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# Drivers and Patterns of Supply Chain Collaboration in the Pharmaceutical Industry: A Case Study on SMEs in China

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## Abstract

**The objectives of this paper are to identify the supply chain collaboration models/patterns and its correspondent advantages on pharmaceutical supply chain. This paper aims to investigate how collaborative activities can impact on the development of supply chain and industry. A case study methodology was adopted in this research, which involved pharmaceutical SMEs. The results indicate that collaborations are common in all phases of pharmaceutical supply chain; the different strength of bargaining power among collaborative partners will impact the advantages achieved at strategic, operational and political levels.**

## Keywords

Supply Chain Collaboration, Pharmaceutical Industry, SME, China

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## 1. Introduction

In the past decades, academia and business practitioners have realized that achieving efficient supply chain and quick responsiveness to the needs of dynamic markets, and the relationships and interactions within organization and among external environment including government agencies, suppliers and academic institutions are increasingly important to firms seeking to benefits and competitive advantages [1]-[3]. A number of empirical results showed that supply chain collaboration had positive impacts on decision-making, problem-solving, and cost-saving [4] [5]. However, the literature on supply chain collaboration is not that wealth, and most of them are not able to fully explain the complexity of the collaborative relationships and seldom consider realistic situations [4]. Further investigation is required to recognize the great potential and value of supply chain collaboration [1].

The pharmaceutical industry is a complex network of organizations involved in drug and medication discovery, development, and manufacture [6] [7]. There are many challenges, such as high cost in research and development (R & D) stage and the declining R & D success rate [8]. Government and regulatory institutions tend to intervene with more [6] and increase the pressures in further development. Collaboration as an effective means to tackle those challenges has been practiced in general by many big pharma companies for a long time [7]. However, for other small and medium sized enterprises (SMEs), not many of them have applied strategy as the

big pharma companies do, although most of them may have realized the need of collaborations to assist them better compete in the market and successfully transfer to a larger scale [9] [10]. Therefore, researches in this area are in urgent need.

As one of the emerging economics, China's pharmaceutical sector is in a significant position in the period of rapid growth of industrialization and urbanization [11]. The pharmaceutical industry in China is largely influenced by government and regulatory institutions in both structure shaping and network building [12] [13]. Those challenges [9] [14]-[16] indicated above also are in a way slowing down China's pharmaceutical industry's pace of progress [17]. To find the way out, strategic collaborations among stakeholders in supply chain are increasingly considered to be able to generate more superiority in current situation [17] [18].

The objective of this paper is to identify the collaboration models/patterns and its related advantages on pharmaceutical supply chain. In the following sections, research questions related to pharmaceutical supply chain collaboration are going to be defined based on literature review; then results generated from case study to answer the questions will be presented; the research contributions, implications, and future directions will be summarized in the conclusion section.

## 2. Literature Review

### 2.1. Pharmaceutical Supply Chain

Supply chain is defined as a series of activities and organizations facilitate material flow from raw materials to final products downstream [19]. Pharmaceutical manufacturer as one the main actors in healthcare supply chain [20], is inevitable to come into contact with other players, like government, regulatory institutions, integrated delivery networks, and other channel members [6] [7] [11] more than only the suppliers and direct customers in pharmaceutical supply chain. However, studies in dyads are mostly focused on downstream network in the pharmaceutical manufacturing and distribution sectors, and the upstream issues are considered separately [21]. An efficient pharmaceutical supply chain cannot count on the stand-alone effort of any individual participant [5], but to collaborate with independent players to approach the common goal [4] in the changing market conditions.

### 2.2. Outsourcing in Pharmaceutical Industry

Outsourcing organizational activities to outside vendors may gain competitive advantages of cost-saving and resource-leverage [22] [23]. Pharmaceutical manufacturers are usually treaded as "innovative enterprise" [8] facing significant challenges of ensuring sufficient investment in R & D [24], hence they tend to outsource some "noncore" activities [9]. However, outsourcing has applied not only to "noncore" activities, the core activities of R & D [20] [23] [25], manufacturing [20] [21] [26], and logistics [9] [27] [28] have been involved as well. This may lead to a need of close collaboration with public science [25] [29] or even flexible strategic alliance with peer competitors [29] [30]. The collaborations in supply chain is indispensable [32] [33], and the strategic alliance in outsourcing can help pharmaceutical organizations to achieve a sustainable development, if done properly.

*Question One: How does collaboration between focal company and outsourcing provider impact on pharmaceutical supply chain?*

### 2.3. Collaboration in Pharmaceutical Supply Chain

Supply Chain collaboration as the key to create value emphasizes on governance through relational means and contract means [1], enables partners to jointly gain sustainable benefits [34]. In pharmaceutical supply chain, the main players who directly associate with pharmaceutical manufacturer are material (medical) suppliers, wholesalers, order distributors (3PLs), competitors, customers (hospitals and physicians), academia (university and research institutions), government, and regulatory institutions [3] [13] [17] [20] [35] [36]. In addition, the outsourcing of manufacturing [25] and acquisition of partners may introduce subcontract partners and subsidiaries into the group.

The creation of alliance can be driven by motivations [33] of cost-reduction [37] [38], supply chain flexibility [22], sustainability [39], and future opportunity [6] [40]. In addition to this, as the increasingly intervene come from government and regulatory institutions [6], it is necessary to maintain a good relationship with the political players, in order to get related support for expansion and better development. The possible collaborations are kind of tied to the running of business [41], at the level of operation, strategy, and policy. In the previous re-

searches, the complexity of dyadic collaborative relationship are not fully discovered [4], there is no related references of collaborative modes/patterns.

*Question Two: How do different collaboration modes/patterns impact on pharmaceutical supply chain?*

## 2.4. Conceptual Framework

In summary, ten dyadic relationships between the focal company (pharmaceutical manufacturer) and possible partners (material supplier, wholesaler, 3PL, competitor, customer, academia, government, regulatory institution, subcontractor, subsidiary) will be investigated in according to the factors/motivations of cost-reduction, flexibility, sustainability, opportunity, and policy & regulation. Moreover, as creation of collaborations stick to business running in the level of operation, strategy and policy [41]; further analysis is based on it.

## 3. Research Methodology

### 3.1. Case Study and Data Collection

Research questions proposed here are mainly about “how”, a case study methodology is preferred for this research [42]. Multiple-case studies are adopted to investigate certain phenomenon in details rather than in general [36] [43]. The three chosen case companies are all SMEs and the parent companies of three cases are located in the same district. Multiple sources of evidence are used to address validity issues [44]. Data collection was collected via interviews, questionnaires in two stages (**Table 1**). In stage one, a 1 - 2 hours interview were taken with the top managers and then department managers. In stage two, a questionnaire are generated and send to them for further detailed information.

### 3.2. Summary of the Case Study Results

As shown in **Table 2**, the ten identified dyadic relations have been confirmed in PM-1 and PM-2, but in PM-3 only seven relation modes exist in business. Due to PM-3 is a pharmaceutical focus on Chinese Patent Medicines, the number of related business practitioners are comparatively not many. The product category is less and production scale is rather small. Thus, the test result [44] is understandable and acceptable.

**Table 1.** Data collection.

Data Collection	Stage 1	Stage 2
Case Company	Pharmaceutical Manufacturer 1 (PM-1): PM-1 is one of the listing companies in SZSC (Shenzhen Stock Exchange) ChiNext Board. As a leading and professional SME in pharmaceutical, their sales network covers more than 30 provinces in China.	
	Pharmaceutical Manufacturer 2 (PM-2): PM-2 is a professional pharmaceutical SME is currently preparing for stock market listing. 9 GMP (Good Manufacturing Practice) plants with more than 500 employees serve more than 20 provinces in China.	
	Pharmaceutical Manufacturer 3 (PM-3): PM-3 is a pharmaceutical SME which is mainly engaged in the development, production, and sales of Chinese Patent Medicines. Their products are not only serving to China local markets, but also sell to Malaysia, Singapore, and other districts in the world.	

**Table 2.** Dyadic relations of case company and partners.

Relation Mode (PM + Partner)	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10
	Material Supplier	Wholesaler	3PL	Competitor	Customer	Academia	Government	Regulatory Institution	Subcontractor	Subsidiary
PM-1	√	√	√	√	√	√	√	√	√	√
			PO (Logistics, >50%)	PO (R & D)		PO (R & D)			PO (R & D)	
PM-2	√	√	√	√	√	√	√	√	√	√
			PO (Logistics, >90%)	PO (Sales)		PO (R & D)			PO (R & D)	
PM-3	√	√	√	-	√	√	√	√	-	-
			FO (Logistics, ≈100%)			PO (R & D)				

PO: Partly Outsourced; FO: Fully Outsourced.

## 4. Analysis and Findings

### 4.1. Collaboration in Outsourcing

The research results indicated that the activities frequently outsourced in China's pharmaceutical industry are R & D and Logistics. The forms of R & D outsourcing are mainly commissioned and joint researches with research institutions or competitors in pharmaceutical manufacturing. Usually, R & D outsourcing occurs when sufficient fund is guaranteed [32] in big pharma, however, in China's market, SMEs tend to partly outsource R & D in order to achieve "sustainability, opportunity" for business and even "cost-saving" for supply chain operation. To ensure the mutual benefits, focal company tends to consider possible partner in many aspects, such as "expertise and experience", "references" and "industry vision" [41]. The formed relationship is more than "buyer-supplier", but alike members of same level in alliance.

The outsourcing of logistics has becoming a key component in pharmaceutical supply chain development, focal companies tend to outsource the distribution function to 3PLs. Different from big Pharma in developed market [38], the logistics outsourcing is not at a strategic level [28], as not many of SMEs in China currently would like to outsource inventory management or other activities associated with their sustainability or opportunity, reasons are the costs and lack of sufficient professional 3PLs, the collaboration decision is still on the operational level to realize "cost-saving" and flexibility in response to the market demand ("flexibility"). Although focal company counts heavily on their 3PL partners, as the "switching costs" are low, in such collaborative relationship, the bargaining power of pharmaceutical manufacturer is higher.

### 4.2. Collaborative Relation Modes in Pharmaceutical Supply Chain

The creating of collaborative relations is motivated by factors in considerations in different levels [41]. And in research market, collaborations exist in all pharmaceutical supply chain phases, relation modes addressed in specific phases are expected to achieve related advantages. "Guanxi networking" in China is described as channels to acquire resources, information, and knowledge, which could help to enhance predetermined performance and to boost future business [45] is similar to the collaborative relation in achieve mutual benefits.

In particular, the importance of networking with "officials" like government and regulatory institutions [45] can be seen, although sometimes it cannot bring about direct benefits in short term. If focal companies tend to build collaboration in strategic level which focus on both "sustainability" and "opportunity", usually, the advantages can be obtained in operational level is limited; as their bargaining power is weakened in a certain degree in business. The collaborative relation with Academia is more alike is able to achieve all identified advantages with less risks in moral hazard and completions [32].

### 4.3. Impacts/Advantages of Collaborations on Pharmaceutical Supply Chain

When the bargaining power of partners in dyadic strategic collaboration is general equilibrium, the formation of alliance enable pharmaceutical manufacturer to obtain opportunities to access resources, knowledge, and information in largest possibility; both focal company and collaborative partner can expect a sustainable development in a long term. When the bargaining power is disequilibrium, the collaborative relationship between partners are more alike "buyer-supplier", and focal companies usually on achieving realistic benefits like "cost-saving" and "Flexibility", which make the collaborative relation transferred from strategic level to operational level. It is interesting to see when the bargaining power of alliance member is general equilibrium; the possibility to gain "cost-saving" is somehow decreased, while the flexibility can be "guaranteed". For certain expected cost-saving may be required to satisfy in "channel" maintaining. Advantages of fund-support and policy/regulation-support is limited in "cost-reduction", the increasingly required level in manufacturing even borne focal company in resource leverage. The flexibility in response to market requirement and industry development is not high. SMEs are sensitive to any political actions in order to seek opportunities for sustainable development.

One possible collaborative relation between focal company and consultants [41] was not involved in analysis. Although it is said that there is potential of consultancies in China, for the professional consultant team can be expected to help organizations better dealing with problems in supply chain and bring about long-term benefits from the process of planning; the costs to invite professional team is in a way block many SMEs to seek collaborations.

## 5. Conclusion

This research identified supply chain collaboration modes at strategic, operational, and political levels. For the contribution to supply chain management, this research concludes more existing collaborative patterns rather than general patterns from the view of “supplier-customer”, and all of them are addressed in different phases of supply chain. For the contribution of pharmaceutical industry, the patterns and the impacts identified are in a way enabling enterprise to better understand the business relationship with their partners. The main limitation of the research is that only 3 case studies are involved. In the future, empirical research in this topic could be extended to other country backgrounds to conduct comparative studies.

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