Influencing Factor Analysis for Cost Benefit Sharing in Healthcare Supply Chain Collaboration

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***Abstract*— This paper proposes the influencing factor analysis for cost-benefit sharing in healthcare supply chain collaboration. The factors are conducted by literature review and in-depth interview with supply chain experts in healthcare sector in Thailand. The factor evaluation based on cost-benefit is analyzed by AHP and the willingness to share cost and benefit is evaluated by TOPSIS. The ranking of factor and the willingness to share are presented.**

Keywords—Cost benefit sharing, Healthcare supply chain, collaboration, Influencing factor

I. INTRODUCTION

Supply Chain Management (SCM) involves integration, coordination and collaboration across organizations and throughout the supply chains [1]. Specifically, the characteristics and complexities of SCM in the healthcare industry are different compared to those of other industries. SCM in the health care industry consists of four main components: Producers, purchasers, providers (hospitals), and patients [2]. Improving the supply chain processes has not been a major priority in the healthcare industry. Improvements in new technologies have focused on providing the highest possible service levels and reductions in costs [3]. With greater margin pressures and declining revenues in the healthcare industry, stakeholders are seeking new and effective ways to gain greater visibility for their operations, in order to lower costs and improve patient care service [4]. Supply chain performance can be improved by linking the supply chain strategy to all the other business strategies, including segmentation, agility, measurement, and benchmarking, alignment, and collaboration [5]. In addition, cooperation and integration activities within an organization and collaboration with external partners can lead to significant cost savings, such as in e-procurement, collaborative planning, replenishments, and forecasting [6].

The fragmentation in the healthcare supply chain and the lack of dominant players to drive favorable changes in industry practices, investment in new technology, and changing established processes are all promising areas for collaborative efforts [7][8]. Supply chain collaboration systems can enhance cost reductions, risk management, and performance improvements in the supply chain [9]. Collaboration can help by taking the costs out of the entire system and providing mutual benefits for all the involved parties. However, collaboration in the healthcare supply chain lags behind because of high investment and difficulties in assessing the benefits of its implementation for the supply chain members [4]. Therefore, it is important to share both costs and benefits based on a fair allocation, namely 'win-win' situation, to all the supply chain members for collaboration successful [10][11].

Previously, the Cost-Benefit Sharing (CBS) process was developed to evaluate benefits and costs, then distribute the costs and share the benefits [12]. A case study of the CBS process in the automotive supply chain was used as a reference [13]. The CBS of Radio Frequency Identification (RFID) implementation in across-company was presented using a case study from the fashion industry [14]. In addition, a Cost-Benefit Analysis (CBA) for implemented global standard system had been investigated in global and individual healthcare supply chain. The expected investments and potential benefits were analyzed. The healthcare value chain system could achieve a positive return on investment from adopting global standards and enabling business processes. The benefits could be shared across the value chain. Nevertheless, CBS and influencing factor analysis were suggested for successful collaboration in healthcare supply chain but details weren't provided [5]. To our knowledge, no empirical research exists which investigates influencing factor for CBS in the context of healthcare supply chain collaboration.

The costs and benefits in the healthcare supply chain are categorized as "co-costs" and "co-benefits" and validated by the Analytical Hierarchy Process (AHP) [15]. The co-cost and co-benefit were considered to analyze influencing factor sharing in healthcare supply chain collaboration.

II. METHODOLOGY

A. Factors Identification by Literature Review

The influencing factor for cost-benefit sharing was related with social exchange theory that is "a social psychological and sociological perspective that explains social change and stability as a process of negotiated exchanges between parties. Social exchange theory posits that human relationships are formed by the use of a subjective cost-benefit analysis and the

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comparison of alternatives". Based on social exchange theory, the related factors were included trust, commitment, reciprocity, and power [16]. The others factor that effect to cost-benefit sharing in the supply chain were risk, firm size, industry type, and IT performance [17].

Moreover, the willingness to share is an important condition for sharing between organizations. Based on some literatures about cooperation or collaborative, the important factor of willingness to share or willingness to corporate must be considered. Therefore, the sharing of cost-benefit in the supply chain collaboration, the factor of willingness to share must be added in the influencing factor analysis [18].

B. Preliminatory In-Depth Interview

Firstly, the influencing factors were defined by literature review and the factors are trust, commitment, reciprocity, power, risk, firm size, industry type, security, and IT performance. However, in the first step of expert interview to identify factor has founded that firm size and industry type had not effect to cost-benefit sharing but the factor of policy, collaboration level, and sharing complexity are included.

C. Finalize In-Depth Interview

Firstly, the in-depth interview with fifteen experts in healthcare supply chain sector in Thailand is performed. Secondly, the influencing factors for cost-benefit sharing are analyzed by Analytical Hierarchy Process (AHP). Finally, the willingness to share of cost and benefit is calculated by The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). The framework of influencing factor for cost benefit sharing has shown in Fig.1.

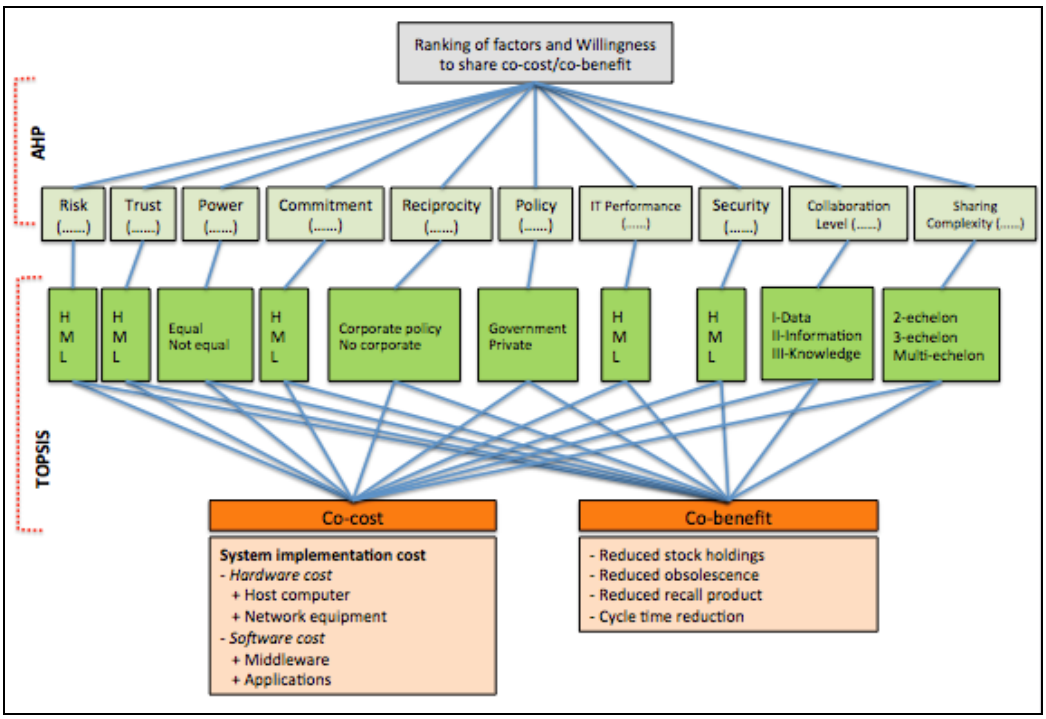

Fig.1. The framework of influencing factor

III. Results

A. Preliminary evaluation results

Based on factors from literature review, they were verified and evaluated priority weight score (scale 1-9) by expert interview in healthcare supply chain and IT specialist fifteen persons based on experience over five years.

This research has collected factors which had weight score over 7.00 to analyze by AHP in the next process [19]. From result as shown in TABLE I, the factors were considered including trust, power, reciprocity, commitment, risk, IT performance, and security.

TABLE I. Preliminary Result Of Factors

Influencing Factors	Priority weight
Trust	8.20
Power	7.20
Reciprocity	7.60
Commitment	8.00
Risk	8.30
IT Performance	7.20
Security	7.60
Collaboration level	5.60
Sharing complexity	6.60

B. Investigated factors from expert interview

This process was concerned to search for other factors that influenced for cost-benefit sharing in healthcare supply chain collaboration. The research result was found other factors that should be considered as "policy" because organization in healthcare supply chain has several type of policy and characters such private or public organization, profit and nonprofit hospital.

C. Influencing factors analysis result by AHP

Based on results from *A* and *B* Topics, the factors were evaluated for weight score by fifteen experts. Then, the weight score of influencing factors has shown in TABLE II.

The weight score of factors were trust (0.261), risk (0.204), commitment (0.169), reciprocity (0.169), policy (0.062), power (0.051), security (0.043), and IT performance (0.041) respectively.

D. Willingness to share costs and benefits by TOPSIS

The willingness to share analysis under influencing factors has shown the relationship structure as Fig.2. The result of willingness to share on influencing factors for cost-benefit sharing in healthcare supply chain collaboration was evaluated by TOPSIS

TABLE II
INFLUENCING FACTORS ANALYSIS OF COST-BENEFIT SHARING

Rank	Factor	Weight	Percentage	CI
1	Trust	0.261	26.1%	0.02
2	Risk	0.204	20.4%	
3	Commitment	0.169	16.9 %	
4	Reciprocity	0.169	16.9 %	
5	Policy	0.062	6.2 %	
6	Power	0.051	5.1 %	
7	Security	0.043	4.3 %	
8	IT Performance	0.041	4.1 %	

The process to evaluate level of willingness was investigated based on case study of collaboration system between organization which high trust and low risk, long-term commitment, and cooperated reciprocity. Therefore, example results of willingness to share based on case has shown in TABLE III.

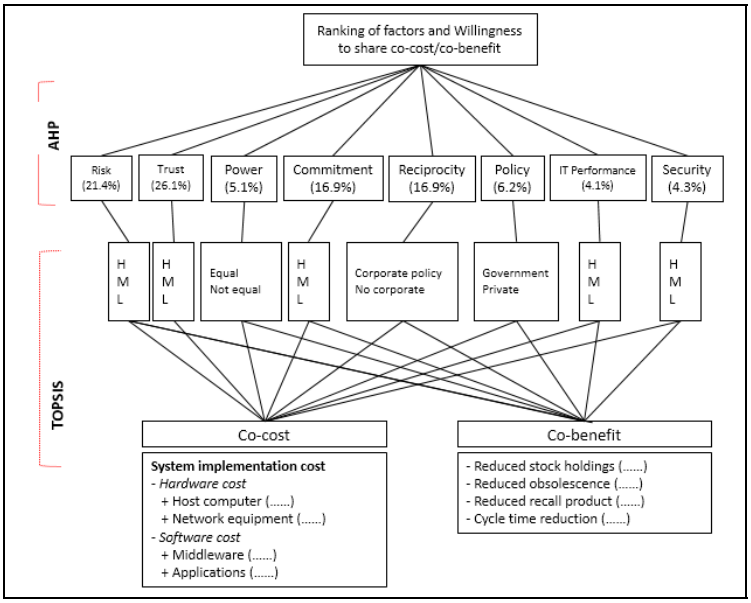

Fig.2. Willingness to share and factors relationship

TABLE III.
WILLINGNESS TO SHARE LEVEL FOR COST-BENEFIT

Cost/Benefit	Willingness to share level)Rank No.)
Host computer	0.750 (1)
Network equipment	0.674 (3)
Middleware	0.687 (2)
Applications	0.585 (9)
Reduced lead time	0.652 (5)
Reduced stock holdings	0.663 (4)
Reduced obsolescence	0.640 (7)
Reduced recall product	0.651 (6)
Reduced counterfeit product	0.611 (8)

IV. DISCUSSION

The cost benefit sharing can be lead to supply chain collaborative successful and enhance the collaborative initiatives in healthcare supply chain with high stakeholder outcomes in win-win situation. The influencing factor was investigated that it should be considered for sharing decision. They were identified to find out knowledge of influencing factor that effect to willingness to share cost and benefit of collaboration. In the next process, the cost benefit sharing should be optimized to allocate for supply chain members.

V. CONCLUSION

This paper presented the influencing factor analysis for cost benefit sharing in healthcare supply chain collaboration. Next phase of this study, the influencing factors of cost benefit sharing will be applied for cost benefit sharing model development. The mutual cost and benefit in healthcare supply chain collaboration will be analyzed to allocate for benefit cost ratio maximization in healthcare supply chain collaboration by optimization model.

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