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Development of a collaborative supply chain model

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Abstract

This research aims to discuss collaborative relations and the factors that affect its formation and intensity in supply chains. To better understand collaborative relations, this research identifies two constructs; **Collaborative potential** and **Collaborative intensity**. This research explores the relevant literature and develops a theoretical framework/model that draws the relations and interrelations between the different factors and their effect over collaborative potentiality and intensity.

Keywords: Collaboration Potential, Collaboration intensity

Introduction

Supply chain business model, being as a new paradigm shift in business relations, encourages the strategic process of coordination between firms to competitively deliver a product or service to the ultimate customer (Benton and Maloni, 2004). However, supply chain integration is, to a large extent, still only a promise and many companies who started collaborative programs did not get very far (Boddy et al, 1998). This suggests that our knowledge of collaborative relations is quite limited (Nummela, 2003). Further studies are necessary to provide guidance for firms wishing to motivate joint action with their partners (Hausman and Johnston, 2009).

Previous studies identified shared returns, commitment, trust, culture and market dynamics as important factors that may affect collaborative relations (Batt and Purchase, 2004; Bititci et al, 2007). However, there is much debate among previous studies on how power differences affect collaborative relations. Besides, there are few studies discussing the effect of innovation on collaborative relations.

In turn, this research aims to explore the factors that affect collaborative relation formation and the factors that determine the degree of partners' interaction in collaborative ventures. Hence, this research is proposing two different constructs:

Collaborative potential: Combination of collaborative opportunity, (i.e. potential benefits partners will gain from collaboration) and collaborative readiness, (i.e. their preparedness to exploit that opportunity). This leads to the first broad research question:

RQ1: *is "collaborative potential" a valid construct? And if so, what are the factors that affect collaborative potential?*

Collaborative Intensity: the depth and degree of interaction in collaborative ventures. This leads to the second broad research question:

RQ2: *is "collaborative intensity" a valid construct? And if so, what are the factors that affect collaborative intensity?*

Research Methodology

This research started with some unstructured exploratory interviews with some industry practitioners to explore collaborative relations within supply chains. This was followed by initial literature review to better understand supply chains. Based on the interviews and the initial literature review, this research is proposing two constructs; collaborative potential and collaborative intensity. This was followed by an in-depth systematic literature review, informed by Tranfield et al (2003), around these two constructs.

Specific management databases, such as Web of Knowledge, Emerald Insight, ABI Inform and Science Direct, were investigated to identify articles discussing supply chain collaborative relations. Abstract and citation search was carried out according to some inclusion and exclusion criteria. Because this research has a particular interest in collaboration between manufacturing dyads, empirical studies focused on service sector companies are excluded. Studies focusing on information technology merely and papers written in other languages rather than English are also excluded. This research utilized 35 usable relevant articles.

After the literature review phase, the researchers were able to raise some additional research questions (to be explored in the literature review section). Besides, the research develops a conceptual framework that draws the interrelations between the different factors that affect collaborative potential and collaborative intensity.

This research aims to build a theory around collaborative relations' formation and depth of interactions between partners. This will be done through exploring the factors that affect collaborative potential and collaborative intensity. Consequently, this research could be classified as an exploratory, deductive and theory-building research.

A case study approach was chosen to test and modify the conceptual model until it reaches its final form. Case study research provides in-depth investigation to the relations between collaborative business partners and the factors that may affect the relation. It allows the researcher to fully understand the different factors within organizational settings and to draw conclusions based on real world data. The data was collected through an in depth semi-structured face to face interviews with key managers that are in a direct contact with the other partner within the case study companies.

The research unit of analysis is the dyadic relationship between business partners in supply chains. This dyadic relationship is considered a major indicator to the relation between various supply chain partners, as supply chains comprise various dyadic relations. During the preparation for data collection, the researchers developed a case study protocol to ensure that the data can be collected, presented and analyzed in a repeatable and reliable manner by a number of different researchers and ensuring that the data is appropriately triangulated. Anonymity was guaranteed for participants as the subject is delicate and can have negative impacts on their relation with their partners.

Two case studies, each case represents a dyad, helped to gain insights into the conditions and specifics of successful collaboration. Following Yin (2003) replication strategy, this research deployed a theoretical replication strategy. This means that cases were selected to produce contrasting results for a predictable reason. The theoretical model, developed from the literature, was tested against the two dyads with the aim of identifying its suitability and modifying it in accordance to the real world data.

Literature and model development

Collaboration is an attempt to build close, long-term connection between organizations which are distinct, but which sees benefits in working closely (Boddy et al, 1998). The concept of joint work is central to collaborative relations resulting in an interpenetration of organizational boundaries (Veludo et al, 2006). There is little doubt that collaboration

is critical for optimal supply chain performance (Sheu et al, 2006). However, there is still confusion surrounding how to make a collaborative relationship work (Whipple et al, 2009). The following section aims to explore the concept of potentiality and the factors that affect partners' collaborative potential.

Collaborative potential

The work of Bititci et al (2007) seems to be a good starting point for exploring how collaborative relations are formed. It provides a broad framework covering strategic, operational, cultural and contractual issues along collaborative supply chains. Similar to Duffy (2008), Batt and Purchase (2004) and Ghijssen et al (2009), Bititci et al (2007) model highlights the importance of potential returns (ROI), management commitment, trust and collaborative culture for collaborative efforts to succeed.

Potential sufficient returns can be seen as the threshold for any business collaborative venture. It is contended that the mutual expected outcome is the major impetus for partners to participate in any collaborative relation (Barratt, 2004; Wu and Cavusgil, 2006). Partners are often reluctant to participate in a relationship if not enough incentives are available (Ghijssen et al, 2009). Generally, the first trigger for top management commitment to collaboration is the potential expected returns.

Management commitment is recognized as an essential ingredient in long term inter-firm relationships (Gundlach et al, 1995). The key to achieving desired collaborative breakthroughs is to establish strong widespread managerial commitment (Hausman and Johnston, 2009). Commitment refers to partners' willingness to make short-term sacrifices to maintain long-term relationships (Yih Wu, et al, 2004) and the intention to develop and maintain a relationship in the future (Duffy, 2008).

Collaborative relations require much cultural support from organizations (Boddy and Macbeth, 2000). Several publications highlighted the importance of the presence of adequate organizational culture in the pace of attaining successful collaborative relations (Mello and Stank, 2005; chin et al, 2004).

Trust refers to the extent to which supply chain partners perceive each other as credible and benevolent (Whipple et al, 2009). Partnering real gains can only be achieved when supply chain partners trust each other (Panayides and Lun, 2009). Lee-Mortimer (1993) highlighted that developing long-term partnerships between partners requires the ability and willingness of both sides to operate in an atmosphere of trust.

The previous literature review highlighted the importance of potential returns, commitment, culture and trust in the building process of collaborative relations. It could be argued that potential returns indicate a potential opportunity for achieving better results; collaborative opportunity. The presence of management willingness, coupled with sufficient levels of trust and supportive collaborative culture reflect the partners' readiness to utilize this collaborative opportunity; collaborative readiness. The presence of collaborative opportunity and collaborative readiness reflect the collaborative potential of partners and puts partners in a position as potential collaborators.

From the previous literature exploration, we can conclude that the collaborative potential is theoretically a valid construct and that returns, commitment, trust and collaborative culture affects partners' collaborative potential. This leads to two additional research questions:

RQ1.1: Are these factors really true in practice?

RQ1.2: Are there other factors that affect collaborative potential?

It should be highlighted that the potentiality factors alone are not sufficient for the continuity of collaborative relations. It is suggested that there are other factors that affect the degree of partners interaction; the collaborative intensity of the relationship.

Collaborative intensity:

Previous research identified that inter-organizational relationships are positioned between continuum anchors of market transactions and vertical integration (Duffy, 2008) with collaborative relations in-between (Golicic and Mentzer, 2005). Golicic et al (2003) proposed the concept of relationship magnitude in which they highlighted the presence of different levels of closeness in business relations.

Generally, it could be identified that there is consensus among previous studies that inter-firm collaborative relations may vary in intensity. We can then conclude that the collaborative intensity is theoretically a valid construct. However, Golicic and Mentzer (2005) identified that the concept of relationship intensity, although previously existed, has received little attention in previous studies and it is important to identify the antecedents of relationships intensity.

To understand collaborative relations intensity, it is important to explore the factors that affect the degree of partners' interaction in collaborative ventures. Yih Wu et al (2004) highlighted the role of product saleability over collaborative ventures indicating the effect of market dynamics over collaboration. Bagchi and Larsen (2002) identified that power and innovation play an important role in determining the level of integration in supply chains. Golicic and Mentzer (2006) highlighted the effect of power on determining collaborative relations degree of interaction. In conclusion, previous studies highlighted the effect which power relations, market dynamics and innovation in specific critical information might have in partnering relations.

Generally, there is much debate among previous studies regarding the role of power differences over collaborative relations (Hausman and Johnston, 2009). Some studies acknowledged exploiting power differences coercively while others highlighted the role of using non-coercive power influences to promote collaboration.

It may be argued that a partner with significant power might not find it necessary to establish a win-win partnership since it can achieve its own profitability and effectiveness through control of its dependent partner (Benton and Maloni, 2004). Hausman and Johnston (2009) identified the importance of exercising power to achieve better inter-organizational collaboration. From the other side, Hausman and Johnston (2009) identified that managing collaborative relations requires employing influence tactics that deepen interdependence. It is contended that non-coercive influence strategies produce positive outcomes (Hausman and Johnston, 2009); hence leading to better opportunity for increasing the levels of partners' interaction. Benton and Maloni (2004) highlighted the importance of partners' feeling of equity no matter what power imbalances between partners. If partners are dissatisfied, contributions might not be the best, which in turn hampers collaborative efforts (Ghijssen et al, 2009).

The nature of the market dynamics is another important factor in determining the desire of firms to undertake close business relations (Yih Wu et al, 2004). Firms need to consider the complexity of the market in order to identify the appropriate focus for a partnering relationship (Whipple et al, 2009). Bagchi and Larsen (2002) highlighted the effect of market dynamics over the level of integration in collaborative business relations. It is contended by Wu and Cavusgil (2006) that high market uncertainty and dynamics can noticeably affect the extent of collaboration between firms.

Collaboration requires the co-ordination between different functions among different partners. It may involve the sharing of confidential information among the collaborating partners (Larsen, 2006). Proprietary resources, such as valuable social networks and technical knowledge, run the risk of being exploited (Wu and Cavusgil, 2006). It is contended by Bagchi and Larsen (2002) that firms with much proprietary information

are more reluctant to engage in deep collaborative arrangements than firms with little proprietary information.

Although previous studies highlighted the effect of market dynamics over partners' degree of interaction, it is clear that there is lack of consensus on the role of power as well as scarcity of literature discussing the role of innovation and critical information over the intensity of collaboration. This leads to some additional questions:

RQ2.1: *what is the role that gap in power plays in collaborative relations?*

RQ2.2: *what is the role that innovation plays in collaborative relations?*

It should be noted that previous studies showed that the potentiality and intensity factors are interrelated. Table 1 provides a summary for the interrelations between the potentiality and intensity factors.

Table 1 – Interrelations table

	Commitment	Culture	Trust	Power	Innovation	Market Dynamics
Commitment	NA	Commitment leads to the establishment of collaborative culture (Nummela, 2003).	Commitment in a relation nurtures mutual trust (Gundlach et al, 1995).	Commitment reduces the likelihood of a dependent party being exploited (Ogbonna and Wilkinson 1998).	NA	Not identified
Culture	Collaborative culture facilitates further commitment (Barratt, 2004).	NA	Culture that supports openness can facilitate the establishment of trust (Barratt, 2004)	Collaborative culture might have a moderating influence on use of influence strategies (Lai, 2008).	Collaborative culture can facilitate the exchange of information (Whipple et al, 2009).	Not identified
Trust	Mutual trust allows for further commitment (Gundlach et al, 1995; Morgan and Hunt, 1994).	Trust is the main foundation to develop a partnering culture (Busch and Hantusch, 2000)	NA	Power can be seen as the antithesis of trust (Hingley, 2005 B; Leonidou et al, 2008)	Trust is essential for the exchange of confidential information (Child, 2001)	Not identified
Power	Power use varies inversely with commitment (Gundlach et al (1995).	Coercive strategies are likely to hinder cooperative atmosphere (Ghijsen et al, 2009).	Power can be seen as the antitheses of trust (Hingley, 2005 B)	NA	Not identified	Not identified
Innovation	Not identified	Not identified	Not identified	Specialist knowledge plays a significant role in alleviating power differences (Johnsen and Ford, 2008)	NA	Specialist knowledge alleviate competition in the market (Johnsen and Ford, 2008)
Market Dynamics	Market dynamics affect the level of commitment (Lai, 2008)	Not identified	Not identified	Market dynamics can determine the level of influence that can be exerted (Lai, 2008).	Not identified	NA

From the preceding literature discussion, it could be argued that these interrelations plays significant role in determining collaborative intensity in dyads. This previous literature discussion led to the development of a conceptual model shown Figure 1 explicating the relations between the potentiality and intensity factors and their interrelations and their effect over partners' collaborative potential and collaborative intensity.

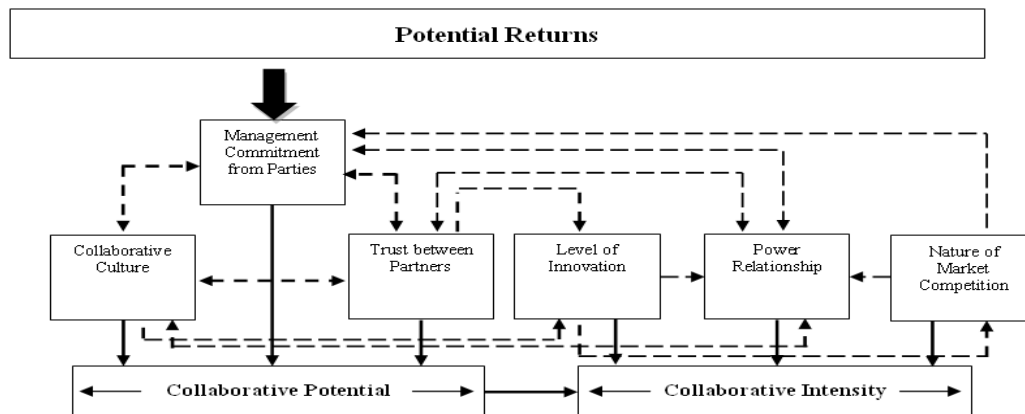


Figure 1 – Proposed model

Case studies and findings:

Two case studies were deeply investigated against the proposed model. The two examined cases represent two different dyads serving the pharmaceutical market. Company X in the two dyads is a UK based subsidiary for a US based Biopharmaceutical Company that develops proprietary products for the pharmaceutical market, based on its own, unique drug-delivery systems. Company Y, the second partner in the first dyad, a UK based company, is a part of a large Japanese company that is considered one of the world's leading designers, manufacturers and marketers of vascular prostheses and medical devices. The second partner (Company Z) in the second dyad, a UK based company, is a leading packaging manufacturer of folding cartons and patient information leaflets for the pharmaceutical and healthcare industries.

First case study

The first case dyad comprises Company X and Company Y representing two collaborating companies. Both companies started their business relation 15 years ago when they jointly developed a usable retrieval device for Company X drug-delivery system. The two partners signed a non-disclosure and confidentiality agreement as well as IP rights agreement. The agreements guarantee that company Y is not able to sell the retrieval device to any other company without prior acceptance from company X. Also company X is not allowed to buy the retrieval device from any other supplier without prior acceptance from company Y. Company X is considered a high-tech company since its expenditure in innovation represents around 20% from its total annual sales. Company Y is also considered a high-tech company as the development of patented devices is considered a crucial part of their business.

It could be identified that the desire of company X to develop its retrieval system jointly with company Y represents a good opportunity to improve the retrieval mechanism for their medicine. For company Y, it could be identified that having such close relation represents a good opportunity to penetrate the pharmaceutical market.

The long-standing history of successful relation between the two companies allowed partners to build a close personal relationship. Both sides highlighted the role of personal relations in establishing trust and commitment in their relation.

The potential expected benefits from the joint development of the retrieval device allowed for top management from both sides to be committed to the relation. In addition, the R&D nature of both companies necessitates massive top-management appreciation and commitment for collaborative relations with partners. Partners' commitment was reflected in several joint activities; reciprocal technical assistance visits, joint training and the sharing of future plans and directions.

This joint project could be seen as the first trigger to build a trustful relation between both sides. The top management commitment and the associated agreements provided a suitable platform for trust to exist between them.

The collaborative business culture in both companies is, to a great extent, adequate for collaborative efforts to prosper. Top-management commitment, the R&D nature and the undertaken activities allowed for establishing a supportive collaborative culture.

To conclude, it could be identified that the expected benefits from collaboration were the major impetus for the two companies to undertake their collaborative venture. In addition, commitment, culture, trust and their interrelations could be seen as factors that affect the degree of readiness of partners to utilize this collaborative opportunity. Hence, the presence of collaborative opportunity and the collaborative readiness of partners to utilize that opportunity reflect high potentiality to collaborate; collaborative potential.

The relation between both sides could be identified as a highly-interdependent relation. The joint development of the retrieval device (joint innovation) and the associated agreements influenced the power relation, market dynamic and the critical information exchange between the two partners.

The joint development of the retrieval device created a market of one customer and one supplier. This eradicated any effect for market competition and triggered the desire from both sides to intensify their interaction. The absence of market competition was reflected on the power relation and the exchange of critical information between the two companies. It helped in manipulating any power difference between the two companies. Although theoretically company Y is in a better position in terms of power (they are supplying 100 % of the retrieval device and this represents around 3-4 % from their total sales), it could be highlighted that the power game has no effect over their relation.

In addition, the market dynamics eliminated the fear of disclosure of confidential information; hence allowing for better opportunity to share any critical information. The signed agreements, coupled with the presence of trust and management commitment make the disclosure of information between the two partners secure.

In conclusion, it could be identified that the current degree of interaction was affected by several factors. The market dynamics created by the joint development of the retrieval device led to a clear interdependence relation; hence allowing them to intensify their interaction. The intensity of the relation resulted also from the elimination of power differences and the high degree of openness in exchanging confidential information. It should be highlighted that power, innovation and market dynamics and their interrelations with the potentiality factors contributed significantly in reaching the current levels of collaborative relation interaction.

Second case study

The second case dyad comprises two companies, company X and company Z representing a non-collaborating dyad. Both companies started their business relation 5 years ago when company X added company Z to its approved suppliers list for packaging materials. Company Z is also considered a high-tech company. However, there is no fixed R&D budget in company Z as they usually work directly with customers in creating cartons and new ideas for packaging materials.

The relation between the two companies could be classified as a close but traditional independent customer-supplier relationship. Despite the close relation, both sides lack the desire to turn this close relation into a collaborative venture. From company X point of view, the market is full of other packaging suppliers and they prefer to let market dynamics identify prices. From the other side, company X represents a small proportion of their business which does not warrant undertaking any collaborative efforts. It could

be identified that the absence of adequate returns led to absence of collaborative opportunity; resulting in partners mitigating any collaborative arrangements.

The absence of a collaborative opportunity led to inadequate levels of commitment from both sides to collaborate. As a result, they do not undertake any joint activities or any collaborative arrangements to manage the relation. Nevertheless, the successful business history between them allowed partners to build a trustful relation as well as building a close personal relationship. It should be noted that both sides of the dyad highlighted the importance of personal relations in nurturing trust between them.

The R&D nature in both companies helped in developing company-wide appreciation of the role of joint work in achieving better results. Yet the commitment from both sides did not reach a suitable level for partners to exploit this supportive culture for the sake of collaboration.

To conclude, it could be seen that the inability to identify potential returns result in the absence of any opportunity for both sides from collaboration. In turn, this led to a lack of partners' commitment to undertake collaboration. Although the relation is characterized by high levels of trust and both companies' culture could be seen as supportive to collaborative efforts, the lack of commitment led to the inability to undertake any collaborative arrangements. The lack of opportunity hindered partners' readiness to collaborate; leading to insufficient collaborative potential. As the relation between the two companies is a non-collaborative relation, assessing the effect of power, innovation and market dynamics over the relation will have no additional value.

Discussion

The initial argument discussed herein was to understand the factors that affect collaborative potential and collaborative opportunity. It was proposed that potential returns (collaborative opportunity) is the major driver for inter-firm collaborative relations. Management commitment, trust and collaborative culture (collaborative readiness) allows partners to exploit that collaborative opportunity leading to high collaborative potential. In actual collaborative ventures, it could be argued that power differences, market dynamics, innovation and their interrelations with the potentiality factors could determine the degree of partners' interactions. In turn, the analysis allowed the researchers to provide explicit answers to the research questions as shown in Table 2

Table 2 – Summary for answers to the research questions

Question No	Answers to the research questions
RQ1	Collaborative potential proved to be both theoretically and empirically valid.
RQ1.1	Collaborative potential proved to be a valid construct in practice. Potential returns, commitment, collaborative culture and trust are the main factors that affect collaborative potential.
RQ1.2	Personal relations affect partners' relations both in collaborative and non collaborative ventures. In collaborative ventures, personal relations allow for better trust and commitment.
RQ2	Collaborative intensity proved to be a valid construct both theoretically and in practice.
RQ2.1	Power affects collaborative relations. The powerful side has better opportunity to direct the relation. The non-coercive use of power is essential for collaborative relations continuity.
RQ2.2	Innovation affects collaborative relations. Joint innovation heightens trust, commitment and culture supportive to collaborative efforts.

At the start-up of the research and after the literature review, this research proposed a conceptual model that draws the interrelations between the factors that affect collaborative relations' potential and intensity. Throughout the empirical work, the model has developed to reach its final form as shown in Figure 2.

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