Distinct Impact of Information Access Patterns on Supplier's Non-contractible Investments and Adaptation for Supply Chain Agility

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Abstract. This study explores how distinct information access patterns affect a supplier's supply chain agility. A supplier's specific investments for IT-enabled supply chain coordination and relational adaptation in supply chain operations are identified as the technical and behavioral antecedents to its supply chain agility. Because both are non-contractible elements in formal contracts and complementary to buyer's supply chain coordination information and buyer's specific investments in monitoring and control, either buyer or supplier may hold up their counterpart based on their own information assets. Therefore, this study draws on the theory of incomplete contracts and suggests that both buyer and supplier need to make their idiosyncratic information assets alienable and accessible to their counterpart so that the rent-seeking problem can be alleviated and the supplier's investment and adaptation incentives improved. This study contributes to the literature by demonstrating that distinct information access patterns can improve a supplier's supply chain agility through the mediation of the non-contractible investments and adaptation made by the supplier.

Keywords: Information access patterns, non-contractible investments, relational adaptation, supply chain agility, theory of incomplete contracts.

1 Introduction

Prior research on inter-firm information sharing for supply chain management (SCM) predominantly emphasizes its value about reducing demand distortion, facilitating synchronous operations and enabling strategic collaboration [18, 19]. While this line of literature answers what values of information sharing are achievable, it rarely tests how these values are realized empirically. All too often, information sharing is treated as a bilateral, holistic phenomenon [26]. The approach does not consider the fact that upward- and downward- information sharing in an supply chain can distinctively

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change supply chain members' incentives to improve their coordination and performance monitoring [20]. Drawing on this idea, this study attempts to shed light on the study of business value of information sharing by exploring the effects of distinct information access patterns on a supplier's non-contractible investments and adaptation for achieving its supply chain agility.

2 Conceptual Background and Research Model

2.1 Supply Chain Agility and Its Antecedents

Supply chain agility has been increasingly recognized as a pivotal capability for firms to adapt to changing market demands [7]. In the literature, there has been general ambivalence of defining supply chain agility as chain- or firm-level construct [28]. This study bases on [3] and regards supply chain agility as a firm-level construct, focusing on a firm's capability to deal with its adjacent customers or suppliers (i.e., internal supply chain). Thus, a supplier's supply chain agility is defined as its capability, internally and in conjunction with its customer, to respond in a speedy manner to market changes or to seize market opportunities with speed and quickness. Since there is scant theoretical research about supply chain agility, this study follows [17] and identifies relevant antecedents from the technical and behavioral perspectives of a supply chain linkage.

Transaction-specific Investments for IT-enabled Process Coordination as Technical Antecedent to Achieving Supply Chain Agility. From a technical perspective, agility is theoretically linked to flexibility in terms of capability- competence relationship [33]. In this vein, agility can be seemed as an extrinsic capability, deriving from a firm's intrinsic competences - such as range and adaptability flexibility of the firm's resources [28]. Range flexibility refers to the number of different states that a firm's resources can achieve; adaptability flexibility represents the timeliness and cost effectiveness of the resources to change from one state to another. Because procurement/sourcing, manufacturing and distribution processes are the focal resources an supplier bases upon for achieving agility [8], this study focuses on analyzing supply chain process flexibility for identifying the technical antecedents to supply chain agility.

It is suggested that inter-organizational information infrastructures can be designed to facilitate distinct modes of coordination for supply chain process flexibility: coordination by plan vs. coordination by feedback [10]. Thus, firms can either structure inter-organizational information flows and interconnected processes (i.e. advanced structuring approach) to reduce the efforts involved in adjusting to changing business environments or effectively and quickly reconfigure a set of inter-organizational processes appropriate for changed business environments through IT-supported learning and adaptation (i.e. dynamic adjustment approach). The research reveals that the coordination efforts in business processes and information infrastructures might require IT-related, transaction-specific investments from supply chain members, because these efforts are not common or standardized practices in

typical inter-firm exchange relationships [10]. Other studies also echo the necessity of integrating supply chain processes and customer knowledge with the support of information technologies for enabling agile supply chain [22].

Specifically, [27] suggests business process and domain knowledge as the primary specific investments a supplier utilizes to leverage its IT use for improving supply chain performance. The former focuses on unique operating, administrative and quality-control processes, and the latter concentrates on idiosyncratic knowledge about competitive analysis, strategy formulation and new-product development. Both types of transaction-specific investments (hereafter, termed transaction-specific investments for IT-enabled supply chain coordination) have the potential to mediate the value creation of IT use on supply chain relationships due to their complementary role in facilitating IT-enabled supply chain coordination. Once these investments are realized by an supplier, further, the reach and richness of its processes and knowledge with respect to a specific customer can be greatly enhanced [22]. Process and knowledge reach can increase the supplier's ex ante information processing capacities, because the closer integrated business processes and the more comprehensive, codified domain knowledge invested enable the supplier to spend less efforts to adjusting to changed environments. Process and knowledge richness can increase the supplier's ex post information processing capacities, since high-quality information available through integrated business processes and improved absorptive capacity to customer-specific knowledge provide the supplier with greater sensing capability to environmental changes and facilitate timely, accurate and customized adjustments in supply chain operations. Since the improved ex ante and ex post information processing capacities increase the range and adaptability flexibility of a supplier's supply chain processes, the created digital options can facilitate the supplier to achieve greater supply chain agility [24]. Therefore, this study posits that:

H_1: A supplier's transaction-specific investments for IT-enabled supply chain coordination are positively related to its supply chain agility.

Relational Adaptation in Supply Chain Operations as Behavioral Antecedent to Achieving Supply Chain Agility. While transaction-specific investments for IT-enabled supply chain coordination improve supply chain agility through enhancing information processing capacities (and, hence, flexibility) of supply chain processes, short-term yet recurrent responses of a supplier to sudden, often unanticipated customer needs contribute to supply chain agility through realizing the requested adaptive adjustments in its supply chain operations (hereafter, termed as relational adaptation in supply chain operations)[32]. The most widely cited cases of relational adaptation in the supplier part are product customization, production capacity adjustment and stockholding or delivery schedule modifications [6, 21]. These efforts probably but not necessarily involve transaction-specific investments, and they are performed frequently over time rather than on a one-time basis [9]. Thus, interfirm relationship, beside economic transaction, has been treated as the unit of analysis for studying interfirm adaptation [6]. In a similar vein, this study identifies relational adaptation as a behavioral characteristic of supply chain relationships [17] and posits it to be complementary to supply chain process flexibility in contributing to supply chain agility [15].

Theoretically, relational adaptation refers to that a firm performs "adaptive, sequential decision-making" in the face of uncertainty [2]. It needs not to be necessarily involved with specific investments and hence the hold-up problem [9]. According to the theory of incomplete contracts, the major merit of relational adaption is that it plays an important role in filling the gap of adaptation requirements incompletely safeguarded by formal contracts in volatile environments [30]. Relational adaptation is particularly necessary for adaptive asset utilization decisions because they are usually noncontractible both ex ante and ex post [9]. It is noncontractible ex ante because unforeseen contingencies make it costly to specify contingent-claims contracts. It is noncontractible ex post due to that adaptation behavior is usually observable but non-verifiable by a third party (e.g., court) ex post [11, 12]. Even though ex post renegotiation is permitted, the incentives of both supplier and buyer might not be the same and so renegotiating a jointly acceptable decision or asset ownership is time-consuming or suboptimal [2]. Since relational adaptation is self-enforcing, it can avoid costly and time-consuming bargaining in the face of uncertainty [5, 16, 29]. As a result, this study argues that a supplier's relational adaptation in supply chain operations can increase its supply chain agility.

H_2: A supplier's relational adaptation in supply chain operations is positively related to its supply chain agility.

2.2 Relating Information Access Patterns to the Antecedents of Supply Chain Agility

Supplier's Access to Buyer's Supply Chain Coordination Information. According to the theory of incomplete contracts, transaction-specific investments for IT-enabled supply chain coordination are also non-contractible because they may be observable but non-verifiable ex post by a third party (e.g., court)[11, 12]. Thus, supply chain partners cannot enter into a contract based on the outcomes of these non-contractibles and they must negotiate and divide the value created by these investments ex post, based their relative bargaining power. The theory suggests that ownership structure matters to the ability to appropriate this value ex post, because the party who owns a property can hold up the other party who makes non-contractible investments based on such property by withdrawing from the relationship, hence, possessing greater bargaining power against the other. This in turn reduce the latter's incentive to make non-contractible investments, detrimental to the overall value created. To resolve this problem, it is suggested that the allocation of property ownership must be aligned with the incentive of the invested party in order to maximize the exchange value [11, 12].

To achieve supply chain agility, a buyer's information assets (e.g., demand, planning or scheduling information) are suggested to be "indispensable" or "complementary" to its supplier's business process and domain knowledge investments for IT-enabled coordination [4, 27]. Because of the buyer's rent-seeking potential, according to the theory of incomplete contracts, the supplier should own the buyer's information assets (or vice versa) in order to increase its investment incentives [4, 12]. When the supplier cannot readily integrate with the buyer to own the latter's information assets, an alternative solution is the buyer makes its information assets "alienable" so that the

supplier can "access" them for making transaction-specific investments for IT-enabled supply chain coordination [4]. As long as the buyer's information assets are alienable, they become contractible assets and the buyer has no "residual rights of control" to these assets [23]. Thus, the supplier has greater investment incentives because it is no longer afraid of being held up by the buyer. Moreover, the supplier also can create greater bargaining power against the buyer since it has full control over its own investments [23, 31]. Again, this strengthens the supplier's incentives to specialize the investments for IT-enabled supply chain coordination for the buyer. Consequently, this study posits that:

> H_3: A supplier's access to its buyer's supply chain coordination information is positively related to its extent of transaction-specific investments for IT-enabled supply chain coordination.

Buyer's Access to Supplier's Supply Chain Operations Information. The difficulty of inducing a supplier's relational adaptation is that the adaptation decisions are non-contractible both ex ante and ex post and, hence, cannot be safeguarded by formal contracts. The reason for the former case is that it is costly to write contingent-claims contracts as environments are unforeseen. For the latter case, there is a moral-hazard problem ex post and so makes renegotiation, after uncertainty is resolved, difficult to achieve first-best adaptation. When environments are too volatile to renegotiate the allocation of decision right ex post back and forth [9], the second-best solution for effective adaptation is to delegate the control of decision right ex ante to the party (e.g., a boss) whose adaptation requirements are most important to joint value creation [25, 30]. Thus, the party delegated with authority can then make self-interested adaptation decisions after uncertainty is resolved while the counterpart (e.g., a subordinate) can receive an incentive payment based on its performance of adaptation [9].

In the supply chain context, a supplier often has control of decision rights over its own assets and operations. However, its decisions might not be aligned with a buyer's interests for achieving supply chain agility. Therefore, according to the theory of incomplete contracts (as discussed above), this study posits that buyer should be delegated with control of decision rights so that it can control its supplier's adaptation decisions once uncertainty is resolved. Nevertheless, the supplier may cheat or shirk due to the presence of asymmetric information and hidden actions [1, 14]. Therefore, the buyer also needs to invest in monitoring the supplier's output or behavior in order to decrease the latter's opportunism [13]. As a result, the buyer is suggested to make specific investments for both monitoring and control in order to increase a supplier's relational adaptation in supply chain operations. Similar to the arguments for hypothesis 3 discussed above, a buyer's specific investments in monitoring and control are complementary to its supplier's information assets associated with supply chain operations. Since the buyer cannot own its supplier's information assets through integration, it does not have enough incentive to make such specific investments. An alternative solution is that the supplier makes its information assets alienable and grants the buyer with access to the alienable information as much as

possible [4, 12]. This can let the buyer avoid being hold up by its supplier while strength its bargaining power and investment incentives, thereby, leading to improved relational adaptation in the supplier side [23, 31]. Accordingly, this study posits that:

H_4: A buyer's access to its supplier's information for monitoring and control is positively related to its supplier's relational adaptation in supply chain operations.

Based on the above discussion, the research model is presented as Figure 1.

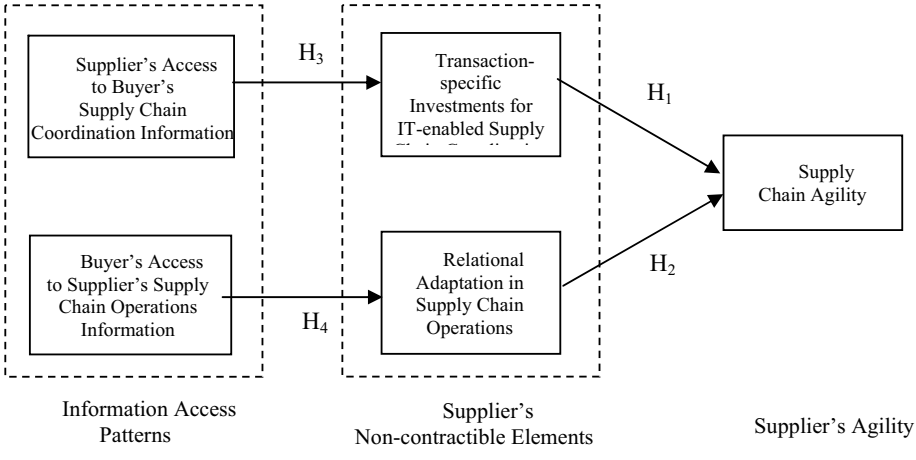

Fig. 1. Research Model

3 Conclusion

This study contributes to the literature by demonstrating that distinct information access patterns can improve a supplier's supply chain agility through the mediation of non-contractible investments and adaptation by the supplier. Our hypotheses explicitly examine how the access of partner's information assets can be utilized to mitigate rent-seeking and mal-adaptation problems, as has long been studied in the transaction costs economics. The distinct effects of upstream- and downstream-information access patterns show that the "ownership" of information assets matters to partner's (in our case, supplier) incentives to make relation-specific investments and adaptation. Thus, future research is suggested to open the black box of the notion of "information sharing" and "information flow integration" in order to advance our knowledge about the impact of the allocation of the property rights of information assets on their business value. From a practitioner's perspective, how and why supply chain members are willing to grant access of their information assets to others is the next issue, which deserves further exploration by future research.

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