000), and appropriate training and change management (Sherer, Kohli, & Baron, 2003).

We argue that previous definitions of conversion effectiveness only partially explain the role of all complementary investments in ensuring sustained organizational success and competitiveness. We introduce the concept of concordance investments in supply chains as one such set of resources. Derived from the word ‘harmony’, concordance investments imply post hoc investments. In Figure 1 we distinguish between complementary investments and concordance investments in supply chain environments. The goal of complementary investments is to insure that IT impacts result in implementation success and payoff, e.g. user training to ensure IT use, reward mechanism to encourage IT adoption, and organizational redesign to insure success through appropriate responsibility and accountability (Steps 1-3 of Figure 1). Many organizations may be content at this stage and accept the return-on-investment achieved thus far as sufficient.

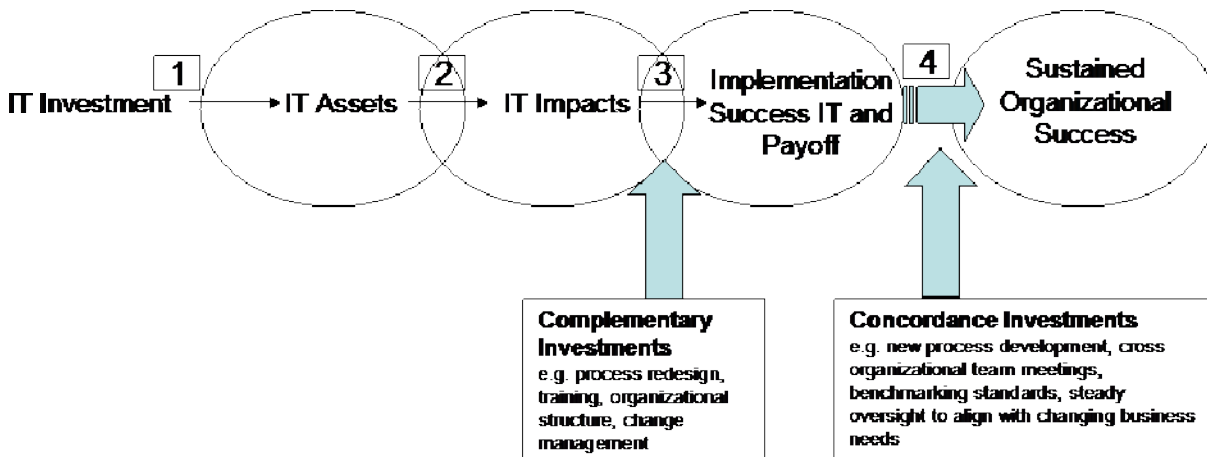


Figure 1: Complementary and Concordance investments in supply chain environments

We propose that concordance investments are made at Step 4 (Figure 1), beyond a point that some firms consider as successful conclusion of the IT implementation. Concordance investments are designed to exploit IT and unleash collaborative synergy between partners and the potential of integrated business processes. Concordance investments require steady oversight to realign IT and business processes to adapt to market needs. In interdependence parlance, concordance investments happen in reciprocal interdependence situations and require mutual adjustment as the coordination mechanism between partners.

COORDINATION WITH COLLABORATIVE PLANNING, FORECASTING AND REPLENISHMENT (CPFR) SYSTEMS

Accurate forecasting is fundamental to improving supply chain performance. Both retailers and manufacturers forecast in order to plan their requirements. Inaccurate forecasts from either retailers or manufacturers lead to increased inventory costs, backorders or loss of sales, and diminished customer goodwill. Recently suppliers and retailers have begun to share their forecasts and develop a single forecast that they both agree upon, an example of coordination by mutual adjustment. CPFR, Collaborative Planning, Forecasting, and Replenishment (CPFR) are IT based collaborative systems in which trading partners mutually agree on business objectives and measures and electronically collaborate to generate, review and update sales forecast and replenishment plans. Synchronization of a buyer’s order cycle with the supplier’s production cycle lowers inventories across the supply chain, and provides higher service levels of the right products in the right locations (Syncre Systems, 2000).

While sharing of demand and inventory information has been shown to reduce supply chain costs, there is little research on how collaborative forecasting impacts supply chain performance (McCarthy & Golicic, 2002). Anecdotal evidence suggests that collaborative forecasting is better. Aviv (2001) shows that there are some benefits from sharing forecasts for future demand, with value increased as diversification of forecasting capabilities increases. We summarize the three types of interdependence, their corresponding coordination, examples and metrics in Table 1.

Interdependence Type	Coordination Mechanism	Example	Coordination metric
Pooled	Standardization	Manufacturer Forecast	Manufacturer forecast error
Sequential	Plan	Retail Forecast provided to manufacturer	Retail forecast error
Reciprocal	Mutual Adjustment	Collaborative Forecast	Collaborative forecast error

Table 1. Coordination Mechanisms for Forecasting in the Supply Chain

CPFR CASE STUDIES AND PRELIMINARY RESULTS

CPFR systems allow both manufacturers and retailers to input their individual forecasts. The system then graphically displays the data and flags exceptions. In order for CPFR systems to support forecasting efforts, complementary investments must be made to support the processes that provide input to the joint forecasting systems. However, the extent of benefit from CPFR systems requires additional investments beyond the use of the system to analyze the data. These investments depend upon the motivation of the collaborating partners to set up processes to communicate and discuss differences flagged by the system. The system itself merely provides information to suggest that the forecasts differ. If both partners simply use the system to determine when forecasts differ with no additional information about the accuracy of each other’s forecasts, and no additional communication mechanisms to discuss these differences, they may simply combine their forecasts and utilize a weighted average forecast as their collaborative forecast. Although the CPFR system is successfully implemented, with such forecasts the partners’ benefits from the system will be limited.

Case Study 1: Consumer Health Products

We analyzed a successful implementation of a CPFR system in which a manufacturer of consumer health products supplied products to a number of different distribution centers of a major national retailer. While the retailer and the manufacturer set up processes to input data and review results, they did not implement changes in communication roles and procedures. The system was used to create a collaborative forecast from the two separate forecasts. Since there was no additional sharing of information beyond the forecast, the collaborative forecast was assumed to be a mean of manufacturer and retailer forecasts.

Results reported in Table 2 indicate that the manufacturer forecast over time was much closer to actual sales than that of the retailer. The adjusted R square for sales as a function of the separate forecasts (manufacturer, retailer) is .613. However, only the manufacturer forecast is highly significant over this time period. T-tests comparing manufacturer and retailer forecasts for all 7 national distribution centers were significant at the .01 level with one exception where significance was .011.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.395	8.218		.900	.369
	Retailer Forecast	-.194	.119	-.151	-1.633	.104
	Manufacturer Forecast	1.125	.114	.916	9.892	.000

Dependent Variable: Sales

Table 2. Results of Regression for Case 1

The collaborative forecasts were not better in forecasting sales than the manufacturer’s forecasts. In other words, coordination by standardization, the lowest cost coordination, actually had the least error. The retailer lacked processes to link partner coordination with internal coordination with no communication mechanisms and no mechanism for concordance investments to exploit the CPFR. Upon further examination of the partner processes we found that the manufacturer had made concordance investment in monitoring public health data from the federal authorities. This specialized data of nationwide locations, combined with the CPFR capabilities, led to the manufacturer’s higher forecast accuracy.

Case Study 2: Consumer Electronics

In the second case study collaborative forecasts between a manufacturer of consumer electronics and a retailer appear to be much more accurate than forecasts of either manufacturer or retailer alone. While there is anecdotal evidence to support our claim, we are currently in the process of collecting additional data. A preliminary dataset of 5 weeks of forecasts for 5 products support our conclusion. The adjusted R-square for prediction of sales with collaborative forecast alone is .541 (Table 3). In this limited dataset, neither manufacturer nor retailer forecasts were significant in predicting sales.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	12241.623	7994.956		1.531	.143
	CollabF	1.044	.216	.752	4.841	.000

Dependent Variable: Sales

Table 3. Results of Regression for Case 2

We hypothesize that collaborative forecasting was more successful because both partners made concordance investments. Preliminary interviews indicate that the partners had made concordance investments in (i) weekly feedback and review of customer data, (ii) disciplined monthly process monitoring of predetermined metrics, (iii) single point of entry for all order/customer issues, and (iv) recurring report generation.

We are also investigating whether product type impacts the value of collaboration and if it drives the efforts of the partners to implement concordance investments. For example, in Case Study 1, we had a static product where global input about the product was available to the manufacturer. The manufacturer therefore did not depend on the retailer input and did not drive concordance investment. Coupled with the lack of concordance investments made in Case Study 1, the manufacturer forecast alone was stronger than the collaborative forecast. Standardization was a sufficient coordination mechanism in the absence of concordance investment in collaboration. However, the product line of Case Study 2 competes in a highly dynamic and competitive environment. The manufacturer needed the retailer’s input because the retailer, being closer to the consumer, could observe sales trends more quickly. The manufacturer insured that more concordance investments were made so that inputs could be incorporated in the forecasts. Mutual adjustment was more beneficial in Case Study 2 due to the fact that concordance investments were made. Thus, we believe that product characteristics may impact the value of collaborative forecasting and therefore may drive the level of concordance investments.

CONCLUSION

Out preliminary findings of IT investments in CPFR systems suggest that:

1. Coordination theory is a lens through which we can frame coordination issues in the supply chain.
2. Organizations need concordance investments to achieve greater value from IT investments. Although coordination is considered a complementary investment in the extant literature, our findings indicate that it provides an incomplete picture of the business value of CPFR.
3. Further research is needed to identify constructs for concordance investments and the metrics to operationalize them.
4. Firms must have the internal coordination capabilities to successfully coordinate with business partners.
5. Product type may drive value of collaboration and therefore the level of concordance investment.

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