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Effective horizontal coordination in coopetitive clusters: developing the required attributes for supply chain management

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ABSTRACT

The coordination of supply chain management activities between firms in a cluster frequently prove to be challenging when many competitors are present. A challenging form of relationship between members that work together while competing in other markets is known as 'coopetition.' Generally, success in the present coopetitive structure may be enhanced through past relationships and disbursement of benefits gained by coordination of activities. Inter-firm coordination of activities between competitors is a horizontal form of engagement, dissimilar to vertical coordination that is frequently studied in supply chain management. These differences are apparent when investigating the barriers to coordination amongst firms in clusters. Complex relationships between members are explored using causal loop diagrams to illustrate the development of the pressures to cooperate or compete. Using a system dynamics approach key variables are identified as leverage points that managers can influence, allowing a more holistic understanding of the long-term impact of decisions.

Keywords: Barriers, coordination, integration, horizontal linkages, horizontal coordination

I. INTRODUCTION

Globally, small and medium sized enterprises (SMEs) contribute greatly to employment and economic output; within New Zealand SMEs with five or fewer employees accounted for one third of retail sales and income in 2007 at NZ $106 (MED, 2009, p. 34-35). Yet many small organisations find opportunities are limited by their small size. One method for overcoming this problem is by working with a network of other organisations. This allows "each member to benefit *as if* it had greater scale or *as if* it had joined with others formally – without requiring it to sacrifice its flexibility" (1998, p. 80; emphasis retained from Porter). In this manner the cluster forms a 'quasi-enterprise' or a 'quasi-firm' (Bruce & Jordan, 2007; Eccles, 1981) in which members both compete and cooperate in a state known as 'coopetition' (Bengtsson & Kock, 2000; Brandenburger & Nalebuff, 1996), whereby "competitors are becoming an important source from which to acquire resources" (Chetty & Wilson, 2003, p. 78). The complex web of interactions between the members prove challenging and few clusters can be identified that appear to have successfully navigated these challenges to enjoy success. This paper focuses on the cyclic interactions in the cluster, identifies key variables, and illustrates key interrelationships using a systems dynamics approach. The outcome points towards areas of concern for managers and indicates directions that effort should be invested in for the best return.

II. LITERATURE REVIEW

The vast bulk of literature in supply chain management focuses, implicitly, on the vertical flow of products from source to the final consumer. The flow of products through the supply chain is a natural and important focus as it satisfies the customer requirements. However, the neglect of the horizontal dimension of the supply chain has been neglected, despite the potential for valuable contributions from coordination along this dimension.

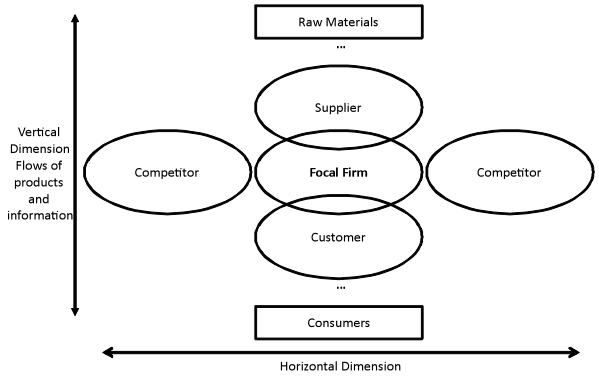

Figure 1. The vertical and horizontal nature of supply chains. Based on Figure 1.1 (Wood, 2010)

When firms look beyond their own borders and seek to work with others they may form a cluster or a network. The horizontal relationships, between "parties engaged in similar activities, that is, located at the same stage of the value chain" (Nassimbeni, 2004, p. 52), are different in nature to vertical relationships. The vertical dimension deals with the flow of products from suppliers to users, while on the horizontal dimension "similar, competing products (substitutes in consumption) are pooled to share a common resource of production or distribution, in a scale strategy" (Nooteboom, 1999, p. 92). When comparing relationships on the two dimensions there will be "different strengths, in terms of size (volume), type, frequency, and durability of exchange, and in terms of force of control" (Nooteboom, 1999, p. 93).

When working in clusters firms find their previous range of actions have been curtailed by the need to cooperate with their competitors. Each firm experiences two pressures that are exerted: the pressure to compete and 'do their own thing' and the pressure to cooperate. If firms feel excessive pressure to compete then the cluster may be pulled apart by inappropriate and competitive actions of some members. The actions of a single member can have repercussions that may not be immediately obvious as the action and the result may be disconnected in space or time (Maani & Cavana, 2000). This is particularly true as 'negative' actions in a cluster may create immediate responses, while 'positive' actions that seek to reinforce the nature of the cooperative relationships. This makes the use of causal loop diagramming (CLDs) particularly useful as a qualitative modelling tool (Maani & Cavana, 2000; Sterman, 2000). A systems thinking approach is valuable as it "acknowledges the messiness of the world and views a problem in the context of its environment" (Maani & Cavana, 2000, p. 37).

A. Existing barriers to integration in supply chain management

Through previous research scholars have identified various barriers to integration and coordination of supply chain management. Fawcett et al. (2008) classifies barriers based on Park and Ungson's (2001) division between managerial complexity (relating to aligning cultures, structures, and processes between firms) and inter-firm rivalry (relating to the motivations and behaviours between firms). Insightfully, it can be noted that it "is people that gather, process, share, and interpret the information, write and uphold the alliance guidelines, and determine and adhere to the goals of their operations" (2008, p. 44), indicating that soft and non-technical issues may be predominantly important in cross-organisational coordination efforts.

Fawcett et al. (2008) identify managerial complexity barriers as: organisation boundary issues, challenges in establishing alliance guidelines, poor evaluation of processes, and difficulties measuring partners' contributions of effort and customer demand. Inter-firm rivalry barriers include: unwillingness to share benefits and information in the alliance, incompatible objectives, and unwillingness to share information between partners (Fawcett et al., 2008). The resistance to change that many employees and organisations embody is also acknowledged to be a barrier to logistics collaboration (Bowersox, 1990). This is related to 'managerial inertia,' bred in the structure of companies, which may be exacerbated by outdated policies based on older organisation forms or systems (Simatupang & Sridharan, 2002). It is necessary for partners to create and meet performance expectations and have clear and adequate goals, along with computability of culture (Whipple & Frankel, 2000). Many of these barriers are also highlighted by Ballou (2007), and they demonstrated remarkable concurrence in the identification of barriers to inter-firm coordination, divided into inter-firm rivalry and managerial complexity (summarised in Table 1).

TABLE I. BARRIERS TO SUPPLY CHAIN INTEGRATION PREVIOUSLY IDENTIFIED

Inter-firm rivalry	Managerial complexity
Inadequate information sharing Lack of willingness to share information Lack of willingness to share rewards and risks Inconsistent operating goals Distrust	Lack of alliance guidelines Poor appraisal of process costs Lack of aligned measures Organisational boundaries Inability to measure contribution to the supply chain Inappropriate metrics Inability to measure customer demand Incompatibility of partners No mechanism for benefit sharing

B. Systems dynamics modelling

The operations of a cluster or a network comprise a set of structures that influence the behaviours of the firms (or 'actors') that operate within it (Senge, 1990). Within this system there are multiple variables with many interrelationships, forming the 'systematic structure.' In order to model the structures and variables that are deemed important in the research, feedback loops and reinforcing structures become important. These can be incorporated into CLDs, a qualitative technique founded on System Dynamics (SD) principles (Sterman, 2000). Interlinked loops can be used to represent an integrated system so that the impact of behaviours and tensions may be understood in a dynamic fashion.

Linkages between variables in a sequence can be used to demonstrate that changes that impact on a single variable may lead to a chain of events culminating in changes to another variable, distant in space and time for the area of the original change. Seemingly simple changes, such as managerial actions, frequently have unexpected and unintended impacts. CLDs fulfil an important role as they allow senses making in a messy world by investigators who can better "understand the multi-dimensional relationships among processes, people and the environment" (Ellram, Tate, & Carter, 2007, p. 323).

In CLDS there are two types of links: positive (indicated by a "+" symbol on the link) and negative (indicated by a " – " symbol on the link). Positive links indicate that if there is a change in the first variable the effect on the subsequent variable will be more than it would otherwise have been; it does not mean that if the first variable increases the second variable increases as well. Negative links indicate that if the cause variable increases the impact of the following variable will be less than otherwise expected (Sterman, 2000).

When the variables have been connected logically a loop can be formed, indicating that a flow of causality has moved from variable to variable and impacts again on the original variable. Two types of loops are present: reinforcing loops (indicated with a "+" symbol enclosed in a circle) and balancing loops (indicated with a " – " symbol enclosed in a circle). Reinforcing loops indicate that the initial and original change in the first variable leads to a chain of affects that enhance or amplify the initial impact.

Contrariwise, balancing loops indicate that the initial impact on the variable will be dampened, or subdued, by the changes flowing around the loop.

Previous research on clusters has also employed CLDs to understand interrelationships in clusters. Lin, Tung, and Huang (2006) claim that "the complex relations involved in the industrial cluster effect can be observed through SD analysis, which is a deficiency of other methodologies" (Lin et al., 2006, p. 482), indicating that SD analysis may yield a superior result to other methods of analysis. In the present study the complexity is enhanced through understanding the tensions between various members.

Previous research on barriers to integration and coordination in supply chain management chose to employ qualitative and quantitative methods to elicit responses from participants on both barriers and how these barriers may be employed. Similarly, the present research used qualitative methods, involving less and more successful clusters, yet augmented this approach with CLD modelling to try to understand the relationships unveiled. Through this attempt at SD analysis a more prescriptive approach may be presented that accounts for the complexity of coopetitive relationships and which may also confirm much of what is uncovered about the managerial approaches demonstrated.

III. METHOD

As there has been little research on horizontal coordination in supply chain management an exploratory stance was adopted. A case study methodology was adopted as this is a method that Yin states is suitable for answering 'How' questions (Yin, 2009). Each cluster, comprised of multiple organisations, is conceived as a case. Three cases were used, where they were clusters that had exhibited various levels of success in their coordination efforts. This allowed a comparison between 'polar' cases, to draw out important distinctions and differences (Eisenhardt, 1989; Pettigrew, 1990). NZBrand operates very successfully to develop and supply emerging markets that individual members otherwise had difficulty breaking into. HortCom seeks to ensure continued adequate shipping capacity for their exports. WineCom exhibits several examples of horizontal coordination in the viticulture industry.

To gather data about the challenges the firms faced semi-structured interviews were used and documents were referred to. Interviews allowed participants to explain relationships and capabilities that may not have been documented elsewhere. As the research involved SMEs generally only one respondent was interviewed from each firm and tended to be a senior manager familiar with the coordination. Interviews were transcribed and all textual documents gathered, and field notes, were aggregated with interview transcriptions in the NVivo software package. This qualitative data analysis package allows researchers to work with large volumes of qualitative data quickly and easily, particularly when searches are involved. It allows the application of different forms of analysis. Data were coded, by breaking apart segments of meaning, which were then aggregated into categories (Glaser & Strauss, 1967; Strauss & Corbin, 1990). These codes highlighted areas of importance in the research and formed the basis for the construction of cases for cluster. These cases, once analysed, were then compared and contrasted in cross-case analysis (Eisenhardt, 1989; Eisenhardt & Graebner, 2007). Cross case analysis highlighted areas of commonality in the approaches used by the clusters to engage in more effective coordination of their supply chain management.

IV. DISCUSSION

This section seeks to outline the cases, identify key variables, and begin to construct CLDs to illustrate key dynamics present within coopetitive clusters.

A. Case introduction

Three cases were identified that allowed adequate access to collect primary data. WineCom operates in the viticulture industry and found itself struggling to coordinate activities amongst members. HortCom operates in the horticulture sector and the membership is comprised of exporters that aggregate volumes to

aid shipping from New Zealand. NZBrand is also in the horticulture industry but was formed with a focus on new markets that the members wanted to enter and develop.

B. Reasons for clustering

One of the key reasons for clustering is to improve the competitive positioning of the cluster and the firms that contribute. Through cooperation, and voluntarily restricting the actions and options available to them, members hope to generate greater profitability over a longer period of time. However, an alternate route of action would be to engage in opportunistic behaviour in a way that creates greater profits for the member in the short-term, but which may, over a period of time, damage the ability of the cluster to operate effectively. This situation matches the 'fixes that fail' archetype (Maani & Cavana, 2000; Senge, 1990), where behaving opportunistically solves the problem of inadequate profit today but reduces long-term competitiveness when the cluster cannot coordinate activities adequately anymore, representing at situation when "[T]oday's problems come from yesterday's 'solutions' " (Senge, 1990, p. 57).

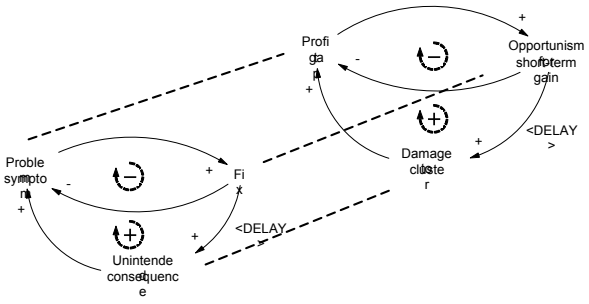

Figure 2. Fixes that fail - the case of coopetition, based on Figure 9.4 (Wood, 2010).

Expanding the balancing loop, the profit gap may lead a firm to be increasingly willing to examine opportunism as a method of increasing profit. If these actions are taken, short-term gains result, increasing profits, and reducing the profit gap.

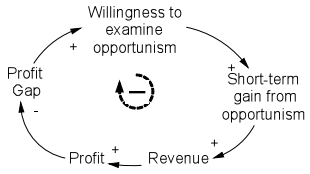

Figure 3. Opportunism forming a balancing loop

When opportunism occurs, while there may be short-term gain this will also damage the trust between members of the cluster. Confidence in the cluster will decrease, decreasing coordination success and reducing the cluster success and revenue generating opportunities. This reduces profit and reinforces the growing profit gap.

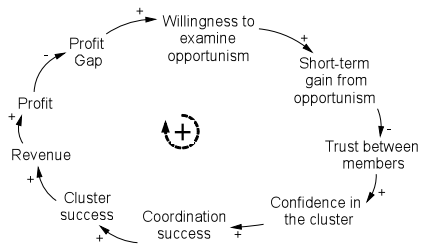

Figure 4. Reinforcing forces to enhance long-term clustering dynamics

Taken together, these diagrams can be combined to create the 'fixes that fail' archetype. This shows that the range of actions taken by members must be carefully considered in the context of the cluster. It is

particularly important as there are delayed responses, where a change in one variable will cause a change in the next variable in the loop, after an appreciable delay.

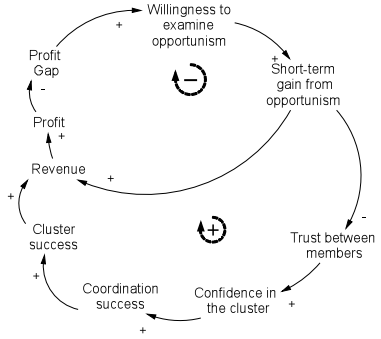

Figure 5. Fixes that fail – coopetition in detail

C. *Horizontal group pressure*

The formation of horizontal group pressure between the members of the group at the same tier in the vertical supply chain is one of the earliest and most critical tasks of the cluster. The presence of this pressure acts as an extraneous variable that impact on the willingness of members to examine opportunism. As more horizontal pressure is generated members are more likely to look for opportunities coordinate activity and less likely to look for opportunities where they can engage in opportunistic behaviours.

One of the key sources of horizontal pressure is the existing social networks of senior managers in the organisations. In many cases the 'old boys' in the industry know of each other and are capable of working together. Within NZBrand many senior managers are "co-directors on industry councils and committees and directors of exporter boards, exporter product groups," which helps them align their interests and their goals. This helps, as one NZBrand manager noted that the members "all had a common goal. So by getting together to collaborate [. . .] the common goal, it was common sense." Shared history and experiences are also important, and this is recognised by some NZBrand managers that noted "the human beings are very familiar with one another, which is a major asset in putting something like [NZBrand] together."

This closeness, and the support of a 'well-disciplined industry', allows a cluster to apply pressure inwards, in a self-policing fashion, to bring each other into line if someone puts a step wrong in a way that could damage the cluster. The familiarity and history between the members allows displeasure at disunity to be expressed, and act as an effective form of control in moderating the behaviour of others in the cluster. During meetings 'hard words' may be used between senior managers, which can have an impact not only on the issue under discussion, but also on the offending member in future interactions within the industry. During such meetings members may be required to defend their actions (or lack of actions) in front of their peers.

There are two factors that impact on the ability to create the horizontal pressure: past history and the coordination and communication processes. The past history, impacting on existing relationships of the managers of firms as they seek to cluster, is largely outside of the control of those seeking to cluster and is considered extraneous. However, effective coordination and communication processes can generate modes of behaviour and routines that enable the groups to exert pressure on members when required. These processes may involve regular meetings and communications about activities, including requirements for discussions about what and why and how activities were accomplished. Routines concerning the sharing of information also enable members to increase visibility so that any inappropriate actions may be brought to the attention of others for discussion.

Hard words and the use of such group pressure, or peer pressure acts as a 'soft' force to enhance the likelihood of cooperation amongst members. Applied and generated in this fashion, the horizontal pressure can be a method of creating'glue' that initially holds the cluster together in the short-term, while the members seek other methods for developing longer-term strategies to generate cooperative pressures in the

cluster. By counterbalancing the competitive forces during the initialisation of a cluster, it can help the members coordinate activities adequately for a period of time, until success may breed the creation of vertical pressures in their supply chain.

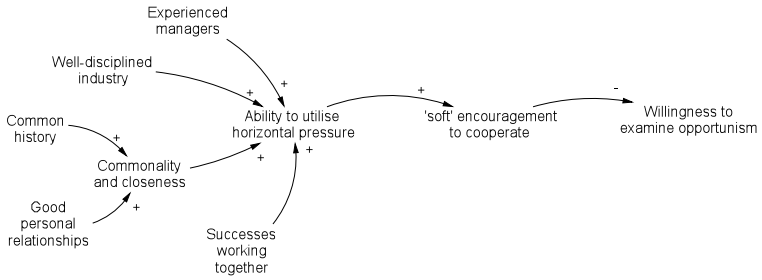

Figure 6. Horizontal pressure in coopetition

D. Vertical group pressure

In comparison to the horizontal group pressure, the vertical group pressure requires a longer period of time to develop and evolve to an effective level. This involves pressures passed vertically through the chain and may originate from the suppliers or customers, or both.

The source of the vertical pressure is the long-term relationships that are capable of developing in supplier-customer relationships. When there is an opportunity to create more value in a supply chain, or reduce the level of costs, greater profits can be generated and shared along the supply chain. Frequently the members of the supply chain are aware of how and where the source of the profits originate.

The growers and packers supply the exporting members of NZBrand and are have a vested interest in the success of the NZBrand venture as these impacts on the structure of the industry and the flow of products, information, and finances throughout the supply chain. One of the most critical KPIs for the growers, whom the exporters ultimately serve, is the return on the fruit. Using the NZBrand venture over time the returns generated per fruit in developing markets has been increased, creating higher returns that are then passed through the supply chain. This is clearly linked to the development of the NZBrand and cluster. The knowledge of the industry structure and the roles that various groups play can be shared through the various industry groups that both operate at single tiers and also across tiers of the supply chain.

In addition there is greater stability in the structure of the organisations in the supply chain. Previously packers would work with different exporters. When an exporter exhibited success, the packer would be able to distribute greater returns to the growers, which became a positive point when competing for the business of growers. As a result the churn of growers that would leave one packer for another was high. The clustering of exporters in NZBrand has stabilised returns in the industry and has created greater uniformity. This uniformity and stability of returns upstream means that there are reduced differences between the packers, and as these returns homogenise, there is a reduced rate of growers switching allegiance between packers.

When customers find a new initiative, such as a cluster, is capable of generating greater value at the same price, support may be shown and greater propensity to work with the cluster. In the case of NZBrand, there was an improved ability of members to supply their customers, with a higher-quality product and more consistent supply. Measures can be taken to improve the quality of the fruit from all members of the cluster to ensure that there is consistency of the supply associated with the brand. Through pooling of supply the range of dates for supply could be increased and the ability for to supply a customer with a fruit of a specific characteristic are improved, through the use of the supply bases of the other members. Through being able to affect economies of scale and to generate savings the chain may be made more competitive.

It is important to note that the vertical pressure from both suppliers and customers can only be generated after positive benefits have been demonstrated. This means that it is a reactive pressure that takes time to develop strongly enough to act as a counteracting force to the competitive nature of the individuals in the cluster. Now, however, one manager noted that NZBrand suppliers and customers would be up in arms if NZBrand ceased to operate. Why, asked a manager, would they even consider doing this? There are too many advantages, even if it is more challenging at times.

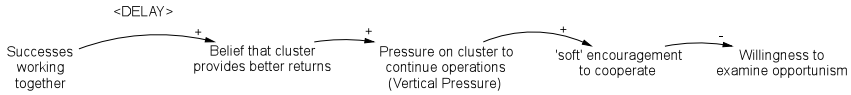

Figure 7. Vertical pressure in coopetition

E. Structures that encourage cooperation

There are two basic forms of rules and procedures – those that govern day-to-day operations and those that help the group work through 'exceptions' that are when problems occur.

When profit gaps increase there is increasing pressure on members. This results in greater operation pressures on internal matters, reducing the resources and capabilities that are diverted to working on 'cluster-level' support. This reduces the cluster success, in the long-run, increasing the profit gap further, representing a reinforcing cycle. However, horizontal pressure can be used to influence the operational support provided for the cluster, with the pressure being initiated when a member makes mistakes. If a member 'comes up short' and fails to fulfil their obligations, horizontal pressure can be exerted to bring them back on track and increase operational support of the cluster. Rules and procedures concerning the communications and obligations of each member can influence horizontal pressure applied to improve the outcome.

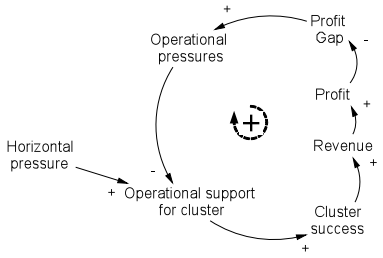

Figure 8. Generating greater cooperation with horizontal pressure

The managerial complexity related to the structuring of procedures that will allow a cluster to deal with a case of opportunism is challenging to overcome and negatively impacts on the sense of urgency to implement the structures. The experience of managers and the foresight to implement such procedures help a cluster to devise and implement such structures. When in place the presence of the structures provide members with a 'soft' encouragement to cooperate.

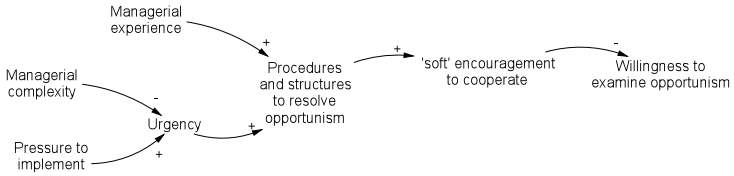

Figure 9. The role of procedures and structures as encouraging cooperation

Methods to share benefits from the clustering act to improve the revenue gained by each member. More structured and equitable solutions therefore share revenue around more fairly, increasing the revenues

gained by most members. The transparency and effectiveness of a 'simple' solution, such as the volume-based solution devised by NZBrand, ensures that confidence is maintained in the cluster operations.

F. Conclusions about the dynamics

When the vertical and horizontal group pressures are compared it seems apparent that the horizontal group pressure should be developed first, and developed strongly, while the measures that are put in place to develop the vertical group pressure are allowed greater opportunity to take seed and flourish. This approach provides a step-by-step implementation path.

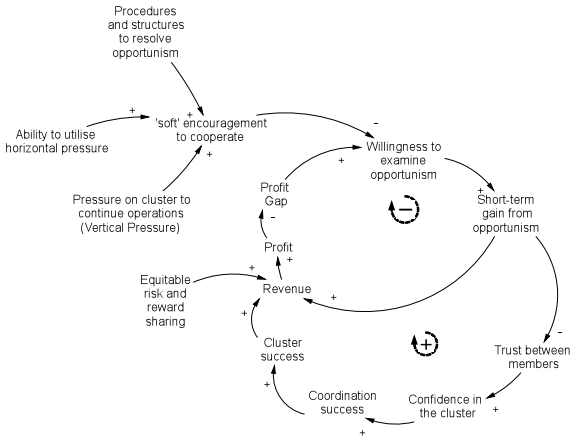

Figure 10. Dynamics in coopetition

One practical implication is that while firms are able to relatively quickly and simply generate horizontal pressure, the development of vertical pressure takes greater time. While the horizontal pressure is being developed, and is helping to glue the cluster together, steps should be taken to ensure that there are adequate sources of value being created in the supply chain, and being demonstrated, so that members are able to sense the development of vertical pressure. Over time the power of the vertical pressure should supplant that of the horizontal pressure and surpass it.

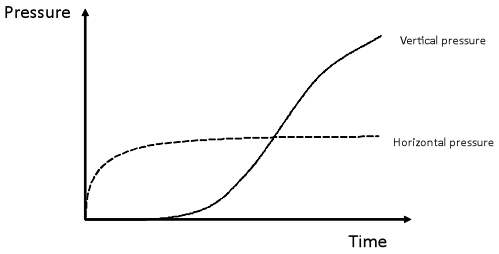

Figure 11. Timing and delays in creating vertical and horizontal pressure

Developing CLDs for the dynamics involved in the coopetitive relationships in the clusters is valuable. They help visually display key variables that impact on the coordination efforts, and the relationships between these, particularly where there are delays that may otherwise cause managers to misperceive the relationships. The visual representation can help managers to comprehend variables that they can impact to generate the responses desired outcomes. Using CLDs in this way demonstrates a valuable use of qualitative approaches in SD. Through this discussion the use of modelling has been used to examine the coopetitive relationships and demonstrate key areas that managers are capable of making substantial improvements with. The web of relationships represents a complex system that managers need to be able to navigate as they simultaneously cooperate and compete with their partners.

V. CONCLUSIONS AND FUTURE RESEARCH

Through this paper the objective has been to demonstrate how CLDs may be used to represent the web of interrelationships in coopetitive clusters that seek to coordinate supply chain activities together. When the intricacies of interrelationships between key variables is presented visually, managers may be better placed to make wise decisions and understand how to best invest their limited time and energy in working with variables to support their long-term objectives. Understanding the extent of interrelationships between the variables involved can help managers to determine the long-term impact of their decisions. Some of the most important relationships demonstrated relate the development of group pressure in the cluster and increasing the willingness of members to share information and coordinate activities. Vertical pressure takes time to develop through success in coordinated supply chain management activities while horizontal pressure may be generated initially. Horizontal pressures provide a force to encourage members to improve on their operational support for the cluster. Risk and reward sharing procedures can improve the revenue of individual members, encouraging improved coordination. This work may be extended by practical application of the principles outlined in managerial settings, with key variables being monitored. Such an approach would provide validation of the dynamics outlined above and indicate areas for refinement.

One of the key limitations of this research is that the research used theoretical sampling to generate a small sample for a case study. This means that statistical generalisation cannot be made from a small sample to a larger population, and instead theoretical generalisation must be employed. Such generalisation requires careful consideration of relevant variables present in both the case being generalised from and the case being generalised to.

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