

The Governance of Cloud Based Supply Chain Collaborations

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Abstract – Despite of the promising benefits of cloud computing in enabling efficient, sustainable and agile Supply Chain Collaborations (SCCs), this service does not eliminate governance challenges in SCCs. Cloud based SCCs may flounder without a proper understanding of how to govern inter-organizational relations and insight into how the cloud service will affect it. Using a case study method, this study aims to: (1) observe cloud based SCCs in practice and (2) get an overview of current governance models that exist for cloud based SCCs. Five types of company roles in cloud based SCCs are proposed to reduce ambiguity in inter-organizational communication. Using this classification, this study introduces market and shared governance for cloud based SCCs besides the hierarchical governance, Network Administrative Organization. This study's contribution is to describe how cloud is currently used to enable diversity of the SCCs' governance models.

Keywords – cloud, collaboration, governance, inter-organizational system, supply chain

I. INTRODUCTION

Evolving over the time, Supply Chain (SC) competition nowadays is not only between companies, but also between entire value chains [1]. SC discussions went beyond intra-organizational and dyadic relationships towards inter-organizational Supply Chain Collaborations (SCCs) perspective. The establishment of SCCs has been increasing over the past three decades, and it has become a new pervasive trend [2]. SCCs emphasize the importance of information sharing among companies in SC to gain competitive advantages by reducing cost and increasing service quality. However, SCCs is often problematic and faces several challenges [3-5]: 1) information system challenges, such as incompatible infrastructure and legacy systems, a lack of standardized Service Level Agreements (SLA), and limited scalability; 2) operations challenges, such as a mismatch of execution parameters and missing cost-benefit evaluations; and 3) organizational challenges, such as a lack of trust, power imbalance, conflicting goals, and a lack of a coordination mechanism. Failure in addressing these challenges could lead companies to havoc. For example, it has been reported that companies with SC disruptions during 1989–2000 experienced on average -40% of abnormal stock returns that were not quickly recovered [6].

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Without the support of an information system, it is difficult to achieve successful SC operations [7]. Succeeding prior innovations, such as internet and RFID, the trend of cloud computing promises to enable efficient, sustainable and agile SCCs by overcoming information system and operational challenges. It is predicted that by 2016 more than 40% of new logistics applications will be cloud based [8]. The cloud potentially enables data exchange and further collaboration in SCCs with a lower capital investment and a higher flexibility compared to on-premise systems [9].

Still, cloud based SCCs have to address the organizational challenges. SCCs may flounder without a proper understanding of how to govern the relationships between companies in inter-organizational context. There is strong conceptual and empirical support for links between the use of governance instruments and supply network outcomes [10]. In a case of cloud based SCCs, the cloud service and the SC activities become closely intertwined. Imposing incompatible governance models would not bring any benefits, but create managerial, as well as operational, problems.

Despite of advancements in the inter-organizational governance model literature, there is little literature on information system enabled inter-organizational collaboration [11]. This study specifically focuses on the governance of cloud based SCCs to complement this literature. This study aims to: (1) observe cloud based SCCs in practice, (2) explore governance models that exists for cloud based SCCs. Our main contribution to the SC management field is the presentation and analysis of cloud based SCCs cases, a phenomenon that has recently received increasing attention but still has not been studied in much depth. Moreover, this study will not only benefit large companies but also SMEs and startups in joining or establishing SCCs by forming SCCs' governance state-of-the-art knowledge. This is not limited to companies in the SC, but also helps the cloud providers who target SCCs as their market.

II. STATE OF THE ART

A. Inter-organizational Governance

Inter-organizational governance is an act to coordinate a collaboration of multiple companies [11, 12]. Several models of inter-organizational governance have been proposed (see Table I).

TABLE I
LITERATURE ON INTER-ORGANIZATIONAL GOVERNANCE MODELS

Governance Models	This study	[13]	[14]	[12]	[11]	[15]
Market	✓	✓	✓			✓
Shared governance	✓			✓		✓
Lead organization	✓		✓	✓		✓
Network	✓			✓	✓	
Administrative Organization		Network				
Firms		✓	✓			

Even though differences in naming and classification are present, there are 4 basic models:

1) *Market*, is formed by contractual relationships between suppliers and buyers [13].

2) *Shared governance*, in which members participate in network governance without a separate and unique governance entity [12].

3) *Lead organization*, in which a particular member coordinates major network-level activities and decision making in a network [12].

4) *Network Administrative Organization (NAO)*, which is a separate entity that is established to govern the network [12].

The integrated firms model is excluded in this classification because it is a new legal entity established through merger or joint venture of companies. Succeeding the organizational restructuring, prior inter-organization collaborations are replaced by intra-organizational interactions under a legal authority [14].

B. Cloud based SCCs

Being in an early development stage, comprehensive definitions of SCCs are scarce. There is no standard term yet; various terms – SC coordination, value network, and supply network – have been used to define different things that are closely related, cover similar concepts or are complementary. To avoid equivocation, we define SCCs as the act of two or more independent companies working together to execute a part or all of their SC activities.

The impact of information systems on a tendency towards hierarchical or formalized governance has been proposed and confirmed by several studies [11, 16]. In addition, these governance models will not only fit for coordinating the complexity of the information systems, but also for supporting the SCCs itself. Referring to SC and SCCs’ definitions, it is clear that the interdependence between companies in SCCs and their goal consensus are high; both factors have been identified as key predictors of hierarchical governance models [12, 16]. Accordingly, lead organization and NAO are predicted to suit cloud based SCCs better than market and shared governance. However, it is suggested that lead organization governance is not a likely fit with information system based collaboration, largely because members may fear that the dominant company uses other members’ data to gain a competitive advantage over them [11]. Thus,

researchers and practitioners suggest that cloud based SCCs to be ideal bases to establish NAO.

We expect that cloud based SCCs can be configured to be compatible with other types of governance models, especially market and shared governance. The fundamental reason lies in the main feature of cloud computing to provide service of infrastructure, platform, and software as a service over the internet. Giving the benefits of no up-front investment, highly scalable, easy access, and reducing business risks [17], cloud technology provides SCCs and its members with flexibility to choose their system providers. Cloud also reduces barriers for companies to enter and exit SCCs. Consequently, hierarchical structures become less important in cloud based SCCs compared to the traditional SCCs. Meanwhile, contracts, together with SLA, as governance mechanisms maintain legal protection for property rights, data ownership and security, and promised system performance.

III. METHODOLOGY

The case study method [18] is selected because cloud based SCCs are still limited in number. Moreover, cloud based SCCs are complex systems in which a case study could provide an in-depth understanding. Case studies were conducted in 7 companies claiming to be 3rd party SCCs cloud integrators and 1 SCCs control tower projects. Cases were selected through online market research or suggestion in interviews, in which the interviewees were asked to mentioned their SCCs’ rivals. The data collection period was April 2014 - June 2015.

With regards to the interviews’ focus on governance, persons with strategic positions in the companies or projects were selected as interviewees (see Table II). Before interviews were done, data was collected through the companies’ or projects’ website and documents. Interviews were recorded and notes were taken during the interviews. The interviews were semi-structured interviews based on a protocol. It comprised open discussion and questions about their companies or project and associated SCCs’ business model and governance. For the first part, the Business Model Canvas (BMC) framework [19] was used given the interviewees’ familiarity with the concept. The second part of the discussion was based on inter-organizational collaboration governance aspects by Markus and Bui [11]: the governance entity’s form and legal status, members, owners, investment and funding, decision making, and data governance.

IV. RESULTS AND DISCUSSION

The data collected is summarized in Table II. There are 8 cases (SCCs A-H). The information of each case was collected from a company (company A-H). These companies’ roles in their SCCs will be discussed later.

The SCCs' establishment years show that most of the SCCs are quite young, being not more than a decade. This fact represents the trend of SCCs over the past decades.

The first part of our results deal with is the cloud based SCCs' business model elements: its value proposition, customer relationships, customers, key resources, partners. The other BMC elements, which are channels, revenue streams, key activities, and cost structures, are not presented in Table II, even though this information was collected during our study. We believe that the elements presented are adequate to explain the nature of SCCs. Value proposition describes the SCCs and their goals. It incorporates the SCCs' scope of SC activities. For example, the coordinated SC activities in case A are logistic activities. Customer relationships presented is explaining how the SCCs have been established and how the targeted customers, which are the SCCs' members, could join the established SCCs. Key resources are the cloud based information systems shared in the SCCs. The last SCCs' business model element concerns their partners who support them in the coordination and SC activities.

The second part of our results deal with is the SCCs' governance aspects. The governance entities, its ownership, investment, and decision making represent the members' participation in the governance. The SCCs' members are presented in the third part of Table II because it belongs to BMC and governance aspects framework. The last aspect, data governance, is identified because it is crucial in information system governance.

Based on the SCCs' business model elements and governance entities, we conclude that companies may have different roles in cloud based SCCs:

1) *Members*, are companies that do SC activities and could involve in the SCCs. By being members, companies are expected to gain benefits and pay costs for using the shared cloud system. This category may include manufactures, warehouses, retailers, logistic service providers, and other parties in SC. Company H is included in this category.

2) *SC partners*, are companies that are not a member of SCCs, but do SC activities to support the SCCs. Examples of this type are logistic providers in case A and G; company A's and G's goals are to maximize their members' benefits by minimizing the transportation cost which might reduce the logistic providers' revenue. Being outside of SCCs means that the companies may get access to the shared cloud system, but their benefits will not be a priority for the SCCs. As a consequence, these companies will not be expected to pay a fee for the cloud system.

3) *Cloud providers*, are companies who deliver cloud based information systems, either software and/or platform as a service, for supporting the coordinated SC activities of SCCs' member and enabling SCCs. It includes company A, B, C, D, E, F, and platform providers in case G and H.

4) *Other partners*, are other companies who support SCCs besides the SC partners and cloud providers. Examples of companies with this role are internet

providers, IS developers to whom cloud providers outsource a part or all of their software and/or platform development, university, research institutes, and employee organizations.

5) *Orchestrators*, are control-tower-like companies that coordinate the SC activities of other companies. Company A, B, D, F, and G belong to this category.

These roles can be classified into *essential roles* – members and cloud providers – and *potential roles* – SC partners, other partners, and orchestrators. Existences of companies with the essential roles in collaborations define that the collaborations are cloud based SCCs. On the other hand, cloud based SCCs do not necessarily have any SC partners, other partners, or orchestrators. Among all case studies, case A and G are the only ones that have SC partners, which are logistic agents, logistic service providers, and customs. In addition, the absence of other partners and orchestrators are presented in case C and H.

Furthermore, one company could have more than one role. These coexisting roles is present in company A, B, D, and F. These companies are not only cloud providers for their SCCs, but also the orchestrators.

By analyzing the companies' roles, the cloud based SCCs structures, and its governance aspects, the governance model of SCCs could be determined. From the case studies conducted, three governance models emerge:

1) NAO, which is represented in case D, F, and G. Its main characteristic is the establishment of legal companies to be the orchestrators. These companies are not always owned by all of the members. However, the members have their representative in the NAO organization structure to ensure their influences in decision making. In the case studies, NAO are usually non-profit organizations, which means that profits are not divided between shareholders, but used for the SCCs' development. This is an important attribute for NAO because it increases the members' trust.

2) Market, which is represented in case A and B. This kind of SCCs is formed by contractual relationships between the orchestrators, which also have roles as cloud providers, and the members. In this governance model, a company does not necessarily have partnerships with other members to enter the SCCs.

3) Shared governance, which is represented in case C and H. In SCCs with this governance model, orchestrators do not exist as all of the members share almost equal responsibilities regarding the coordination activities.

The collaboration in case E does not fit in any model. The SCCs have not been well planned yet, because company E is still in an early stage of development.

Lastly, all of the cases portray a certain degree of data governance formality in the form of a Non-Disclosure Agreement (NDA). NDA gives all of the companies legal power to ensure their data security and increase their trust towards other companies in the SCCs.

TABLE II
CASE STUDY RESULT

Case: cloud based SCCs	A	B	C	D	E	F	G	H
Interviewees	1	2	2	1	2	1	1	1
Interviewees' roles	Director operations in company A	Partners in company B	Company C's Partner	CEO in company D	Owners in company E	Managing director in company F	Director in company G	Project initiator and business analyst in company H
SCCs' Establishment	2010	2008	2014	1980	2014	2002	2012	2013
Cloud Based SCCs' Business Model Canvas Elements	Netherlands	Belgium	Netherlands	Netherlands	Netherlands	Netherlands	Netherlands	Netherlands
Value proposition	<ul style="list-style-type: none"> A logistic cross SCC orchestration A neutral and transparent orchestrator SC consultation Logistic operations outsourcing Cost & CO₂ reduction 	<ul style="list-style-type: none"> A logistic horizontal cross SCC orchestration SC consultation Cost & CO₂ reduction 	<ul style="list-style-type: none"> Omni-channel logistic SCCs Cost & CO₂ reduction 	<ul style="list-style-type: none"> A transportation marketplace Cost & CO₂ reduction Information transparency 	<ul style="list-style-type: none"> A location and transportation channel specific logistic collaboration A neutral orchestrator Increase in efficiency Cost reduction 	<ul style="list-style-type: none"> A location and transportation channel specific logistic collaboration A neutral orchestrator Increase in efficiency Cost reduction 	<ul style="list-style-type: none"> An industry-specific SCC orchestration Increase in efficiency and accessibility to members Cost & CO₂ reduction 	<ul style="list-style-type: none"> A distribution collaboration Transportation operational data visibility
Customer relationships: how to be SCCs' members	Contracts with company A	Contracts with company B	Contracts with company C & members' connections	Location based community & contracts with company D	Not yet well defined	Location based community & contracts with company F	Industry-based community & contracts with company G	Partnerships with a supermarket chain & contracts with a platform provider
Key resources: cloud services	<ul style="list-style-type: none"> Logistic data center SC collaboration platform & software Owned by company A 	<ul style="list-style-type: none"> Logistic data center SC collaboration platform & software Owned by company B 	<ul style="list-style-type: none"> A social media alike system for SCC, owned by company C 	<ul style="list-style-type: none"> A location-based cargo & transport search engine Companies rating system Owned by company E 	<ul style="list-style-type: none"> A location-based cargo & transport search engine Companies rating system Owned by company E 	<ul style="list-style-type: none"> SC information exchange platform & software, owned by company F 	<ul style="list-style-type: none"> E-auction and logistic platform and software Mobile application Owned and customized by a cloud provider 	<ul style="list-style-type: none"> Traffic data center Logistic control tower platform and software Owned and customized by a cloud provider
Partners	Logistic agents, logistic service providers, customs, IT providers, members' IS providers, universities	An IS developer, IT providers, members' IS providers, universities, legal advisors	Company C, IT providers, a logistic research institute, universities	An IS developer, IT providers, members' IS association, universities	Business angels, a logistic research institute, financial auditor, an IS developer, an IT provider, university	An IS developer, IT providers, members' IS employer organization	Logistic service providers, an industry-specific wholesaler association, a platform provider, members' IS providers, university	A platform provider, an IS integrator, members' IS providers, IT providers
Cloud Based SCCs' Governance Aspects	Contract based governance with private company A	Contract based governance with private company B	Governed by the members	Non-profit private company D	Not yet well defined	Non-profit private company F (est. in 2009)	Non-profit public company G	Governed by the members
Entities' owners	-	-	-	Shareholders, which are major members	Not yet well defined	Shareholders, which are transportation hubs	Shareholders, which are major members	-
Investment and funding	-	-	-	Shareholders & government	Not yet well defined	Shareholders	Bank, creditors	-
Decision making	Decision making based on contracts	Decision making based on contracts	Members	Shareholders & a trade association as members' representation	Not yet well defined	Managing, supervisory, & advisory board as community' representation	Board of directors as community & system developer	Members and an IS integrator
Data governance	Non-Disclosure Agreement (NDA)	NDA, multilateral contract between customers	NDA, members have a full data ownership & access to its privacy setting	NDA	NDA	NDA, members have a full data ownership, access transparency	NDA, members have a full data ownership, access transparency	NDA, members have a full data ownership, access transparency
Cloud Based SCCs' Business Model Canvas Elements and Governance Aspects (Intersection)	Private companies	Private companies	Retailers & E-retailers	Transportation hubs	Small and medium private companies	Transportation hubs	Producers	A supermarket chain
Customers: SCCs' Members	Private companies	Logistic service providers	Private & public organizations	Logistic service providers	Logistic service providers	Logistic service providers	Large traders	Logistic service providers (company H is one of them)
			Logistic service providers	Warehouses	Warehouses	Warehouses	An auction company	
				Customs	Customs	Customs		
				Authorities	Authorities	Authorities		

V. CONCLUSION

Increasingly, companies jump on the bandwagon of cloud based SCCs. Most of them are using similar words – such as control tower, integrator, collaborator – to describe their role, even though they offer different services in SCCs, which also have different proposed governance model. This creates ambiguity as to how the planned SCCs should work. If this is not addressed, ambiguity could drive their potential members away to their rivals. Thus, a structured way to communicate a company's role in cloud based SCCs to their potential members or other parties is needed. We proposed a classification for companies' roles in cloud based SCCs: members, SC partners, cloud providers, other partners, and orchestrators. This classification, together with the governance model explanation, will help to describe the phenomenon of cloud based SCCs.

The introduction of cloud in SCCs breaks down the old paradigm of SCCs governance which endorses NAO. Benefiting from the flexibility of cloud and the legal strength of contracts, SCCs nowadays could adopt market and shared governance. The cases in this studies have portrayed how these governance models support the flexibility and transparency of cloud based SCCs.

This study is limited to cross sectional situation of the cloud based SCCs in order to present the existing governance. Further research on longitudinal case studies will be interesting because different governances may overlap and coexist throughout the cloud based SCCs' life cycle [13].

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