An interactive resource analysis of supply chain interdependencies

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ABSTRACT

Firms are increasingly seen as interdependent entities in both the business network literature and in strategy research. The mainstream resource perspective nevertheless maintains an independent resource perspective focusing on the creation of internal rents. There are therefore few studies that investigate how mainstream understandings of resources fit with the idea of cooperative strategy. That is the ambition of this study, which builds on real time involvement of a logistics network where a start-up, a logistics service provider, tried to create resource bundles in cooperation with external partners. The study contributes with a reinterpretation of the meaning of valuable and rare resource attributes. Moreover, due to different resource interactions, resource bundles made of non-superior resources may also lead to the creation of relational rents.

Key words: Resource interactions, resource based view, supply chains, interdependence, 4PL logistics

INTRODUCTION

Whereas competition is the norm in strategic management, cooperation is stressed among business network scholars such as IMP researchers. However, firms are increasingly portrayed as interdependent entities rather than as independent actors also within the strategy domain. Developments in the literature on strategic networks and relational strategy suggest that the traditional image of the atomistic firm competing for profits in impersonal marketplaces is inadequate (e.g. Dyer and Singh, 1998). Firms are perceived as embedded in networks where both economic and social dimensions are important (Gulati et al., 2000). Yet, despite the idea that a firm's critical resources may span its boundaries, there are few studies that investigate how mainstream understandings of resources fit with the idea of cooperative strategy. That is the objective of this study.

Supposedly, managers try to use the best available resources, and scholars working in the resource-based tradition ask what it is about resources that give them inherent potential for value creation (see e.g. Holcomb et. al., 2009). The resource based view (RBV) regards firm-specific resources which can be fundamental sources of sustainable competitive advantage; when valuable, rare, inimitable and non-substitutable (Barney, 1991). However, the focus on certain resource attributes may be overstressed (c.f. Priem and Butler, 2001). The extended RBV (e.g. Lavie, 2006) highlights that interdependencies between firms can provide access to external resources. The extended RBV questions firm independence, but does not address resource attributes per se. Resource interactionists (e.g. Håkansson and Waluszewski, 2002; Baraldi et al 2012) downplay the importance of inherent resource attributes and intrinsic resource value, partly in line with work on cogency effects and resource bundles (e.g. Black and Boal, 1994; Dierickx and Cool, 1989). That is, there are interdependencies on at least two levels of analysis; the firm level and the resource level. These levels are seldom acknowledged in combination.

The research questions for this study are therefore phrased accordingly: how do the presence of resource interdependence and cooperative ambitions between firms correspond with mainstream resource attributes? That is, do resources need to be valuable and rare to provide advantages? Can non-superior resources create common benefits?

This research builds on a study of a logistics network where a start-up, a logistics service provider (LSP), tried to create resource bundles in cooperation with external partners. The objective of this study is to add to our understanding of cooperative strategy based on a

synthesized and interactive analysis of resources. We suggest that a more dynamic understanding of interactions and resource interdependencies is achieved by combining insights from work on both resource attributes and resource interactions. By acknowledging both firm level and resource level interdependencies, the meaning of valuable and rare need to be reinterpreted.

The remaining of the paper is organized as follows. A literature review presents work on resource attributes and resource interactions. The study's design and methods are presented thereafter, followed by an illustration of the development of two LSP relationships. The analysis and theoretical implications are subsequently discussed.

LITERATURE REVIEW

The review highlights previous work on resources in terms of independence and interdependence, on firm and resource levels respectively (see Table 1.)

Resource perspectives	**Resource value assumption**	**Resource level**		**Firm level**	
		Independence	Interdependence	Independence	Interdependence
Classical RBV	Inherent	X		X	
The extended RBV	Inherent	X			X
Resource bundles	Bundled		X	X	
Cogency effects	Interactive		X	X	
Resource interactions	Interactive		X		X

Table 1: Independence and interdependence on firm and resource levels

The resource based view

The RBV has been widely used in strategic management (e.g. Wernerfelt 1984; Barney, 1991; Dierickx and Cool 1989). RBV's focus is on resources that are owned or controlled by a focal firm. RBV further assumes that each firm tries to avoid dependence on its external environment and tries to make its buyers or suppliers to be dependent on it (Hitt et. al., 2012).

Barney (1991) suggests that resources that are valuable (i.e., capitalize on opportunities and/or deal with threats) and rare (i.e., scarcely held among other firms) can produce competitive advantage. When these resources are concurrently not imitable (i.e., they cannot easily be copied by competitors), not substitutable (i.e., other resources cannot realize the same purpose), and not transferable (i.e., they cannot be purchased in resource markets) a sustainable competitive advantage may be obtained (Barney, 1991; Priem and Butler, 2001).

RBV does not regard resources (or capabilities) in isolation. Teece et al's (1997) claim that to be strategic, a capability must be honed to a user need. Similarly, value is created only when resources are evaluated, manipulated, and deployed appropriately within the firm's environmental context (Lippman and Rumelt, 2003). Yet, the emphasis on independence and inherent resource value is maintained in this line of research. Peteraf (1993) for instance, discusses what would happen if some firms do not have superior resources that are in limited supply. In such a situation, "… rents will be dissipated and only normal returns will be earned by efficient (now homogenous) producers" (p.181). Teece et al (1997) emphasize resources or capabilities that are unique or difficult to replicate. These claims maintain a belief in given resource value. Similarly, Sirmon et al. (2007) claim that holding rare, inimitable, and non-substitutable resources is a necessary but not sufficient condition for firms to achieve competitive advantage; firms must also manage those resources effectively to achieve competitive advantage. Bromiley and Rau (2016) suggest that the "necessary but not sufficient" statement by Sirmon et al (2007) means that without RBV resource attributes, firms cannot achieve competitive advantage.

The extended resource based view

Lavie (2006) suggests that RBV undermines the essential contribution of the resources of various partners. We also need to pay attention to resources that are external and embedded in a focal firm's network. In particular, RBV assumes away "*a cooperative type of interaction, in which the superior resources of counterpart firms can actually contribute to the focal firm's performance*." (Lavie, 2006, 641). The extended RBV build on the claim that certain benefits cannot be generated independently by individual firms (Dyer and Singh, 1998). This perspective thereby emphasizes interdependencies between firms. However, similar to RBV, interdependencies at the resource level are not articulated; a resource has an inherent value.

Resource bundles

Work on resource bundles essentially maintains a competitive focus based on resources within a focal firm. That is, resource bundles are independent beyond the combinations of the focal firm. Interdependence at the resource level is highlighted in the form of resource-capability combinations. To illustrate, resources within the firm's resource portfolio are integrated (i.e., bundled) to create capabilities, with each capability being a unique combination of resources allowing the firm to take specific actions. This implies that a firm's sustainable competitive advantage is contingent on the firm's ability to continuously recombine its asset stocks and apply them to new market opportunities. Two firms with similar bundles of resources can thereby have different effects on performance (Dierickx and Cool, 1989). This implies that value may not be determined for each resource factor individually but for an entire bundle (e.g. Black and Boal, 1994).

Work on resource bundles focuses on bundling rather than the resource bundles per se (e.g. Sirmon et al. 2007). While a given resource may have the potential to yield a valuable service, that service will remain latent until deployed via a relevant capability (Penrose, 1959; Amit and Schoemaker, 1993; Makadok, 2001). It is therefore argued that firms realize a performance advantage when managers synchronize the resource management processes within and between interdependent bundles such that organizational performance is optimized (Holcomb et. al., 2009). Newbert (2008) points out that this line of reasoning commonly assumes that the firm is actually capable of exploiting its resources and capabilities to realize the potential value of resources.

Cogency effects

Black and Boal's (1994) work maintains a competitive focal firm perspective, visible in the argument that value depends on what other factors are present or controlled by the specific firm in question. It also maintains an emphasis on resource attributes, in line with the resource-based view. This is clear in Black and Boal's (1994) claim that the strategic value of cogency effects among resources is dependent upon specific intra and inter-resource inherited characteristics. Yet, it also adds an interactive dimension since there are interdependencies between resources that deserve attention, for instance, interdependencies between factors that make up a resource and between resources that make up competencies. An enhancing cogency relationship exists when the presence of one factor magnifies the impact of a different factor. An enhancing relationship may be unidirectional or asymmetric; for instance,

when changes in A magnify changes in B but not vice versa. Suppressing cogency relationships exist when the presence of one factor diminishes the impact of another (Black and Boal, 1994).

Resource interactions

Resource interactionists stress interdependence on both the firm and resource levels of analysis. RBV assumes that a focal firm tries to avoid dependence on its external environment and tries to make its buyers or suppliers to be dependent on it. Work on resource interactions take a view similar to the extended RBV by stressing that firms need to acknowledge interdependencies and build on them in a systematic way to create value.

As to the resource level, work on resource interaction is in line with resource bundles and cogency which highlight interdependencies between individual resources. The focus of resource interactionists are on resource interfaces and resource imprints. Resource interfaces are the contact points along which two specific resources interact or influence each other's technical, economic and social features (Baraldi and Strömsten, 2006). Resource interfaces indicate how focal resources 'fit' each other when they are utilized together. Changing the resources with which one resource is combined, or the interactions that underpin these, will alter the value and emergent features of that resource (Håkansson and Waluszewski, 2002). Resource imprints (Baraldi et. al., 2012) highlight that resources are seldom utilized or developed in isolation. They become influenced by other resources through connected interfaces.

By focusing on resource interfaces and imprints, the resource interactionists downplay the focus on resource attributes. (Håkansson and Waluszewski, 2002; Baraldi et. al., 2012) The value of a resource depends on how and which other resources it is combined with, a view which contrasts with mainstream reasoning promoting an understanding of inherent resource value. According to work on resource interactions, we need to consider both firm level and resource level interdependencies and reframe the emphasis on single resources and their attributes.

The illustration of a conventional whiteboard and a modern smartboard show that matching and mismatching resource interfaces may exist both with and without cogency effects:

- The interface between a whiteboard and a whiteboard pen is a resource match without cogency effect. Value is co-created (a message can be written) while neither resource has an impact on the other.
- Similarly, the interface between a smartboard and a smartboard pen is a resource match without cogency effect. Value is co-created (a message can be written) while neither resource has an impact on the other.
- The interface between a smartboard and a whiteboard pen is a resource mismatch with a unidirectional suppressing cogency effect. Value is not created (only a limited message can be written) while the whiteboard pen has suppressing effect on the smartboard (the whiteboard pen colors the smartboard).
- The interface between a whiteboard and a smartboard pen is a resource mismatch without cogency effect. Value is not co-created (no message can be written) while neither resource has an impact on the other.

According to Black and Boal (1994), resources are made up of factor networks which have specific inter-resource relationships. These can be analyzed by considering not only cogency effects but also resource interfaces and resource imprints highlighted by resource interactions scholars. As indicated above, we suggest that there are interesting complementarities between work on resource bundles and resource interactions. Insights from both areas improve the understanding of what make bundles competitive or not.

RESEARCH DESIGN AND METHOD

The study complements classical resource theories with an interactive process-oriented approach. The view where reality was perceived as a constellation of things (resource attributes) was balanced with a process understanding (Langley, 2007; Pettigrew, 1997) of resource interactions. To study such interactions, we employed a longitudinal comparative case approach in a logistics network. LSPs are increasingly providing advanced services (Wang et. al., 2016), where the value created depends on cooperation between various providers and their manufacture and retail clients.

The fourth party logistics (4PL) expression was originally phrased by Accenture to denote an information-based firm that coordinates multiple asset-based organizations (Badem and Mueller, 1999). A third party logistics firm (3PL) is such an organization; a firm that utilizes

its physical resources such as distribution centers and vehicles. We followed the principle of theoretical sampling (Eisenhardt and Graebner, 2007) and chose a 4PL as the focal case firm. The study focuses on TLog's relationships to two 3PLs, DLog and BLog.

Case setting and focal relationships

Since 4PLs do not own physical logistics resources, these firms are, theoretically, in a position to provide services by combining their own digital resources with the physical resources of the most appropriate 3PL providers (cf. Hoek and Chong, 2001; Rushton and Walker, 2007). A 4PL's physical resource neutrality and has been claimed to provide advantages in terms of resource objectivity, independence and flexibility (Africk and Calkins, 1994). Few studies have empirically investigated this claim, explaining why this was our initial research focus. As the study proceeded, we realized that the '4PL resource advantage' was difficult to achieve. We found that a dynamic set of resource interdependencies made independence inaccessible, and reduced the 4PL's capacity to "plug and play/unplug" (Fabbe-Costes, 2005) its various 3PL relationships. Moreover, we found that it was challenging for the managers to only use 'the best' available resources, thereby testing the 4PL's objectivity.

The study's focal firm TLog was a 4PL focusing on fast moving consumer goods and beverage supply chain and logistics services. These supply chains are demanding in terms of transportation and storage requirements (fragile and temperature sensitive goods). The complexity of the beverage supply chain and demanding logistics services enabled the emergence of 4PLs in this industry.

Data collection and quality

Excellent access to the study's focal 4PL TLog and the contracted 3PLs enabled us to trace resources in the logistics network from the point when TLog was established in 2007 to 2015 when a competitor acquired the firm's Nordic operations. The study was conducted in real time from summer 2008 to the beginning of 2015. Structured and semi-structured interviews were triangulated with documents and observations to leverage the strengths of each data source and possibly compensate for weaknesses. To reduce the bias of single-sourced data, we interviewed persons from both TLog and the 3PLs. Moreover, one of the authors visited TLog for two months during the summer of 2010 to observe and talk with employees and managers. In addition to numerous informal talks during this period, 24 formal interviews

were conducted, all recorded and transcribed verbatim. In addition, four feedback session were arranged, one for TLog Norway in 2009, another for TLog's Nordic managers in 2012 and two sessions for one of the founders in 2014 and 2017. These meetings provided opportunities to discuss tentative ideas and findings. Finally, two of the founders have since 2009 given annual guest lectures at our school's executive MBA program, which has provided further insights on the development of the firm and its network.

TLog provided fully integrated supply chain services and was responsible for administrative logistics services such as demand and inventory management, purchase orders, and customer service. 3PL services focused on inbound transportation, warehousing, and outbound transportation. Table 2 illustrates the cost structure and the importance of establishing well working relationships.

3PL: inbound transportation (depending on the geographic location)	30-35%
3PL: warehousing	20-25%
3PL: outbound transportation	15-25%
4PL: demand and inventory management, purchase orders, and customer service.	20-25%

Table 2: Price structure of TLog's service portfolio

TLog received payment for its 4PL services only, the firm did not add a margin to 3PL services. The managers thereby highlighted the importance of keeping the terms between themselves and their 3PLs as transparent as possible.

Analysis

The analysis was informed by insights from the resource perspectives presented in the literature review, according to figure1.

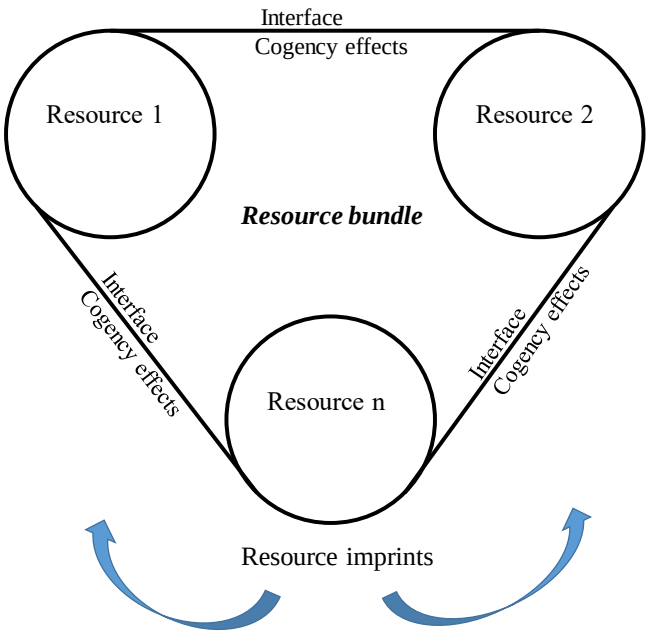

Figure1: Analytical dimensions

Stage 1 was characterized by identification and evaluation of TLog's internal resources. Stage 2 focused on identifying and evaluating external resources in two 3PL relationships. In stage 3 we focused on a resource bundle created by the 4PL and its different 3PLs. To deepen our understanding of the bundle, we further considered resource interactions and cogency effects. We followed the resource interaction approach including an emphasis on resource interfaces and imprints, where we categorized interfaces as either matching or mismatching, and imprints as either enhancing or suppressing. Finally, we reconsidered the intended resource bundle by analyzing the combination of 4PL and 3PL resources under assumptions of interdependence.

RESOURCE INTERACTIONS IN A LOGISTICS NETWORK

TLog developed close to 70 criteria for selecting specific 3PL partners. Prioritized themes included (1) strategic intention to engage in 4PL-3PL cooperation, (2) proven track record in beverage logistics, (3) terms leading to competitive advantage for TLog clients (4) quality in line with customers' expectations and (5) flexibility and capacity to grow according TLog's ambitions. TLog visited a number of 3PLs in in the Nordic region based on an initial evaluation of online offers from potential partners. Several relationships were considered

during these negotiations. The 4PL came to develop relationships to five different 3PLs. Below we focus on TLog's relationships to DLog and BLog.

The TLog-DLog Relationship

TLog's initial 3PL choice was influenced by ongoing discussions with a large potential client. The potential client was interested in TLog's 4PL services, and it preferred to work with its current 3PL, which happened to be DLog. TLog contracted with DLog in early 2009 for both warehousing and distribution in Norway, as well as warehousing in Sweden. DLog was a large international 3PL serving a variety of supply chains. The firm was a competent provider of beverage logistics services. DLog initially appeared to fulfill the TLog's requirements in terms of proven track record in beverage logistics, terms leading to competitive advantage for TLog clients, quality in line with customers' expectations and capacity to grow according TLog's ambitions.

TLog and DLog appeared to be a good match, however, DLog's strategic intention to develop this particular 4PL-3PL cooperation never materialized. TLog's managers successively perceived that DLog showed little interest in the 4PL's partner mentality. DLog primarily worked with TLog because the 3PL wanted to maintain its volume, but the firm seemed reluctant to provide competitive 3PL prices to help TLog to further expand its network. An explanation for DLog's position was that the 3PL already had an established relationship with a competing 4PL. At the beginning of its relationship with TLog, DLog shared the same warehouse between the two 4PLs, but eventually the competing 4PL convinced DLog to move TLog to another location. The competitor was not interested in sharing physical infrastructure resources with TLog. Simultaneously, DLog raised its warehousing price for TLog, whereby the 4PL initiated a search for alternative 3PL relationships for the warehousing service.

Meanwhile, on the distribution side, DLog pooled resources to combine its distribution of heavy goods and light goods. The 3PLs distribution of beverage (heavy goods) was interdependent on clients in its fashion supply chain (clothing/light goods). When DLog lost its main client in the Norwegian fashion supply chain, the 3PL decided to end its beverage operations as well. This change became the definite setback for the TLog-DLog relationship,

which lasted less than one year. TLog contracted with BLog for both warehousing and distribution services in the middle of 2009.

The TLog-BLog Relationship

TLog set out to develop a long-term and close relationship with BLog. The 3PL was a large Norwegian-based LSP that had worked with many supply chain categories. The relationship to BLog was different since the 3PL scored high regarding strategic intention to engage in 4PL-3PL cooperation. However, BLog was inexperienced in beverage logistics. The 3PL did not have a proven track record in beverage logistics or a quality in line with customers' expectations. During the first year in operation, BLog's services were of an inferior quality. The 3PL needed help in building new skills regarding service and infrastructure operations. Consequently, the 4PL committed to assist BLog; the managers tried to get close to the 3PL's operational personnel: *"We have visited most of BLog's terminals, telling people what to do. We have had meetings with drivers telling them what to do, how to meet the customer, how to provide services in the retailer stores, …."* (TLog manager). BLog eventually accepted TLog's suggestions. TLog also invited its largest client to participate and provide advice to the 3PL regarding service improvements. The client shared its logistics knowledge on beverage storage and distribution, which further helped BLog to improve. With TLog's help, backed up by the large client, BLog showed a remarkable ability to increase its performance. For a while, BLog turned into a competitive 3PL in beverage logistics. The final retail customers acknowledged TLog-BLog cooperation which was rewarded with a best performance reward in 2011.

However, the TLog-BLog relationship soon experienced new problems. TLog's market share declined, from over 10 percent to 5 percent during 2011. Some of its clients chose other LSPs or performed strategic transformations that made their relationship to TLog unwarranted. As a result, TLog became less attractive for BLog, and the 3PL felt that it could not maintain its competitive price levels. BLog requested compensation.

The situation was dramatic for TLog: the 4PL needed more clients to regain its competitiveness. By the end of 2011, TLog initiated discussions with Sapphire, a large client in electronics which required a Nordic logistics solution. Despite representing a new supply chain category, TLog decided to include this client in its network. BLog was also positive since it had ambitions to expand to other Nordic countries, something this client's business

could enable. BLog therefore offered TLog a competitive price on its 3PL services. However, the new client relationship consumed a lot of TLog's time and reduced overall performance in the network. Despite serious attempts to succeed, the relationship with Sapphire was terminated after one year.

A more promising network growth occurred in early 2013. TLog contracted with a major beverage client, reaching its highest market share ever in the Norwegian market. However, TLog's successful network growth added complexity to BLog's operations, and the 3PL's performance declined. The LSP was unable to develop and implement new service routines and infrastructures. Once again, TLog had to work intensively with BLog to reach acceptable service levels. The 4PL also started to consider additional 3PLs relationships.

ANALYSIS

This section analyses the focal resources in the two relationships.

Resource attributes and resource interactions in the DLog relationship

The TLog-DLog relationship portrays a case characterized by stable resource attributes throughout the time frame of the relationship's duration. TLog did not bring new business to DLog's operations, but their cooperation helped to maintain the business of a large client; a client that desired to work with both LPSs. This made the network valuable. Both the 4PL and the 3PL brought superior competencies which helped to create a competitive resource bundle. From a classical RBV perspective, TLog's 4PL competence was valuable, arguably rare and not easily imitated. It was not non-substitutable sine at least one other actor offered similar services. From an extended resource perspective (as seen from the 4PL's point of view) the 3PL's competence was competitive (valuable and rare). The analysis did not expose any cogency effects between the resources. That is, the 4PL's competence neither improved nor reduce the 3PLs competence, and vice versa. Moreover, the match between the 4PL's competence and the 3PL's competence was good (see figure 2).

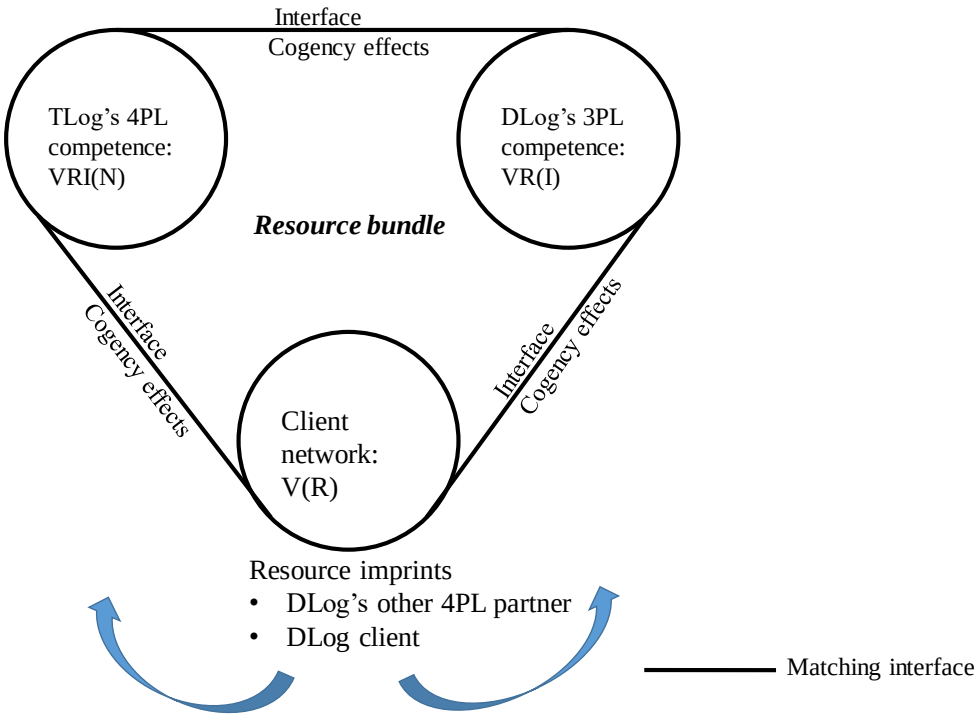

Figure 2: An interactive resource perspective on the TLog-DLog relationship

The relationship was characterized by two strong resources ((4PL and 3PL competencies) and a small but nevertheless valuable client network with good resource matches (interfaces), which created a competitive resource bundle. The bundle, once established, remained stable and competitive over time. The firms created relational rents that neither party could have obtained in isolation. The joint performance of TLog and DLog was, as viewed from the final retail tier's perspective, good all along.

Despite these characteristics, the TLog-DLog relationship was terminated after only one year. This case demands a broader analysis of the relationship covering not only the entire supply chain but the network, since events and resource constellations in adjoined supply chains ultimately ruined a collaboration that, when viewed in isolation, seemed competitive. This relationship highlights the importance of acknowledging resource imprints (c.f. Baraldi et al, 2012). In particular, the competing 4PL and the loss of one of DLog's clients in another supply chain category created such suppressing imprints that the TLog-DLog relationship was terminated.

Resource attributes and resource interaction in the BLog relationship

In the TLog-BLog relationship, single resources evolved and created both matching and mismatching interfaces and suppressing cogency effects. Figure 3 illustrates the development

of single resources, resource interfaces, a crucial resource imprint and a suppressing cogency effect.

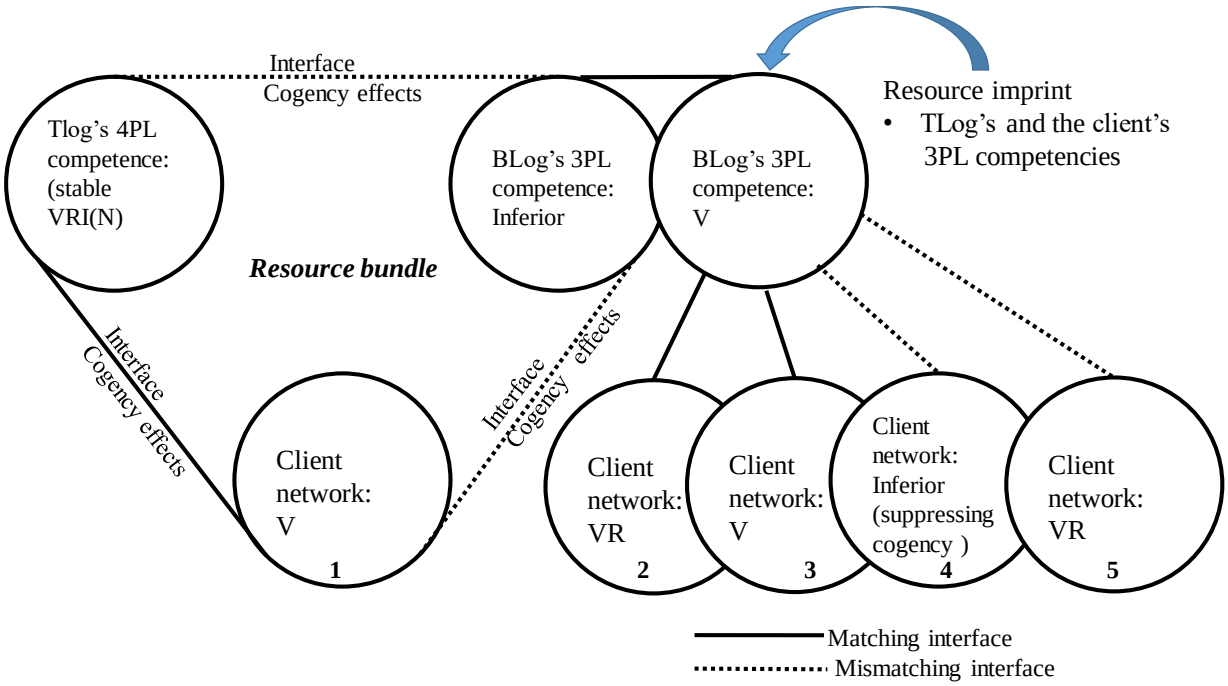

Figure 3: An interactive resource perspective on the TLog-BLog relationship

As indicated in phase 1, the 4PL's competence remained superior in the BLog relationship. As seen from an extended resource perspective, the 3PL's competence was not even valuable in this relationship; BLog's competence was inferior. The client network represented a valuable but not rare resource; TLog brought one new customer to BLog's network. Fifue 3 suggests that BLog's competence was a concern at the start of the relationship.

In phase 2 there were two developments of particular interest in this relationship; the improvement of the 3PL's competence and the growth of the client network. Regarding the 3PL's competence, we need to acknowledge the enhancing imprint that the 4PL's 3PL competence had on BLog's competence. This enhancing imprint successively helped to develop the 3PL's competence, when viewed in isolation, from inferior to become valuable. In addition, in phase 2 the development if the network (in terms of size) and the 3PL's competence (in terms of improvement) matched well. The 3PL was given adequate time to successively improve its competence. An enhancing imprint and a matching resource interface contribute positively to the development of the bundle.

In phase 3, TLog started to lose clients; making the network less valuable. Almost in parallel, the parties received the industry performance reward. It is noteworthy that a competitive bundle was created at this stage by combining two matching non-superior resources, one of these being inferior only a few months earlier. However, analyzing the interface in this phase reveals a paradox. While the 3PL benefitted from a smaller network, it also started to get increasingly discontented with the smaller volumes provided by TLog.

Subsequently in phase 4, the client network grew again, but the recruitment of the electronics client proved to represent a suppressing cogency effect. The new client in electronics, Sapphire, was renamed by TLog's managers to 'Vampire' since it consumed too much of their attention. Sapphire represented a suppressing cogency effects since its reduced the value of the single resource (the client network) in addition to creating a growing mismatch between the network and both the 4PL's and the 3PL's competencies. When analyzed in isolation, the network prohibits value creation. Only compatible clients add synergies to the network (cf. Lavie, 2006).

In phase 5, Sapphire is gone and the network grows with compatible clients. Viewed in isolation this is a good development. From a classical resource perspective, TLog's network turns more valuable when analyzed in isolation. This is due to the removal of the client that brought negative network externalities in favor of new clients in the beverage supply chains. From a resource interaction standpoint however, the new larger size created a mismatch with the 3PL's competence, despite representing 'the right' kind of growth. The 3PL had developed its competence regarding beverage logistics operations, however, its ability to redesign new service routines to accommodate additional growth was still weak. The interface becomes increasingly mismatched; the larger network did not match with BLog's level of competence.

To sum up, neither TLog nor BLog provided superior resources to their relationship (besides TLog's 4PL competence). Yet, their joint work resulted in the industry's best performance for a certain period. The point is that it was not *despite of* these characteristics but *thanks to* these non-superior resources and the matching interfaces that the parties were able to create common benefits. BLog, temporarily at least, transformed into a competitive 3PL and improved its reputation in this fast moving consumer goods chain, and TLog improved the reputation and performance of its 4PL network. When TLog's network resource (size)

actually started to grow was also when performance declined. The interface weakened the resource match with BLog's resource (competence).

Theoretical implications

The literature review presents a number of theoretical perspectives on resources; different approaches which often are seen as antagonistic rather than complementary. Unsurprisingly, an interactive resource analysis put emphasis on resource interfaces, imprints and cogency effects. However, it also depends on an appreciation of resource attributes since they have an impact on all interactive dimensions. That is, resource attributes are fundamental since they shape the development of cogency effects, interfaces and imprints. In this respect we suggest that previous work on resource attributes and resource interactions are complementary. Based on such a link, we emphasize the importance of interdependence rather than independence, on both firm level and resource levels of analysis. Moreover, an interactive resource analysis builds on the ambition to create relational rents aiming for cooperative advantage rather than focusing on internal rents and firm specific competitive advantage.

The studied relationships follow the extended RBV by illustrating that external resources are fundamental in an interactive resource analysis. Dyer and Singh (1998, p 666-667) defined complementary resource endowments as "*distinctive resources of alliance partners that collectively generate greater rents than the sum of those obtained from the individual endowments of each partner."* From an interactive standpoint, we need to place Dyer and Singh's (1998) claims in perspective. The quote above stresses the distinctiveness of partner resources. Moreover, Dyer and Singh (1998) emphasized that for resources to generate rents through an alliance, it is necessary that neither firm in the partnership can purchase the relevant resources in a secondary market. The emphasis on distinctiveness and the idea that relevant resources can be purchased imply that Dyer and Singh's focus was on the resource per se. That is, the belief that a resource in itself has a value and that it can be acquired somewhere and transferred intact to another setting is maintained. Our case illustrates that neither TLog nor Blog would have reached the highest level of industry performance in isolation, but it is also a fact that BLog's resources could have been purchased elsewhere in the market by TLog. These illustrations are in favour of a view suggesting that resources do not have inherent value.

Based on the comparative case study and the different resource approaches, we propose that the particular qualities of resource attributes need to be reinterpreted when interdependencies on both firm and resource levels are acknowledged. Consider the emphasis on valuable and the conventional focus on production economies of scale. For instance, Dyer and Singh (1998) suggest that firms are able to increase productivity by substituting special-purpose assets for general-purpose assets. They argued that alliance partners are able to increase the efficiency associated with interfirm exchanges as they increase the volume and scope of transactions between the alliance partners. Resource interactions are affected by such production economies of scale, but these do not necessarily highlight the network effects which also influence resource value. Consider demand side network externalities (Katz and Shapiro, 1985) which are essential in networks. When a network effect is present, the value of a product or service is dependent on the number of others using it. McIntyre et al (2016) argue that users of video streaming services such as Netflix value a large number of available movies and programs, while movie studios and other content providers benefit from a large base of viewers. Similarly, clients of a 4PL network value a large number of 3PL providers, while these providers benefit from the size of the 4PL client network. The more clients who join a logistics network, the more valuable the network is for the firms who belong. Moreover, the number of senders and receivers the 4PL and its 3PLs can provide both direct and indirect network effects that need to be considered when analyzing resource value. By considering the effect that one user of a good or service has on the value of that product to other people, the externality argument is also a resource interaction claim.

To repeat, a resource does not necessarily have an inherent value. To justify its existence, a 4PL needs to bring clients to its 3PLs' infrastructures. Adding one more (compatible) client directly affects the value of services to other clients in the network. Our point is that Sapphire was not, per se, a 'Vampire'; the firm only appeared so through interactions with other firms in TLog's network.

This line of reasoning expands previous work on the exploitation of a valuable resource-capability combinations. Common resources (or capabilities) can be essential to the attainment of a competitive advantage provided they are paired with other capabilities (or resources) in such a way that the resulting combination in which they are exploited is rare (e.g. Newbert 2008). That is, previous work stress that competitive advantage does not arise at the level of individual resources and capabilities but rather at the level of resource-capability combinations; hence individual resources need not to be rare.

The claim that firms need not necessarily possess rare resources and rare capabilities adds to the resource debate; it is also important to acknowledge resource interfaces and the claim that resources do not have inherent value. From a cooperative standpoint, based on the intention to create relational rents, interdependence implies that value can increase when a resource provides many rather than few matching interfaces with other resources. That is, a resource may instead be considered valuable if it enhances other resources through matching interfaces and enhancing cogency effects. This challenges our conventional understanding of rare.

If a firm wants other firms to be willing to relate and connect to its resources, the conventional connotation of rare may be counterproductive from an interactive perspective. It suggests that few combinations and matching interfaces exist. Consequently, whether or not resources purchased on the open market can be rare is not necessarily the bottom line question for understanding firm advantage (cf. Hitt et al, 2016). As to inimitability, we follow Håkansson and Waluszewski (2002) and Lavie (2006) who argue that the inimitability of resources will depend less on the nature of resources and more on the nature of relationships between the firm and its partners.

The understanding of the studied relationships depends on an analysis of both resource attributes and resource interactions. In the first case we learn that superior resources may not lead to the development of relational rents due to suppressing imprints from the extended network. In the second case we learn that the joint work of the 3PL and the 4PL resulted in an industry best performance reward. Yet, the bundle was, regarding resources in isolation, initially based on inferior 3PL competence and a noncompetitive client network. Matching resource interfaces, rather than individual resource attributes, explain the initial development of the TLog-BLog relationship. Moreover, in the TLog-BLog relationship it also becomes apparent that the improvement of a single resource does not necessarily strengthen the resource bundle since interfaces may start to mismatch. The development of the 3PLs competence did not match the dynamic decline and growth of the client network. We therefore propose that:

- Proposition 1: Matching interfaces and enhancing imprints may create relational rents when non-superior resources interact.

- Proposition 2: Mismatching interfaces and suppressing imprints may hinder relational rents when superior resources interact.
- Proposition 3: Improvements in single resources may create mismatching resource interfaces resulting in less competitive resource bundles.

These propositions require a reinterpretation of classical RBV attributes, according to table 3.

Resource perspectives	**Resource based view**	**An interactive resource analysis**
Assumption	Independence	Interdependence
Primary focus	Individual resource	Resource bundle
Creation of	Internal rents	Relational rents
Aim	Firm level competitive advantage	System level cooperative advantage
Aim reached when	Valuable, rare, inimitable and non-substitutable	Interfaces match, cogency effects are enhanced, suppressing resource imprints are circumvented

Table 3: Resource perspectives

From a managerial perspective, we agree with Hitt et al (2016) that an argument in favor of classical RBV is that it is simple to use. An interactive resource perspective admittedly adds complexity by asking managers to also consider cogency effects, resource interfaces and resource imprints from the extended network. We suggest that the resulting complexity can be worthwhile to acknowledge. Managers can benefit from an approach that acknowledges that the combination of uncompetitive internal and external resources may create a competitive resource bundle if interfaces match and imprints are enhancing. Similarly, the combination of competitive internal and external resources may create an uncompetitive resource bundle if interfaces mismatch and imprints are suppressing. We thereby suggest that managers can scan more broadly for resources in their surroundings. They should not only search for superior resources, but common (non-superior) resources may also create benefits when combined in creative ways (c.f. Nag and Gioia, 2012).

CONCLUSION

Due to the characteristics of firm resources to generate rents, it is unlikely if not impossible to be able to determine a priori the set of resources needed to gain or sustain a competitive advantage (Barney, 1991; Peteraf, 1993). The findings of this study add that even if we could determine such characteristics, they may not lead to sustainable sources of competitive advantage due to various interaction effects. Individual resources with desirable qualities may not create competitive bundles if interfaces and imprints are not aligned. Similarly, individual resources with weak qualities may develop competitive bundles when interfaces and imprints are favorable.

Whereas traditional resource based views concentrate on resources that are internal to a focal firm, the relational view and the extended view of interconnected firms emphasize superior resources of counterparts. This study joins these arguments with a focus on resource interactions. It thereby redirects the emphasis on superiority of resources to include also the quality of resource interfaces and cogency imprints.

Regarding logistics strategy, this study has acknowledged that the 4PL business represents an interesting development of logistics firms. Whereas extant studies on 4PLs are mainly conceptual and focus on their advantages, we show empirically that realizing some of the associated benefits may be challenging. 4PL objectivity and independence may be difficult to realize due to resource interdependencies that exist in business relationships.

Future research need to consider how resource interactions take place and the scope of managerial leverage regarding proactive resource combinations. Considering the few studies that exist in the interface between strategic management and logistics, we would also like to stress that LSP strategy represent an interesting setting in its complexity where a broad network understanding seems pertinent in order to create value. Previous research seldom acknowledges the influence of the wider network for LSP strategizing.

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